

Alcoa Huntly-Myara
Targeted Flora Survey

Report to Alcoa of Australia Limited

20 March 2024



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3				

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Executive Summary

Alcoa commissioned Biologic Environmental Survey to undertake targeted Threatened and Priority flora searches, and to record any Weeds of National Significance, declared or invasive weed species, within the Huntly Mine and Myara region. The Survey Area is located 63 km southeast of Perth, within the Northern Jarrah Forest IBRA subregion, and covers an area of approximately 110 ha.

The targeted flora surveys were completed over two field trips, 9 to 13 October 2023 and 29 November to 1 December 2023, totalling 25 person days. The field survey involved botanists walking grid lines 10 to 20 m apart while searching for significant flora and significant weed species within the Survey Area.

No Threatened flora taxa were recorded by this survey. Four Priority listed flora taxa were recorded from the Survey Area, which included:

- *Acacia horridula* (P3) (21 individuals from eight locations);
- *Thysanotus anceps* (P3) (nine individuals from nine locations);
- *Senecio leucoglossus* (P4) (819 individuals from 162 locations); and
- *Stylidium ireneae* (P4) (two individuals from one location).

Some minor constraints were encountered during the field survey, including disturbances that may have affected results (dust covering and potentially concealing significant flora in areas along haul roads) and access restrictions within the Survey Area (clearing works restricting access to some areas).

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1 Introduction

1.1 Background

Alcoa of Australia Limited's (Alcoa) Western Australian (WA) mining operations comprise the Huntly and Willowdale bauxite mines. They are located in Alcoa's Mining Lease 1SA (ML1SA) (Figure 1.1), 63 kilometres (km) southeast of Perth, within the Northern Jarrah Forest (NJF) Interim Biogeographic Regionalisation for Australia (IBRA) subregion. Alcoa has approval to mine within the ML1SA subject to submitting draft five-year mine plans and associated environmental management programs known as the Mining and Management Program (MMP). The MMP is submitted to the State's Mining and Management Program Liaison Group (MMPLG) on an annual basis.

Alcoa has committed to undertaking pre-clearance ecological surveys for the Huntly Mine, Myara region and Willowdale Mine, Larego region as part of its MMP assessment by the MMPLG. These surveys will be based on conceptual clearing alignments which will be submitted as part of the MMP and will be used to:

- Amend the conceptual alignment to avoid significant flora and vegetation
- Create management plans to ensure any identified Weeds of National Significance (WoNS) or declared and invasive weeds are not spread
- Inform translocation and environmental management plans as required
- Assist Alcoa in preparing MMP submission to MMPLG.

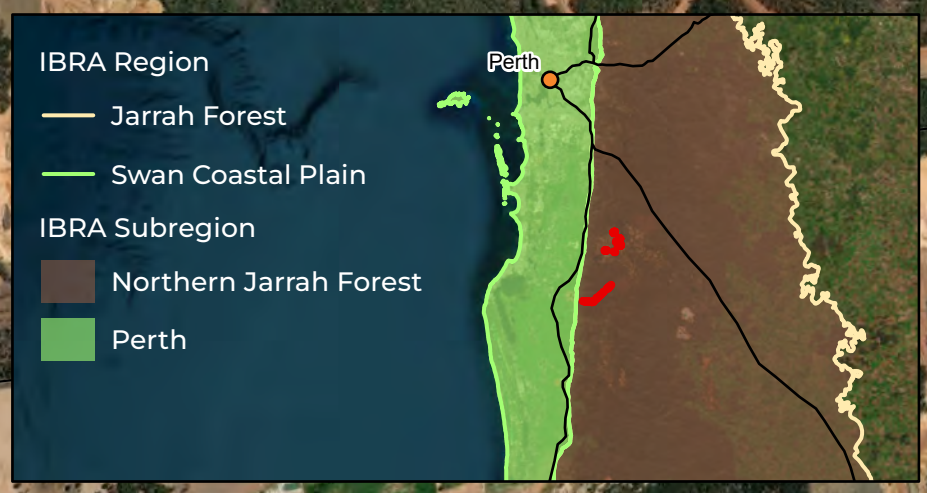
Alcoa commissioned Biologic Environmental Survey Pty Ltd (Biologic) to undertake targeted Threatened and Priority flora searches, and to record any Weeds of National Significance (WoNS), declared or invasive weed species, within the Huntly Mine and Myara region, hereby referred to as the Survey Area (Figure 1.1). The Survey Area covers approximately 110 hectares (ha).

1.2 Scope and Objectives

The overarching objective of the targeted flora survey was to search for and record the occurrence of all Threatened and Priority flora species, Weeds of National Significance (WoNS), or declared or invasive weed species that occur within the Survey Area. The purpose of this survey is to meet the commitment made by Alcoa to undertake pre-clearance ecological surveys for the Huntly Mine, Myara region and Willowdale Mine, Larego region as part its MMP assessment by the MMPLG.

412000 414000 416000 418000

6410000 6408000 6406000



LEGEND

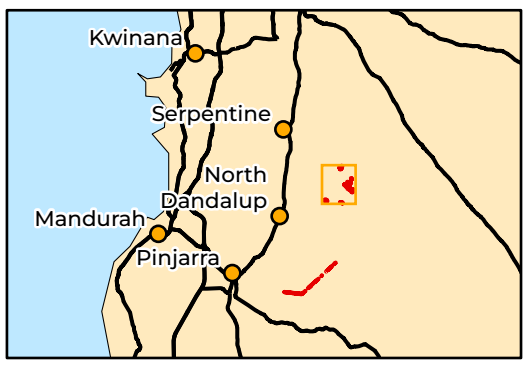
Survey Area

Local Road

Scale 1:23,800

0 0.5 1 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 23/02/2024



Biologic

ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 1.1a: Survey Area and regional context

410000 412000 414000 416000

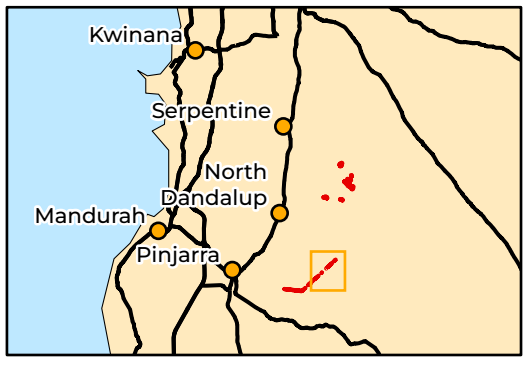
6394000 6392000 6390000 6388000

IBRA Region
Jarrah Forest
Swan Coastal Plain
IBRA Subregion
Northern Jarrah Forest
Perth



LEGEND
Survey Area
Local Road

Scale 1:23,800
0 0.5 1 Km
Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator
Created: 23/02/2024



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Huntly-Myara
Targeted Flora Survey

Figure 1.1b: Survey Area and regional context

404000
406000
408000
6390000
6388000
6386000
6384000

IBRA Region
Jarrah Forest
Swan Coastal Plain
IBRA Subregion
Northern Jarrah Forest
Perth

Perth

North Spur Rd
Del Park Rd
Scarp Rd
Grey Rd

LEGEND
Survey Area
Local Road

Scale 1:23,800
0 0.5 1 Km
Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 23/02/2024

Kwinana
Serpentine
North Dandalup
Mandurah
Pinjarra

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ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 1.1c: Survey Area and regional context

As per the scope of works, Biologic undertook;

- A review previous flora and vegetation studies of the region;
- A desktop study to determine the likelihood of finding threatened and priority species during different flowering seasons;
- Targeted flora surveys in 10 or 20 m traverses in a grid pattern to identify threatened and priority species presence or absence, while also recording:
  - Other conservation significant flora species when identified; and
  - Any WoNS, declared and invasive weeds to be managed; and
- Prepare a report that meets Environmental Protection Authority (EPA) Guidance for submission to the MMPLG as part of the MMP submission.

1.3 Compliance

Significant flora and vegetation is protected at a state and commonwealth level and legislated by the following parliamentary acts:

- WA Biodiversity Conservation Act 2016 (BC Act);
- WA Environmental Protection Act 1986 (EP Act); and
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The EPA outline guidance for biological surveys in WA. All aspects of botanical assessments at Biologic are compliant with the following technical guidance statements at the level of Environmental Impact Assessment (EIA):

- EPA Technical Guidance for Flora and Vegetation Surveys for EIA (EPA, 2016b);
- Environmental Factor Guidelines for flora and vegetation (EPA, 2016a); and
- Draft Survey Guidelines for Australia's threatened orchids. Guidelines for detecting orchids listed as 'Threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (DoE, 2014).

1.3.1 Legislation

Within Western Australia (WA), native flora is protected under the BC Act and at a national level under the EPBC Act. Any action that has the potential to impact on native flora needs to be approved by relevant state and/ or commonwealth departments as dictated by the state EP Act. These codes, jurisdiction and level of protection are detailed in Appendix A.

1.3.2 Introduced Flora

Introduced flora can pose a threat to native vegetation and biodiversity. The Commonwealth of Australia, in collaboration with the states and territories, has identified 32 WoNS based on an assessment process that prioritises these weeds according to their invasiveness, potential for spread, and environmental, social, and economic impacts. A list of 20 WoNS was endorsed in 1999, and a further 12 were added in 2012 (DoEE, 2019).

A database of Declared Pests (DP) is kept by the Department of Primary Industries and Regional Development (DPIRD). This database falls under State jurisdiction, legislated by the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Some introduced flora taxa may be classified within categories that have legal control or management requirements (Appendix A). These requirements must be met by the landholder.

2 Desktop Assessment

2.1 Methods

A desktop assessment, comprising database searches and a review of information provided by Alcoa, was undertaken prior to the field survey. The purpose of the desktop assessment was to identify significant flora and vegetation values, and introduced flora taxa, occurring, or potentially occurring, in the Survey Area.

2.1.1 Database Searches

Database searches were undertaken to generate a list of significant vascular flora taxa previously recorded within, and near the Survey Area, including introduced flora taxa. Table 2.1 outlines the databases interrogated that formed the desktop assessment. Searches were mostly conducted with a 20 km radius of the Survey Area. DBCA database search results were provided to Biologic by Alcoa. The Western Australian Organism List (WAOL) database (DPIRD, 2023) was buffered to the two Local Government Authorities (LGAs) occurring across the Survey Area (Shire of Murray and Shire of Serpentine-Jarrahdale).

Table 2.1: Details of database searches conducted.

Provider	Database	Reference	Parameters
Western Australian Herbarium	WAH specimen database	DBCA (2023b) (provided by Alcoa)	Buffer of 20 km from the Survey Area polygon
DBCA	Threatened and Priority Flora		Buffer of 20 km from the Survey Area polygon
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	EPBC Act Protected Matters Search Tool	DCCEEW (2023)	Buffer of 20 km from the Survey Area polygon
Atlas of Living Australia (ALA)	ALA species occurrence search	ALA (2023)	Circle of radius 20 km centres on the coordinates: -32.553033 E, 116.132749 S
Department of Primary Industries and Regional Development (DPIRD)	Declared Plants Database - WAOL	DPIRD (2023)	Shire of Murray and Shire of Serpentine-Jarrahdale

2.1.2 Assessment of Occurrence

2.1.2.1 Alcoa Assessment

Alcoa provided Biologic with a detailed Threatened and Priority flora likelihood risk assessment for the entirety of Alcoa operations in the NJF. Two-hundred and thirty-three Threatened and Priority flora taxa were assessed on their likelihood of occurring, or possibly occurring, within Alcoa's mining locations. Alcoa have used an internal process and decision matrix to determine the likelihood of a species occurring within the separate mining

locations (i.e., Myara, Larego). A number of different parameters were used to determine the likelihood of a species, giving each taxa a High, Moderate, or Low rating.

2.1.2.2 Biologic Assessment

The Biologic assessment of occurrence is a condensed version of Alcoa's likelihood of occurrence assessment, combined with our desktop assessment. Biologic's assessment of occurrence has been completed for the Survey Area only and not the entire Alcoa operations. To condense the list of significant taxa, non-Northern Jarrah Forest taxa (based on the landscape category) and taxa whose distribution did not overlap the Survey Area (based on the distribution category and Myara region) were excluded. One hundred and sixty-one taxa (161) were excluded from the Alcoa assessment, leaving a shortened list of 72 significant taxa for the Biologic assessment (Appendix B). The condensed list of 72 taxa from the Alcoa assessment were also identified from the Biologic desktop assessment. The Biologic desktop assessment did not include any additional significant flora taxa. Following the review of the Alcoa assessment of occurrence and Biologic's desktop assessment, each significant flora taxon was ranked using the following definitions presented in the decision matrix (Table 2.2).

Table 2.2: Assessment of occurrence decision matrix

		Habitat Categories (within the Survey Area)			
		Core/ critical habitat present	Suitable habitat present/ within known distribution	Marginal habitat present/ adjacent to known distribution	No suitable habitat present/ outside of known distribution
Species records/ Occurrence Categories	Recorded in the Survey Area	Confirmed	Confirmed	Confirmed	Confirmed
	Recorded within <2km	Highly Likely	Likely	Possible	Possible
	Recorded within 2–5 km	Likely	Possible	Possible	Unlikely
	Recorded within 5–20 km	Possible	Possible	Unlikely	Unlikely
	Recorded >20 km	Possible	Unlikely	Unlikely	Highly Unlikely
	Taxa considered locally/regionally extinct	Unlikely	Unlikely	Highly Unlikely	Highly Unlikely

2.2 Results

2.2.1 Significant Flora

The Biologic desktop assessment identified 72 significant flora taxa (Figure 2.1, Appendix B). No existing records of significant flora occur within the survey area. Sixteen significant taxa were considered Highly Likely, Likely, or Possible to occur in the Survey Area (Table 2.3), with the following composition:

- Highly Likely:
  - *Acacia horridula* (P3), *Calothamnus graniticus* subsp. *leptophyllus* (P4), *Pimelea rara* (P4), and *Senecio leucoglossus* (P4).
- Likely:
  - *Hibbertia hortiorum* (P1), *Thysanotus anceps* (P3), *Grevillea pimeleoides* (P4), and *Stylidium ireneae* (P4).
- Possible:
  - *Anthocercis gracilis* (T), *Hibbertia acrotoma* (P1), *Bossiaea modesta* (P2), *Tetratheca phoenix* (P2), *Cyathochaeta teretifolia* (P3), *Acacia oncinophylla* subsp. *patulifolia* (P4), *Cyanothamnus tenuis* (P4), and *Eucalyptus* ×*graniticola* (P4).

The remaining taxa were considered either Unlikely (41 taxa) or Highly Unlikely (15 taxa) to occur (Appendix B). Of the 72 taxa assessed for likelihood, 11 are listed as Threatened under the BC Act, with one considered Possible to occur within the Survey Area (Table 2.3). The Assessment of Occurrence was reviewed following the completion of the Spring targeted field surveys. This is discussed further in Section 3.3.

Three taxa identified during the desktop assessment were only identified during the review of Alcoa's Threatened and Priority flora likelihood risk assessment. As such, these taxa do not have associated latitudes and longitudes, and were not able to be mapped on Figure 2.1.

2.2.2 Introduced Flora

The desktop assessment identified 50 significant environmental weeds that may potentially occur within the Survey Area. All 50 of these taxa are listed as DPs, while 29 are listed as WoNS (Appendix C). The list of significant weeds includes numerous *Opuntia, Cylindropuntia* and *Rubus* species that are grouped together in the WoNS listing.

400000
440000
480000
6440000
6400000
6360000
Canning
Bickley
Carmel
Pickering Brook
North Fremantle
Gosnells
Fremantle
Corbett
Karragullen
Jandakot
Kelmscott
Clarence
Bedfordale
Mandogalup
Wungong
Kwinana
Byford
Brookton Hwy
Rockingham
Ennis Av
Kwinana Fwy
Westdale
Safety Bay
Jarrahdale
Karnup
Port Kennedy
Peelhurst
Keysbrook
Singleton
Furnissdale
Yunderup
Wandering
Dwellingup
Forrest Hwy
Coolup
Dwarda
Ranford
Boddington
Pinjarra Williams Rd
Lake Clifton
Hamel
Waroona
Yalup Brook
Waterous
Wagerup
Cookernup
South Western Hwy
Myalup
Wokalup
Harvey

LEGEND

Survey Area

State Road

Rail

Scale 1:400,000

0 5 10 15 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator

Created: 26/02/2024

Perth
Kwinana
Mandurah
Bunbury

Biologic

ALCOA

Huntly-Myara Targeted Flora Survey

Figure 2.1: Significant flora records from the desktop assessment

Significant Flora

T

- *Andersonia* sp. Saxatilis (F. and J. Hort 3324)
- *Andersonia gracilis*
- *Austrostipa jacobsiana*
- *Banksia mimica*
- *Caladenia huegelii*
- *Calytrix breviseta* subsp. *breviseta*
- *Conospermum undulatum*
- *Darwinia apiculata*
- *Diuris drummondii*
- *Diuris micrantha*
- *Diuris purdiei*
- *Drakaea elastica*
- *Drakaea micrantha*
- *Eleocharis keigheryi*
- *Eucalyptus ×balanites*
- *Goodenia arthrotricha*
- *Grevillea curviloba*
- *Grevillea flexuosa*
- *Grevillea thelemanniana*
- *Lasiopetalum pterocarpum*
- *Lepidosperma rostratum*
- *Morelotia australiensis*
- *Synaphea* sp. Fairbridge Farm (D. Papenfus 696)
- *Synaphea* sp. Pinjarra (R. Davis 6578)
- *Synaphea* sp. Pinjarra Plain (A.S. George 17182)
- *Synaphea* sp. Serpentine (G.R. Brand 103)
- *Synaphea stenoloba*
- *Thelymitra magnifica*
- *Thelymitra stellata*
- *Tribonanthes purpurea*
- *Verticordia fimbrilepis* subsp. *fimbrilepis*
- *Verticordia plumosa* var. *ananeotes*

P1

- *Acacia lasiocarpa* var. *bracteolata* long peduncle variant (G.J. Keighery 5026)
- *Anthotium* sp. Darling Range (F. Hort and B. Hort 2431)
- *Boronia juncea* subsp. *juncea*
- *Caladenia uliginosa* subsp. *patulens*
- *Calytrix simplex* subsp. *simplex*
- *Darwinia hortiorum*
- *Deyeuxia inaequalis*
- *Drosera oreopodion*
- *Eriochilus glareosus*
- *Gastrolobium* sp. Prostrate Boddington (M. Hislop 2130)
- *Grevillea bipinnatifida* subsp. *pagna*
- *Hibbertia acrotoma*
- *Hibbertia ambita*
- *Hibbertia hortiorum*
- *Hibbertia polyancistra*
- *Isopogon* sp. Canning Reservoir (M.D. Tindale 121 and B.R. Maslin)
- *Levenhookia preissii*
- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133)
- *Paracaleana gracilicordata*
- *Paracaleana granitica*
- *Ptilotus sericostachyus* subsp. *roseus*
- *Senecio gilbertii*
- *Stachystemon exilis*
- *Synaphea odocoileops*
- *Thysanotus formosus*
- *Xanthoparmelia darlingensis*
- *Xanthoparmelia sammyi*

Biologic

P2

- *Acacia benthamii*
- *Amanita wadulawitu*
- *Andersonia* sp. Blepharifolia (F. and J. Hort 1919)
- *Banksia recurvistylis*
- *Bossiaea modesta*
- *Calectasia grandiflora*
- *Cardamine paucijuga*
- *Craspedia* sp. Waterloo (G.J. Keighery 13724)
- *Diuris brevis*
- *Euphrasia scabra*
- *Gonocarpus keigheryi*
- *Grevillea ornithopoda*
- *Haloragis aculeolata*
- *Johnsonia pubescens* subsp. *cygnorum*
- *Lepyrodia curvescens*
- *Melaleuca viminalis*
- *Millotia tenuifolia* var. *laevis*
- *Netrostylis* sp. Chandala (G.J. Keighery 17055)
- *Paracaleana ferricola*
- *Phyllangium palustre*
- *Poranthera moorokatta*
- *Pterostylis frenchii*
- *Schizaea rupestris*
- *Stenanthemum sublineare*
- *Stylidium korijekup*
- *Tetratheca phoenix*
- *Thelymitra variegata*
- *Thysanotus* sp. Badgingarra (E.A. Griffin 2511)

P3

- *Acacia drummondii* subsp. *affinis*
- *Acacia horridula*
- *Acacia oncinophylla* subsp. *oncinophylla*
- *Actinotus repens*
- *Allocasuarina grevilleoides*
- *Amanita carneiphylla*
- *Amanita drummondii*
- *Amanita fibrillopes*
- *Amanita kalamundae*
- *Amanita preissii*
- *Amanita wadjukiorum*
- *Andersonia* sp. Audax (F. Hort, B. Hort and J. Hort 3179)
- *Angianthus drummondii*
- *Asteridea gracilis*
- *Babingtonia urbana*
- *Banksia kippistiana* var. *paenepeccata*
- *Banksia subpinnatifida* var. *imberbis*
- *Beaufortia purpurea*
- *Blennospora doliiformis*
- *Boronia capitata* subsp. *gracilis*
- *Byblis gigantea*
- *Carex tereticaulis*
- *Chamaescilla gibsonii*
- *Chordifex gracilior*
- *Cyathochaeta teretifolia*
- *Dampiera triloba*
- *Dicrastylis reticulata*
- *Dillwynia dillwynioides*
- *Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459)
- *Eryngium*sp. Ferox (G.J. Keighery 16034)
- *Gastrolobium* sp. Asperum (F. Hort 2864)
- *Gonocarpus pycnostachyus*
- *Goodenia katabudjar*
- *Grevillea dissectifolia*
- *Grevillea prominens*
- *Hakea oldfieldii*
- *Halgania corymbosa*
- *Hemigenia microphylla*
- *Isopogon autumnalis*
- *Jacksonia gracillima*
- *Lasiopetalum glutinosum* subsp. *glutinosum*
- *Lasiopetalum membranaceum*
- *Lepyrodia heleocharoides*
- *Loxocarya magna*
- *Meionectes tenuifolia*
- *Myriophyllum echinatum*
- *Netrostylis* sp. Blackwood River (A.R. Annels 3043)
- *Olearia strigosa*
- *Petrophile filifolia* subsp. *laxa*
- *Pithocarpa corymbulosa*
- *Schoenus benthamii*
- *Schoenus capillifolius*
- *Schoenus pennisetis*
- *Schoenus* sp. Waroona (G.J. Keighery 12235)
- *Stackhousia* sp. Red-blotched corolla (A. Markey 911)
- *Stylidium aceratum*
- *Stylidium marradongense*
- *Stylidium paludicola*
- *Stylidium roseonanum*
- *Stylidium trudgenii*
- *Styphelia filifolia*
- *Synaphea pandurata*
- *Tetratheca parvifolia*
- *Tetratheca pilifera*
- *Tetratheca similis*
- *Thysanotus anceps*
- *Thysanotus cymosus*
- *Xanthoparmelia subimitatrix*

P4

- *Acacia alata* var. *platyptera*
- *Acacia cuneifolia*
- *Acacia flagelliformis*
- *Acacia oncinophylla* subsp. *patulifolia*
- *Acacia semitrullata*
- *Aponogeton hexatepalus*
- *Banksia insulanemorecincta*
- *Caladenia integra*
- *Caladenia speciosa*
- *Calothamnus accedens*
- *Calothamnus graniticus* subsp. *leptophyllus*
- *Chorizema ulotropis*
- *Conostylis pauciflora* subsp. *pauciflora*
- *Cyanothamnus tenuis*
- *Darwinia* sp. Dryandra (G.J. Keighery 9295)
- *Darwinia thymoides* subsp. St Ronans (J.J. Alford and G.J. Keighery 64)
- *Dodonaea hackettiana*
- *Drosera occidentalis*
- *Eucalyptus exilis*
- *Eucalyptus rudis* subsp. *cratyantha*
- *Eucalyptus* x *graniticola*
- *Goodenia verreauxii*
- *Grevillea pimeleoides*
- *Grevillea saccata*
- *Hemigenia platyphylla*
- *Jacksonia sericea*
- *Kennedia beckxiana*
- *Lasiopetalum bracteatum*
- *Lasiopetalum cardiophyllum*
- *Microtis quadrata*
- *Ornduffia submersa*
- *Parsonsia diaphanophleba*
- *Pimelea rara*
- *Rumex drummondii*
- *Schoenus natans*
- *Senecio leucoglossus*
- *Stylidium ireneae*
- *Stylidium longitubum*
- *Stylidium striatum*
- *Thysanotus glaucus*
- *Tripterococcus* sp. Brachylobus (A.S. George 14234)
- *Trithuria australis*
- *Verticordia lindleyi* subsp. *lindleyi*

Biologic

Table 2.3: Summary of the assessment of occurrence

Taxa (Conservation Status)	Alcoa Myara rating	Source	Proximity from Survey Area
Highly Likely			
Acacia horridula (P3)	High	A, B, D	0.4 km SE
Calothamnus graniticus subsp. *leptophyllus* (P4)	High	A, B	0.03 km NNW
Pimelea rara (P4)	High	A, B, D	0.4 km NNE
Senecio leucoglossus (P4)	High	A, B, D	1.1 km WSW
Likely			
Hibbertia hortiorum (P1)	High	A, B, D	0.8 km S
Thysanotus anceps (P3)	High	A, B	4.4 km SE
Grevillea pimeleoides (P4)	High	A, B, D	0.9 km WNW
Stylidium ireneae (P4)	High	A, B, D	0.4 km WSW
Possible			
Hibbertia acrotoma (P1)	High	A, B	1 km WSW
Bossiaea modesta (P2)	Moderate	A, B	6.1 km SE
Tetratheca phoenix (P2)	High	A, B, D	3 km ENE
Cyathochaeta teretifolia (P3)	High	A, B, D	1.6 km WNW
Acacia oncinophylla subsp. *patulifolia* (P4)	High	A, B	4.4 km S
Cyanothamnus tenuis (P4)	High	A, B, D	0.4 km WSW
Eucalyptus x *graniticola*	Moderate	A, B	1.7 km S
Anthocercis gracilis (T)	High	A, B, C	0.9 km WSW

Source key: A = Alcoa likelihood assessment, B = DBCA (TPFL &/or WAH) (DBCA, 2023b), C = Protected Matters Search Tool (EPBC) (DCCEEW, 2023), D = Atlas of Living Australia (ALA) (ALA, 2023).

3 Field Survey

3.1 Methods

3.1.1 Survey Timing & Personnel

Two field surveys were conducted at the Survey Area, totalling 25 person days from four personnel. Project roles and licences are listed in Table 3.1. The field survey dates, and effort are as follows:

- Targeted Trip 1: 9-13 October 2023 (16 person days)
- Targeted Trip 2: 29 November – 1 December 2023 (9 person days).

Table 3.1: Project team & licences

Biologic Personnel	Project Involvement	Licencing	Experience
Principal Botanist			
Clinton van den Bergh	Project management support, reviewer for quality assurance	-	19 yrs
Ryonen Butcher	Field team lead; taxonomic support. Field Survey: Trip 1: 9-13 October 2023 Trip 2: 29 November – 1 December 2023	FB62000405 TFL 145-2122	26 yrs
Senior Botanist			
Julie Fielder	Field Survey: Trip 1: 9-13 October 2023 Trip 2: 29 November – 1 December 2023	FB62000476	>20 yrs
Rachel Meissner	Specimen identification lead	-	27 yrs
Botanist			
Kaylin Geelhoed	Field survey lead; reporting lead; data management. Field Survey: Trip 1: 9-13 October 2023 Trip 2: 29 November – 1 December 2023	FB62000238-2	6 yrs
Darcy Reith	Field Survey: Trip 1: 9-13 October 2023	FB62000359 TFL 2223-0092	6 yrs

3.1.2 Weather & Climate

Long-term average (LTA) climate data and monthly temperature and rainfall data was drawn from the Bureau of Meteorology (BoM) Karnet weather station (station 9111, located ~6 km north), however, monthly rainfall data at this station was inconsistent, missing several days of rainfall data during most months. Therefore, monthly rainfall data was also drawn from the Mount Solus weather station (station 9260, located ~9 km east), which has consistent data.

Daytime climatic conditions during the field survey were fine and dry, with a maximum temperature of 27.4°C during Trip 1, and 33°C during Trip 2. Maximum temperatures experienced during the field survey were hotter than the long-term average (LTA) for both October (Trip 1 – 20.9°C) and November (Trip 2 – 24.5°C) (BoM, 2024). Weather conditions did not present any survey limitations. In the three months prior to the survey, total rainfall was observed at 120.4 mm which is less than the equivalent total of the long term average for the same time of year; 149.2 mm (BoM, 2024).

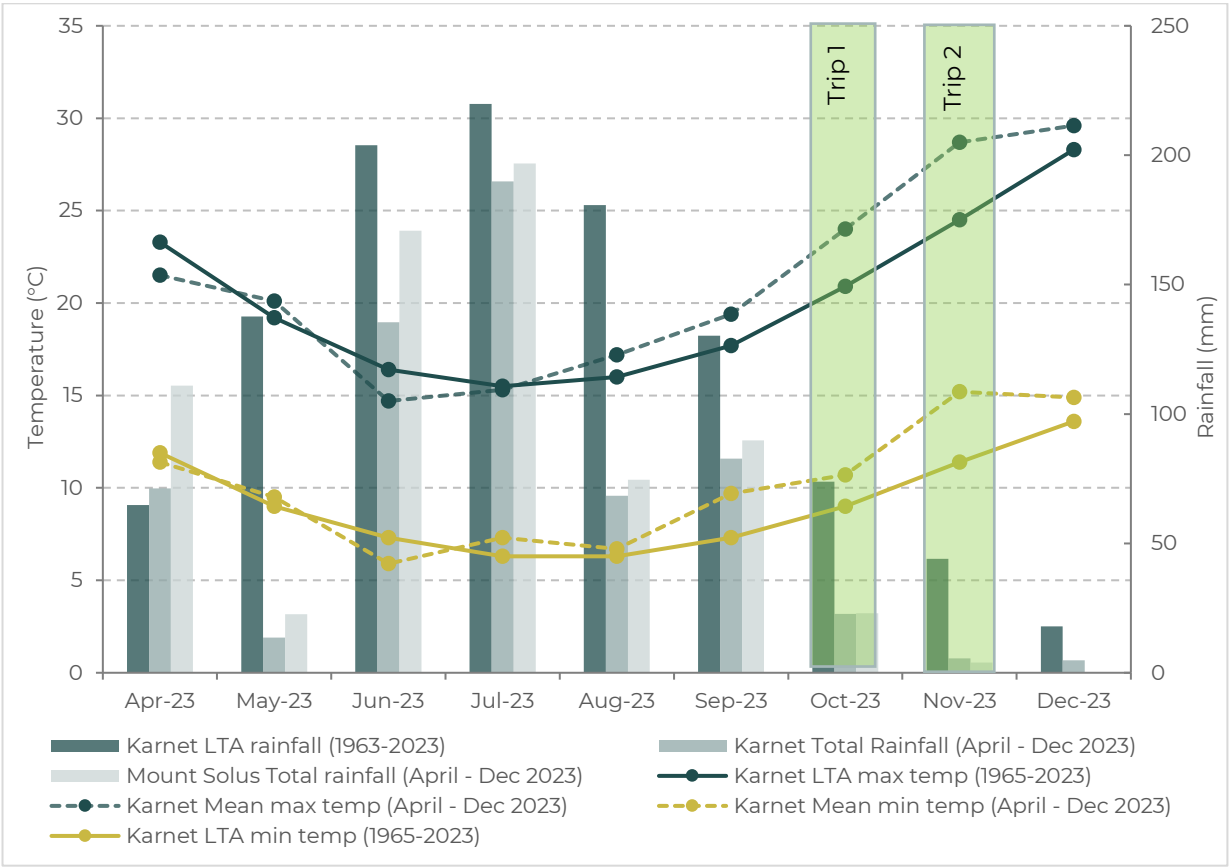


Figure 3.1: Long term and current climatic data for the Survey Area (BoM Station #009111 and #009260)(BoM, 2024) with approximate survey timing shown in shaded box.

3.1.3 Targeted Flora Survey

The targeted field survey involved botanists walking grid lines approximately 10 to 20 m apart searching for significant flora and significant weeds within the Survey Area (Figure 3.2). The key species that were targeted include those that are known to occur in the Survey Area, and those that are considered to be highly likely, likely, or possible to occur following the assessment of occurrence (Table 2.3).

Where a significant flora species was identified in the field, searches were conducted within a minimum radius of 10 m from the given specimen, to document the number of individual plants and the spatial extent of the population. Where possible, the entire population was traversed to determine the extent and size of the population. Depending on the number and density of individuals, coordinates were either recorded per plant, or for a number of individuals within a 10 m radius. The following information was recorded as part of each search:

- GPS track logs of search effort;
- number, condition, and reproductive status of individuals in each population if present;
- coordinates of either each plant (if few) or the extent of the population (if many) using a GPS; and
- photographs of individuals and of the broad vegetation community and habitat.

Threatened and Priority Flora Report Forms (TPRFs) will be completed and submitted to the Department of Biodiversity, Conservation and Attractions (DBCA), as required under the flora collecting permits. Conservation significant flora specimens will be vouchered with the Western Australian Herbarium (WAH) where required and appropriate.

3.1.4 Nomenclature & Specimen Identification

Flora nomenclature used in this report is consistent with the WAH's plant census, provided on Florabase (WAH, 1998-). All species names are current at the time of report preparation. Specimens were identified by Senior Botanist, Dr Rachel Meissner, and Principal Botanist, Ryonen Butcher, supported by the Biologic botanical team, using the appropriate taxonomic keys, Western Australian reference herbarium and, where required, relevant taxonomic experts at the WAH. Specimens identified as being of significance (i.e. Threatened, Priority listed), or difficult to identify specimens were submitted to WAH for authoritative identification (accession number 10705).

412000 414000 416000 418000

6410000 6408000 6406000

Kingsbury Dr

LEGEND

Survey Area

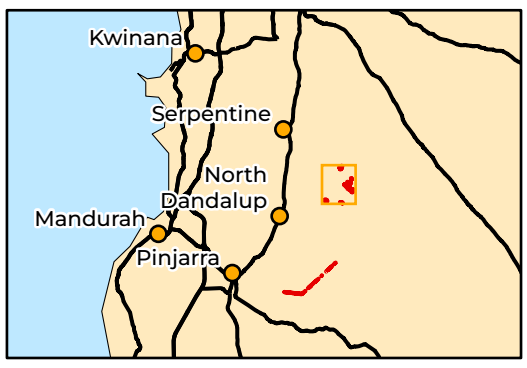
Traverse

Local Road

Scale 1:23,800

0 0.5 1 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 23/02/2024



Biologic

ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 3.2a: Survey effort and traverses of the Survey Area

410000 412000 414000 416000

6394000 6392000 6390000 6388000

LEGEND

Survey Area

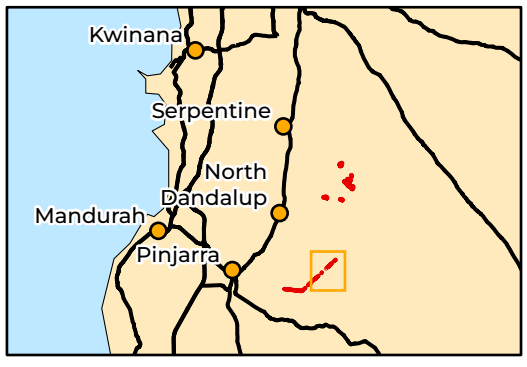
Traverse

Local Road

Scale 1:23,800

0 0.5 1 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 23/02/2024



Biologic

ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 3.2b: Survey effort and traverses of the Survey Area

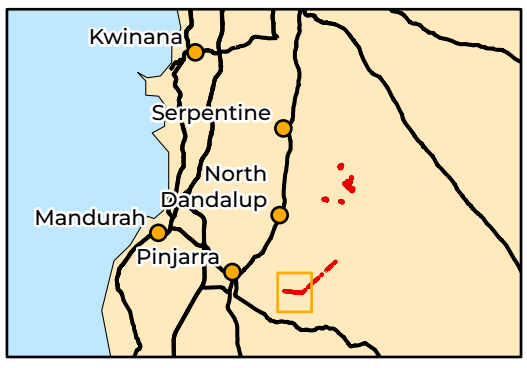
404000
406000
408000
6390000
6388000
6386000
6384000
Del Park Rd
North Spur Rd
Scarp Rd
Grey Rd

LEGEND

Survey Area
Traverse
Local Road

Scale 1:23,800
0 0.5 1 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 23/02/2024



Biologic

ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 3.2c: Survey effort and traverses of the Survey Area

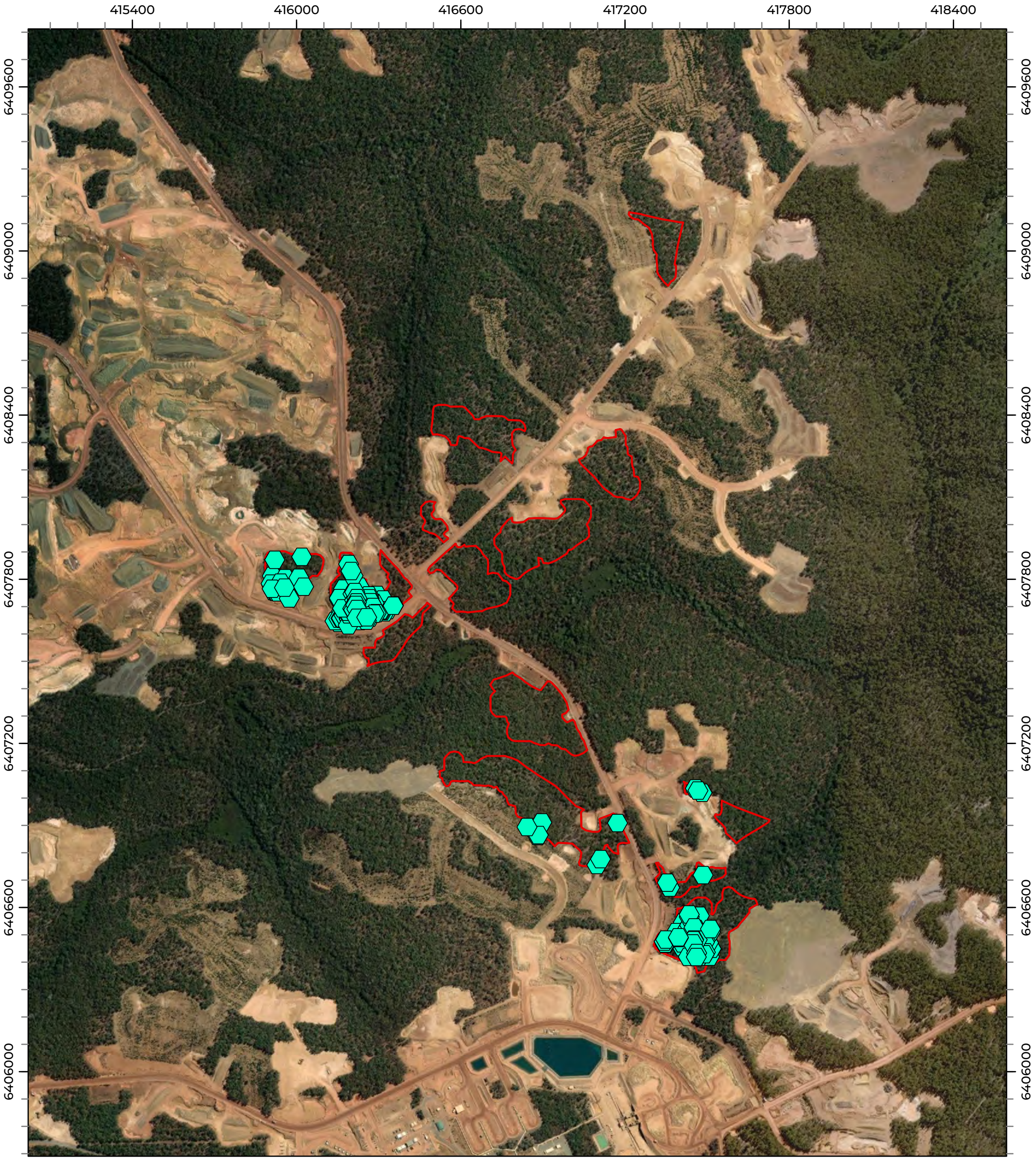
3.1.5 Introduced Flora

While completing the targeted survey, locations of any significant environmental weeds (WoNS and DPs listed under Section 12 and Section 22 of the BAM Act) located in the survey area were recorded. If found, searches within a minimum 20 m radius from the given specimen were conducted to document the number of individual plants and map the spatial extent of the infestation.

3.2 Results

3.2.1 Significant Flora

Four significant flora taxa were recorded from the Survey Area during the Spring targeted surveys, *Acacia horridula* (P3), *Thysanotus anceps* (P3), *Senecio leucoglossus* (P4), and *Stylidium ireneae* (P4). Detailed descriptions and a summary of the population density and extent is provided in Table 3.2, while location information is presented in Figure 3.3. Counts of individuals were estimated when the populations were large.



LEGEND

Survey Area

Significant Flora

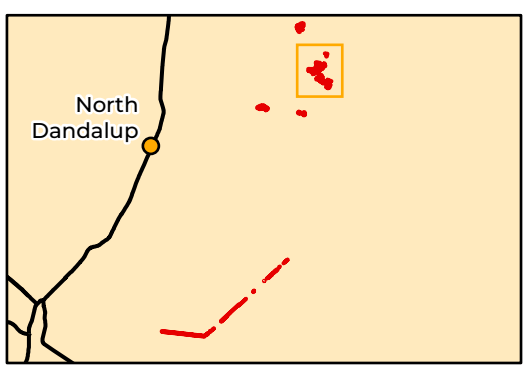
Senecio leucoglossus - P4

Scale 1:13,000

0 100 200 300 400 Meters

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator

Created: 26/02/2024



Biologic

ALCOA

Huntly-Myara

Targeted Flora Survey

Figure 3.3a: Significant flora recorded in the Survey Area

413600 414200 414800 415400 416000 416600

6406000 6405400 6404800 6404200 6403600 6403000 6402400

LEGEND

Survey Area

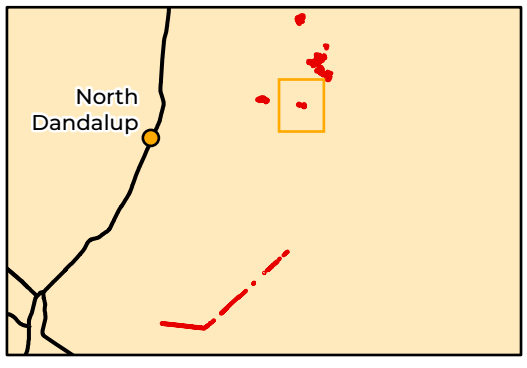
Significant Flora

Thysanotus anceps - P3

Scale 1:13,000

0 100 200 300 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 26/02/2024



Biologic

ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 3.3b: Significant flora recorded in the Survey Area

411200 411800 412400 413000 413600 414200

6393400 6392800 6392200 6391600 6391000 6390400 6389800

LEGEND

Survey Area

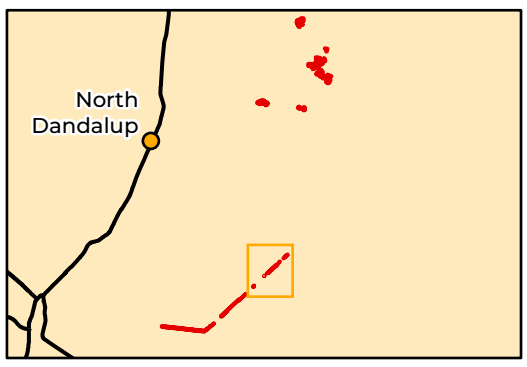
Significant Flora

Thysanotus anceps - P3

Scale 1:13,000

0 100 200 300 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 26/02/2024



Biologic

ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 3.3c: Significant flora recorded in the Survey Area

407600 408200 408800 409400 410000 410600

6389800 6389200 6388600 6388000 6387400 6386800 6386200

Del Park Rd

LEGEND

- Survey Area
- Local Road

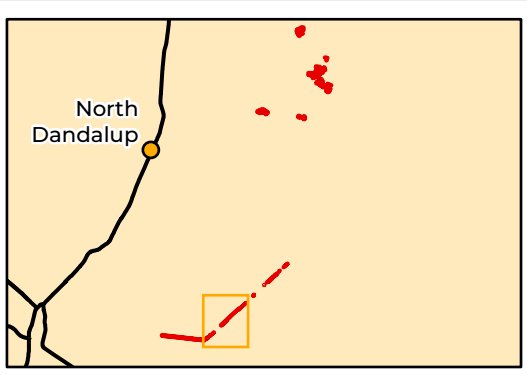
Significant Flora

- *Acacia horridula* - P3
- *Senecio leucoglossus* - P4
- *Stylidium irenae* - P4

Scale 1:13,000

0 100 200 300 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 26/02/2024



Biologic

ALCOA
Huntly-Myara
Targeted Flora Survey

Figure 3.3d: Significant flora recorded in the Survey Area

404600 405200 405800 406400 407000 407600

6388600 6388000 6387400 6386800 6386200 6385600 6385000

North Spur Rd

LEGEND

- Survey Area
- Local Road

Significant Flora

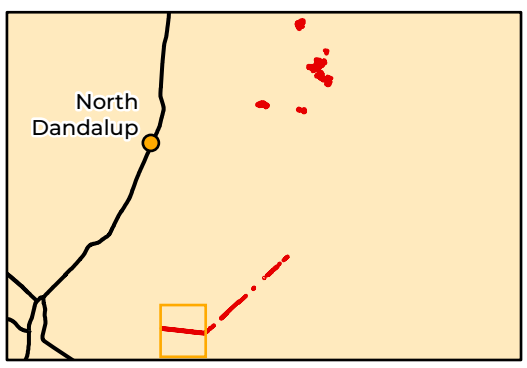
- *Acacia horridula* - P3
- *Calothamnus graniticus subsp. leptophyllus* - P4

Scale 1:13,000

0 100 200 300 400 Meters

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator

Created: 26/02/2024



Biologic

ALCOA

Huntly-Myara

Targeted Flora Survey

Figure 3.3e: Significant flora recorded in the Survey Area

Table 3.2 Significant flora recorded in the Survey Area

Description	Habitat	Results of targeted assessment	Representative floristic material / habit and/or habitat
Priority 3			
Acacia horridula A harsh, slender, single stemmed shrub that grows 0.3 – 0.6 m high. The branchlets are normally red-brown, puberulous, with antrorse to patent hairs. (DBCA, 2021). Phyllodes are semi-trullate, often crowded, acuminate, pungent, and glabrous, with a prominent midrib. The inflorescences are simple, with one per axil, and globular heads, while the flowers are pale-yellow or cream and occur from May to August (DBCA, 2021; WAH, 1998-). The pods of *Acacia horridula* are elongated, generally terete, curved, striated, and narrowed at both ends.	*Acacia horridula* is known to occur in sand or gravelly soils over granite, and rocky hillsides of the Jarrah Forest and Swan Coastal Plain IBRA regions. It is often recorded in open *Eucalyptus* woodland vegetation, however, can also be found in dense shrubland (WAH, 1998-).	Twenty-one individuals of *Acacia horridula* were recorded from eight locations within the Survey Area. All records of *Acacia horridula* were recorded from along the conveyor between Banksiadale and Oakley.	 Source: World Wide Wattle (DBCA, 2023d) (left), Biologic photo (right)
Thysanotus anceps A rhizomatous, perennial herb, growing to 0.4 m high. It is generally leafless; however, leaves may be present in young plants only. The stem persists for more than one year, branches monopodially three or four times, is quadrangular and hirsute at the base, then becoming glabrous and flattened above (Brittan, 1987). This taxon produces purple flowers with elliptic petals and six stamens, generally between October to December (Brittan, 1987; WAH, 1998-).	*Thysanotus anceps* is known to occur in white or grey sand, lateritic gravel, and soils. It has been recorded in the Geraldton Sandplains, Jarrah Forrest and Swan Coastal Plain IBRA regions (Brittan, 1987; WAH, 1998-).	Nine individuals of *Thysanotus anceps* were recorded from nine locations within the Survey Area. *Thysanotus anceps* was identified along the conveyor system and in the Myara mining area.	  *Thysanotus anceps* Source: Biologic photo (left), Florabase (WAH, 1998-) (right)
Priority 4			
Senecio leucoglossus An erect, glabrous annual herb, growing to 1 m in height. The leaves are coarsely dentate to pinnatisect, with 2-5 projections per side (Wilson, 2015). The flowers are white and are produced between August and December, and the fruit are dry, indehiscent and achene (WAH, 1998-; Wilson, 2015).	*Senecio leucoglossus* is known to occur in gravelly brown/ grey loam or clayey sand over laterite or granitic soils (WAH, 1998-), often growing on hillsides or slopes, ridges, or amongst granite rocks. It has been recorded from the Jarrah Forest, Swan Coastal Plain and Warren IBRA regions, from Perth to just north of Donnelly River (WAH, 1998-).	Eight hundred and nineteen individuals of *Senecio leucoglossus* were recorded from 162 locations within the Survey Area. Most of the records (~155 locations) occurred in the Myara mining area, while the remaining locations occurred along the conveyor.	  Source: Biologic photo

Description	Habitat	Results of targeted assessment	Representative floristic material / habit and/or habitat
Stylidium ireneae An erect, perennial herb, up to 0.3 m high and forming a small compact bush (Lowrie & Kenneally, 1998). The rosette nodes are situated on the soil surface or are shortly prop-rooted and connected by leafless stolons. The stems are maroon coloured, longitudinally ridged, sparsely glandular-hairy, with a few caducous leaves and a terminal rosette of crowded leaves (Lowrie & Kenneally, 1998). Leaves are oblanceolate-spathulate, lunate in section, minutely mucronate at the apex, and very sparsely hairy or almost glabrous. The inflorescence of this taxon is racemose, while the flowers are pink, and are produced between October and December (Lowrie & Kenneally, 1998; WAH, 1998-).	Stylidium ireneae is known to occur in brown or white loamy sand , often over laterite, and grows in valleys near creek lines, and often with Agonis (Lowrie & Kenneally, 1998; WAH, 1998-). Most records of Stylidium ireneae occur in the Northen Jarrah Forest near Dwellingup, with other records occurring on the Swan Coastal Plain, near Perth, and in the Warren region, near Augusta and Manjimup (WAH, 1998-).	Two individuals of *Stylidium ireneae* were recorded from one location within the Survey Area. The two individuals of *Stylidium ireneae* were recorded along the conveyor system.	  Source: Florabase (WAH, 1998-) (left), Biologic photo (right)

3.2.2 Introduced Flora

No environmentally significant weeds (WoNS or DPs) were recorded during the Spring field surveys. Although weeds were observed throughout the survey area (i.e. **Hypochaeris glabra*, **Taraxacum* sp.), none were identified to be WoNS or DPs for the local region.

3.3 Review of Occurrence Assessment

No significant flora taxa were known to occur within the Survey Area prior to mobilisation. Two Priority 3 taxa (*Acacia horridula* and *Thysanotus anceps*), and two Priority 4 taxa (*Senecio leucoglossus* and *Stylidium ireneae*) were recorded during the field survey, which are now confirmed to occur (Table 3.3, Figure 3.3). The full assessment of occurrence pre and post-survey is presented in Appendix B. A summary of the changes to the Highly Likely, Likely and Possible pre-survey taxa, and the reasoning for the change is presented in Table 3.3.

Of the four taxa previously deemed Highly Likely to occur in the Survey Area (Table 3.3):

- *Acacia horridula* (P3) was confirmed;
- *Senecio leucoglossus* (P4) was confirmed;
- *Calothamnus graniticus* subsp. *leptophyllus* (P4) is now considered Possible; and
- *Pimelea rara* (P4) is now considered Possible.

Of the four taxa considered Likely in the pre-survey assessment, two were confirmed, one is now considered Possible, and one is now considered Unlikely to occur in the Survey Area. The eight taxa considered Possible in the pre-survey assessment are now all considered Unlikely or Highly Unlikely to occur in the survey area (Table 3.3).

Table 3.3: Summary of the review of assessment of occurrence

Taxon	Post-Survey Likelihood	Reasoning
Pre-survey likelihood – Highly Likely		
Acacia horridula (P3)	Confirmed	Recorded during the Spring targeted surveys
Senecio leucoglossus (P4)	Confirmed	
Calothamnus graniticus subsp. *leptophyllus* (P4)	Possible	A known location of this taxa was visited, and a collection was made during the survey, which was confirmed post-survey. This enabled the team to familiarise themselves with this taxon's habit and habitat. Suitable habitat observed when visiting the location was not seen during the surveys, however, is potentially within the greater Myara Survey Area.

Taxon	Post-Survey Likelihood	Reasoning
Pimelea rara (P4)	Possible	Taxon is inconspicuous when not in flower, and the survey was out of season for this taxon (Summer flowering time). Suitable habitat is potentially within the greater Myara Survey Area.
Pre-survey likelihood – Likely		
Thysanotus anceps (P3)	Confirmed	Recorded during the Spring targeted surveys
Stylidium ireneae (P4)	Confirmed	
Hibbertia hortiorum (P1)	Possible	Based on Florabase records, this species occurs within the Huntly-Myara area; however, that collection has been only tentatively identified as *Hibbertia hortiorum* (M. Hislop, WAH, pers. comm.). This species is only subtly distinguished from *H. ovata*, which is morphologically variable across its range. All *Hibbertia* voucher specimens collected during this survey were identified as *H. ovata* at the WAH based on leaf size and indumentum, and sepal indumentum characters. Additional taxonomic work is needed to determine whether the prostrate, mat-forming habit that defines *H. hortiorum* is sufficient to recognise it as different from *H. ovata*.
Grevillea pimeleoides (P4)	Unlikely	Suitable habitat (rocky hillsides, gravelly soils over granite) for this taxon does not appear to occur within the Survey Area.
Pre-survey likelihood – Possible		
Acacia oncinophylla subsp. *patulifolia* (P4)	Unlikely	Suitable habitat (granitic soils) for this taxon does not appear to occur within the Survey Area.
Anthocercis gracilis (T)	Highly Unlikely	Suitable habitat of these taxa does not occur within the Survey Area
Hibbertia acrotoma (P1)	Highly Unlikely	
Bossiaea modesta (P2)	Highly Unlikely	
Tetratheca phoenix (P2)	Highly Unlikely	
Cyathochaeta teretifolia (P3)	Highly Unlikely	
Cyanothamnus tenuis (P4)	Highly Unlikely	
Eucalyptus ×graniticola (P4)	Highly Unlikely	

3.4 Limitations and Constraints

The (EPA, 2016b) outlines several potential limitations to flora surveys. These aspects are assessed and discussed in Table 3.4. No major limitations or constraints were identified for the survey.

Table 3.4: Survey limitations and constraints

Potential limitation or constraint	Constraint	Applicability to this survey
Availability of data and information	No	The Jarrah Forest bioregion has been subjected to numerous biological surveys, with many commissioned by Alcoa, and enough contextual work was available to complete the assessment
Competency/ experience of the survey team, including experience in the bioregion surveyed	No	The field personnel involved in the survey are experienced in undertaking targeted surveys of similar nature, including within the Jarrah Forest bioregion, and with the species of significance targeted during the survey. Both Ryonen Butcher and Julie Fielder have 5+ yrs of experience conducting surveys within the Jarrah Forest bioregion.
Proportion of flora recorded/collected and any identification issues	No	The targeted flora survey was conducted within the guidance for flora and vegetation assessment of WA (EPA, 2016b). All flora encountered was either identified in the field or collected by field staff. All specimens collected and observed in the field were able to be confirmed by Biologic taxonomists or were confirmed by WAH (accession number 10705).
Timing, weather, and season	No	Rainfall was below average but adequate for this level of survey. The field surveys were conducted in the optimal seasonal timing for this bioregion (spring), and for the Southwest botanical province. Surveys could also be conducted across different seasons to capture specific conservation significant flora that flower during other seasons (i.e. *Pimelea rara*, highly likely to occur but only flowers during Summer and is otherwise inconspicuous). However, as the optimal timing for the majority of significant flora likely to be identified in the survey area is spring, the October to December surveys undertaken were during the optimal season and not considered a limitation. Conditions experienced during and prior to both surveys were considered normal of the season and were not considered a limitation.
Disturbance that may have affected results, e.g. fire, flood	Yes – Minor	Dust was a concern during Trip 1 (October) as the Survey Areas visited were situated along a major haul road. Dry conditions and frequent use caused the roads and adjacent bushland to be very dusty, with a thick layer of dust covering approximately 10 m of bushland from the road, which could potentially cover small, juvenile, or inconspicuous significant taxa.

Potential limitation or constraint	Constraint	Applicability to this survey
Appropriate area fully surveyed (effort & extent)	No	Time and access restrictions meant that the team was only able to survey a small proportion of the provided Survey Area. However, any missed areas are to be surveyed during 2024. The areas surveyed during the spring surveys were adequately searched, with the team walking grid lines approximately 10 to 20 m apart. The first day and a half of Trip 1 (October 2023) was spent completing inductions (both online and in-person) and sorting out site access. This resulted in field survey time being three of the five allocated days. Additionally, during Trip 2 (Nov/ Dec 2023), half a day was lost to blast road closures.
Access restrictions within the Survey Area	Yes – Minor	Part of the conveyor Survey Area was not able to be completed due to clearing works taking place along the conveyor corridor. This clearing occurred under powerlines under the clearing act and meant that a small area (~280 m long and 5 m wide) along the conveyor, approximately 5 km southwest of Banksiadale, could not be surveyed. The team noticed the work just before the start of this area and we weren't able to pass by the works to check the other end. As we weren't able to access this section, it was missed during the current survey and will hopefully be assessed during the 2024 surveys. This area was also not shown on any of the figures as the figures only displayed areas that were traversed and searched.
Problems with data and analysis, including sampling bias	No	No limitations with data collection were encountered during the field survey. No statistical analysis was conducted.

4 Conclusion

A targeted flora survey was conducted for the Huntly-Myara Survey Area, located 63 km southeast of Perth, in the Northern Jarrah Forrest IBRA subregion, and covering an area of approximately 110 ha. The surveys occurred in October, November, and December 2023, totalling 25 person days. There were minor constraints that limited the survey (access restrictions and minor disturbances). The survey and reporting have been completed in line with EPA and Alcoa guidelines.

The key outcomes of the survey are as follows:

- Four taxa of significance were recorded during the survey, including:
  - *Acacia horridula* (P3), 21 individuals of from eight locations;
  - *Thysanotus anceps* (P3), nine individuals from nine locations.
  - *Senecio leucoglossus* (P4), 819 individuals from 162 locations;
  - *Stylidium ireneae* (P4), two individuals from one location; and
- No significant environmental weed species (WoNS or DPs) were recorded during the survey.

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Appendix A: State and commonwealth conservation codes

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Threatened Fauna and Flora Species	
Extinct (EX)	A native species is eligible to be included in the Extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	A native species is eligible to be included in the Extinct in the Wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CR)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the Conservation Dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming Vulnerable, Endangered or Critically Endangered; or (b) the following subparagraphs are satisfied (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; and (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Category	Definition
Threatened Ecological Communities (TEC)	
Critically Endangered	An ecological community is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	An ecological community is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered nor endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Biodiversity Conservation Act 2016

Category	Definition
Threatened Fauna and Flora Species	
Critically Endangered (CR)	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Published under schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.
Endangered (EN)	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Published under schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.
Vulnerable (VU)	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Published under schedule 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.

Category	Definition
Extinct in the Wild (EW)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened flora species listed as extinct in the wild.
Threatened Ecological Communities (TEC)	
Critically Endangered (CR)	An ecological community is eligible for listing in the category of critically endangered ecological community at a particular time if, at that time — (a) it is facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines; and (b) listing in that category is otherwise in accordance with the ministerial guidelines.
Endangered (EN)	An ecological community is eligible for listing in the category of endangered ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community; and (b) it is facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.
Vulnerable (VU)	An ecological community is eligible for listing in the category of vulnerable ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community or an endangered ecological community; and (b) it is facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.
Collapsed	An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time — (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover — (i) its species composition or structure; or (ii) its species composition and structure.

Department of Biodiversity, Conservation and Attractions Priority Definitions

Category	Definition
Priority Fauna and Flora Species	
Priority 1 (P1)	Poorly-known Species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural, or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 (P2)	Poorly-known Species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g., national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3 (P3)	Poorly-known Species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 (P4)	Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Furthermore, any species or ecological communities that may be rare but for which there is insufficient information available to allocate a threatened status under the BC Act, can also be listed as Priority species by the WA Department of Biodiversity, Conservation and Attractions (DBCA).

Significant flora may extend beyond the assigned codes and in line with EPA (2016b) may include:

- Being identified as Threatened, Critically Endangered, Endangered, Vulnerable, Extinct or Extinct in the Wild species (State listed BC Act and/or commonwealth listed EPBC Act);
- Being listed as Priority flora species (DBCA, 2023c);
- Locally endemic or associated with a restricted habitat type (e.g., surface water or groundwater dependent ecosystems);
- New species or anomalous features that indicate a potential new species;
- Range extensions or representative of outer population extent (particularly at the extremes of range, recently discovered range extensions or isolated outliers of the main range);
- Unusual species; restricted subspecies, varieties, naturally occurring hybrids, or complex taxonomic groups; or
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant vegetation may extend beyond the assigned codes and in line with EPA (2016b) may include:

- Being identified as Threatened Ecological Community (TEC), Critically Endangered, Endangered, Vulnerable or Collapsed ecological community (State listed BC Act and/or commonwealth listed EPBC Act)
- Identified as a Priority Ecological Community (PEC) (DBCA, 2023a);
- Restricted or endemic distribution;
- Degree of historical impact from threatening processes (such as mining or agricultural);
- A role as a refuge for significant flora; or
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

Introduced flora

Legal Status Definitions of Listed Plants in Western Australia

Legal status	Definition
Declared Pest, Prohibited – s12	Prohibited organisms are declared pests by virtue of section 22(1) and many only be imported and keep subject to permits
Declared Pest – s22(2)	Declared pests must satisfy any applicable import requirements when imported and may be subject to control keeping requirements
Permitted – s11	Permitted organisms must satisfy applicable import requirements and import permits (where required)
Permitted Requires Permit – r73	Regulation 73 permitted organisms may be subject to restriction under legislation other and the BAM Act (2007)
Unlisted	Unlisted organisms are prohibited in WA
Control Categories	**Definition**
C1 Exclusion	Organisms should be excluded from parts or all of WA
C2 Eradication	Organisms should be eradicated from all or parts of WA
C3 Management	Organisms should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism, or prevent or contain the spread of the organism
Unassigned	Declared pests that are recognised a having a harmful impact under certain circumstances where their subsequent control requirements are determined by a plan or other legislative arrangements under the Act
Keeping Categories	**Definition**
Prohibited Keeping	Can only be kept under a permit or public display, education, or scientific purposes
Restricted Keeping	Kept under a permit by private individuals due to low risk of becoming a problem for the environment
Exempt Keeping	No permit or conditions are required for keeping. Organism may be subject to restrictions under the Wildlife Conservation Act (1950)

Appendix B: Biologic flora assessment of occurrence

Taxon	Source			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Source	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Pre-survey likelihood – Highly Likely									
Acacia horridula	P3			Harsh, slender, single-stemmed shrub, 0.3-0.6(-1) m high. Fl. yellow, May to Aug. Gravelly soils over granite, sand. Rocky hillsides.	Yes	Yes	0.4 km SE	A, B, D	Confirmed
Senecio leucoglossus	P4			Erect annual, herb, to 1.3 m high. Fl. white, Aug to Dec. Gravelly lateritic or granitic soils. Granite outcrops, slopes.	Yes	Yes	1.1 km WSW	A, B, D	Confirmed
Calothamnus graniticus subsp. *leptophyllus*	P4			Erect, multi-stemmed shrub, 1-2 m high. Fl. red, Jun to Aug. Clay over granite, lateritic soils. Hillsides.	Yes	Yes	0.03 km NNW	A, B	Possible
Pimelea rara	P4			Shrub, 0.2-0.35 m high. Fl. white, Dec or Jan. Lateritic soils.	Yes	Yes	0.4 km NNE	A, B, D	Possible
Pre-survey likelihood – Likely									
Thysanotus anceps	P3			Rhizomatous, leafless perennial, herb, to 0.4 m high. Fl. purple, Oct to Dec. White or grey sand, lateritic gravel, laterite.	Yes	Yes	4.4 km SE	A, B	Confirmed
Stylidium ireneae	P4			Lax perennial, herb, (0.06-)0.1-0.28 m high, Leaves oblanceolate, 0.4-2 cm long, 1-3 (-5) mm wide, apex subacute to acuminate, margin entire, glandular. Inflorescence racemose. Fl. pink, Oct to Dec. Sandy loam. Valleys near creek lines, woodland, often with Agonis.	Yes	Yes	0.4 km WSW	A, B, D	Confirmed
Hibbertia hortiorum	P1			Prostrate, densely-spreading, mat forming shrubs, to 0.1 m high and 0.6 m wide. Fl. yellow, Sep-Oct. Brown sandy gravels over laterite of jarrah-marri forest. Slopes, roadsides.	Yes	Yes	0.8 km S	A, B, D	Possible
Grevillea pimeleoides	P4			Non-lignotuberous shrub, 0.4-2.4 m high. Fl. yellow-orange, May to Nov. Gravelly soils over granite. Rocky hillsides.	No	Yes	0.9 km WNW	A, B, D	Unlikely
Pre-survey likelihood – Possible									
Acacia oncinophylla subsp. *patulifolia*	P4			Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Fl. yellow, Aug to Nov or Nov to Dec. Granitic soils, occasionally on laterite.	No	Yes	4.4 km S	A, B	Unlikely
Anthocercis gracilis	T	VU	VU	Erect, spindly shrub, to 0.6(-1) m high. Fl. yellow-green, Sep to Oct. Sandy or loamy soils. Granite outcrops.	No	Yes	0.9 km WSW	A, B, C	Highly Unlikely
Hibbertia acrotoma	P1			Lax, openly-branched, prostrate to spreading shrubs, 0.2 – 0.5 m high, to 0.4 m wide. Fl. yellow, Aug-Sep. Dark brown and/or yellow loam or sandy loam over laterite or granite in moist jarrah-marri forest. Hillsides, steep slopes, and among large granite boulders.	No	No	1 km WSW	A, B	Highly Unlikely
Bossiaea modesta	P2			Slender, trailing & twining shrub. Fl. yellow & red, Oct to Dec. Soils derived from granite. Damp areas close to stream.	No	Yes	6.1 km SE	A, B	Highly Unlikely
Tetratheca phoenix	P2			Few-branched shrub (subshrub), to 0.25 m high. Brown gravelly loam over granite. Mid-upper slopes, often near large rock outcrops.	Possible	Adjacent	3 km ENE	A, B, D	Highly Unlikely
Cyathochaeta teretifolia	P3			Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	No	Adjacent	1.6 km WNW	A, B, D	Highly Unlikely

Taxon	Source			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Source	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Cyanothamnus tenuis	P4			Procumbent or erect and slender perennial shrub, to 0.5 m high. Fl. blue. Brown sandy clay or loam over granite. Hillsides, amongst granite outcrops.	No	Yes	0.4 km WSW	A, B, D	Highly Unlikely
Eucalyptus x *graniticola*	P4			(Mallee) Erect-stemmed, lignotuberous, to 4 m tall, bark smooth, cream, powdery, sometimes rough–grey and flaky at base. Fl. cream, Sep-Nov. Grows on granite, ocbil surrounded by sloping sheet granite rock as an isolated emergent mallee.	No	Adjacent	1.7 km S	A, B	Highly Unlikely
Pre-survey likelihood – Unlikely									
Morelotia australiensis	T	VU	VU	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown, Nov to Dec. Grey/brown sandy clay loam. Flat plains.	Possible	Yes	7.5 km WSW	A, B, C	Unlikely
Millotia tenuifolia var. *laevis*	P2			Ascending to erect annual, herb, 0.02-0.1 m high. Fl. yellow, Sep to Oct. Granite or laterite soils.	Possible	Yes	17.1 km NNW	A, B	Unlikely
Acacia oncinophylla subsp. *oncinophylla*	P3			Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Fl. yellow, Aug to Oct. Granitic soils.	Possible	Yes	8.4 km SE	A, B	Unlikely
Adenanthos cygnorum subsp. *chamaephyton*	P3			Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Fl. white-cream-pink-green/green, Jul or Sep to Dec or Jan. Grey sand, lateritic gravel.	Possible	Yes	49 km NNE	A	Unlikely
Asteridea gracilis	P3			Annual, herb, 0.15-0.35 m high. Fl. white-pink, Sep to Dec. Sand, clay, gravelly soils.	Possible	Yes	37.9 km N	A, B	Unlikely
Gastrolobium sp. Asperum (F. Hort 2864)	P3			Erect, spreading, or spindly shrub, to 1 m tall. Fl. yellow, red or orange, Sep. Dry yellow/brown sand, or loam over laterite. Low slopes, flats, along graded boundary tracks.	Possible	No	15 km E	A, B	Unlikely
Lasiopetalum glutinosum subsp. *glutinosum*	P3			Perennial, multi stemmed shrub, 0.5-1.5 m high. Fl. pink/purple. Brown silty clay/sandy loam. Outcrops, slopes, valleys.	Possible	No	4.4 km WNW	A, B	Unlikely
Andersonia sp. Saxatilis (F. & J. Hort 3324)	T	CR		Erect, single stemmed shrub, multi-branching above ground level and dividing into dense terminal branchlets, growing to 1 m high. Flowers white/pink, Sept-Nov. Dry brown sand, or loam. Granite outcrops, slopes.	No	No	12.1 km NE	A, B	Highly Unlikely
Diuris drummondii	T	VU	VU	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	No	No	11.2 km W	A, B	Highly Unlikely
Diuris purdiei	T	EN	EN	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps.	No	No	4.7 km WNW	A, B, C	Highly Unlikely
Eleocharis keigheryi	T	VU	VU	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans.	No	No	19 km SSW	A, B	Highly Unlikely
Grevillea flexuosa	T	VU	VU	Irregular few-branched, non-lignotuberous shrub, to 2 m high. Fl. creamy-yellow, Jul to Oct. Red-brown sand with laterite & gravel, sand over granite. Ridgetop plateau & associated breakaways.	No	No	14.5 km NNE	A, B	Highly Unlikely
Lasiopetalum pterocarpum	T	CR	EN	Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Fl. pink, Aug to Dec. Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines.	No	No	2.8 km NNW	A, B, C, D	Highly Unlikely

Taxon	Source			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Source	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Darwinia hortiorum	P1			Erect to spreading, densely branched, compact, glabrous shrubs, to 0.7 m tall, to 0.8 m wide. Fl. green and red, Sep to Dec. Loam, or loam/clay soil associated with laterite. Jarrah forest, growing in association with large granite outcrops and their drainage lines.	No	No	14.5 km ENE	A, B, D	Highly Unlikely
Paracaleana gracilicordata	P1			Perennial, herb, to 0.07 m high. Fl. green-yellow-purple, Oct to Nov. Growing on moss mats, granite. Outcrops.	No	No	10.9 km N	A, B, D	Highly Unlikely
Paracaleana granitica	P1			Perennial, herb, to 0.07 m high. Fl. green-purple, Oct to Dec. Growing on moss mats, granite. Outcrops.	No	No	6.6 km NNE	A, B, D	Highly Unlikely
Banksia recurvistylis	P2			Non-lignotuberous shrub, to 2 m high and 3 m wide. Single stemmed at base. Fl. pale yellow, Nov to Dec. Lateritic soils. Granite outcrops within jarrah-marri forest.	Possible	No	10.5 km ENE	A, B, D	Highly Unlikely
Grevillea ornithopoda	P2			Slender, erect shrubs, 1-3 m high. Fl. white or cream, Sep-Oct. White/red/brown loam or clay. Riverbanks.	No	Yes	2.6 km SSW	A, B	Highly Unlikely
Lepyrodia curvescens	P2			Dioecious, shortly creeping, tufted rhizomatous, herb, 0.24-0.4 m high, rhizomes on surface or to 1 cm deep. Fl. Sep to Nov. Sand, laterite. Seasonally inundated swampland.	No	Yes	9.1 km SSW	A, B, D	Highly Unlikely
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	P3			Erect, spreading, single-stemmed shrub to 1.3m. Fl. white/pink, Oct-Dec. Dry yellow/brown sand, loam, or granitic soils. Granite sheets/outcrops, slopes, drainage lines.	No	No	10.7 km ENE	A, B	Highly Unlikely
Blennospora doliiformis	P3			Erect annual, herb, to 0.15 m high. Fl. yellow, Oct to Nov. Grey or red clay soils over ironstone. Seasonally-wet flats.	No	Yes	19.2 km W	A, B	Highly Unlikely
Dicrastylis reticulata	P3			Woolly shrub, (0.15-)0.6-1.2(-1.5) m high. Fl. white, Sep to Dec. Sandy soils, often over granite. Amongst granite rock, hills, flats.	No	No	15.4 km ENE	A, B, D	Highly Unlikely
Grevillea dissectifolia	P3			Erect, spreading, single stemmed shrubs, 1-2.5 m high. Fl. white, cream or pink, Jun-Nov. White/grey/yellow sand over laterite. Slopes, drainage lines, granite outcrops.	Possible	Yes	8.1 km SE	A, B	Highly Unlikely
Halgania corymbosa	P3			Erect shrub, 0.35-1 m high. Fl. blue-purple, Aug to Nov. Gravelly soils, soils over granite.	Possible	Yes	6.3 km W	A, B	Highly Unlikely
Isopogon autumnalis	P3			Low, open, multistemmed shrub, 0.4-1 m high. Fl. pale yellow. White/grey sand and laterite. Ridge hill shelf, slopes.	No	No	11.2 km WNW	A, B	Highly Unlikely
Lepyrodia heleocharoides	P3			Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Fl. Dec. Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps.	No	Yes	4.6 km W	A, B	Highly Unlikely
Meionectes tenuifolia	P3			Prostrate, annual semi aquatic herb, erect stems to 0.35 m high. Fl. orange. Red/green trifid and linear leaves. Grey/black loam over granite. Seasonally wet flats, swamps, granite flats.	No	Yes	4.3 km W	A, B	Highly Unlikely
Pithocarpa corymbulosa	P3			Erect to scrambling perennial, herb, 0.5-1 m high. Fl. white, Jan to Apr. Gravelly or sandy loam. Amongst granite outcrops.	No	No	15.6 km NNW	A, B	Highly Unlikely

Taxon	Source			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Source	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Stackhousia sp. Red-blotched corolla (A. Markey 911)	P3			Erect, perennial shrub. Fl. yellow/cream. Brown/white sandy clay over laterite/granite. Lowlands, slopes, edges of granite.	Possible	Adjacent	5.8 km WSW	A, B	Highly Unlikely
Synaphea pandurata	P3			Clumped shrub (subshrub), 0.2-0.55 m high. Yellow-grey, yellow-brown, yellow-red sands and sandy loams, dark brown loam, laterite gravel, granite. In undulating areas.	Possible	No	15.3 km NE	A, B, D	Highly Unlikely
Tetratheca pilifera	P3			Spreading shrub, 0.1-0.3 m high. Fl. purple, Aug to Oct. Gravelly soils	Possible	Yes	7.8 km S	A, B, D	Highly Unlikely
Tetratheca similis	P3			Spreading shrub, to 0.3 m high. Fl. pink, Aug to Sep. Sandy clay with lateritic boulders.	Possible	No	19.3 km E	A, B	Highly Unlikely
Caladenia speciosa	P4			Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white-pink, Sep to Oct. White, grey or black sand.	No	Yes	10.7 km W	A, B, D	Highly Unlikely
Chorizema ulotropis	P4			Sprawling, open, semi-prostrate shrub, to 0.45 m high. Fl. orange-yellow, Jul to Sep. Moist to dry soils, white sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats.	Possible	Yes	8.2 km SE	A, B	Highly Unlikely
Drosera occidentalis	P4			Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Fl. pink/white, Oct to Dec or Jan. Grey clayey sand. Flats, winter wet depressions.	No	Yes	8.2 km SSW	A, B, D	Highly Unlikely
Hemigenia platyphylla	P4			Spreading shrub, 0.2-1.5 m high. Fl. blue-purple, Sep to Nov. Sandy & loamy soils. Granite rocks, slopes	Possible	No	8.5 km NNE	A, B, D	Highly Unlikely
Microtis quadrata	P4			Tuberous, perennial, herb, to 0.4 m high. Fl. cream-white, Dec or Jan. Brown/grey sand or clay over laterite. Winter-wet swamps, drainage lines.	No	Yes	11.2 km WNW	A, B	Highly Unlikely
Ornduffia submersa	P4			Aquatic, floating herb. Fl. cream/white/yellow, Sep-Oct. Grey/brown clay. Ephemeral creeks, wetlands, open depressions.	No	Yes	11 km W	A, B	Highly Unlikely
Parsonsia diaphanophleba	P4			Woody climber, to 10 m high. Fl. white/cream & pink, Jan to Feb or Apr to Jun or Sep. Alluvial soils. Along rivers.	No	Adjacent	6.2 km NNW	A, B, D	Highly Unlikely
Schoenus natans	P4			Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown, Oct. Winter-wet depressions.	No	Yes	5.8 km SW	A, B	Highly Unlikely
Trithuria australis	P4			Small, annual, reddish, aquatic herb. Fl. Oct. Brown or black clay. Swamps, winter-wet flats.	No	Yes	19.1 km SSW	A, B	Highly Unlikely
Pre-survey likelihood – Highly Unlikely									
Diuris micrantha	T	VU	VU	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	No	No	29.3 km NW	A, B, C	Highly Unlikely
Tribonanthes purpurea	T	VU	VU	Tuberous, perennial, herb, 0.03-0.04 m high. Fl. pink-purple, Aug. Seasonally wet soils in moss swards & herbfields among granite rocks.	No	No	38.5 km NNE	A, B	Highly Unlikely
Verticordia fimbrilepis subsp. *fimbrilepis*	T	VU	EN	Shrub, 0.3-0.7 m high. Fl. pink-white, Oct to Dec or Jan. Gravelly sandy or clayey soils. Flats, road verges	Possible	No	27.3 km NNE	A, B, C	Highly Unlikely
Calytrix simplex subsp. *simplex*	P1			Shrub, ca 0.2 m high. Fl. purple, Oct to Nov. Shallow soils, red/brown gravel-loam/clay-loam. Granite outcrops, slopes, swamps.	No	Adjacent	24.4 km N	A, B	Highly Unlikely

Taxon	Source			Habit and Habitat	Habitat within Survey Area	Within Current Known Distribution	Distance to Nearest Record	Source	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Isopogon sp. Canning Reservoir (M.D. Tindale 121 & B.R. Maslin)	P1			Erect, spreading, single-stemmed shrub, to 1.2 m high. Fl. cream-pink, Jun. Brown, yellow or grey sand over laterite. Flats and low plains.	No	No	32.6 km NE	A, B	Highly Unlikely
Byblis gigantea	P3			Small, branched perennial, herb (or sub-shrub), to 0.45 m high. Fl. pink-purple/white, Sep to Dec or Jan. Sandy-peat swamps. Seasonally wet areas.	No	Adjacent	21.4 km ENE	A, B, D	Highly Unlikely
Juncus meianthus	P3			Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Fl. brown, Nov to Dec or Jan. Black sand, sandy clay. Creeks, seepage areas.	No	Yes	57.1 km S	A	Highly Unlikely
Petrophile filifolia subsp. *laxa*	P3			Erect, spreading shrub, to 0.75 m high. White gritty sand, brown, red, yellow, white, or grey sand, brown-yellow sandy clay. Winter-wet sites, flats, slopes, swamps, drainage lines.	No	No	22.7 km ENE	A, B	Highly Unlikely
Thysanotus cymosus	P3			Caespitose perennial, herb (with fibrous roots with ellipsoidal tubers), to 0.3 m high. Fl. purple, Sep to Oct. Clay, granitic or lateritic sand.	Yes	No	27 km E	A, B	Highly Unlikely
Acacia cuneifolia	P4			Erect or straggly shrub, 1-3 m high. Fl. yellow, Jul to Oct. Sand, clay, or loam over granite. Granite outcrops & hills, rocky watercourses.	No	No	21.6 km ENE	A, B	Highly Unlikely
Darwinia thymoides subsp. St Ronans (J.J. Alford & G.J. Keighery 64)	P4			Low, erect, spreading shrub, to 0.4 m tall. Fl. red, Oct-Nov. Dry yellow-brown sand, or loam over laterite. Upper slopes, fringing granite outcrops.	No	No	22.3 km SE	A, B	Highly Unlikely
Eucalyptus exilis	P4			(Whipstick mallee), 2-6 m high, bark smooth. Fl. white, Aug to Oct. Grey sand, gravelly loam. Lateritic ridges.	No	No	28.6 km ENE	A, B	Highly Unlikely
Goodenia verreauxii	P4			Perennial, herb, to 0.5 m high. Fl. yellow, Nov to Dec or Jan. White/grey or yellow sand. Flats.	No	No	27.4 km NNE	A, B	Highly Unlikely
Hydrocotyle lemnoides	P4			Aquatic, floating annual, herb. Fl. purple, Aug to Oct. Swamps.	No	No	44.4 km NE	A	Highly Unlikely
Lasiopetalum bracteatum	P4			Erect, open shrub, 0.4-1.5 m high. Fl. pink-purple, Aug to Nov. Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	No	No	26.5 km ENE	A, B	Highly Unlikely

Source: A = Alcoa likelihood assessment, B = WAH and TPFL databases (DBCA, 2023b), C = Protected Matters Search Tool (DCCEEW, 2023), D = Atlas of Living Australia (ALA, 2023).

Appendix C: Significant weeds identified from the desktop assessment

Family	Taxon	Source		Declared Plant Pests (DPs)	Weeds of National Significance (WoNS)
		ALA	WAOL		
Alismataceae	*Sagittaria platyphylla*		•	Yes	Yes
Apocynaceae	*Calotropis procera*		•	Yes	
	Cryptostegia madagascariensis		•	Yes	
	Gomphocarpus fruticosus	•	•	Yes	
Araceae	*Pistia stratiotes*		•	Yes	
	Zantedeschia aethiopica	•	•	Yes	
Araliaceae	*Hydrocotyle ranunculoides*		•	Yes	
Asparagaceae	*Asparagus asparagoides*		•	Yes	Yes
Asteraceae	*Chondrilla juncea*		•	Yes	
	Onopordum acaulon		•	Yes	
	Silybum marianum		•	Yes	
	Xanthium spinosum		•	Yes	
	Xanthium strumarium		•	Yes	
Boraginaceae	*Echium plantagineum*		•	Yes	
Cactaceae	*Austrocylindropuntia cylindrica*		•	Yes	Yes
	Austrocylindropuntia subulata		•	Yes	Yes
	Cylindropuntia fulgida		•	Yes	Yes
	Cylindropuntia imbricata		•	Yes	Yes
	Cylindropuntia kleiniae		•	Yes	Yes
	Cylindropuntia pallida		•	Yes	Yes
	Cylindropuntia tunicata		•	Yes	Yes
	Opuntia elata		•	Yes	Yes
	Opuntia elatior		•	Yes	Yes
	Opuntia engelmannii		•	Yes	Yes
	Opuntia microdasys		•	Yes	Yes
	Opuntia monacantha		•	Yes	Yes
	Opuntia polyacantha		•	Yes	Yes
	Opuntia puberula		•	Yes	Yes
	Opuntia stricta		•	Yes	Yes
	Opuntia tomentosa		•	Yes	Yes
Euphorbiaceae	*Jatropha gossypifolia*		•	Yes	Yes
Fabaceae	*Alhagi maurorum*		•	Yes	
	Neltuma glandulosa × velutina		•	Yes	Yes
	Parkinsonia aculeata		•	Yes	Yes
	Senna alata		•	Yes	
	Senna obtusifolia		•	Yes	
	Ulex europaeus		•	Yes	Yes
Iridaceae	*Moraea flaccida*		•	Yes	
	Moraea miniata		•	Yes	
Rhamnaceae	*Ziziphus mauritiana*		•	Yes	
Rosaceae	*Rubus anglocandicans*	•	•	Yes	Yes
	Rubus laudatus		•	Yes	Yes
	Rubus rugosus		•	Yes	Yes
	Rubus ulmifolius	•	•	Yes	Yes
Rubiaceae	*Galium aparine*		•	Yes	
	Galium spurium		•	Yes	
Solanaceae	*Solanum elaeagnifolium*		•	Yes	Yes
	Solanum linnaeanum		•	Yes	
Tamaricaceae	*Tamarix aphylla*		•	Yes	Yes
Verbenaceae	*Lantana camara*		•	Yes	Yes

Willowdale Targeted Flora Survey – Desktop review of Spring 2023 extension areas

Technical Memorandum

Alcoa of Australia Ltd

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Template 2.8.1

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Abbreviations

Abbreviation	Description
Alcoa	Alcoa of Australia Limited
ALA	Atlas of Living Australia
BC Act	*Biodiversity Conservation Act 2016*
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DP	Declared Pest
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
ELA	Eco Logical Australia
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
IBRA	Interim Biogeographic Regionalisation for Australia
JAF01	Northern Jarrah Forest IBRA subregion
MMP	Mining and Management Program
PDWSA	Public Drinking Water Source Area
PMST	Protected Matters Search Tool
WAH	Western Australian Herbarium
WoNS	Weed of National Significance

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1. Introduction

1.1. Project background

Alcoa of Australia Limited's (Alcoa) Western Australian mining operations includes the Willowdale bauxite mine, located in Alcoa's Mining Lease 1SA, east of Waroona, Western Australia. Alcoa has approval to mine within Mining Lease 1SA subject to submitting draft five-year mine plans and associated environmental management programmes known as the Mining and Management Program (MMP) to the State's Mining and Management Program Liaison Group on an annual basis. Alcoa has committed to undertaking pre-clearance ecological surveys for the Willowdale Mine (Larego region) as part of its MMP assessment.

Eco Logical Australia (ELA) was engaged by Alcoa to undertake pre-clearance flora surveys in the Larego region of Willowdale mine. The pre-clearance flora surveys comprise Threatened and Priority Flora and Key Weed species (Weeds of National Significance [WoNS] and Declared Pest plants [DP]) surveys conducted over three survey periods (Spring 2023, Autumn 2024, and Spring 2024). The results of these surveys will be used to: amend conceptual clearing alignments to avoid significant flora and vegetation; create management plans to ensure any identified WoNS or DP and invasive weeds are not spread; inform translocation and environmental management plans as required; and assist Alcoa in preparing its MMP submission.

Following completion of the Spring 2023 survey component it was identified that 96 small areas were omitted from the base assessment layer. These omitted areas have a total of 52.4 ha and occur adjacent to the areas surveyed in Spring 2023, which totalled 65 areas covering 801.0 ha (ELA 2024).

1.2. Scope of works

Eco Logical Australia (ELA) was engaged by Alcoa to undertake a desktop assessment of omitted areas (hence referred to as 'extension areas') in view of results from the Spring 2023 survey (ELA 2024; Figure 1). The scope of works included:

- Undertake a desktop assessment to identify potential conservation significant flora species occurring with the extension areas; and
- Preparation of a brief technical memorandum, detailing findings of the desktop assessment.

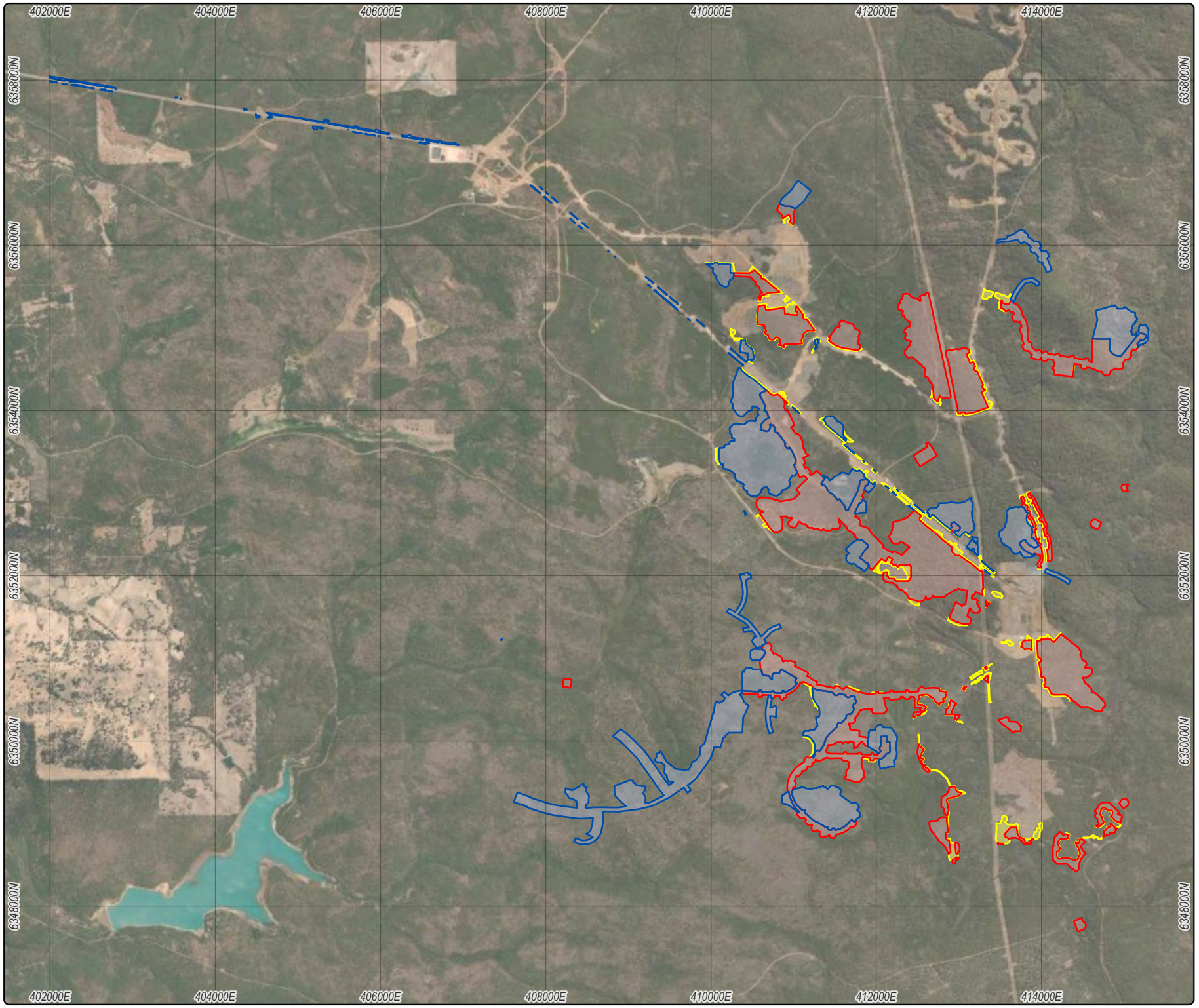
2. Environmental setting

Broad environmental values for the region relevant to the extension areas are presented in Table 1 below. For more detailed information refer to ELA (2024).

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Table 1: Environmental values of the region

Existing environmental attributes	Survey area
Interim Biogeographical Regionalisation for Australia (IBRA) Bioregion (DCEEW 2023a)	Jarrah Forest
IBRA Subregion (DCEEW 2023a)	Northern Jarrah Forest (JAF01)
Geology, landform, and soils (Department of Primary Industries and Regional Development [DPIRD] 2022)	**Darling Plateau System:** lateritic plateau with gravelly soils and Jarrah-marri-wandoo forest and woodland. **Murray Valleys System**: deeply incised valleys with red loamy earths, shallow duplexes and rock outcrop and Jarrah-marri-wandoo forest and woodland with mixed shrubland.
Soil Units (Australian Soil Resource Information System 2023; DPRID 2022)	**Unit JZ1:** underlain by a dissected plateau with strongly undulating relief and some moderately incised valleys. Soils are characterised by lateritic gravels and block laterite, with the chief soils being ironstone gravels with sandy and earthy matrices. **Unit Mw31:** comprises deeply incised, steep scarp and valley side slopes of the Darling scarp and its more deeply incised tributary valleys; chief soils are red earths on the colluvial slope deposits, with massive rock outcrops a feature.
Beard's (1979) vegetation mapping (DPIRD 2019)	**West Darling 3**: medium forest of jarrah and marri.
Regional Forest Agreement mapping (Mattiske and Havel 1998)	**Cooke:** Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* (semiarid and arid zones) and on deeper soils adjacent to outcrops, closed heath of Myrtaceae-Proteaceae species and lithic complex on granite rocks and associated soils in all climate zones, with some *Eucalyptus laeliae* (semiarid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to perarid zones). **Dwellingup 1:** Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones. **Murray 1:** Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones. **Swamp:** Mosaic of low open woodland of *Melaleuca preissiana-Banksia littoralis*, closed scrub of Myrtaceae spp., closed heath of Myrtaceae spp. and sedgelands of *Baumea* and *Leptocarpus* spp. on seasonally wet or moist sand, peat and clay soils on valley floors in all climatic zones. **Yarragil 1:** Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones. **Yarragil 2:** Open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on slopes, woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones
Hydrology (DWER 2018a, b; DWER 2023)	**Catchments**: Harvey Diversion_Harvey and Harvey Estuary_Harvey River. **Public drinking water source areas (PDWSA)**: Samson Brook Catchment (P1) and Stirling Dam Catchment (P1).
Environmentally Sensitive Areas (ESAs) (DBCA 2023a; DCCEEW 2023b; DWER 2021)	Dwellingup State Forest, a Section 5(1)(a) reserve.



Legend

Extension Areas

Survey areas (ELA 2024)

Priority 1

Priority 2

Figure 1: Location of extension areas and 2023 spring survey areas

0 0.5 1 2

Kilometres

Datum/Projection:
AGD 1984 AMG Zone 50

23PER5309-JP Date: 23/04/2024

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3. Methodology

3.1. Desktop review

Database searches were undertaken as part of the desktop review in ELA (2024), with these searches (and results of the field survey) being used to determine the likelihood of conservation significant flora occurring within the extension areas.

3.1.1. Database searches

The following Commonwealth and State databases were searched for information relating to conservation significant flora within the extension areas. Applied search buffers used are considered suitable based on flora expected to occur (**Table 2**).

Table 2: Database searches undertaken for the extension areas

Database	Reference	Search area
Atlas of Living Australia Spatial search for records.	Atlas of Living Australia 2023	10 km buffer around project area envelope
Commonwealth EPBC Act Protected Matters Search Tool (PMST) for Matters of National Environmental Significance, including any Threatened species listed under the EPBC Act.	DCCEEW 2023c	10 km buffer around project area envelope
DBCA Threatened and Priority flora database searches for Declared Rare Flora listed under the latest WA Biodiversity Conservation (listing of native species) (flora) order and Priority Flora [ref# 64-0223FL]^	DBCA 2023b	Area ~150 km x 80 km covering Alcoa operations areas and buffer

^Supplied by Alcoa

3.1.2. Literature review

The following publicly available literature and previous survey reports relevant to the extension areas were reviewed:

- *Flora and vegetation management plan (Draft) – Huntly and Willowdale mines* (Mattiske Consulting 2022).
- *Assessment of matters pertaining to the renewal of the Regional Forest Agreement for the South-West Forest Region of Western Australia* (Government of Western Australia 2019).
- Eco Logical Australia 2024. *Willowdale Targeted Flora Survey – Spring 2023* Prepared for Alcoa of Australia.

Aerial photography for the survey areas was reviewed to identify land use patterns, the extent of vegetation, relevant landscape/catchment matters and any other relevant issues where possible.

3.1.3. Likelihood of occurrence assessment

An assessment of the likelihood of Threatened and Priority flora species being present within the extension areas was carried out. The assessment is based on specific likelihood of occurrence criteria. The criteria include factors such as: location and recency of previous records in relation to the extension areas; suitable landforms, soils and habitat that appear to be present based on the desktop review and aerial imagery; and known flowering periods. In addition, Alcoa's location specific risk rating for Larego (Alcoa 2023) was considered during development of ELA's likelihood ratings.

Conservation codes, categories and criteria for flora protected under the EPBC Act and the State *Biodiversity Conservation Act 2016* (BC Act) are provided in Appendix A (DBCA 2023c, DBCA 2023d). Criteria used for this assessment are presented in Appendix B.

4. Results and Discussion

4.1. Desktop assessment

The PMST search (DCCEEW 2023c) and review of the DBCA Threatened and Priority flora database search (DBCA 2023b) was undertaken to identify conservation significant flora species recorded within, or nearby to, the extension areas (current and historic). A review of conservation significant flora species recorded by ELA (2024) was also undertaken. Conservation significant flora species previously recorded within, and in proximity to the extension areas are presented in **Figure 2**.

4.1.1. Conservation significant flora species

A total of 76 conservation significant flora species were identified during the desktop assessment. Of these three were considered likely to occur within the extension areas, 10 were considered as having the potential to occur, and 63 were considered unlikely to occur. The full flora likelihood of occurrence assessment is provided in Appendix C.

The three conservation significant flora species considered likely to occur within the extension areas were all recorded by ELA (2024), and were therefore known to occur in the local area, these being:

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133; listed as P1 by DBCA),
- *Grevillea prominens* (P3), and
- *Senecio leucoglossus* (P4).

Netrostylis sp. Nannup (P.A. Jurjevich 1133) is a perennial, caespitose sedge that grows in valley floor and creeklines on damp soils within woodland and tall shrubland (WAH 1998-). One historical record of this species was located in a creekline between survey areas LR23_28 and LR23_P2_31 (DBCA 2023b; now a cleared area immediately adjacent to a conveyor). ELA (2024) recorded one individual *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) plant in a creekline within survey area LR23_23 (ELA 2024). The occurrence(s) of *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) in the extension areas would likely be restricted to creeklines and associated creek margins (e.g. riparian and flood out zones with clay loam soils).

Grevillea prominens is a spreading shrub that grows in gravelly loam along creeklines in jarrah forest (WAH 1998-). Multiple historical records occur within 25 km, including two records that are less than 100 m southeast of survey area LR23_6 (ELA 2024). ELA (2024) recorded a total of 11 individual plants from 11-point locations. Plants recorded by ELA (2024) were mostly growing adjacent to creeklines on gentle slopes in loamy soils on laterite in jarrah-marri forest. The occurrence(s) of *Grevillea prominens* in the extension areas would likely be restricted to deep gravelly loams adjacent to creeklines and other low-lying areas (e.g. damplands and wetlands).

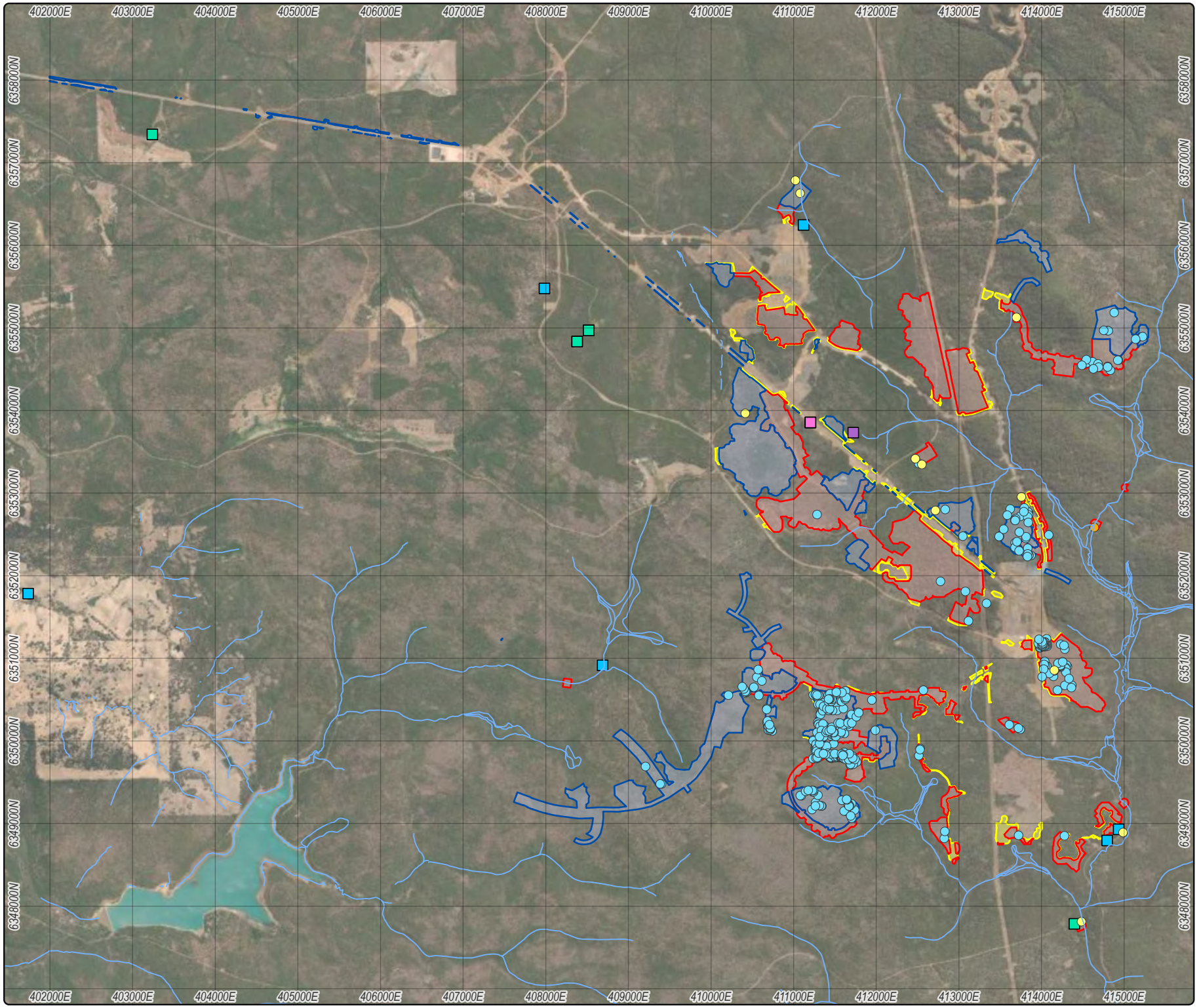
Senecio leucoglossus is an annual herb that grows on gravelly lateritic or granitic soils on slopes or granite outcrops in jarrah-marri forest (WAH 1998-). Multiple historical records occur within 25 km, including one directly adjacent to Turbidity area b (DBCA 2023b; ELA 2024). ELA (2024). ELA (2024) recorded a

total of 2,063 individual plants from 348-point locations, with the majority of records occurring in the east and south of the mine area. *Senecio leucoglossus* was relatively common across the broader survey area, and the same would be expected within the extension areas; particularly those comprising mid and upper slopes with gravelly lateritic soils.

Ten conservation significant flora species were considered as having the Potential to occur within the extension areas, namely:

- *Hibbertia acrotoma*, listed as P1 by DBCA
- *Melaleuca viminalis,* listed as P2
- *Schizaea rupestris*, listed as P2
- *Actinotus repens*, listed as P3
- *Cyathochaeta teretifolia*, listed as P3
- *Netrostylis* sp. Blackwood River (A.R. Annels 3043), listed as P3
- *Tetratheca parvifolia*, listed as P3
- *Cyanothamnus tenuis*, listed as P4
- *Pimelea rara*, listed as P4
- *Stylidium ireneae*, listed as P4

A precautionary approach was taken when assigning a Potential likelihood of occurrence rating for the fore mentioned species. These Potential likelihood ratings were primarily based on the presence and proximity of previous database records, and presence of suitable habitat (both vegetation and landform) noted during systematic searches conducted by ELA (2024) in locations adjacent to the extension areas.



Legend

- Extension Areas
- Streams

Survey areas (ELA 2024)

- Priority 1
- Priority 2

Conservation significant flora (DBCA 2023)

- Priority 1
- Priority 2
- Priority 3
- Priority 4

Conservation significant flora (ELA 2024)

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)

Figure 2A: Conservation significant flora previously recorded within and in the vicinity of the extension areas (Overview)

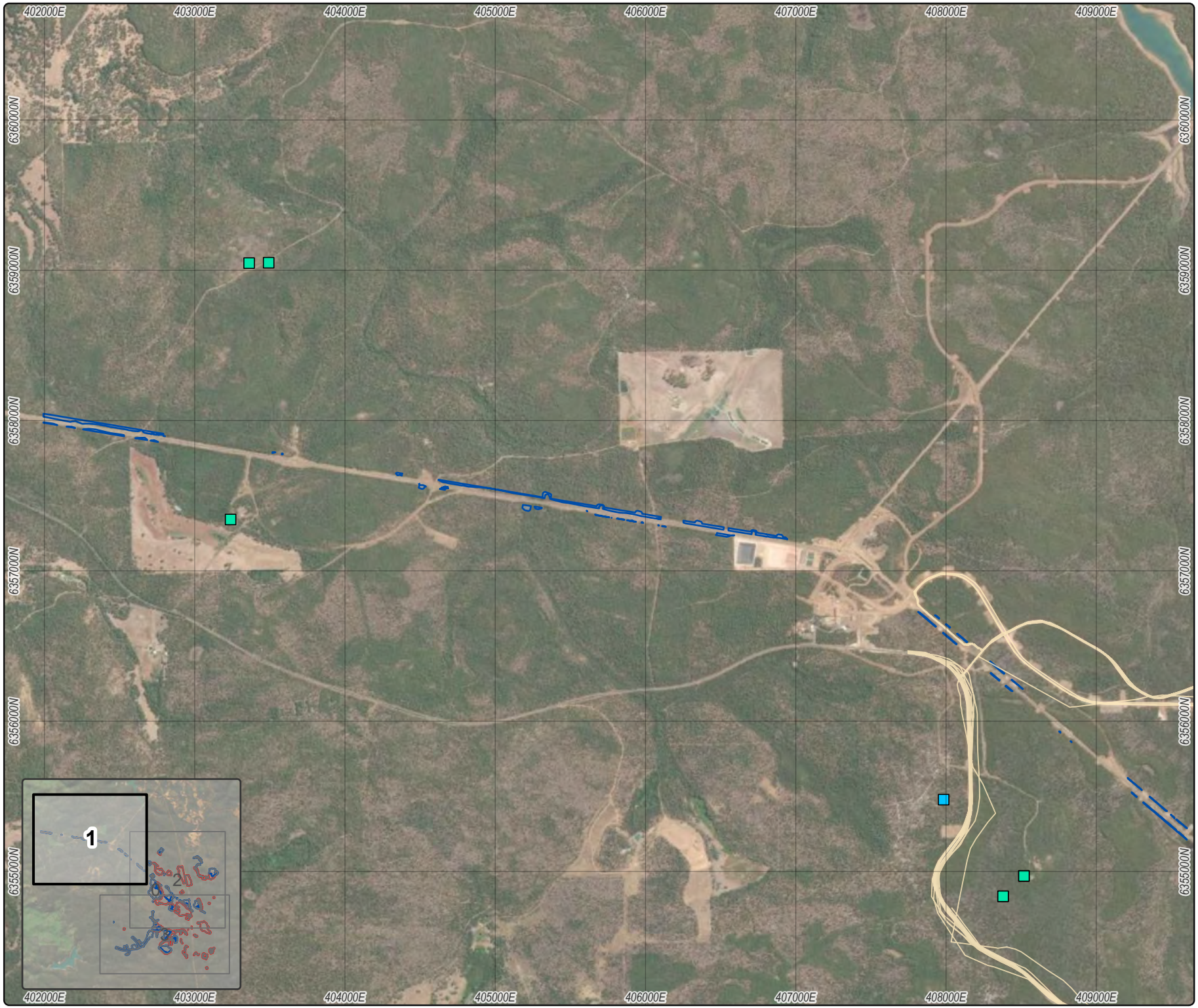
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Legend

- Extension Areas
- GPS Tracks

Survey areas (ELA 2024)

- Priority 2

Conservation significant flora (DBCA 2023)

- Priority 3
- Priority 4

Figure 2B: Conservation significant flora previously recorded within and in the vicinity of the extension areas (Detailed Map 1 of 3)

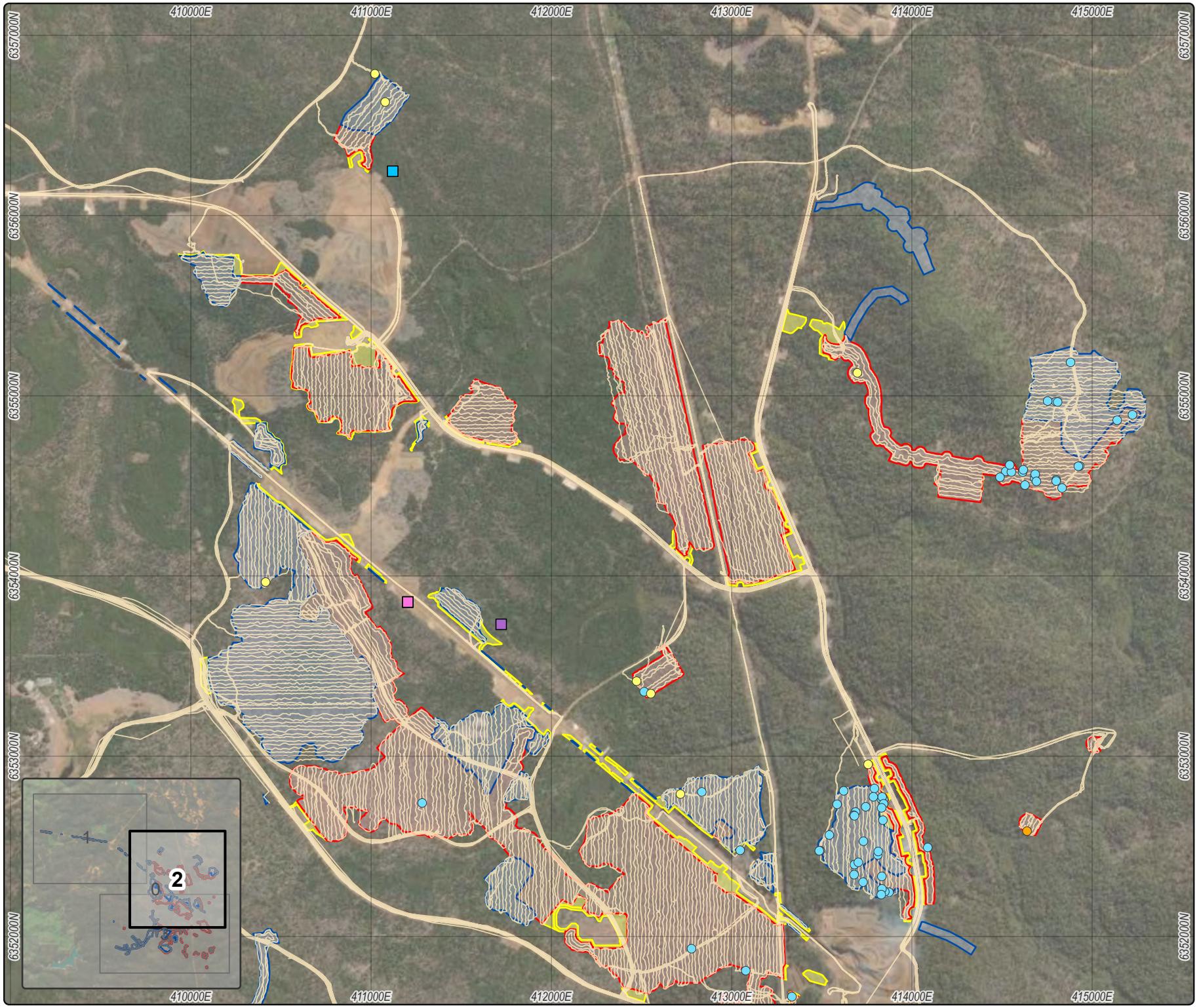
0 0.25 0.5 1
Kilometres

Datum/Projection:
AGD 1984 AMG Zone 50

23PER5309-JP Date: 22/04/2024

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Legend

- Extension Areas
- GPS Tracks

Survey areas (ELA 2024)

- Priority 1
- Priority 2

Conservation significant flora (DBCA 2023)

- Priority 1
- Priority 2
- Priority 3

Conservation significant flora (ELA 2024)

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)

Figure 2C: Conservation significant flora previously recorded within and in the vicinity of the extension areas (Detailed Map 2 of 3)

0 0.25 0.5 1

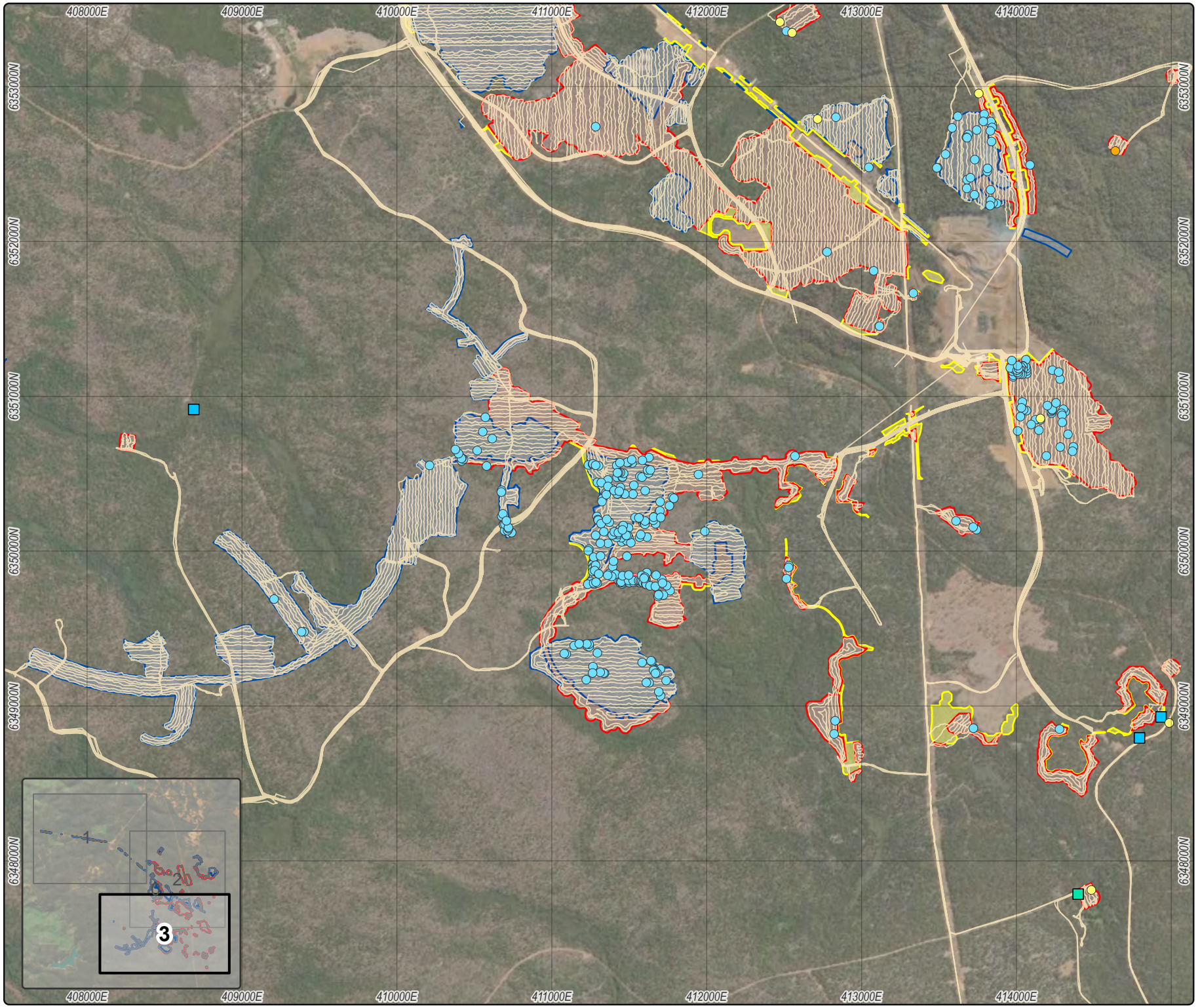
Kilometres

Datum/Projection:
AGD 1984 AMG Zone 50

23PER5309-JP Date: 22/04/2024

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Legend

- Extension Areas
- GPS Tracks

Survey areas (ELA 2024)

- Priority 1
- Priority 2

Conservation significant flora (DBCA 2023)

- Priority 3
- Priority 4

Conservation significant flora (ELA 2024)

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)

Figure 2D: Conservation significant flora previously recorded within and in the vicinity of the extension areas (Detailed Map 3 of 3)

0 0.25 0.5 1
Kilometres

Datum/Projection:
AGD 1984 AMG Zone 50

23PER5309-JP Date: 22/04/2024

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Appendix A Framework for conservation significant flora and fauna ranking

CATEGORIES OF THREATENED SPECIES UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)

Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the EPBC Act. Species listed as 'conservation dependent' and 'extinct' are not Matters of National Environmental Significance and therefore do not trigger the EPBC Act.

Category	Definition
Extinct (EX)	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	Taxa known to survive only in captivity or as a naturalised population well outside its past range; or taxa has not been recorded in its known and/or expected habitat at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	Taxa considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Taxa considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Taxa considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	Taxa has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	Taxa has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	There is inadequate information to make a direct, or indirect, assessment of taxa's risk extinction based on its distribution and/or population status.
Not Evaluated (NE)	Taxa has not yet been evaluated against the criteria.
Migratory (MI)	Not an IUCN category. Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state; • the agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA); • the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); or • the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (ROKAMBA).

CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA

The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Specially protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

Threatened species (T)

Threatened fauna is that subset of 'Specially Protected Fauna' listed under Schedule 2 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 made by the Minister under sections 13(1), 19(1) and 23(1) of the Act and regulation 174(1) of the *Biodiversity Conservation Regulations 2018*.

Threatened flora is that subset of 'Rare Flora' listed under Schedule 1 of the Biodiversity Conservation (Listing of Native Species) (Flora) Order 2022 made by the Minister under sections 19(1) and 23(1) of the BC Act and regulation 174(1) of the *Biodiversity Conservation Regulations 2018*.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Code	Description
Critically Endangered species	CR	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under Schedule 2-Division 1 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for critically endangered fauna or Schedule 1-Division 1 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.
Endangered species	EN	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under Schedule 2-Division 2 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for endangered fauna or Schedule 1-Division 2 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.
Vulnerable species	VU	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under Schedule 2-Division 3 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for endangered fauna or Schedule 1-

Category	Code	Description
		Division 3 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild, as follows:

Category	Code	Description
Extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Extinct Species under Schedule 3 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for endangered fauna or Schedule 2 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.
Extinct in the wild species	EW	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. These species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

Categories are detailed below.

Category	Code	Description
Migratory species	MI	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under Schedule 1-Division 2 of the 5 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022.
Species of special conservation interest (conservation dependent fauna)	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under Schedule 1-Division 1 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022.
Other specially protected species	OS	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under Schedule 1-Division 3 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022.

Priority species (P)

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Definition
Priority 1	P1	Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	P2	Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	P3	Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	P4	Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix B Likelihood of occurrence assessment criteria

Likelihood rating	Criteria
Recorded	The species has previously been recorded within the survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
Likely	The species has not previously been recorded from within the survey area. However, (to qualify requires one or more criteria to be met): • the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area; • core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present; and • there is a medium to high probability that a species uses the survey area.
Potential	The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met): • targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area; • the survey area has been assessed as having potentially suitable habitat through habitat modelling; • the species is known to be cryptic and may not have been detected despite extensive surveys; • the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys; ıecies has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met): • doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution); and • coordinates are doubtful.
Unlikely	The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and: • it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded • it is unlikely to occur due to few historic record/s and no other current collections in the local area. The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches. The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.
Does not occur (one or more criteria requires to be met).	The species is not known to occur within the IBRA bioregion based on current literature and distribution. The conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat. The survey area lacks important habitat for a species that has highly selective habitat requirements. The species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators.

Appendix C Flora likelihood of occurrence assessment

Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
Synaphea sp. Fairbridge Farm (D.Papenfus 696)	CR	CR	DCCEEW 2023	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow, Oct.	Selena's Synaphea occurs on grey, clayey sand with lateritic pebbles in low woodland areas near winter-wet flats.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Caladenia bryceana subsp. *bryceana*	EN	EN	Alcoa 2023	Tuberous, perennial, herb, 0.05-0.1 m high. Fl. green-yellow, Aug to Oct.	Sand, loam. Adjacent to watercourses, winter-wet sites.	**Unlikely** ELA (2024) observed marginal habitat to be present, however no nearby records; nearest record ~100km SE (1985), all other records NE of Albany. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Caladenia leucochila	EN	EN	Alcoa 2023	Perennial orchid which produces a single hirsute leaf from an underground tuber in late autumn and grows through winter and spring. The leaf dehisces at the end of spring and the plant spends summer and early autumn as a dormant tuber. Flower stem to 0.4m high, 1-2 flowers that are 5-10cm across. Fl. Cream-pale yellow-greenish yellow-maroon, mid Sep-late Oct.	Jarrah, Marri and Sheoak forest over *Xanthorrhoea preissii* and dwarf scrub of *Bossiaea ornata*, *Banksia nivea* and *Lechenaultia biloba* in well-drained sandy slopes. Frequently occur under *Allocasuarina fraseriana* in leaf litter. Found in open woodland, tends to be in the lower parts of the valley between 230-245m ASL and slightly upslope of seasonally damp areas.	**Unlikely** ELA (2024) observed marginal habitat to be present, however no nearby records; all records ~55km SE (2008-2012) near Collie. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Diuris purdiei	EN	EN	DCCEEW 2023	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct.	Sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent *Melaleuca preissiana, Eucalyptus calophylla, E. marginata* and *Nuytsia floribunda*.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Grevillea rara	EN	EN	Alcoa 2023	Dense, prickly shrub, to 2 m high. Fl. white-pink/white, Oct.	Lateritic loam. Creeklines.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby (<25km) records. A cluster of recent records near Worsley refinery ~40km S. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Jacksonia velveta	EN	EN	Alcoa 2023	Open, upright, sometimes sprawling shrub, to 1.9 m high. Fl. yellow-orange, Dec.	Brown gravelly loam, dry grey sand, ironstone. Slight hillslopes, ridges.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby (<25km) records. Nearest record ~30km E (2017). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Banksia mimica	EN	VU	DCCEEW 2023	Prostrate, lignotuberous shrub, 0.15-0.4 m high. Fl. yellow-brown, Dec or Jan to Feb.	Flat to gentle slopes, on grey and white sand in open woodlands.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Anthocercis gracilis	VU	VU	DCCEEW 2023	Erect, spindly shrub, to 0.6(-1) m high. Fl. yellow-green, Sep to Oct.	Sandy or loamy soils. Granite outcrops.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby records. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Diuris drummondii	VU	VU	DBCA 2023	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan.	Low-lying depressions and swamps.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).

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Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
Diuris micrantha	VU	VU	Alcoa 2023, DCCEEW 2023	A tuberous, perennial herb that grows 0.3-0.6 m high. Fl. yellow and brown, Sep-Oct.	Brown loamy clay areas, Winter-wet swamps and in shallow water.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Eleocharis keigheryi	VU	VU	Alcoa 2023, DCCEEW 2023	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov.	Small clumps in a substrate of clay or sandy loam. This species is emergent in freshwater creeks, and transient waterbodies such as drainage lines and claypans in water to approximately 15 cm deep.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Morelotia australiensis	VU	VU	DBCA 2023, DCCEEW 2023	Perennial sedge 0.3-1.3m high, 0.1-0.6m across. Rhizome short, thick, woody, 8-15mm diam. Culms terete, 2.0-5.5mm diam, multi-striate, glabrous. Leaves mostly basal and 3-4 cauline; lamina of basal leaves 12-18cm long, 2-6mm wide, linear, finely- multi-striate, pubescent when young, green to blue-green, margins sparsely scabrous. Inflor narrow panicle-like, 15-27cm long, 10-20mm wide. Fl. Oct-Feb, usually one year post-fire.	East side of SCP; historical populations near Armadale and Canning apparently now extinct. Usually in winter-wet swampy depressions, drainage lines or sandy rises adjacent swamps. Grey sand over clay or yellow and sandy or clayey lateritic soils. Open *Corymbia calophylla* or *Eucalyptus marginata* woodland over low shrubs, herbs and sedges.	**Unlikely** ELA (2024) observed suitable habitat to be present. Several recent (2008-2010) nearby records<25km away, however these all occur in foothills. Species tends to occur along the foothills of the scarp rather than in pure jarrah forest. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Tribonanthes purpurea	VU	VU	Alcoa 2023	Tuberous, perennial, herb, 0.03-0.04 m high. Fl. pink-purple, Aug.	Seasonally wet soils in moss swards & herbfields among granite rocks.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, however no nearby (<25km) records. Nearest record ~85km SE (1999). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Caladenia uliginosa subsp. *patulens*	-	P1	DBCA 2023	Tuberous, perennial, herb, 0.2-0.35 m high. Fl. green-cream, Sep to Oct.	Clay loam and gravel. Well drained soils amongst dense shrubs.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Caladenia validinervia	-	P1	Alcoa 2023	Plants solitary. Leaf 5–16 cm long, 3–6 mm wide, linear, erect, incurved in cross section, pale green, the basal 1/5 irregularly blotched with red-purple. Scape 12–21 cm tall. Flowers 1 or 2, 5–8 cm across, pale yellow to pale creamy yellow with prominent, dull red stripes, Sep-early Oct.	Between Collie and Manjimup and eastward to near Rocky Gully, growing in sandy gravelly soil in *Corymbia calophylla-E. marginata* forest with *Anigozanthos manglesii*, *Persoonia* and Lechenaultia species.	**Unlikely** ELA (2024) observed marginal habitat to be present, however no nearby records; nearest record ~45km SE (1965) near Collie. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Calytrix simplex subsp. *simplex*	-	P1	Alcoa 2023	Shrub, ca 0.2 m high. Fl. purple, Oct to Nov.	Jarrah woodland over heath. Slopes, flats. Granitic and lateritic soils.	**Unlikely** ELA (2024) observed marginal habitat to be present, with nearest record ~30km E (2020). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Deyeuxia inaequalis	-	P1	DBCA 2023	Erect, tufted annual, grass-like or herb, 0.75 m high. Leaves mostly basal. Leaf-sheaths scaberulous, glabrous on surface. Ligule an eciliate membrane, 3–5 mm long, membranous, lacerate, truncate. Leaf-blades linear, 5–12 cm long, 1–5 mm wide. Inflorescence solid, a panicle. Panicle linear or oblong, dense, 1–6 cm long.	Slopes, flats. Gravelly sandy loam. Forest of *Eucalyptus marginata* and *Corymbia calophylla*.	**Unlikely** ELA (2024) observed marginal habitat to be present. One recent record (2021) nearby (<25km) record to N, however all other records S of Margaret River. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Hemigenia rigida	-	P1	ALA 2023	Upright or spreading shrub, 0.1-0.6(-1) m high. Fl. blue-purple/violet, Aug to Dec or Jan.	Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops, flats, ironstone ridges.	**Unlikely** ELA (2024) observed marginal habitat to be present. All records >100km to SE. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).

Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
Hibbertia acrotoma	-	P1	DBCA 2023	Lax, openly-branched, spreading shrubs with stems to 0.5 m. Fl. Yellow, Aug-Sep.	Steep slopes, gravelly loam, granite boulders/outcrops. Jarrah-marri forest.	**Potential** ELA (2024) observed potentially suitable habitat to be present. One relatively recent (2005) nearby record 16km to N on scarp. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Hibbertia ambita	-	P1	Alcoa 2023	Shrub to 80cm. Fl. Yellow, Aug-Oct.	Slopes. Lateritic soils. Jarrah-marri forest.	**Unlikely** ELA (2024) observed marginal habitat to be present. All records ~40km NE. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	-	P1	DBCA 2023	Perennial, caespitose sedge to 0.9m.	Valley floors, creeklines. Damp sand, loam, clay. Woodland and tall shrubland.	**Likely** This species was recorded by ELA (2024) within a minor creekline; therefore it is known to occur in the local area.
Cardamine paucijuga	-	P2	DBCA 2023	Slender erect annual, herb, to 0.4 m high. Usually glabrous; leaves petiolate, pinnate, with 1-4 pairs of pinnae, ovate to linear. Sepals 1.5-2 mm long, sometimes purple, margins white; petals 2.5-3.5 mm long, white, rarely pink; stamens 6. Siliqua linear, 10-30 mm long, 0.7-1 mm wide, erect; style slender or obtuse, to 1 mm long; pedicels in fruit spreading, 3-15 mm long. Fl. white, Sep to Oct.	Winter-wet depressions and flats, drainage lines. Rich soils in moist to dry habitats. Marri, karri forest. *Eucalyptus rudis, Melaleuca rhaphiophylla*. Melaleuca tall shrubland.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. One recent (2016) nearby (<25km) record, at base of foothills. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Gonocarpus keigheryi	-	P2	Alcoa 2023, DBCA 2023	Erect or decumbent shrub to 20cm high. Fl. Green, Dec-Feb.	Watercourses, seasonally wet areas. Lateritic gravelly or clayey sand. Jarrah, Marri, Karri forest.	**Unlikely** ELA (2024) observed marginal habitat to be present. One nearby record ~21km SE but not recent (1997). All other records further S. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Grevillea ornithopoda	-	P2	Alcoa 2023, DBCA 2023	Slender erect shrub to 3 m high by 2 m wide. Fl. cream-white, Jun-Oct.	Riverbanks. *Eucalyptus rudis, E. patens*.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. Several recent (2017-2019) nearby (<25km) records to N. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Leucopogon extremus	-	P2	Alcoa 2023	Low, spreading shrub to 40cm high. Fl. Greenish-white, Sep-Oct.	Valley bottoms, creeks. Sandy clay, sandy loam. *Callitris pyramidalis* tall shrubland over Myrtaceous mid shrubland and sedges.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. Nearest record ~35km SE (2006). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Logania sylvicola	-	P2	Alcoa 2023	Erect to spreading compact multi-branched shrub 50 cm high, up to 50 cm wide. Leaves opposite, subsessile; linear, 3–5 mm long, 0.5–0.6 mm wide. Fl. White-cream, Aug-Sep.	Woodland to open forest vegetation on the mid-slope of laterite rises associated with brown clay to clayey sand.	**Unlikely** ELA (2024) observed suitable habitat to be present, however nearest recent record ~60km SE (2005). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Melaleuca viminalis	-	P2	Alcoa 2023	Small tree to 10 m with pendulous foliage. Fl. Red, Nov-May.	Watercourses. Sandy clay.	**Potential** ELA (2024) observed suitable habitat to be present. One recent (2005) nearby record 10km NW on scarp. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).

Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
Millotia tenuifolia var. *laevis*	-	P2	Alcoa 2023, DBCA 2023	Ascending to erect annual, herb, 0.02-0.1 m high. Fl. yellow, Sep to Oct.	Granite or laterite soils. Jarrah and Allocasuarina woodland.	**Unlikely** ELA (2024) observed suitable habitat to be present, however no nearby (<25km) recent records. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Schizaea rupestris	-	P2	ALA 2023, Alcoa 2023, DBCA 2023	Rhizomatous, perennial, herb or grass-like or (fern), 0.1-0.2 m high, fronds simple, glossy; sporangia-bearing segments in pinnately arranged `cock's comb'.	Sand. Gullies, creek banks, shaded moist rock faces.	**Potential** ELA (2024) observed suitable habitat to be present. 1 recent (2000) nearby record 4km N. 1 older (1997) record immediately adjacent areas L23_127 and L23_123. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Stylidium acuminatum subsp. *acuminatum*	-	P2	Alcoa 2023	Perennial herb to 20cm high, scape to 40cm. Basal rosette. Fl. Pale yellow, Nov-Dec.	Disturbed areas, hillslopes. Lateritic gravelly loam. Jarrah-marri forest.	**Unlikely** ELA (2024) observed suitable habitat to be present, however no nearby (<25km) records. Nearest record ~30km S (1967). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Stylidium korijekup	-	P2	DBCA 2023	Perennial, herb, 0.18-0.34 m high. Leaves in a spreading rosette, spathulate (lamina ovate–elliptic), apex obtuse–subacute, margin entire, 4–6 cm long (petioles 3–4 mm long, lamina 1.4–2 cm long), 9–16 mm wide, glabrous. Scape c. 18–34 cm high. Fl. Cream, Oct.	Well-drained grey-brown sandy loam with laterite. Upland ridges. *Eucalyptus marginata* and *E. haematoxylon* woodland with *Xanthorrhoea acanthostachya* and *X. gracilis*.	**Unlikely** ELA (2024) observed marginal habitat to be present. Two recent (2005-2006) nearby (<25km) records. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Thysanotus sp. Badgingarra (E.A. Griffin 2511)	-	P2	Alcoa 2023	Perennial, herb (with tuberous roots), ca 0.35 m high. Fl. blue, Dec.	Gentle slopes and flats. Grey sand with lateritic gravel. Eucalypt woodland.	**Unlikely** ELA (2024) observed suitable habitat to be present, however No nearby (<25km) records. Nearest record ~60km E (1960). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Acacia oncinophylla subsp. *oncinophylla*	-	P3	Alcoa 2023	Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Fl. yellow, Aug to Oct.	Granitic soils, with boulders and outcrops. In heath and open woodland.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby (<25km) records. Nearest recent record 75km N (2013). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Actinotus repens	-	P3	ALA 2023, DBCA 2023	Prostrate perennial herb to 5cm high, 20cm wide. Fl. White, Jan-Mar.	Sandy clay and mud in valleys along creeklines and edges of watercourses. Eucalyptus or Melaleuca dominated woodland.	**Potential** ELA (2024) observed suitable habitat to be present. 3 nearby records: one in area L23_039 (2020); one ~100m SE of L23_131 (2003); one ~7km N (2000). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Adenanthos cygnorum subsp. *chamaephyton*	-	P3	Alcoa 2023	Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Fl. white-cream-pink-green/green, Jul or Sep to Dec or Jan.	Grey sand, lateritic gravel.	**Unlikely** ELA (2024) observed suitable habitat to be present, however No nearby (<25km) records. Given this conspicuous shrub was not recorded during the Spring 2023 targeted flora survey (ELA 2024), it is unlikely t occur within the extension areas.
Angianthus drummondii	-	P3	ALA 2023, Alcoa 2023, DBCA 2023	Erect annual, herb, to 0.1 m high. Fl. yellow, Oct to Dec.	Grey or brown clay soils, ironstone. Seasonally wet flats.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP and foothills species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Asteridea gracilis	-	P3	Alcoa 2023	Annual, herb, 0.15-0.35 m high. Fl. white-pink, Sep to Dec.	Slopes, flats. Sand, clay, gravelly soils. Eucalypt woodland over heath.	**Unlikely** ELA (2024) observed marginal habitat to be present. Nearest record ~30km E (1980), all recent records >100km N. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).

Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
Calytrix pulchella	-	P3	Alcoa 2023	Shrub, 0.3-0.7(-1) m high. Fl. pink, Aug to Nov.	Grey or white sand over laterite. Ridges, flats.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby records. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Carex tereticaulis	-	P3	DBCA 2023	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown, Sep to Oct.	Damp flats, edges of watercourses. Black peaty sand.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Chamaescilla gibsonii	-	P3	DBCA 2023	Clumped tuberous, herb. Fl. blue, Sep.	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Cyathochaeta teretifolia	-	P3	ALA 2023, Alcoa 2023, DBCA 2023	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown.	Grey sand, sandy clay. Swamps, creek edges.	**Potential** ELA (2024) observed suitable habitat to be present. One older (1997) nearby (<25km) record just outside L23_127. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Dillwynia dillwynioides	-	P3	DBCA 2023	Decumbent or erect, slender shrub, 0.3-1.2 m high. Fl. red & yellow/orange, Aug to Dec.	Sandy soils. Winter-wet depressions.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Eryngium sp. Ferox (G.J. Keighery 16034)	-	P3	Alcoa 2023	Perennial herb to 30cm high. Fl. Purple, blue, Dec-Jan	Winter-wet flats, clay. Eucalypt woodland, Melaleuca shrubland over herbs and sedges.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Grevillea prominens	-	P3	ALA 2023, Alcoa 2023, DBCA 2023	Spreading shrub, 0.5-1.7 m high, 0.3-1 m wide. Fl. cream-white, Sep to Oct.	Gravelly loam. Along creeklines.	**Likely** This species was recorded by ELA (2024) within a minor creekline; therefore it is known to occur in the local area.
Hakea oldfieldii	-	P3	Alcoa 2023	Open, straggling shrub, up to 2.5 m high. Fl. white-cream/yellow, Aug to Oct.	Red clay or sand over laterite. Seasonally wet flats.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. No nearby (<25km) records. Three recent records ~35km NE. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Hemigenia microphylla	-	P3	Alcoa 2023, DBCA 2023	Slender shrub, 0.4-1.8 m high. Fl. blue-purple, Sep to Dec.	Sandy clay, peaty clay, granite. Winter-wet depressions.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. No nearby (<25km) records. Three recent records ~35km NE. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Juncus meianthus	-	P3	Alcoa 2023	Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Fl. brown, Nov to Dec or Jan.	Black sand, sandy clay. Creeks, seepage areas.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby (<25km) records. Nearest record ~35km S (2005). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Lepyrodia heleocharoides	-	P3	Alcoa 2023	Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Fl. Dec.	Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby (<25km) records. Nearest record ~70km N (2003).

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Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
						This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Meionectes tenuifolia	-	P3	Alcoa 2023	Annual semi-aquatic herb. Flowering in October to December.	Seasonally wet poorly drained flat and granite flats, ironstone gravel, hilltop on grey sand, loam, clay.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. No nearby (<25km) records. Nearest record ~27km NE (2007). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Netrostylis sp. Blackwood River (A.R. Annels 3043)	-	P3	Alcoa 2023	Sprawling sedge to 1.5m high.	Creeklines, swamps. Sandy or peaty clay loam. *Eucalyptus patens, E. megacarpa* woodland, Melaleuca tall shrubland.	**Potential** ELA (2024) observed suitable habitat to be present. 1 nearby record in area L23_039 (2020). Next nearest record ~27km NE (2018). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Stylidium aceratum	-	P3	Alcoa 2023, DBCA 2023	Fibrous rooted annual, herb, 0.05-0.09 m high, leaves spathulate. Fl. pink/white, Oct to Nov.	Sandy soils. Swamp heathland.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. Two recent (2003-2013) nearby records 14km NW in foothills. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Stylidium paludicola	-	P3	ALA 2023	Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. pink, Oct to Dec.	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Tetratheca parvifolia	-	P3	Alcoa 2023, DBCA 2023	Small shrub, 0.2-0.3 m high. Fl. pink, Oct.	Slopes. Gravelly, sandy loam over granite. Jarrah-Marri forest over heath.	**Potential** ELA (2024) observed suitable habitat to be present. 1 recent (2005) nearby record 10km S. All other records further S. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Tetratheca pilifera	-	P3	Alcoa 2023	Spreading shrub, 0.1-0.3 m high. Fl. purple, Aug to Oct.	Rocky slopes, rocky drainage lines. Gravelly and sandy loam. *Eucalyptus wandoo* woodland.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. Nearest record ~25km N (1997). All other records >100km N. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Acacia oncinophylla subsp. *patulifolia*	-	P4	Alcoa 2023	Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Fl. yellow, Aug to Nov or Nov to Dec.	Granitic soils, occasionally on laterite.	**Unlikely** ELA (2024) observed marginal habitat to be present. Only nearby (<25km) record from 1992 and on SCP. All recent records >100km N (2005-2015). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Acacia semitrullata	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream-white, May to Oct.	White/grey sand in open heath, frequently fringing seasonally dry swamps, and in sand over laterite in shallow depressions in open Jarrah (*Eucalyptus marginata*) forest.	**Unlikely** ELA (2024) observed marginal habitat to be present, however this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Calothamnus graniticus subsp. *leptophyllus*	-	P4	DBCA 2023	Erect, multi-stemmed shrub that grows 1-2 m high. Fl. red, Jun-Aug.	Clay over granite, lateritic soils. Hillsides.	**Unlikely** ELA (2024) observed suitable habitat to be present, one old (1979) nearby (<25km) record. Given this conspicuous shrub was not recorded during the Spring 2023 targeted flora survey (ELA 2024), it is unlikely it occur within the extension areas.

Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
Chorizema ulotropis	-	P4	Alcoa 2023	Sprawling, open, semi-prostrate shrub, to 0.45 m high. Fl. orange-yellow, Jul to Sep.	Moist to dry soils, white sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats.	**Unlikely** ELA (2024) observed marginal habitat to be present. No nearby (<25km) records. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Conostylis pauciflora subsp. *pauciflora*	-	P4	ALA 2023	Rhizomatous, stoloniferous perennial, grass-like or herb, 0.1-0.35 m high. Fl. yellow, Aug to Oct.	Grey sand, limestone. Hillslopes, consolidated dunes. SCP only.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Cyanothamnus tenuis	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Erect, slender shrub to 40cm high. Fl. Blue, pink, white, Aug-Nov.	Slopes, flats. Granitic or lateritic stony soils. Eucalypt woodland, Myrtaceous shrubland.	**Potential** ELA (2024) observed suitable habitat to be present. One recent (2005) nearby (<25km) record. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Drosera occidentalis	-	P4	Alcoa 2023	Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Fl. pink/white, Oct to Dec or Jan.	In swampy flats. White/black sand over yellow clay.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Eucalyptus x graniticola	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Erect-stemmed lignotuberous mallee to 4 m tall; bark smooth, cream, powdery, sometimes rough–grey and flaky at base. Adult leaves petiolate, lanceolate with lamina averaging 11 cm long × 2.5 cm wide, alternate, concolorous, dull, grey-green. Inflorescence axillary, unbranched, 7-flowered. Buds pedicellate, ovoid to globular, to 9 mm long x 6 mm wide; operculum obtusely conical. Stamens erect of inflexed, all fertile, cream. Fruit pedicillate, subcampanulate, 6 mm long × 7 mm wide. Fl. May-Nov. Hybrid between *E. rudis* and *E. drummondii*.	Granite outcrops on Darling Scarp. Soil pocket surrounded by westward sloping sheet granite rock as an isolated emergent mallee over closed shrubland/sedgeland.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. One recent (2006) nearby record <2km to N. All other nearby (<25km) records historical. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Hydrocotyle lemnoides	-	P4	Alcoa 2023	Aquatic, floating annual, herb. Fl. purple, Aug to Oct.	Swamps.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. No nearby (<25km) records. Nearest record ~45km SE (2011). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Lasiopetalum bracteatum	-	P4	ALA 2023	Erect, open shrub, 0.4-1.5 m high. Fl. pink-purple, Aug to Nov.	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	**Unlikely** ELA (2024) observed suitable habitat to be present, however no recent nearby (<25km) records. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Lasiopetalum cardiophyllum	-	P4	Alcoa 2023	Erect, multi-stemmed shrub, 0.2-0.5 m high. Fl. pink, Aug to Dec or Jan.	Lateritic gravelly soils, sandy clay. Flats, hillslopes.	**Unlikely** ELA (2024) observed suitable habitat to be present, however no nearby (<25km) records. Nearest recent record ~35km E (2007). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Microtis quadrata	-	P4	Alcoa 2023	Orchid to 40cm high. Fl. Cream-white, Oct-Dec.	Winter-wet flats, drainage lines. Sand, loam, clay over laterite. Jarrah-Marri forest, Melaleuca shrubland.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. No nearby (<25km) records. Nearest record ~40km NW (1984) on Swan Coastal Plain. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).

Species	Conservation status		Source*	Description	Habitat	Likelihood
	EPBC Act	BC Act / DBCA				
Ornduffia submersa	-	P4	Alcoa 2023	An aquatic herb growing in water 60 cm deep with leaves and flowers floating on the surface. Fl. White-cream-yellow, Oct-Nov.	Wetlands, open depressions, winter wet flats. Sandy clay. *Melaleuca rhaphiophylla, M. preissiana, M. incana* over sedges.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. One nearby (~17km NW) recent (2000) record but on Swan Coastal Plain. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Parsonsia diaphanophleba	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Woody climber, to 10 m high. Fl. white/cream & pink, Jan to Feb or Apr to Jun or Sep.	Alluvial soils. Along rivers.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. 1 recent (2015) nearby records 20km N. Several older records in same area. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Pimelea rara	-	P4	Alcoa 2023, DBCA 2023	Shrub, 0.2-0.35 m high. Glabrous except for inflorescence. Leaf lamina bluish-green (when dry). Fl. white, Dec or Jan.	Slopes. Lateritic soils. Jarrah-marri forest.	**Potential** ELA (2024) observed suitable habitat to be present. Nearest record ~14km N (1998). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Pultenaea skinneri	-	P4	Alcoa 2023	Slender shrub, 1-2 m high. Fl. yellow/orange & red, Jul to Sep.	Sandy or clayey soils. Winter-wet depressions.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. Nearest record ~35km S (2006). This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Schoenus natans	-	P4	Alcoa 2023	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown, Oct.	Winter-wet depressions.	**Unlikely** ELA (2024) did not observe suitable habitat to be present. Nearest record ~14km NW (2012) but on Swan Coastal Plain. Nearest JAF records ~35km SE. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Senecio leucoglossus	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Erect annual, herb, to 1.3 m high. Fl. white, Aug to Dec.	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	**Likely** This species was recorded by ELA (2024) within a minor creekline; therefore, it is known to occur in the local area.
Stylidium ireneae	-	P4	Alcoa 2023, DBCA 2023	Lax perennial, herb, (0.06-) 0.1-0.28 m high. Basal rosette of leaves, leaves oblanceolate, 0.4-2 cm long, 1-3 (-5) mm wide, apex subacute to acuminate, margin entire, glandular. Scape glandular. Inflorescence racemose. Fl. pink, Oct to Dec.	Sandy loam. Valleys near creek lines, woodland, often with Agonis.	**Potential** ELA (2024) observed suitable habitat to be present. Multiple recent (2000) nearby records 8-18km N. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Stylidium longitubum	-	P4	ALA 2023	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec.	Sandy clay, clay. Seasonal wetlands.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).
Trithuria australis	-	P4	Alcoa 2023	Aquatic annual herb to 2cm high.	Edges of wetlands, seasonally wet flats. Silty clay. Melaleuca shrubland, sedgeland, herbland.	**Unlikely** ELA (2024) did not observe suitable habitat to be present, in addition this is a SCP species. This species was not recorded during the Spring 2023 targeted flora survey (ELA 2024).

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Willowdale Targeted Flora Survey – Spring 2023

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Template 2.8.1

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Abbreviations

Abbreviation	Description
Alcoa	Alcoa of Australia Limited
BAM Act	State Biosecurity and Agriculture Management Act 2007
BC Act	State Biodiversity Conservation Act 2016
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DP	Declared Pest
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
ELA	Eco Logical Australia
EPA	Environmental Protection Authority
EP Act	State Environmental Protection Act 1986
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
ESA	Environmentally Sensitive Area
IBRA	Interim Biogeographic Regionalisation for Australia
JAF01	Northern Jarrah Forest IBRA subregion
MMP	Mining and Management Program
PDWSA	Public Drinking Water Source Area
PMST	Protected Matters Search Tool
TEC	Threatened Ecological Community
WAH	Western Australian Herbarium
WoNS	Weed of National Significance

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Executive Summary

Eco Logical Australia (ELA) was engaged by Alcoa of Australia Limited (Alcoa) to undertake pre-clearance flora surveys in the Larego region of Willowdale mine. The pre-clearance flora surveys comprise Threatened and Priority Flora and Key Weed species surveys conducted over three survey periods (Winter/Spring 2023, Summer/Autumn 2024 and Winter/Spring 2024). The results of these surveys will be used to: amend conceptual clearing alignments to avoid significant flora and vegetation; create management plans to ensure any identified Key Weeds are not spread; inform translocation and environmental management plans as required; and assist Alcoa in preparing its annual Mining and Management Program submission to the State's Mining and Management Program Liaison Group.

A total of 131 individual survey areas (the 'project area') were proposed to be covered in the Spring 2023 survey period, with total area of 818.5 ha. This technical report summarises results of the desktop assessment and Spring 2023 field survey and defines the conservation significant and introduced flora values of the project area.

A comprehensive desktop assessment was undertaken to assess the potential presence of conservation significant flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the State *Biodiversity Conservation Act 2016* (BC Act) and by Department of Biodiversity, Conservation and Attractions (DBCA). Prior to the field survey, two conservation significant flora species were considered as Likely to occur within the project area, namely *Actinotus repens* and *Netrostylis* sp. Blackwood River (A.R. Annels 3043; both listed as P3 by DBCA). A total of 20 species were considered to have Potential to occur and 54 species were assessed as Unlikely to occur.

The pre-clearance flora field survey was conducted by four personnel over 11 days from 22 to 27 October and 30 October to 03 November 2023 in accordance with the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (2016). A total of 65 survey areas (comprising 801.0 ha) out of the proposed 131 survey areas (comprising 818.5 ha) were surveyed in the Spring 2023 field survey. All of the 38 Priority 1 survey areas (comprising 456.3 ha) and a total of 27 Priority 2 survey areas (comprising 344.7 ha) were surveyed in Spring 2023. Only 17.5 ha of Priority 2 survey areas (66 areas) remain to be surveyed. ELA will survey the 66 uncompleted areas in the Summer/Autumn 2024 and/or Spring 2024 survey periods.

No Threatened flora species listed under the EPBC Act or the BC Act were recorded within the project area.

Three Priority flora species listed by DBCA were recorded within the project area, namely: *Netrostylis* sp. Nannup (P.A. Jurjevich 1133), listed as P1 by DBCA; *Grevillea prominens*, listed as P3 by DBCA; and *Senecio leucoglossus*, listed as P4 by DBCA. One individual *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) plant was recorded at one point location within survey area LR23_23. A total of 11 *Grevillea prominens* plants were recorded at 11 point locations within eight survey areas, with points generally occurring in the north and east of the project area. *Senecio leucoglossus* was broadly distributed across eastern and southern portions of the project area, with a total of 2,063 individual plants recorded at 348 point locations across 20 survey areas.

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One flora species recorded within the project area, *Boronia stricta*, represented a northeast range extension of approximately 125 km. A total of 30 individual *B. stricta* plants were recorded across five point locations in survey area LR23_18, situated in the south of the project area.

Following the field survey, 69 of the 76 conservation significant flora species identified from the desktop assessment as possibly occurring were considered Unlikely to occur with the project area. This assessment is based on presence or absence of suitable habitat for the species, proximity to previous recent records, sufficient searches for the species and detectability of the species. Four conservation significant flora species were considered to have Potential to occur within the project area, namely: *Hibbertia acrotoma*, listed as P1 by DBCA; *Stylidium korijekup*, listed as P2 by DBCA; *Actinotus repens*, listed as P3 by DBCA; and *Eucalyptus* x *graniticola*, listed as P4 by DBCA.

Two Key weed species were recorded during the field survey, namely Blackberry (**Rubus* sp.) and Arum lily (**Zantedeschia aethiopica*). Blackberry is listed under the *Biosecurity and Agriculture Management Act 2007* as a Declared Pest and as a Weed of National Significance. Approximately 310 Blackberry plants were recorded at 31 points within the Hoffman Mill townsite Reserve survey area, and thickly infested both sides of the existing watercourse. One individual Arum lily plant was recorded within the same survey area.

1. Introduction

1.1. Project background

Alcoa of Australia Limited's (Alcoa) Western Australian mining operations includes the Willowdale bauxite mine, located in Alcoa's Mining Lease 1SA, east of Waroona, Western Australia. Alcoa has approval to mine within Mining Lease 1SA subject to submitting draft five-year mine plans and associated environmental management programmes known as the Mining and Management Program (MMP) to the State's Mining and Management Program Liaison Group on an annual basis. Alcoa has committed to undertaking pre-clearance ecological surveys for the Willowdale Mine (Larego region) as part of its MMP assessment.

Eco Logical Australia (ELA) was engaged by Alcoa to undertake pre-clearance flora surveys in the Larego region of Willowdale mine. The pre-clearance flora surveys comprise Threatened and Priority Flora and Key Weed species (Weeds of National Significance [WoNS] and Declared Pest plants [DP]) surveys conducted over three survey periods (Winter/Spring 2023, Summer/Autumn 2024 and Winter/Spring 2024). The results of these surveys will be used to: amend conceptual clearing alignments to avoid significant flora and vegetation; create management plans to ensure any identified WONS or DP and invasive weeds are not spread; inform translocation and environmental management plans as required; and assist Alcoa in preparing its MMP submission.

A total of 131 individual survey areas, comprising 38 Priority 1 areas and 93 Priority 2 areas, were proposed to be covered in the Spring 2023 survey period (Figure 1). Priority 1 areas include 2024 MMP submission areas, and Priority 2 areas include 2025 MMP submission areas. These survey areas are henceforth referred to as the 'project area', with total area of 818.5 ha (456.3 ha of which are Priority 1 and 362.2 ha are Priority 2). Survey areas are listed in Appendix A.

This technical report summarises results of the desktop assessment and Spring 2023 field survey and defines the conservation significant and introduced flora values of the project area.

1.2. Scope of works

This report addresses the Spring 2023 items in the Scope of Works listed below:

- A desktop assessment to determine the likelihood of finding threatened and priority species during different flowering seasons
- Field surveys to determine the presence and location of Threatened and Priority flora species and Key Weed species (WoNS, DP)
- Preparation of a technical survey report
- Provision of all spatial data recorded during the field surveys

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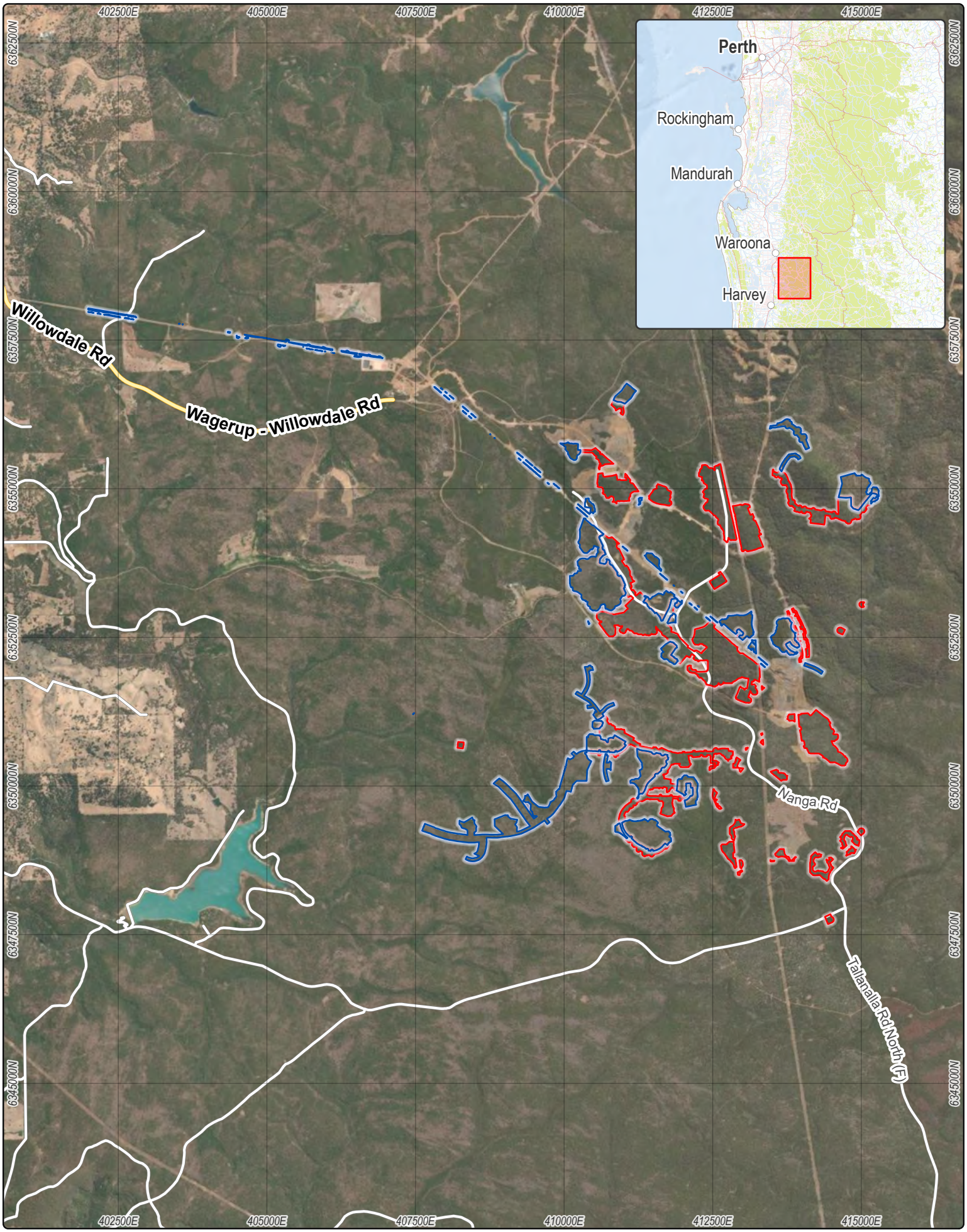


Figure 1: Project overview

Survey areas

- Priority 1
- Priority 2

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Kilometres

Datum/Projection:
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2. Environmental setting

2.1. Bioregion

The Interim Biogeographic Regionalisation for Australia (IBRA) currently classifies 89 bioregions across Australia, based on a range of biotic and abiotic factors such as climate, vegetation, fauna, geology and landform (Thackway and Cresswell 1995; Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2023a). These bioregions are currently further refined into 419 subregions representing more localised and homogenous geomorphological units in each bioregion (DCCEEW 2023a). IBRA divides Western Australia into 26 biogeographic regions and 53 subregions based on dominant landscape characteristics of climate, lithology, geology, landform and vegetation.

The project area is located in the Jarrah Forest bioregion, and more specifically the Northern Jarrah Forest subregion (JAF01). JAF01 is described as a plateau characterised by Jarrah-Marri forest on laterite gravels, woodlands of Wandoo - Marri on clayey soils in the east, *Agonis* shrublands on eluvial and alluvial deposits and Jarrah forests in a mosaic with a variety of species-rich shrublands in areas of Mesozoic sediments (Williams and Mitchell 2001).

2.2. Climate

The project area has a warm, Mediterranean climate with hot dry summers and mild wet winters (Williams and Mitchell 2001). Based on climate data from the nearby Bureau of Meteorology (BoM) Mt William weather station (station number 109501, rainfall data 2004-present, located less than 1 km from the conveyor in the west of the survey area), the project area receives an annual average rainfall of 1159 mm, with most of the rainfall occurring during the months of June, July and August (BoM 2023a; Figure 2). In the 12 months preceding the October-November 2023 field survey, the project area received a total of 1129 mm of rainfall, which is very similar to the long-term average (BoM 2023a). A total of 316 mm of rainfall was recorded in the three months prior to the field survey, which is lower than the long-term average for the same period (414 mm; BoM 2023a).

Temperature data for the project area was available from the Dwellingup weather station (station number 9538, temperature data 1935-present, located approximately 26 km north of the project area). Mean maximum air temperatures of the survey area range from 31.0°C in January to 15.8°C in July, while mean minimum temperatures of the survey area range from 15.4°C in February to 5.6°C in July (BoM 2023a; Figure 2).

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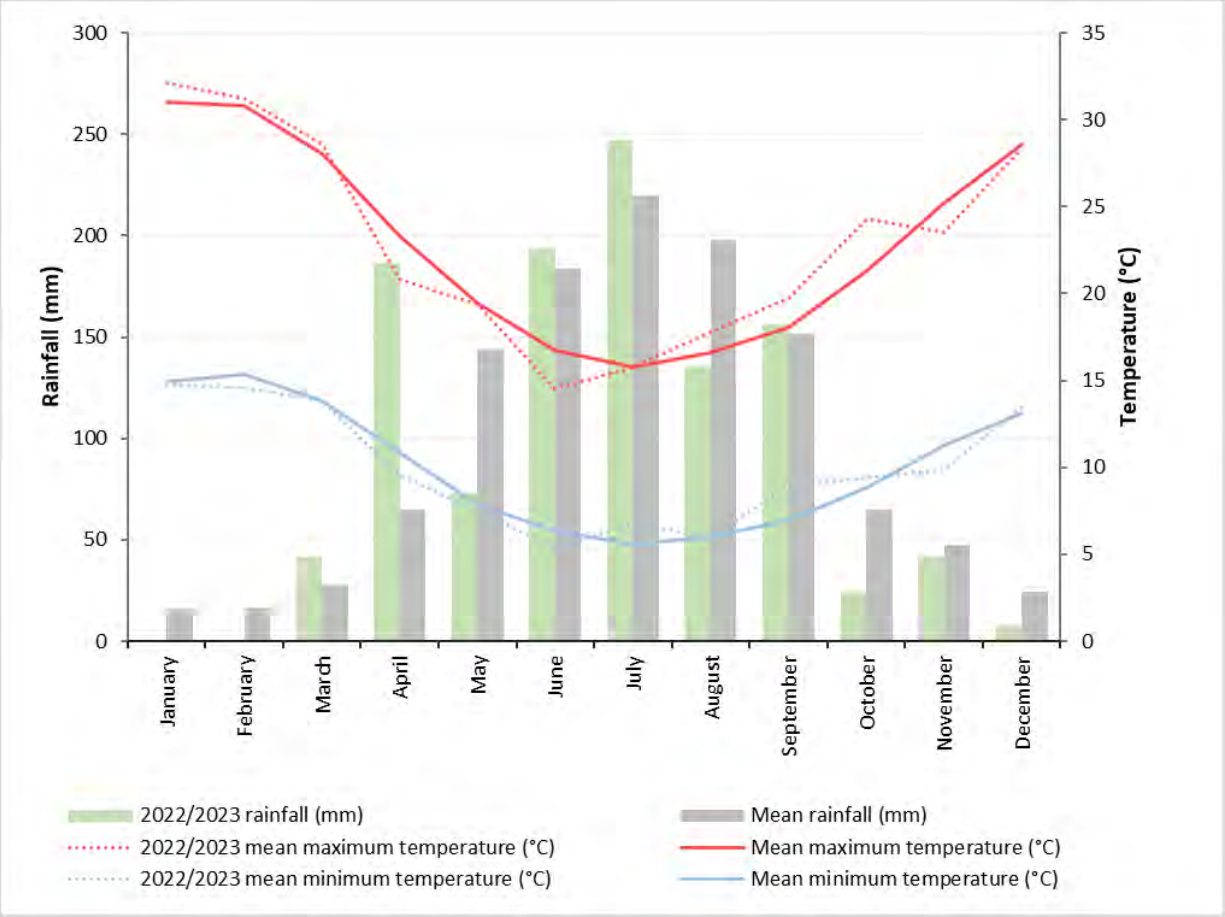


Figure 2: Climate data for the project area

2.3. Geology, landforms and soils

Soil-landscape mapping prepared by the Department of Primary Industries and Regional Development (DPIRD), provides an inventory and condition survey of lands at a 1: 250,000 scale (DPIRD 2022). The majority of the project area is situated on the Darling Plateau system, which comprises a lateritic plateau with gravelly soils and Jarrah-marri-wandoo forest and woodland (817.2 ha; 99.8% of the project area; Figure 3). The Murray Valleys System, which comprises deeply incised valleys with red loamy earths, shallow duplexes and rock outcrop and Jarrah-marri-wandoo forest and woodland with mixed shrubland is mapped over the heads of valleys in the west of the project area (1.5 ha; 0.2% of the project area; Figure 3).

Two soil units have been mapped across the project area, namely JZ1 and Mw31 (Australian Soil Resource Information System 2023). The soils of JZ1 underlie most of the project area (816.4 ha; 99.8% of the project area) and are underlain by a dissected plateau with strongly undulating relief and some moderately incised valleys. Soils are characterised by lateritic gravels and block laterite, with the chief soils being ironstone gravels with sandy and earthy matrices (DPIRD 2022). Unit Mw31 underlies the western portion of the conveyor (1.3 ha; 0.2% of the project area) and comprises deeply incised, steep scarp and valley side slopes of the Darling scarp and its more deeply incised tributary valleys; chief soils are red earths on the colluvial slope deposits, with massive rock outcrops a feature (DPIRD 2022).

2.4. Regional vegetation

Vegetation type and extent have been mapped at a regional scale by Beard (1979) who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 1:250,000, the DPIRD has compiled a list of vegetation extent and types across Western Australia (Shepherd et al. 2002).

There is one pre-European vegetation association mapped across the project area, namely West Darling 3, which is described as 'medium forest of jarrah and marri' (DPIRD 2019;Figure 4). This vegetation association has 86% of its pre-European extent remaining within the Northern Jarrah Forest subregion (Department of Biodiversity, Conservation and Attractions [DBCA] 2019a).

Regional Forest Agreement mapping within the southwest forest region of Western Australia covers the pre-1750 distribution of vegetation complexes (Mattiske and Havel 1998). Six vegetation complexes are mapped across the project area (DBCA 2018a; Figure 5), with Dwellingup 1 being the most extensive (673.1 ha; 82.2%). All these vegetation complexes have more than three-quarters of their pre-European extent remaining within the Darling Plateau subregion (DBCA 2019b; Table 1)

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Table 1: Vegetation complexes of the Southwest forest region (Mattiske and Havel 1998)

Vegetation complex	Vegetation	Area within project area (ha)	Proportion of project area (%)	Area remaining within Darling Plateau subregion of SW forests (ha)	Proportion remaining within Darling Plateau subregion of SW forests (%)
Cooke	Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* (semiarid and arid zones) and on deeper soils adjacent to outcrops, closed heath of Myrtaceae-Proteaceae species and lithic complex on granite rocks and associated soils in all climate zones, with some *Eucalyptus laeliae* (semiarid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to perarid zones).	63.3	7.7	30,304.2	82.4
Dwellingup 1	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.	673.1	82.2	181,038.8	86.8
Murray 1	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones.	1.8	0.2	52,296.0	76.1
Swamp	Mosaic of low open woodland of *Melaleuca preissiana-Banksia littoralis*, closed scrub of Myrtaceae spp., closed heath of Myrtaceae spp. and sedgelands of *Baumea* and *Leptocarpus* spp. on seasonally wet or moist sand, peat and clay soils on valley floors in all climatic zones.	1.1	0.1	40,613.0	75.7
Yarragil 1	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.	55.0	6.7	64,927.1	81.0
Yarragil 2	Open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on slopes, woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.	24.6	3.0	46,475.3	92.5
Total		*818.7*	*100.0*		

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2.5. Hydrology

The project area is situated within two catchments, Harvey Diversion_Harvey River and Harvey Estuary_Harvey River (Department of Water and Environmental Regulation [DWER] 2018a; Figure 6). There are several subcatchments associated with the main watercourses that intersect the project area, all of which eventually flow into the Harvey River. The subcatchments (with associated watercourses; DWER 2018b) are Stirling Dam (Harvey River mainstream flows into Stirling Dam), Samson Brook (Samson Brook flows into Samson Brook Dam/Lake Kabbanup), Samson Drain (Black Tom Brook and another significant stream flow into Samson South Drain) and Logue Drain (a major tributary of the Harvey River flows into Logue Brook Dam/Lake Brockman).

Multiple local drainage lines run through the greater Larego area (Figure 6), although these only intersect the following survey areas: LR23_P2_62, LR23_35, LR23_26, LR23_23, LR23_28, LR23_15, Turbidity_a, Turbidity_b.

Most of the project area occurs within public drinking water source areas (PDWSA) Samson Brook Catchment and Stirling Dam Catchment, both of which are Priority 1 (P1) PDWSAs (Figure 6; DWER 2023). Samson Brook Catchment, via Samson Brook dam and Samson Brook pipehead dam supply drinking water for the Waroona and Hamel water supply scheme and the Integrated Water Supply System (DWER 2019). Stirling Dam Catchment, via Stirling dam, provides Harvey's town water supply and acts as a strategic supply to Perth Metropolitan Area (Waters and Rivers Commission 2000). P1 source protection areas are defined to ensure that there is no degradation of the water source and are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use (Waters and Rivers Commission 2000).

The project area does not lie within any mapped Groundwater Dependent Ecosystems or Inflow Dependent Ecosystems (BoM 2023b).

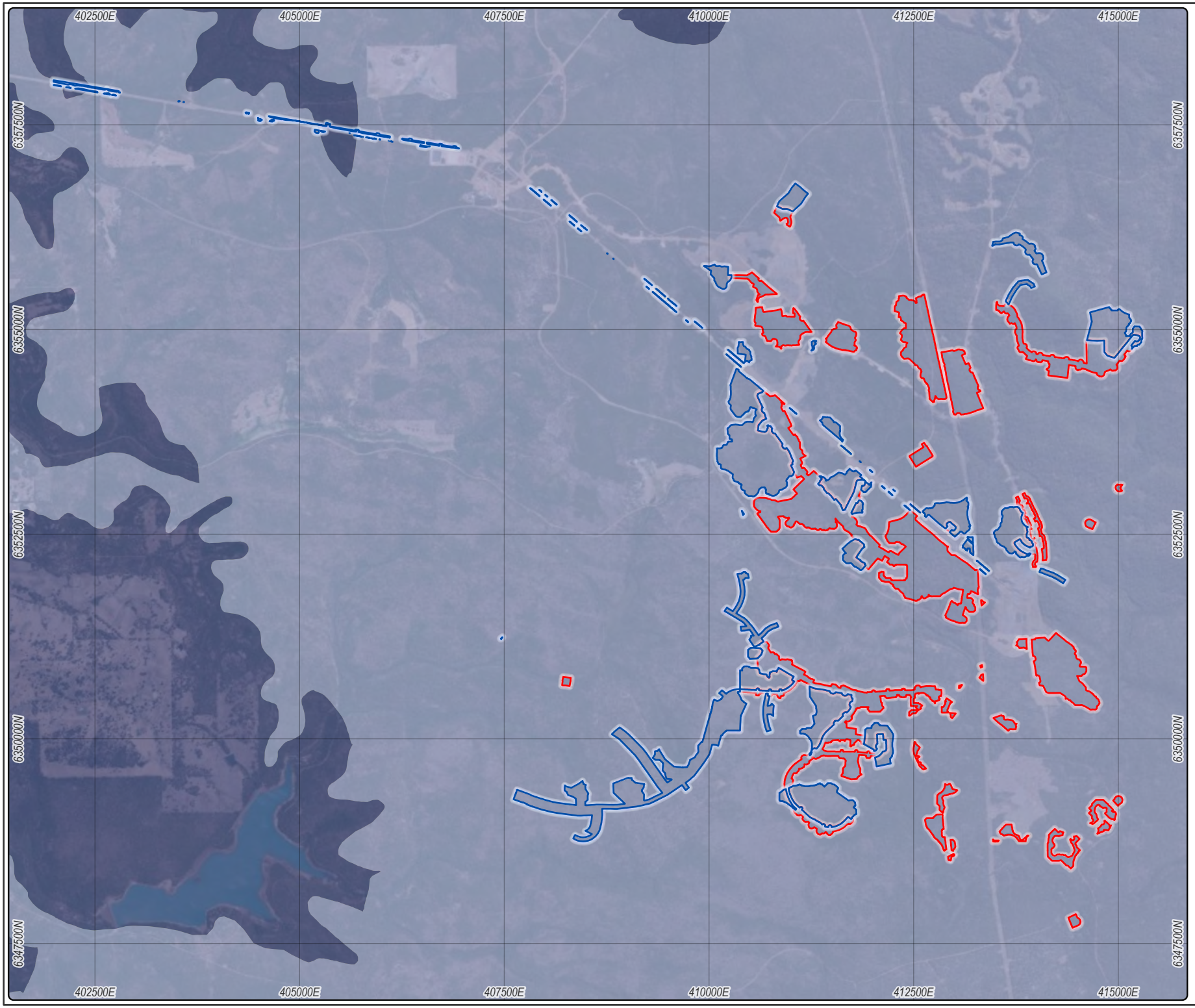
2.6. Areas of conservation significance

Environmentally Sensitive Areas (ESAs) are defined in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under s51B of the *Environmental Protection Act 1986* (EP Act). ESAs include areas declared as World Heritage, included on the Register of the National Estate, defined wetlands, Bush Forever sites, vegetation containing rare (Threatened) flora and/or Threatened Ecological Communities (TECs). There are 15 ESAs within 5 km of the project area (DWER 2021; Figure 7).

Most of the project area (except for survey areas LR23_P2_88, LR23_P2_95 and LR_P2_96) is located within Dwellingup State Forest, a Section 5(1)(a) reserve (DBCA 2023a; Figure 7). Protected areas within Dwellingup State Forest in the vicinity of the project area include: Lane Poole Reserve (a conservation park), located less than 500 m from survey areas LR23_P2_62, LR23_35 and LR23_P2_49; and an unnamed Section 5(1)(h) reserve at Mt William, located approximately 500 m from survey area LR23_P2_46 (DCCEEW 2023b).

There are no nationally or internationally important wetlands occurring within 20 km of the project area (DBCA 2018b). The nearest wetland listed in the Directory of Important Wetlands of Australia is Peel-Harvey Estuary, located approximately 29 km northwest of the project area; the Harvey River flows into this wetland. Peel-Harvey Estuary is part of the Ramsar listed Peel-Yalgorup System (DBCA 2017).

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Legend

Survey areas

- Priority 1
- Priority 2

Land systems

- Darling Plateau System
- Murray Valleys System

Figure 3: Land systems

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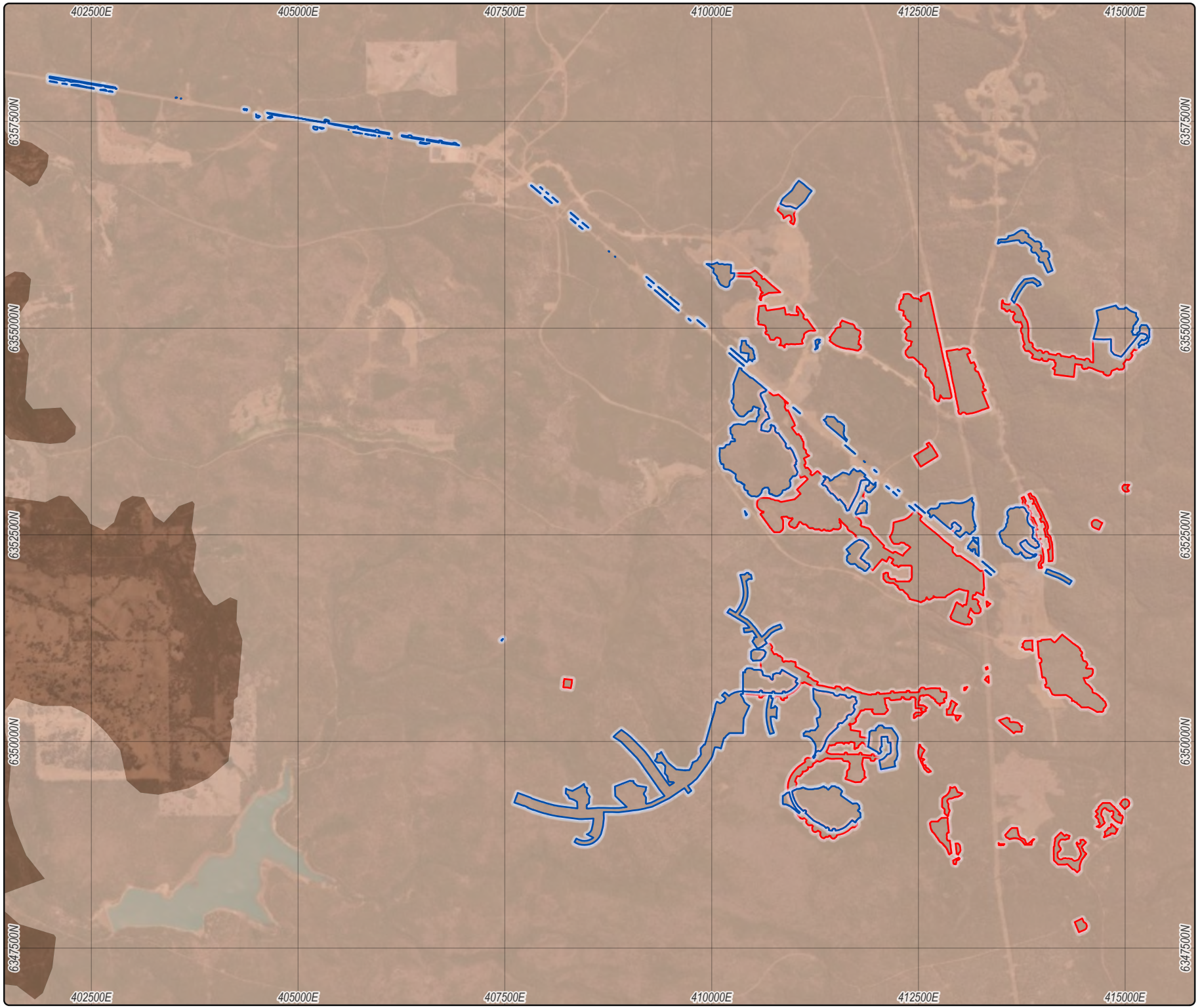
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Legend

Survey areas

- Priority 1
- Priority 2

Pre-European vegetation associations

- WEST DARLING_3
- WEST DARLING_4

Figure 4: Broad-scale vegetation - Pre-European vegetation associations

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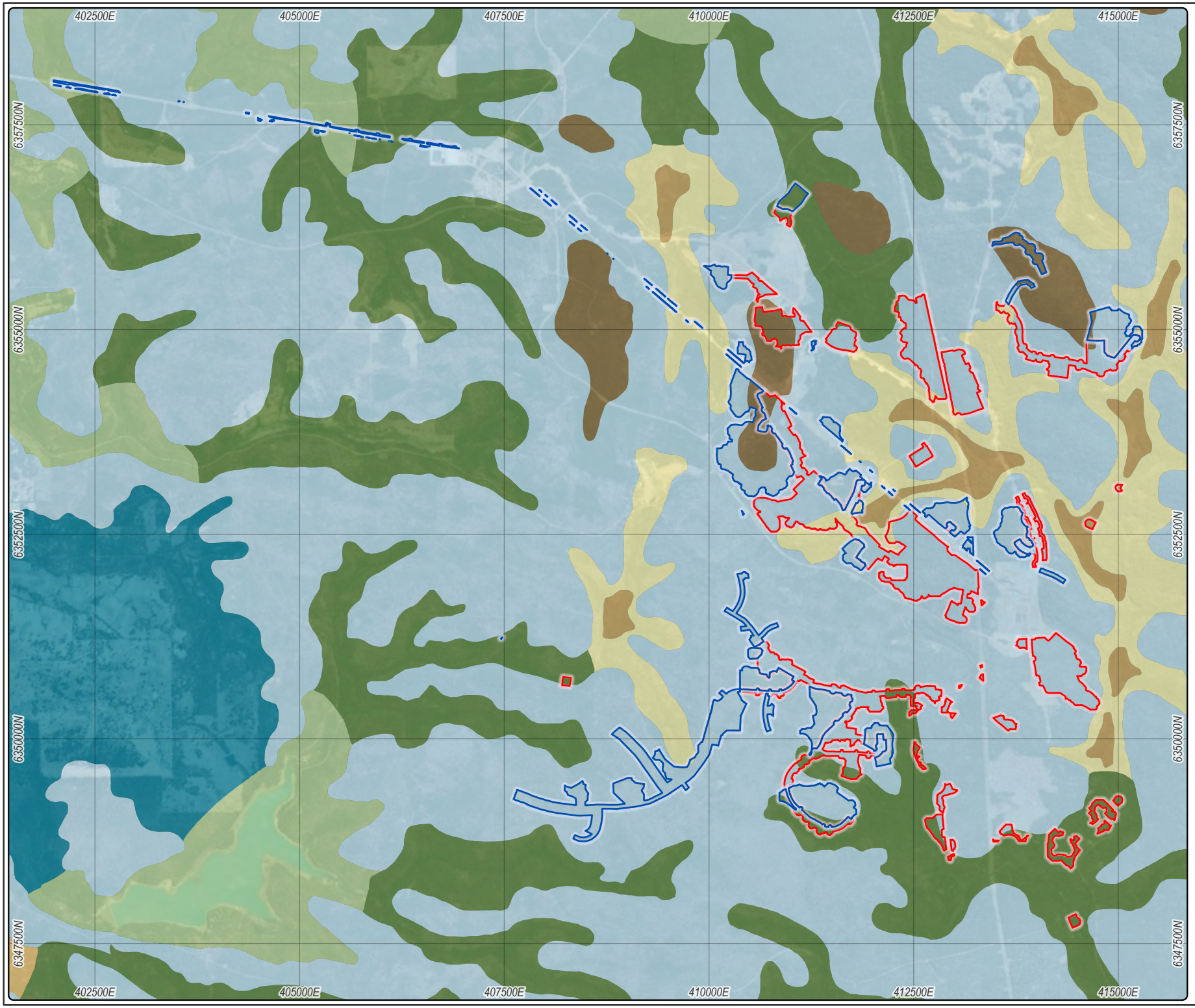
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Legend

Survey areas

- Priority 1
- Priority 2

South West forest vegetation complexes

- Cooke
- Darling Scarp
- Dwellingup
- Helena 1
- Murray 1
- Swamp
- Yarragil 1
- Yarragil 2

Figure 5: Broad-scale vegetation mapping - South West forest vegetation complexes

0 0.5 1 2

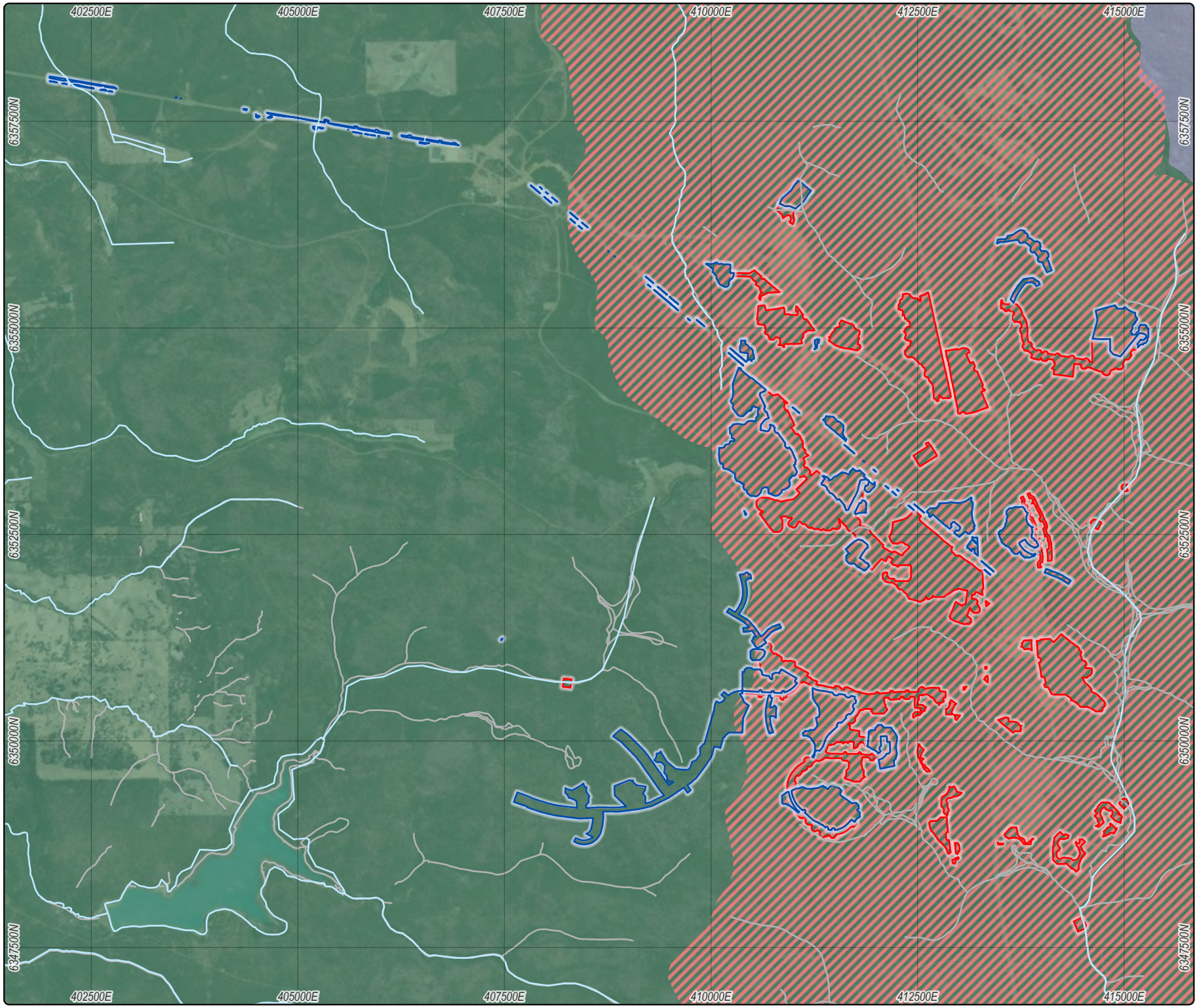
Kilometres

Datum/Projection:
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Legend

- Hydrography, linear
- Streams

Survey areas

- Priority 1
- Priority 2

Hydrographic catchments – subcatchments

- Harvey
- Murray River & Tributaries

Public drinking water source areas

- Protection Area - P1

Figure 6: Hydrology

0 0.5 1 2

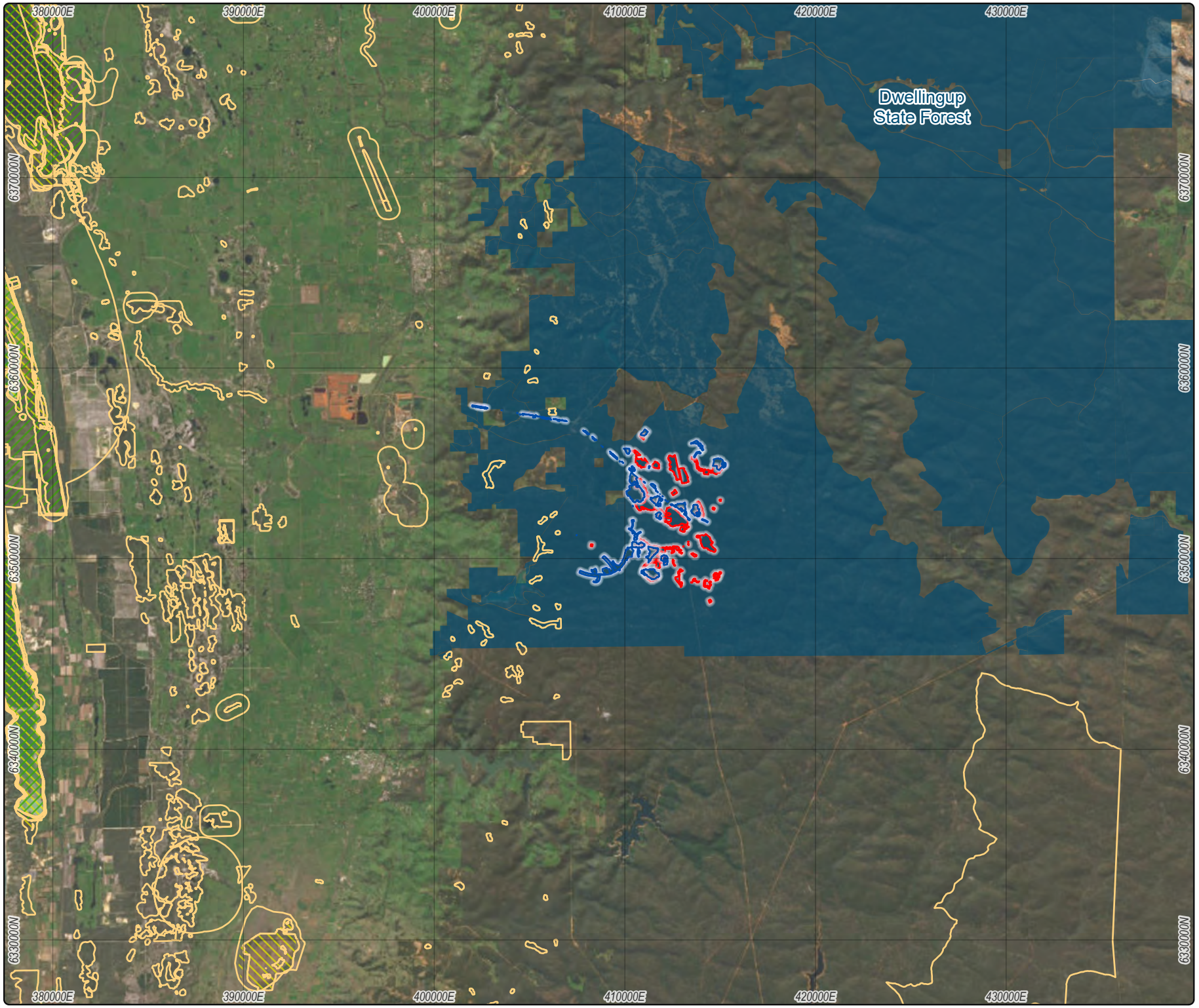
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Datum/Projection:
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Legend

- Environmentally Sensitive Area (ESA)
- Ramsar sites
- Directory of Important Wetlands
- DBCA Legislated Lands and Waters

Survey areas

- Priority 1
- Priority 2

Figure 7: Areas of conservation significance

0 2.5 5 10

Kilometres

Datum/Projection:
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3. Methodology

3.1. Desktop review

An initial desktop assessment prior to the field survey was undertaken to determine environmental values and conservation significant flora, vegetation or other environmental features (such as riparian areas, wetlands) relating to the project area.

3.1.1. Database searches

The following Commonwealth and State databases were searched for information relating to conservation significant flora in order to inform the field survey. Applied search buffers used are considered suitable based on flora expected to occur within the project area (Table 2).

Table 2: Database searches undertaken for the survey areas

Database	Reference	Search area
Atlas of Living Australia Spatial search for records.	Atlas of Living Australia 2023	10 km buffer around project area envelope
Commonwealth EPBC Act Protected Matters Search Tool (PMST) for Matters of National Environmental Significance, including any Threatened species listed under the EPBC Act.	DCCEEW 2023c	10 km buffer around project area envelope
DBCA Threatened and Priority flora database searches for Declared Rare Flora listed under the latest WA Biodiversity Conservation (listing of native species) (flora) order and Priority Flora [ref# 64-0223FL]^	DBCA 2023b	Area ~150 km x 80 km covering Alcoa operations areas and buffer

^Supplied by Alcoa

Additionally, Commonwealth and State government spatial datasets for land system mapping, regional vegetation mapping and hydrology were reviewed, as described in sections 2.3, 2.4 and 0.

3.1.2. Literature review

The following publicly available literature and previous survey reports relevant to the project area were reviewed:

- *Flora and vegetation management plan (Draft) – Huntly and Willowdale mines* (Mattiske Consulting 2022)
- *Assessment of matters pertaining to the renewal of the Regional Forest Agreement for the South-West Forest Region of Western Australia* (Government of Western Australia 2019)

Aerial photography for the survey areas was reviewed to identify land use patterns, the extent of vegetation, relevant landscape/catchment matters and any other relevant issues where possible.

3.1.3. Likelihood of occurrence assessment

An assessment of the likelihood of Threatened and Priority flora species being present within the project area was carried out. The assessment is based on specific likelihood of occurrence criteria. The criteria include factors such as: location and recency of previous records in relation to the project area; suitable landforms, soils and habitat that appear to be present based on the desktop review and aerial imagery; and known flowering periods. In addition, Alcoa's location specific risk rating for Larego (Alcoa 2023) was considered during development of ELA's likelihood ratings.

Conservation codes, categories and criteria for flora protected under the EPBC Act and the State *Biodiversity Conservation Act 2016* (BC Act) are provided in Appendix B (DBCA 2023c, DBCA 2023d). Criteria used for this assessment are presented in Appendix C.

3.2. Field survey

3.2.1. Survey team and timing

The field survey was conducted by Emily Chetwin (Botanist), Dr Jeff Cargill (Principal Ecologist), Glenn Maslen (Ecologist) and Maitland Ely (Graduate Ecologist) over 11 days from 22 to 27 October and 30 October to 03 November 2023. Field staff had valid scientific licences to conduct flora and vegetation surveys and to take Threatened and Priority flora in WA at the time of the survey (Table 3).

The survey timing was consistent with the Environmental Protection Authority (EPA) recommendations for undertaking Detailed and flora and vegetation surveys in the South-west botanic region i.e., Spring (September to November; EPA 2016).

Table 3: Survey team

Staff	Project role	Licence
Emily Chetwin	Project management, Field survey, Taxonomic flora identification, Reporting	Flora scientific collection licence: FB62000026-3 Declared Rare Flora permit: TFL 124-2021 DRA Permit: 3296
Dr Jeff Cargill	Project and Technical oversight, Field survey	Flora scientific collection licence: FB62000138-2 Declared Rare Flora permit: TFL 2223-0115 Regulation 4 Authority: CE006933
Glenn Maslen	Field survey	Flora scientific collection licence: FB62000376
Maitland Ely	Field survey	Flora scientific collection licence: FB62000455

3.2.2. Survey areas

A total of 65 survey areas comprising 801.0 ha out of the proposed 131 survey areas comprising 818.5 ha were surveyed in the Spring 2023 field survey (Appendix A). All of the 38 Priority 1 survey areas (comprising 456.3 ha) and a total of 27 Priority 2 survey areas (comprising 344.7 ha) were surveyed in Spring 2023.

Only 17.5 ha of Priority 2 survey areas (66 areas) remain to be surveyed. Three of the remaining survey areas, L23_P2_12, L23_P2_47 and L23_P2_52 (total area 11.6 ha) are situated in the northeast portion of the project area. The other 63 remaining survey areas (total area 6.0 ha) are all small, narrow (<10 m wide) areas located adjacent to the conveyor belt west of the Larego site offices. ELA will survey the 66 uncompleted areas in the Summer/Autumn 2024 and/or Spring 2024 survey periods.

3.2.3. Targeted Threatened and Priority flora survey

A survey was undertaken to assess the presence of Threatened and Priority Flora species within the survey areas. Potentially occurring species and associated suitable habitat were determined during the desktop likelihood assessment. The Targeted flora survey involved personnel walking systematic

transects, spaced approximately 20 m apart, where terrain, vegetation and safe access allowed. All encountered conservation significant flora and vegetation were recorded by taking the coordinates of each individual and/or a centroid coordinate location for a group of individuals within a 20 m radius using a handheld GPS unit. The number of individuals and/or percentage covers for each location was recorded. Track logs as shown in Figure 8 attest to the time and effort expended.

3.2.4. Key Weed species survey

The locations of any WoNS and DP species encountered during the Targeted Threatened and Priority flora survey were recorded by taking the coordinates of each individual and/or a centroid coordinate location for a group of individuals within a 20 m radius. An estimate of the population size was also recorded.

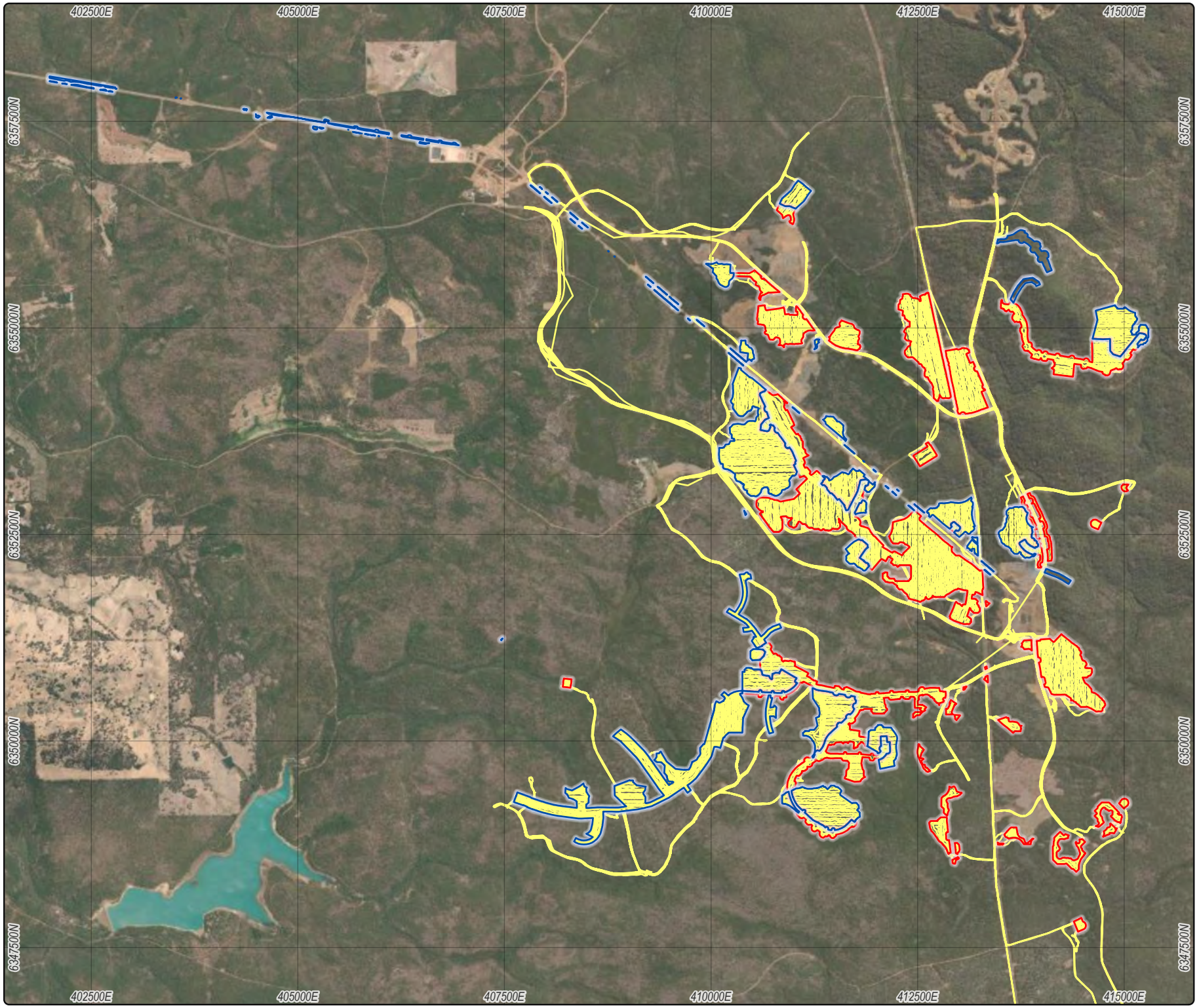
3.2.5. Flora identification and nomenclature

Representative specimens of all known and suspected conservation significant species were collected for verification/identification. All collections were assigned a unique collecting number. Subsequent occurrences of the collected representative specimens were recorded using unique GPS symbols. For all representative specimens collected of potential conservation significant flora, the following data were recorded:

- GPS location
- Time and date observed
- Observer details
- Population size estimate
- Location of population boundaries (if appropriate)
- Associated habitat/landscape element
- Associated vegetation
- A colour photograph

Flora specimen identification following the field survey was undertaken by ELA taxonomic specialists at the Western Australian Herbarium (WAH). Suitable material that meets WAH specimen lodgement requirements, such as flowering material and range extensions, will be submitted along with Threatened and Priority flora report forms to DBCA, as required by conditions of collection licences issued under the BC Act.

Nomenclature used for the flora species within this report follows the WA Plant Census as available on FloraBase (WAH 1998-).



Legend

Survey effort (tracks)

Survey areas

Priority 1

Priority 2

Figure 8A: Survey effort (Overview)

0 0.5 1 2

Kilometres

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Legend

Survey effort (tracks)

Survey areas

Priority 2

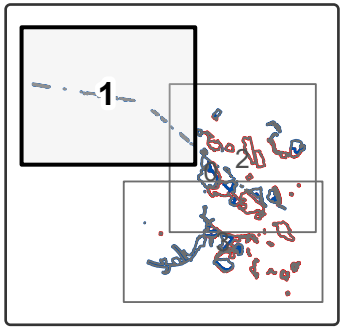


Figure 8B: Survey effort (Detailed Map 1 of 3)

0 0.25 0.5 1

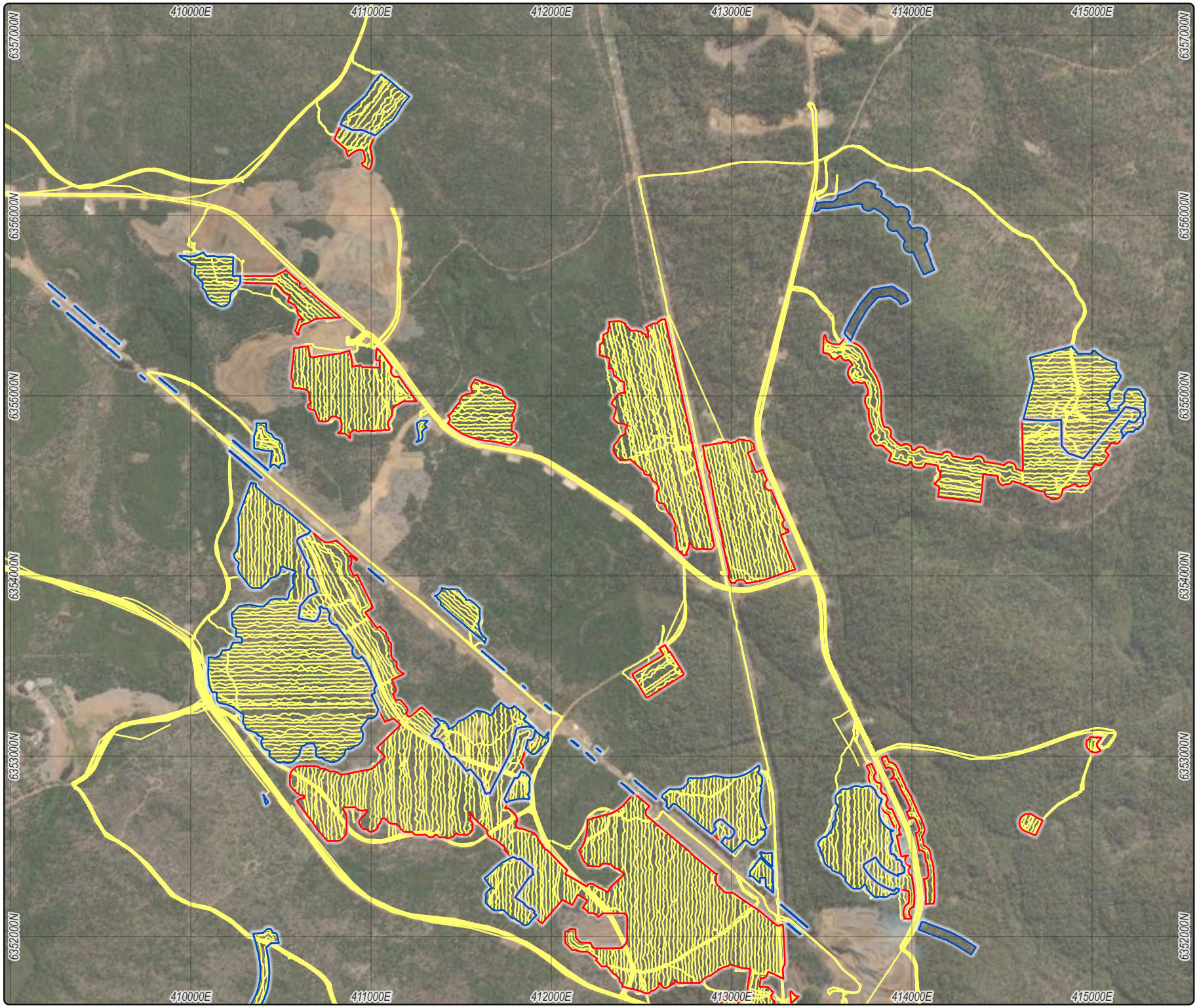
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Legend

Survey effort (tracks)

Survey areas

Priority 1

Priority 2

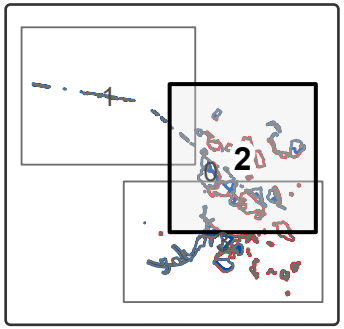


Figure 8C: Survey effort (Detailed Map 2 of 3)

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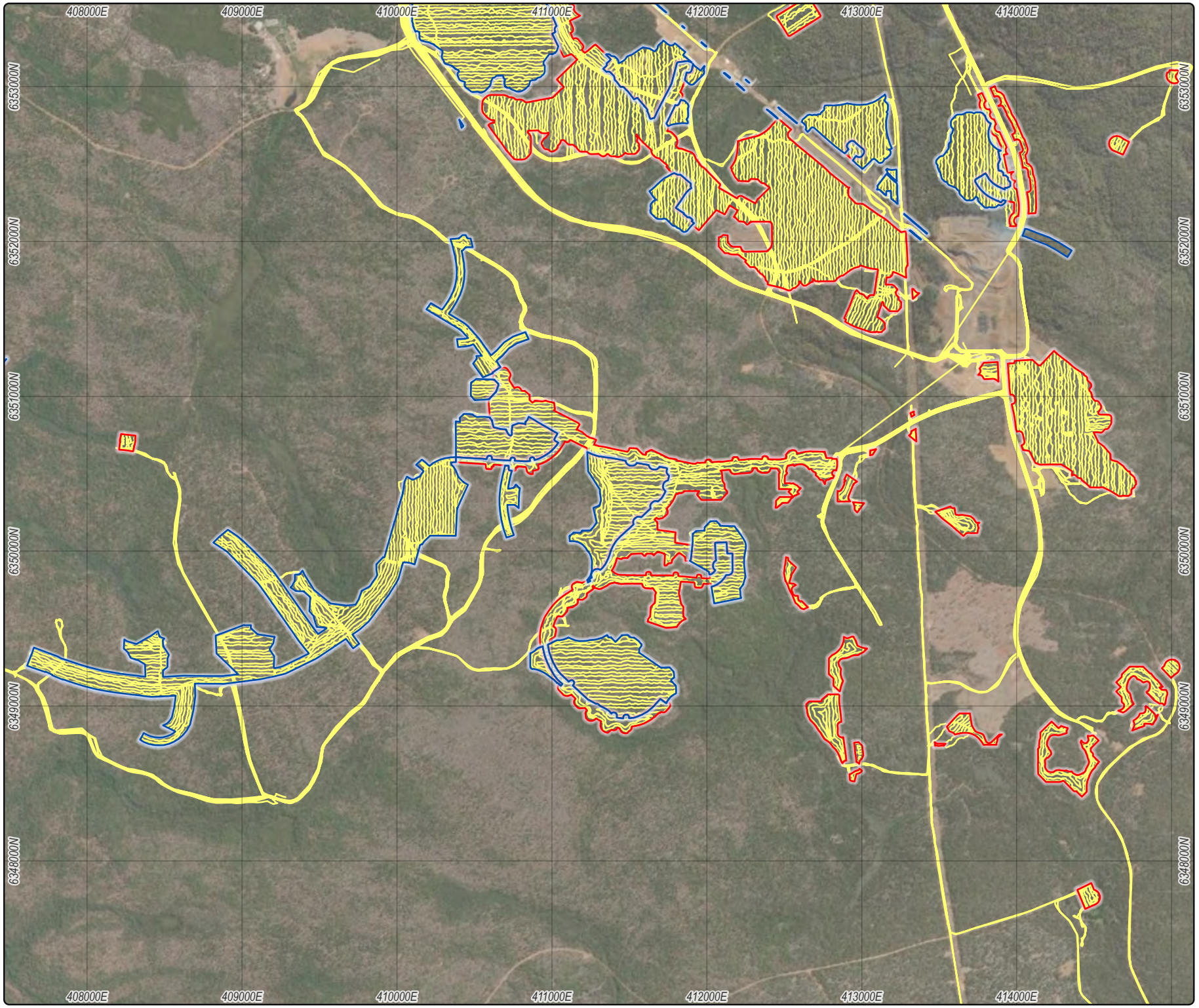
Kilometres

Datum/Projection:
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Legend

Survey effort (tracks)

Survey areas

Priority 1

Priority 2

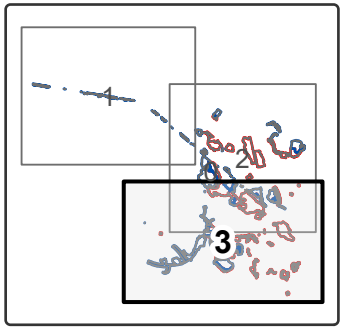


Figure 8D: Survey effort (Detailed Map 3 of 3)

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Kilometres

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3.3. Limitations

The EPA Technical Guidance document (EPA 2016) recommends including a discussion of the constraints and limitations of the survey methods used. An assessment of potential constraints and limitations of this survey are summarised in Table 4 below. One potential limitation was identified, regarding difficulty in traversing small areas of particularly dense vegetation around creeklines.

Table 4: Survey limitations

Potential survey limitation	Impact on survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a limitation**. Land system mapping (DPIRD 2022) and broad-scale vegetation mapping (DPIRD 2019) were available at a scale of 1:250,000. Available information, including the Huntly and Willowdale mines' draft Flora and vegetation management plan (Mattiske Consulting 2022) was sufficient to provide context at varying scales and therefore was not considered a limitation.
Scope (i.e. what life forms, etc., were sampled).	**Not a limitation**. The survey requirement of a Targeted flora survey, in accordance with relevant State and Commonwealth legislation and EPA guidance was adequately met.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a limitation**. Where flora encountered in the field was suspected of being a conservation significant species, it was collected for later identification and given a unique identifying number. Populations in new survey areas of previously collected species were also collected to be verified later.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a limitation.** A total of 65 survey areas comprising 801.0 ha out of the proposed 131 survey areas comprising 818.5 ha were surveyed in the Spring 2023 field survey. All of the 38 Priority 1 survey areas (comprising 456.3 ha) and a total of 27 Priority 2 survey areas (comprising 344.7 ha) were surveyed in Spring 2023. Only 17.5 ha of Priority 2 survey areas (66 areas) remain to be surveyed. ELA will survey the 66 uncompleted areas in the Summer/Autumn 2024 and/or Spring 2024 survey periods.
Mapping reliability.	**Not a limitation**. Coverage of all survey areas was considered to be excellent. High quality aerial maps were used for the field survey.
Timing, weather, season, cycle.	**Not a limitation.** The survey was undertaken in the appropriate season for flora and vegetation surveys, i.e. Spring (September-November), as specified by the EPA Technical Guidance (EPA 2016). Rainfall over the 12 months preceding the field survey was similar to the long-term average; over the three months prior to the field survey rainfall was lower than the long-term average for the same period (316 mm compared with 414 mm; BoM 2023a). Conditions were favourable for flowering and fruiting of vascular plant species, allowing confident identification of conservation significant flora species.
Disturbances (fire, flood, accidental human intervention, etc.).	**Not a limitation.** Disturbances within survey areas included historical clearing, fire, vehicle tracks and weed invasion. This did not negatively impact the ability to meet objectives outlined in the scope of works.
Intensity (in retrospect, was the intensity adequate).	**Not a limitation**. The survey effort for the Targeted flora survey was adequately met. All survey areas covered were searched for conservation significant flora and key weed species by field staff undertaking systematic transects spaced approximately 20 m apart across the survey areas. This method provides an accurate assessment of habitat characteristics and likelihood of conservation significant species.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a limitation**. The number of personnel conducting this field survey in the given time was adequate to undertake the required level of survey across the proposed survey areas. Only 17.5 ha of Priority 2 survey areas (66 areas) remain to be surveyed;

Potential survey limitation	Impact on survey
	these areas will be surveyed in the Summer/Autumn 2024 and/or Spring 2024 survey periods.
Access problems (i.e. ability to access survey area).	**Potential limitation**. Most parts of the survey areas completed in the Spring 2023 survey period were able to be accessed. However, in very small portions of the survey areas within creeklines (<10 ha of over 800 ha surveyed) extremely dense vegetation meant that 20 m spacing of systematic traverses was not always safely able to be adhered to.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	**Not a limitation**. The personnel conducting this field survey were all suitably qualified to identify specimens, having previously undertaken multiple flora and vegetation surveys in the Jarrah Forest bioregion of Western Australia. Project Director Dr Jeff Cargill has over 15 years' experience working in the Jarrah Forest Bioregion, including extensive botanical and rehabilitation survey work within Alcoa lease areas. Project Manager Emily Chetwin has over 5 years' experience working in the Jarrah Forest Bioregion, including several botanical and rehabilitation surveys within Alcoa lease areas. Additional field personnel Glenn Maslen and Maitland Ely have previous experience working in the Jarrah Forest Bioregion, including dieback and rehabilitation surveys within Alcoa lease areas.

4. Results

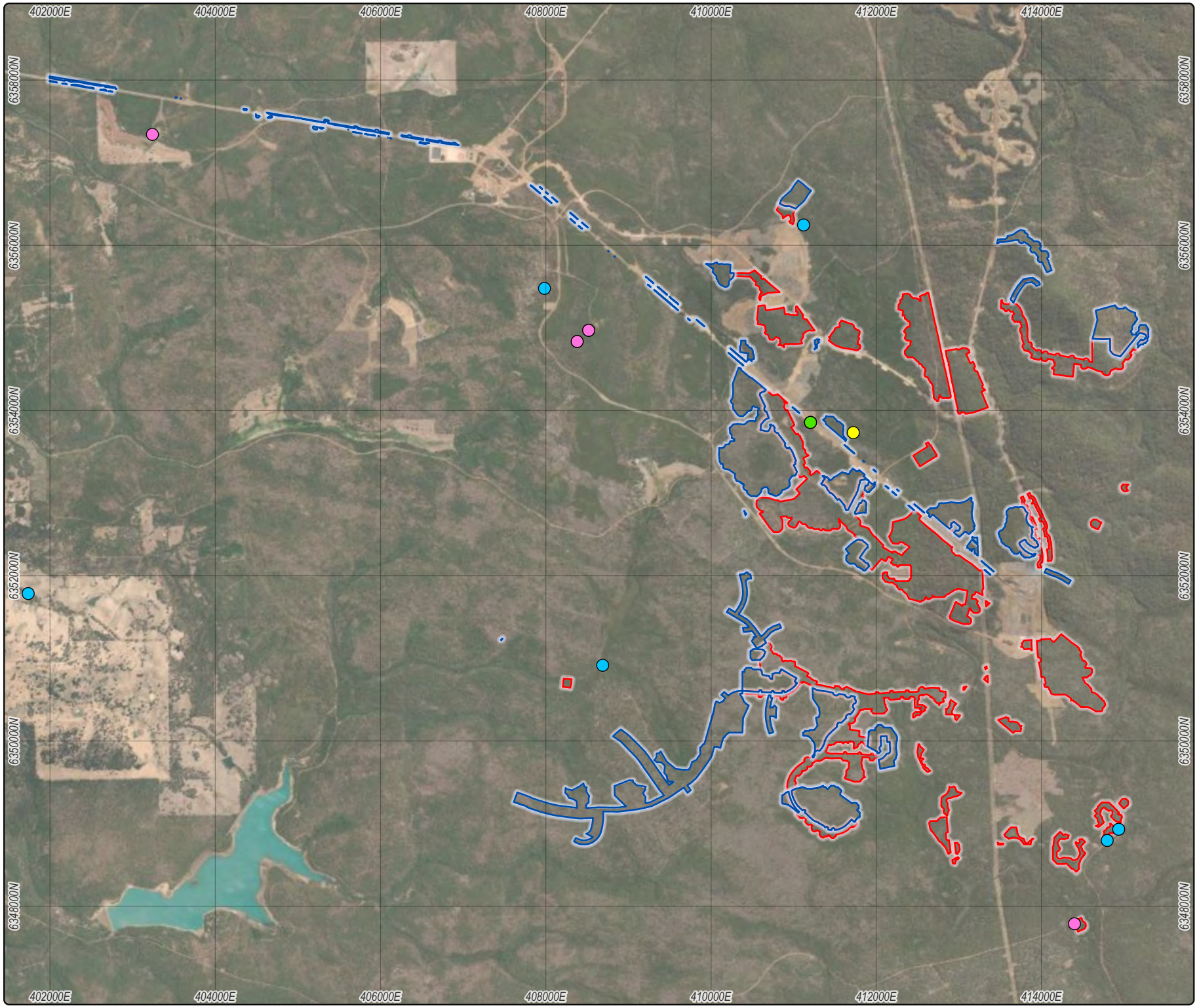
4.1. Desktop assessment

The PMST search (DCCEEW 2023c) was undertaken to identify conservation significant flora species recorded within, or nearby to, the survey area (current and historic; Appendix D). A review of the DBCA Threatened and Priority flora database search (DBCA 2023b) was also undertaken. Conservation significant flora species previously recorded within, and in proximity to the project area are presented in Figure 9.

4.1.1. Conservation significant flora species

The pre-survey flora likelihood of occurrence assessment is provided in Appendix E. Prior to the field survey, two conservation significant flora species were considered as Likely to occur within the project area, namely *Actinotus repens* and *Netrostylis* sp. Blackwood River (A.R. Annels 3043; both listed as P3 by DBCA). A total of 20 species were considered to have Potential to occur and 54 species were assessed as Unlikely to occur. The full flora likelihood of occurrence assessment is given in Appendix E.

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Legend

Survey areas

- Priority 1
- Priority 2

Conservation significant flora

- Priority 1
- Priority 2
- Priority 3
- Priority 4

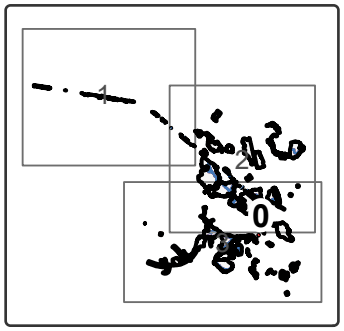


Figure 9A: Conservation significant flora previously recorded within and in the vicinity of the project area (Overview)

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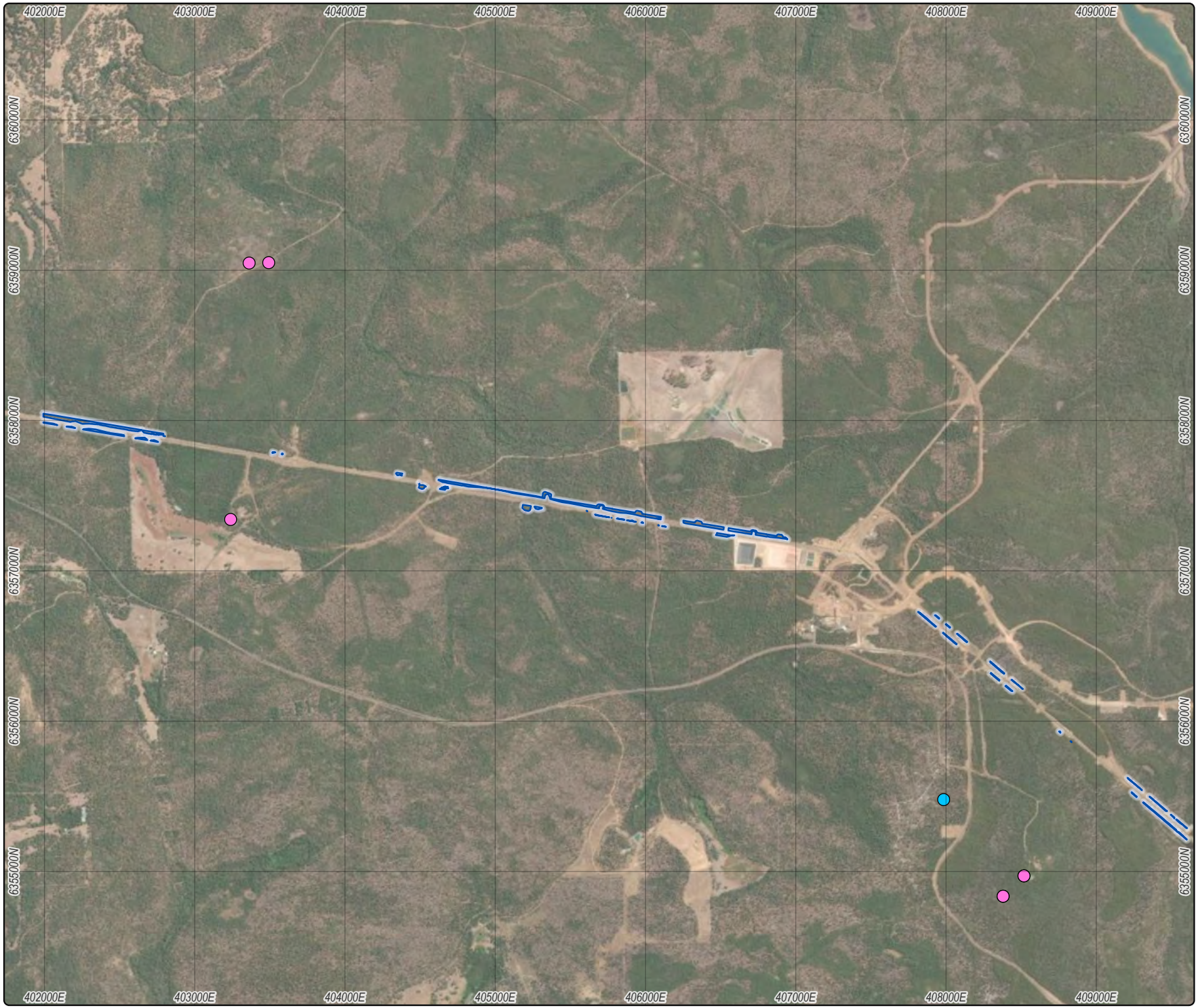
Kilometres

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Legend

Survey areas

- Priority 2

Conservation significant flora

- Priority 3
- Priority 4

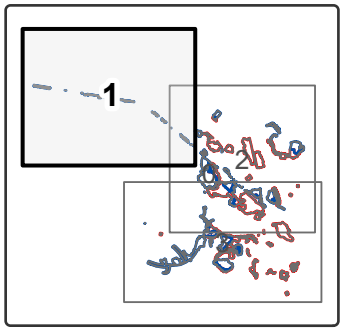


Figure 9B: Conservation significant flora previously recorded within and in the vicinity of the project area (Detailed Map 1 of 3)

0 0.25 0.5 1

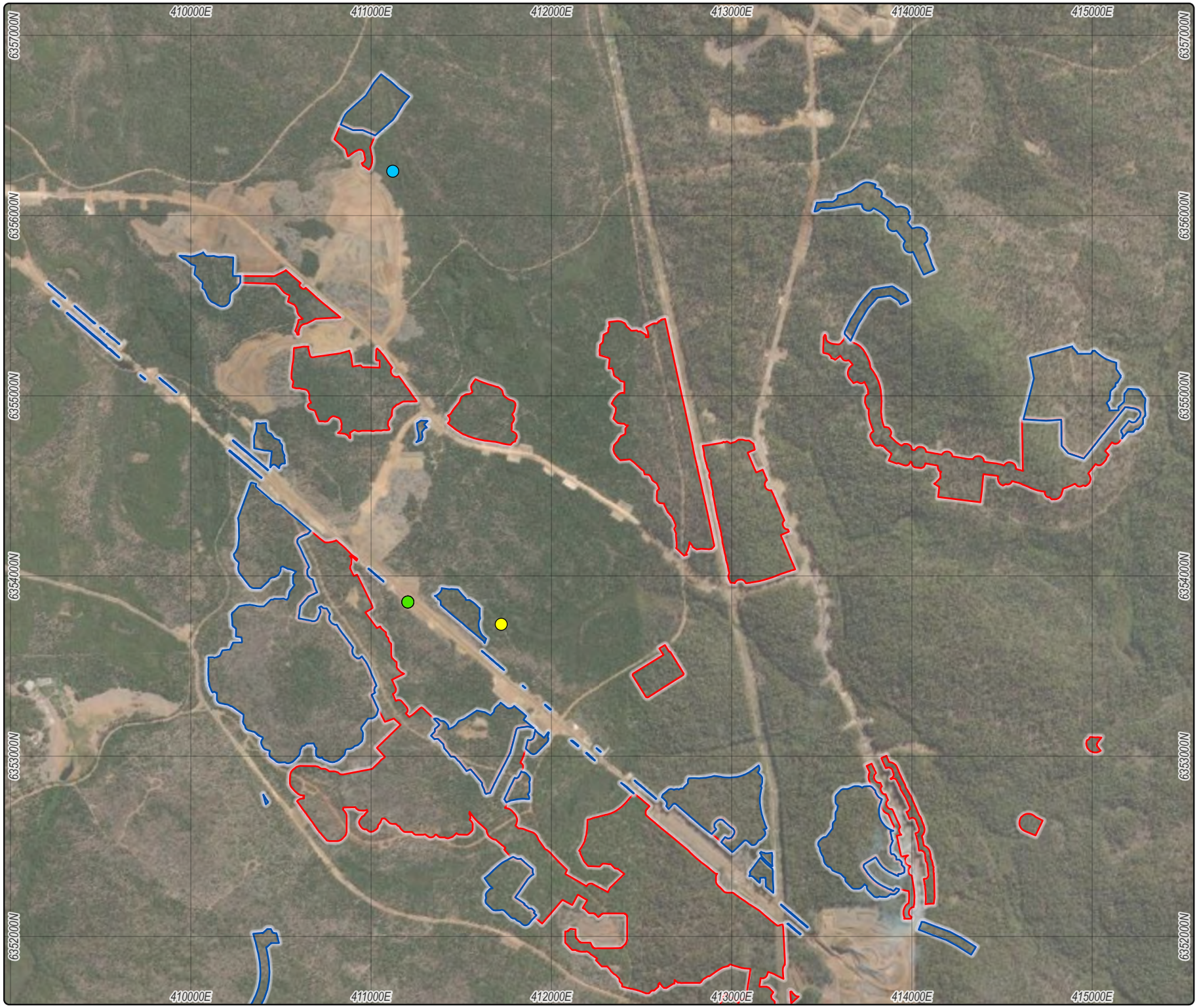
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Legend

Survey areas

- Priority 1
- Priority 2

Conservation significant flora

- Priority 1
- Priority 2
- Priority 3

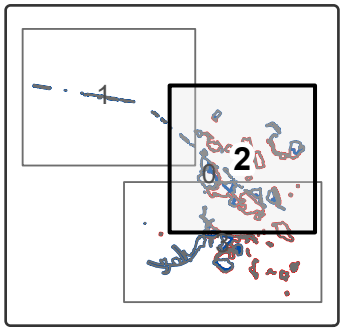


Figure 9C: Conservation significant flora previously recorded within and in the vicinity of the project area (Detailed Map 2 of 3)

0 0.25 0.5 1

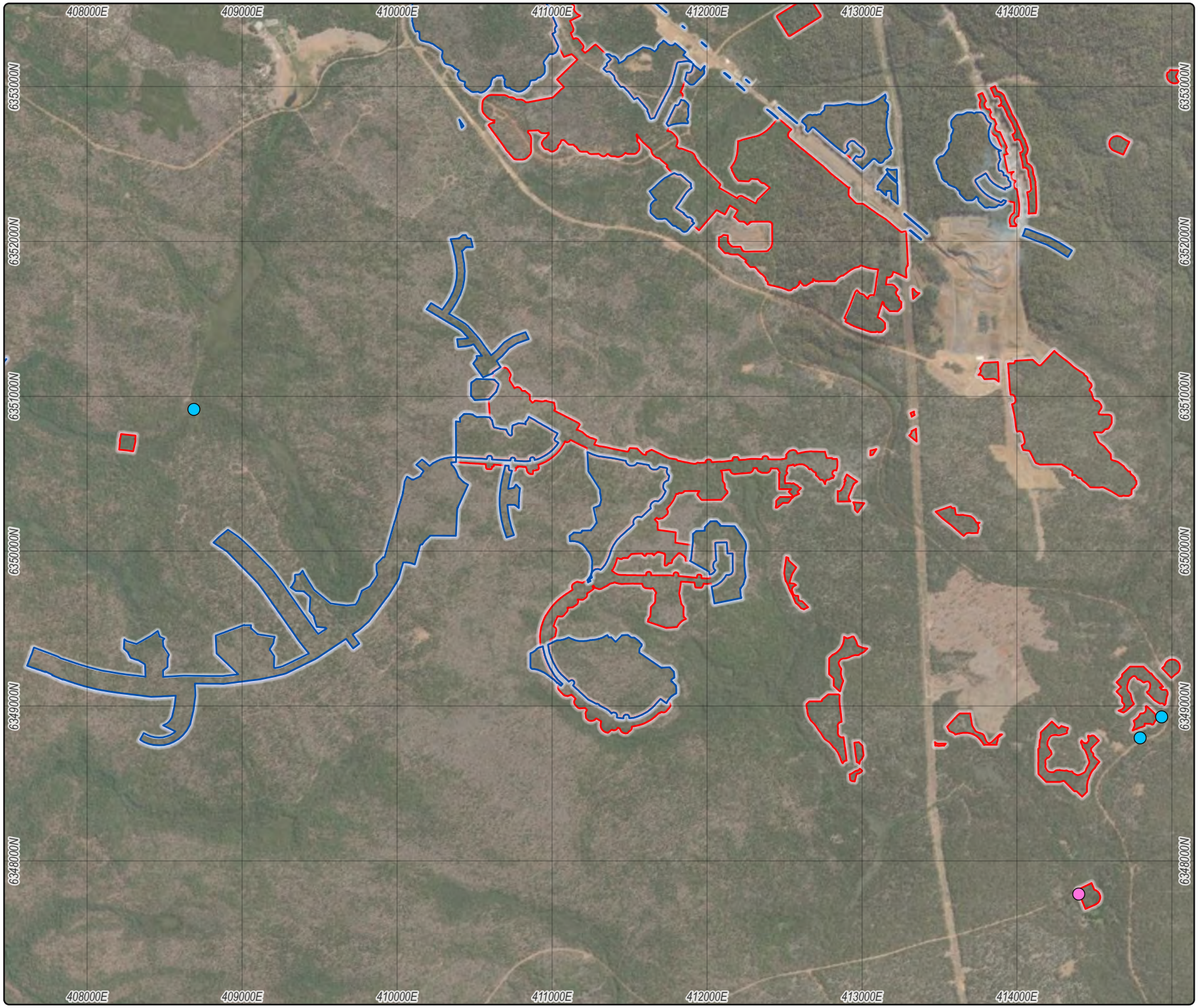
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Legend

Survey areas

- Priority 1
- Priority 2

Conservation significant flora

- Priority 3
- Priority 4

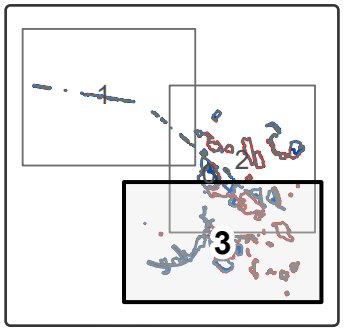


Figure 9D: Conservation significant flora previously recorded within and in the vicinity of the project area (Detailed Map 3 of 3)

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Kilometres

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4.2. Flora and vegetation survey

4.2.1. Conservation significant flora species

No Threatened flora species listed under the EPBC Act or the BC Act were recorded within the project area.

Three Priority flora species listed by DBCA were recorded within the project area, namely:

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133; listed as P1 by DBCA)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)

One individual *Netrostylis* sp. Nannup (P.A. Jurjevich 1133; P1) plant was recorded within a creekline in survey area LR23_23 located approximately 2 km northeast of the Larego site offices.

A total of 11 individual *Grevillea prominens* (P3) plants were recorded at 11 point locations within eight survey areas (and one location just outside LR23_6, confirming a previous record), generally in the north and east of the project area.

Senecio leucoglossus (P4) was broadly distributed across eastern and southern portions of the project area, with a total of 2,063 individual plants recorded at 348 point locations across 20 survey areas.

One flora species recorded within the project area, *Boronia stricta*, represented a northeast range extension of approximately 125 km. A total of 30 individual *B. stricta* plants were recorded across five point locations (all within 50 m of a creekline) in survey area LR23_18, situated in the south of the project area.

DBCA Threatened and Priority flora report forms are provided in Appendix F. The locations of conservation significant flora recorded within the survey areas are given in Appendix G and shown in Figure 10.

Following the field survey, 68 of the 75 conservation significant flora species identified from the desktop assessment (see Section 4.1.1) as possibly occurring were considered Unlikely to occur with the project area. This assessment is based on presence or absence of suitable habitat for the species, proximity to previous recent records, sufficient searches for the species and detectability of the species.

Four conservation significant flora species were considered to have Potential to occur within the project area, namely:

- *Hibbertia acrotoma* listed as P1 by DBCA
- *Stylidium korijekup*, listed as P2 by DBCA
- *Actinotus repens*, listed as P3 by DBCA
- *Eucalyptus* x *graniticola*, listed as P4 by DBCA

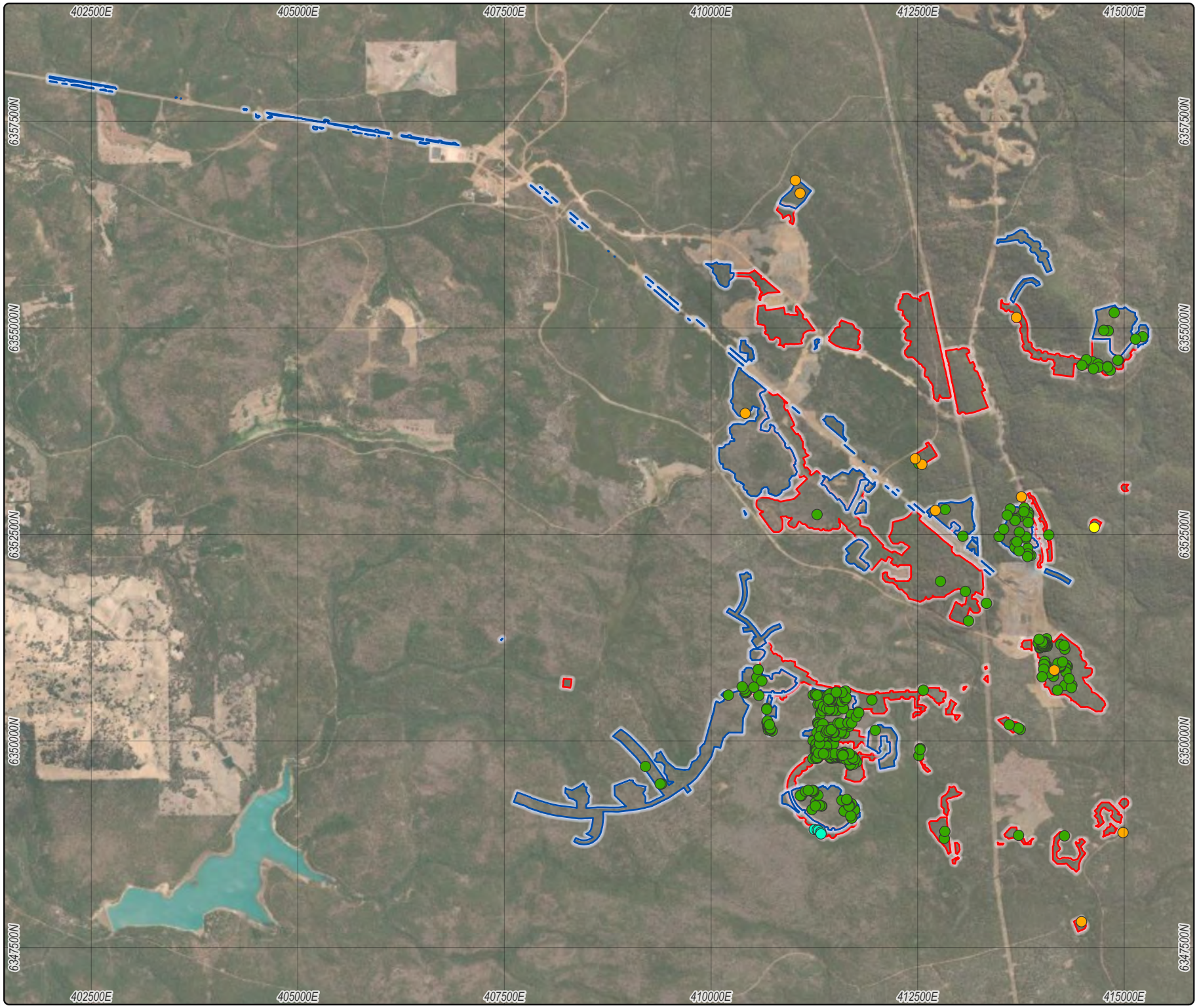
The complete flora likelihood of assessment is presented in Appendix E.

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4.2.2. Key weed species

Two key weed species were recorded during the field survey, namely Blackberry (**Rubus* sp.) and Arum lily (**Zantedeschia aethiopica*). Blackberry is listed under the State *Biosecurity and Agriculture Management Act 2007* (BAM Act) as a DP, with control category C3 (Management) and Keeping category 'Exempt' (DPIRD 2023) and as a WoNS (as 'Rubus fruticosus aggregate'; Centre for Invasive Species Solutions 2021).

Approximately 310 Blackberry plants were recorded at 31 point locations within survey area Turbidity-b (Hoffman Mill townsite Reserve) and thickly infested both sides of the watercourse. One individual Arum lily plant was also recorded within the Turbidity-b survey area. Locations of the Key weed species are shown in Figure 11 and listed in Appendix H.



Legend

Survey areas

- Priority 1
- Priority 2

Conservation significant flora

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)
- *Boronia stricta* (RE)

Figure 10A: Conservation significant flora recorded within and in the vicinity of the project area in Spring 2023 (Overview)

0 0.5 1 2

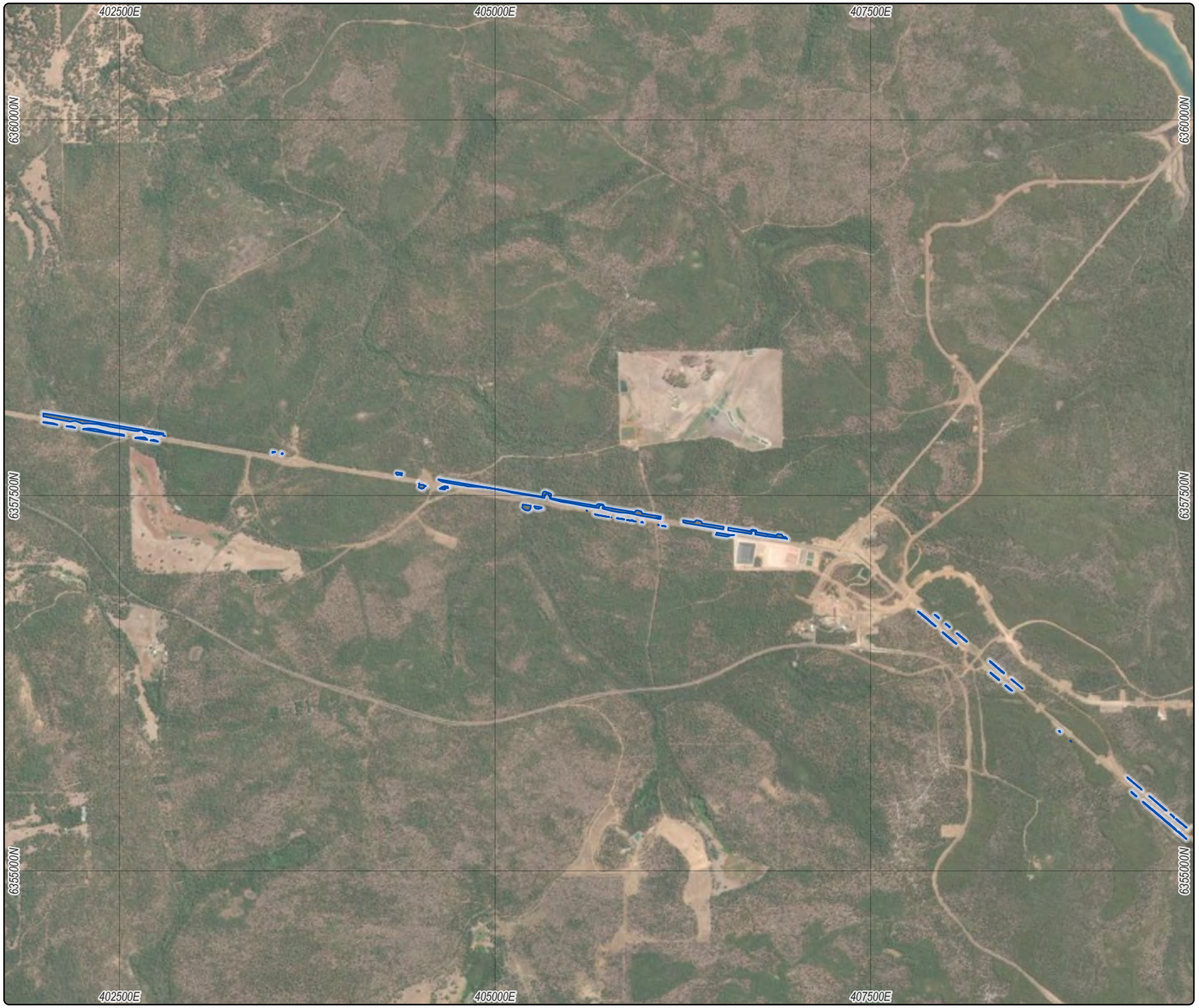
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Legend

Survey areas

Priority 2

Figure 10B: Conservation significant flora recorded within and in the vicinity of the project area in Spring 2023 (Detailed Map 1 of 3)

0 0.25 0.5 1

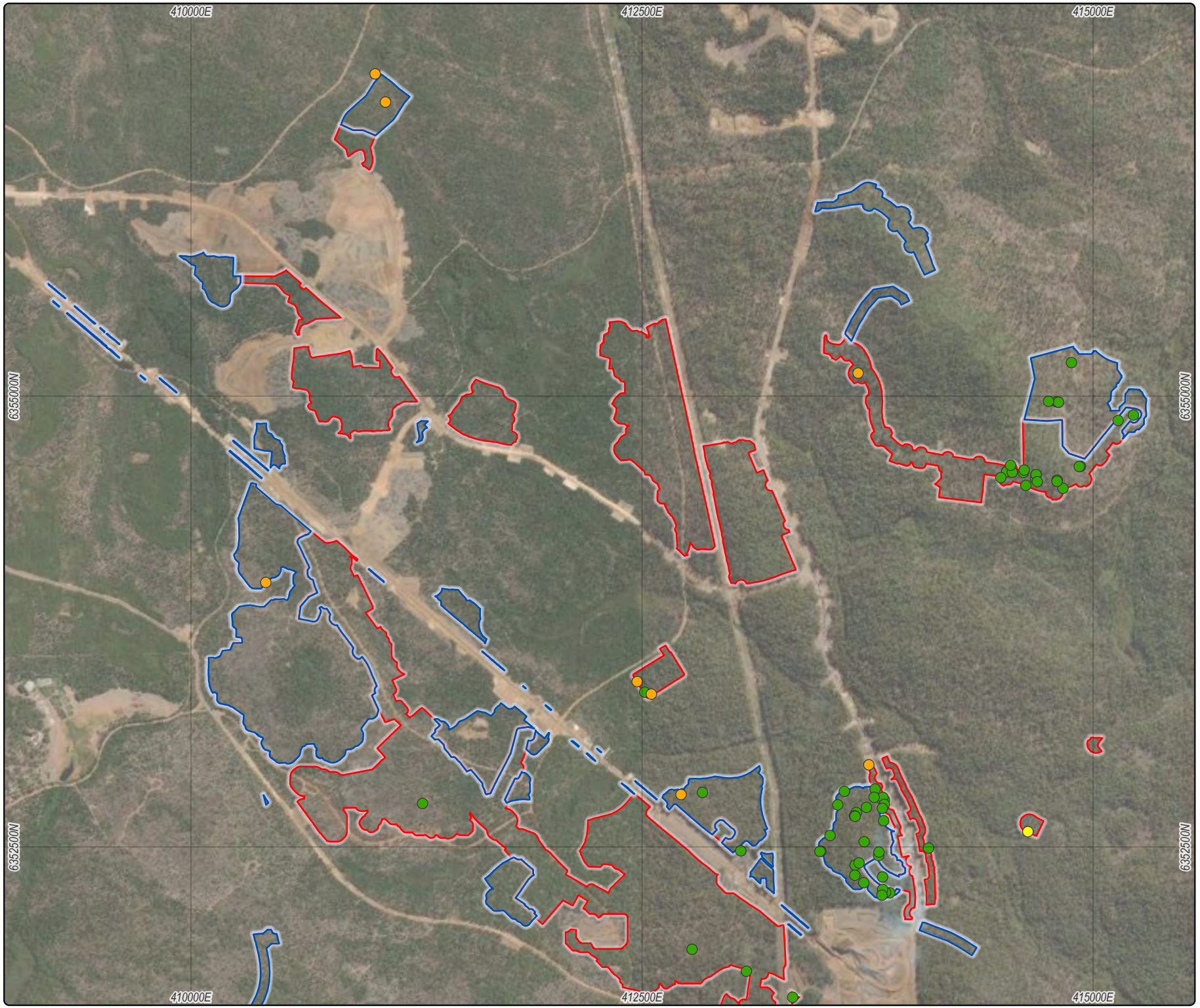
Kilometres

Datum/Projection:
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Legend

Survey areas

- Priority 1
- Priority 2

Conservation significant flora

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)

Figure 10C: Conservation significant flora recorded within and in the vicinity of the project area in Spring 2023 (Detailed Map 2 of 3)

0 0.25 0.5 1

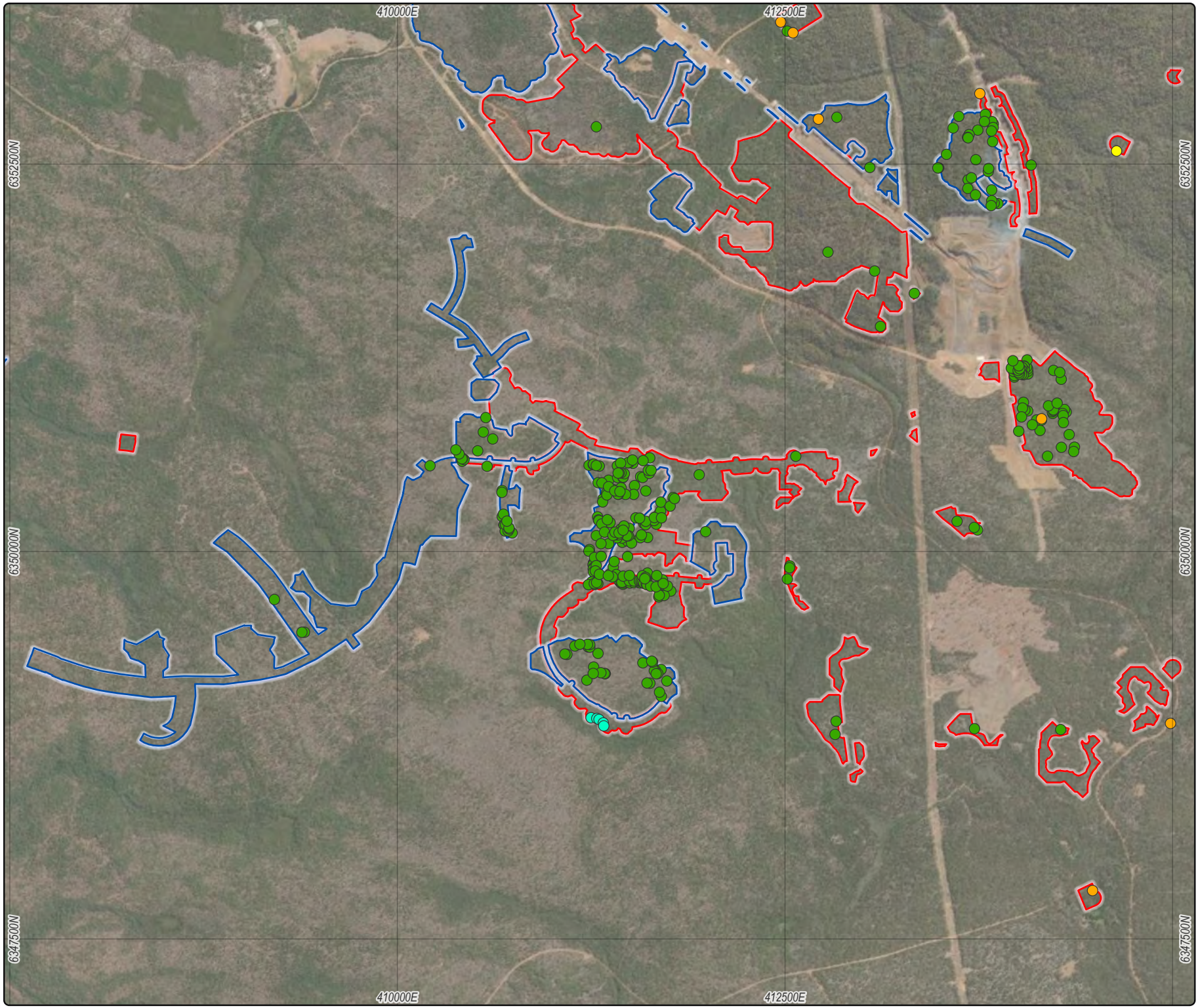
Kilometres

Datum/Projection:
AGD 1984 AMG Zone 50

23PER5309-JP Date: 22/03/2024

N

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Legend

Survey areas

- Priority 1
- Priority 2

Conservation significant flora

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)
- *Boronia stricta* (RE)

Figure 10D: Conservation significant flora recorded within and in the vicinity of the project area in Spring 2023 (Detailed Map 3 of 3)

0 0.25 0.5 1

Kilometres

Datum/Projection:
AGD 1984 AMG Zone 50

23PER5309-JP Date: 22/03/2024

N

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Legend

Survey areas

Priority 1

Weed records

**Rubus* sp.

**Zantedeschia aethiopica*

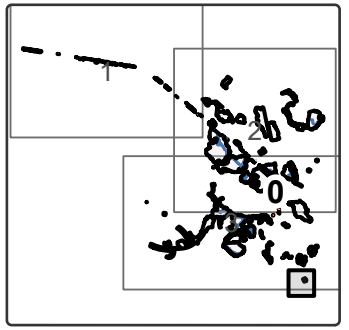


Figure 11: Key weed species recorded within and in the vicinity of the project area in Spring 2023

0 12.5 25 50

Metres

Datum/Projection:
AGD 1984 AMG Zone 50

23PER5309-JP Date: 22/03/2024

N

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5. Discussion

5.1. Flora and vegetation

5.1.1. Conservation significant flora species

Flora species recorded in the project area were typical of the central part of the Jarrah Forest IBRA bioregion (WAH 1998-).

No Threatened flora species listed under the EPBC Act or the BC Act were recorded within the project area. Three Priority flora species listed by DBCA were recorded within the project area:

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133; listed as P1 by DBCA)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)

The perennial, caespitose sedge *Netrostylis* sp. Nannup (P.A. Jurjevich 1133; Plate 1) grows in valley floor and creeklines on damp soils within woodland and tall shrubland (WAH 1998-). One occurrence of this species was recorded in 1997 between survey areas LR23_28 and LR23_P2_31 (DBCA 2023b) in a creekline with dense vegetation (now a cleared area immediately adjacent to a conveyor). In the current survey, one individual *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) plant was recorded in a creekline within survey area LR23_23 (Figure 10; Appendix F; Appendix G).

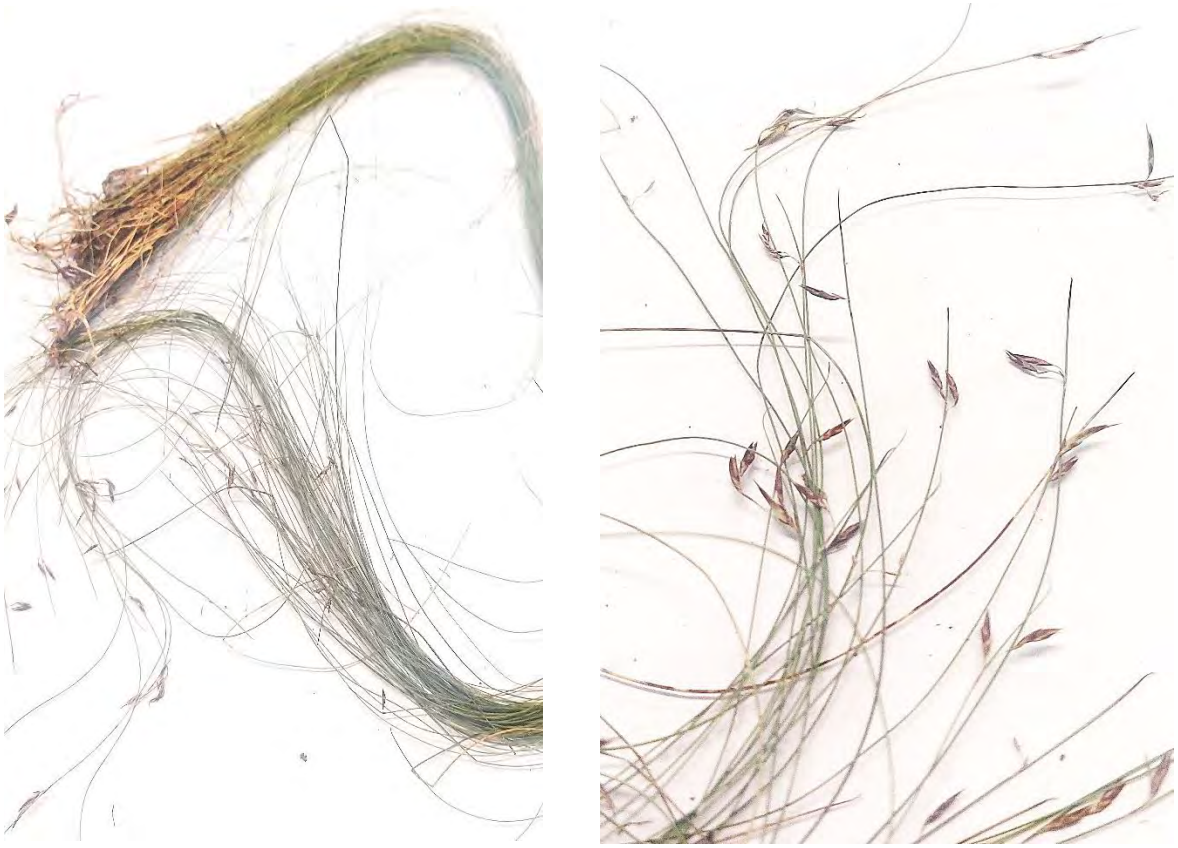


Plate 1: *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1) (a) habit (b) culms, leaves and inflorescence ©ELA 2023

Grevillea prominens is a spreading shrub that grows up to 1.7 m high and 1 m wide and has cream-white flowers that appear from September to October (Plate 2). It grows in gravelly loam along creeklines in jarrah forest (WAH 1998-). Multiple historical records from 1979-1997 are located within 25 km to the west and southeast of the project area (DBCA 2023b). These include two records (both from 1996) less than 100 m southeast of survey area LR23_6, both occurring in jarrah forest on a slope above a creek. In the current survey, a total of 11 individual plant were recorded at 11 separate point locations within eight survey areas (and one location just outside LR23_6, confirming a previous record), generally in the north and east of the project area (Figure 10; Appendix F; Appendix G). Plants recorded within the project area were mostly growing on gentle slopes in loamy soils on laterite in jarrah-marri forest. The collected specimens could be distinguished from the similar, non-listed, species *G. trifida* by the combination their glabrous nature and having fruiting pedicels that extend beyond the leaves.



Plate 2: *Grevillea prominens* (P3) (a) habit (b) fruit and leaves ©ELA 2023

The annual herb *Senecio leucoglossus* grows to 1.3 m high and has distinctive toothed leaves and white flowers that appear from August to December (Plate 3). It grows on gravelly lateritic or granitic soils on slopes or granite outcrops in jarrah-marri forest (WAH 1998-). There are multiple historical records (1899-2009) of *S. leucoglossus* within 25 km of the project area, including one (from 1982) directly adjacent to Turbidity area b (DBCA 2023b). In the current survey, a total of 2,063 individual plants were recorded at 348 point locations across 20 survey areas; most records were located in the east and south of the project area (Figure 10; Appendix F; Appendix G). In the northwest corner of survey area LR23_20, located approximately 200 m east of the Larego sites offices, a dense population of 172 individuals of *S. leucoglossus* was clustered around several irrigation lines running through the vegetation (Figure 10), suggesting that the species responds well to regular watering.



Plate 3: *Senecio leucoglossus* (P4) (a) habit (b) flowers ©ELA 2023

Boronia stricta is an erect, slender shrub that grows 0.6-2 m high and has pink flowers from September to December or January to May (Plate 4). It grows in sand or sandy clay in seasonally swampy areas within tall myrtaceous shrubland or low woodland over low shrubland and sedgeland. *B. stricta* is known to occur from near Dunsborough south to Augusta and east to Cape Riche (WAH 1998-). A total of 30 individual *B. stricta* plants were recorded across five point locations (all within 50 m of a creekline) in survey area LR23_18, situated in the south of the project area. The records of *B. stricta* made in the current survey therefore represent a northeast extension to its known range by approximately 125 km.



Plate 4: *Boronia stricta* (a) habit (b) leaves and flowers ©ELA 2023

Following the field survey, four conservation significant flora species were considered to have Potential to occur within the project area:

- *Hibbertia acrotoma* listed as P1 by DBCA
- *Stylidium korijekup*, listed as P2 by DBCA
- *Actinotus repens*, listed as P3 by DBCA
- *Eucalyptus* x *graniticola*, listed as P4 by DBCA

Hibbertia acrotoma is an openly-branched, spreading shrub that grows to 0.5 m tall and produces yellow flowers in August to September. It grows on steep slopes with gravelly loam and granite boulders or outcrops in jarrah-marri forest (WAH 1998-). It is known to occur on the Darling Scarp, with the nearest record (from 2005) located approximately 16 km to the north of the project area (DBCA 2023b).

Eucalyptus x *graniticola* is an erect-stemmed mallee to 4 m tall that flowers from May to November. It is known to be a hybrid between *Eucalyptus rudis* and *E. drummondii,* and displays characteristics from both parent species. *Eucalyptus* x *graniticola* grows as an emergent from dense heath on granite outcrops on Darling Scarp (Threatened Species Scientific Committee 2006). It is known from five locations on the Darling Scarp (DBCA 2023b), with the most recent (2006) located 1.5 km north of survey area LR23_P2_88 towards the western end of the conveyor. Survey area LR23_P2_88 and other Priority 2 survey areas located on the Darling Scarp were not surveyed during the Spring 2023 survey period (these survey areas form part of the 17.5 ha remaining to be surveyed in the Summer/Autumn 2024 and/or Spring 2024 survey periods). Until the survey areas located on the Darling scarp are surveyed, both *Hibbertia acrotoma* and *Eucalyptus* x *graniticola* cannot be discounted as occurring within the project area.

Stylidium korijekup is a perennial herb with leaves 4-6 cm long growing in a basal rosette. The flowering scape is 18-34 cm tall and bears cream flowers in early October. It grows in well-drained grey-brown sandy loam with laterite on upland ridges within *Eucalyptus marginata* and *E. haematoxylon* woodland with *Xanthorrhoea acanthostachya* and *X. gracilis* (Wege et al. 2007). *S. korijekup* is known from three locations, the nearest (from 2005 and 2006) being 16 km southwest of the project area (WAH 1998-). *Stylidium* species can be challenging to survey as they are often difficult to find when they are not in flower, usually have narrow flowering windows, and different species can be easily confused with one another (Wege 2017). Given that suitable habitat was present in the project area and that this small, cryptic herb may not have been observable if not in flower, it cannot be ruled out as occurring with the project area.

Actinotus repens is a prostrate perennial herb that grows to 5 cm high and 20 cm wide. Its white flowers are present from January to March. It occurs on sandy clay and mud in valleys along creeklines and edges of watercourses in *Eucalyptus* or *Melaleuca* dominated woodland (Henwood 2013). There are three records (from 2000-2020) of *A. repens* within 10 km of the project area; one approximately 200 m east of survey area LR23_035, one 500 m northeast of LR23_15 and one approximate 9 km north of the project area (DBCA 2023b). Given that there was suitable habitat within the project area and that this small herb may not have been observed because it was not in flower during the time of the survey and the vegetation of its preferred habitat was often extremely dense, it cannot be ruled out as occurring with the project area.

5.1.2. Key weed species

Two Key weed species were recorded within the Turbidity b survey area, namely Blackberry and Arum lily. The Turbidity b survey area is located within Hoffman Mill townsite Reserve. Several factors within this survey area are vectors for spread of weeds and provide good conditions for growth, including historical clearing, vehicle and pedestrian tracks, and a creekline (Harvey River mainstream). The presence of weed species was, therefore, to be expected in this area. Historical clearing altered the native vegetation structure and allowed Blackberry to flourish within survey area Turbidity b. Blackberry grew extremely densely on both sides of the creekline, to the exclusion of native flora species.

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Appendix A Spring 2023 survey areas

Survey area	Area (ha)	Priority level	Completed in 2023	Centroid location (AGD 84; MGA zone 50)	
				mE	mN
L23_1	0.28	1	Y	412940	6348529
L23_2	0.56	1	Y	412980	6348692
L23_3	0.09	1	Y	413502	6348739
L23_4	6.36	1	Y	414335	6348519
L23_5	2.19	1	Y	413637	6348876
L23_6	1.16	1	Y	414827	6348904
L23_7	5.59	1	Y	412771	6348910
L23_8	3.96	1	Y	414806	6349195
L23_9	2.94	1	Y	412911	6349363
L23_10	1.23	1	Y	412614	6349639
L23_11	2.53	1	Y	413628	6350181
L23_12	0.25	1	Y	412975	6350277
L23_13	1.09	1	Y	412898	6350385
L23_14	0.08	1	Y	413068	6350627
L23_15	0.96	1	Y	408259	6350688
L23_16	0.21	1	Y	413334	6350738
L23_17	0.05	1	Y	413326	6350873
L23_18	72.44	1	Y	412226	6350533
L23_19	1.19	1	Y	413826	6351151
L23_19	1.19	1	Y	414308	6350818
L23_20	41.03	1	Y	413341	6351650
L23_21	0.14	1	Y	412951	6352574
L23_22	0.92	1	Y	414656	6352613
L23_23	1.02	1	Y	413802	6352355
L23_24	5.26	1	Y	414052	6352551
L23_25	3.19	1	Y	415005	6353052
L23_26	0.50	1	Y	412593	6353446
L23_27	3.94	1	Y	411236	6352890
L23_28	160.30	1	Y	413082	6354328
L23_29	24.61	1	Y	411632	6354882
L23_30	9.10	1	Y	410879	6355020
L23_31	20.38	1	Y	414828	6354645
L23_32	31.77	1	Y	412590	6354817

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Survey area	Area (ha)	Priority level	Completed in 2023	Centroid location (AGD 84; MGA zone 50)	
				mE	mN
L23_33	39.87	1	Y	410584	6355534
L23_34	4.96	1	Y	410909	6356402
L23_35	2.66	1	Y	412940	6348529
L23_P2_1	1.74	2	Y	410911	6349291
L23_P2_2	28.26	2	Y	411398	6349194
L23_P2_3	10.46	2	Y	411980	6349996
L23_P2_4	3.13	2	Y	410714	6350314
L23_P2_5	84.03	2	Y	409035	6349329
L23_P2_6	21.88	2	Y	411429	6350300
L23_P2_7	14.85	2	Y	410544	6350719
L23_P2_8	2.00	2	Y	410558	6351034
L23_P2_10	8.89	2	Y	407465	6351214
L23_P2_11	0.05	2	Y	410354	6351479
L23_P2_12	1.64	2	n	413346	6352029
L23_P2_13	0.07	2	Y	414196	6351991
L23_P2_14	1.26	2	Y	413351	6352098
L23_P2_15	6.38	2	Y	413164	6352366
L23_P2_16	0.29	2	Y	411770	6352247
L23_P2_18	16.52	2	Y	413199	6352425
L23_P2_19	0.03	2	n	410416	6352742
L23_P2_20	0.05	2	n	413710	6352519
L23_P2_22	14.55	2	Y	412424	6352809
L23_P2_23	0.02	2	n	412520	6352802
L23_P2_24	0.01	2	n	411821	6352809
L23_P2_25	0.03	2	n	412958	6352715
L23_P2_26	0.90	2	Y	412214	6352987
L23_P2_27	0.02	2	n	412262	6353022
L23_P2_28	13.12	2	Y	412131	6353059
L23_P2_29	0.01	2	n	411918	6353060
L23_P2_30	0.03	2	n	411980	6353259
L23_P2_31	3.32	2	Y	411619	6353069
L23_P2_32	0.03	2	n	411848	6353372
L23_P2_33	74.95	2	Y	411684	6353511
L23_P2_34	0.11	2	Y	411502	6353801
L23_P2_35	0.11	2	Y	411025	6353994

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Survey area	Area (ha)	Priority level	Completed in 2023	Centroid location (AGD 84; MGA zone 50)	
				mE	mN
L23_P2_36	2.17	2	Y	410568	6353444
L23_P2_37	0.35	2	Y	410297	6354613
L23_P2_38	0.03	2	n	410322	6354664
L23_P2_39	0.01	2	n	410433	6354715
L23_P2_40	0.03	2	n	411277	6354803
L23_P2_41	23.52	2	Y	409866	6355052
L23_P2_42	0.03	2	n	409734	6355089
L23_P2_43	0.01	2	n	409569	6355229
L23_P2_44	0.14	2	n	414925	6354978
L23_P2_45	0.04	2	n	409563	6355308
L23_P2_46	0.02	2	n	409510	6355353
L23_P2_47	2.40	2	n	409425	6355352
L23_P2_48	0.03	2	n	409416	6355433
L23_P2_49	5.22	2	Y	409251	6355498
L23_P2_50	0.01	2	n	413715	6355454
L23_P2_51	0.01	2	n	409251	6355573
L23_P2_52	7.53	2	n	410137	6355647
L23_P2_53	0.03	2	n	408832	6355851
L23_P2_54	0.01	2	n	408758	6355916
L23_P2_55	0.04	2	n	413791	6356094
L23_P2_56	0.06	2	n	408417	6356206
L23_P2_57	0.04	2	n	408465	6356239
L23_P2_58	0.04	2	n	408327	6356282
L23_P2_59	0.01	2	n	408340	6356343
L23_P2_60	0.01	2	n	408108	6356540
L23_P2_61	0.07	2	n	408026	6356536
L23_P2_62	6.54	2	Y	408012	6356622
L23_P2_63	0.01	2	n	407941	6356682
L23_P2_64	0.13	2	n	407873	6356667
L23_P2_65	0.60	2	n	411027	6356586
L23_P2_66	0.01	2	n	406583	6357224
L23_P2_67	0.01	2	n	406514	6357226
L23_P2_68	0.01	2	n	406748	6357233
L23_P2_69	0.01	2	n	406122	6357283
L23_P2_70	0.01	2	n	406087	6357290

Survey area	Area (ha)	Priority level	Completed in 2023	Centroid location (AGD 84; MGA zone 50)	
				mE	mN
L23_P2_71	0.50	2	n	406049	6357295
L23_P2_72	0.01	2	n	406252	6357305
L23_P2_73	0.01	2	n	405978	6357309
L23_P2_74	0.01	2	n	406386	6357292
L23_P2_75	0.02	2	n	405906	6357321
L23_P2_76	0.01	2	n	405847	6357330
L23_P2_77	0.05	2	n	405774	6357341
L23_P2_78	0.17	2	n	405706	6357353
L23_P2_79	0.03	2	n	405609	6357387
L23_P2_80	0.01	2	n	405285	6357405
L23_P2_81	0.01	2	n	405209	6357407
L23_P2_82	0.01	2	n	404654	6357534
L23_P2_83	0.08	2	n	404683	6357546
L23_P2_84	1.59	2	n	404659	6357547
L23_P2_85	0.01	2	n	404673	6357547
L23_P2_86	0.04	2	n	404512	6357547
L23_P2_87	0.01	2	n	405733	6357402
L23_P2_88	0.01	2	n	404377	6357623
L23_P2_89	0.02	2	n	404358	6357633
L23_P2_90	0.07	2	n	403583	6357765
L23_P2_91	0.01	2	n	403521	6357776
L23_P2_92	0.17	2	n	402731	6357853
L23_P2_93	0.25	2	n	402651	6357868
L23_P2_94	0.02	2	n	402797	6357884
L23_P2_95	0.04	2	n	402683	6357911
L23_P2_96	1.10	2	n	402388	6357912
Turbidity a	0.87	1	Y	402175	6357945
Turbidity b	1.46	1	Y	402036	6357968

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Appendix B Framework for conservation significant flora and fauna ranking

CATEGORIES OF THREATENED SPECIES UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)

Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the EPBC Act. Species listed as 'conservation dependent' and 'extinct' are not Matters of National Environmental Significance and therefore do not trigger the EPBC Act.

Category	Definition
Extinct (EX)	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	Taxa known to survive only in captivity or as a naturalised population well outside its past range; or taxa has not been recorded in its known and/or expected habitat at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	Taxa considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Taxa considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Taxa considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	Taxa has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	Taxa has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	There is inadequate information to make a direct, or indirect, assessment of taxa's risk extinction based on its distribution and/or population status.
Not Evaluated (NE)	Taxa has not yet been evaluated against the criteria.
Migratory (MI)	Not an IUCN category. Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state; • the agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA); • the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); or • the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (ROKAMBA).

CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA

The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Specially protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

Threatened species (T)

Threatened fauna is that subset of 'Specially Protected Fauna' listed under Schedule 2 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 made by the Minister under sections 13(1), 19(1) and 23(1) of the Act and regulation 174(1) of the *Biodiversity Conservation Regulations 2018*.

Threatened flora is that subset of 'Rare Flora' listed under Schedule 1 of the Biodiversity Conservation (Listing of Native Species) (Flora) Order 2022 made by the Minister under sections 19(1) and 23(1) of the BC Act and regulation 174(1) of the *Biodiversity Conservation Regulations 2018*.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Code	Description
Critically Endangered species	CR	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under Schedule 2-Division 1 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for critically endangered fauna or Schedule 1-Division 1 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.
Endangered species	EN	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under Schedule 2-Division 2 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for endangered fauna or Schedule 1-Division 2 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.

Category	Code	Description
Vulnerable species	VU	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under Schedule 2-Division 3 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for endangered fauna or Schedule 1-Division 3 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild, as follows:

Category	Code	Description
Extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Extinct Species under Schedule 3 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022 for endangered fauna or Schedule 2 of the Biodiversity Conservation (Rare Flora) Notice 2022 for critically endangered flora.
Extinct in the wild species	EW	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. These species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

Categories are detailed below.

Category	Code	Description
Migratory species	MI	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under Schedule 1-Division 2 of the 5 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022.
Species of special conservation interest (conservation dependent fauna)	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under Schedule 1-Division 1 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022.
Other specially protected species	OS	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under Schedule 1-Division 3 of the Biodiversity Conservation (Listing of Native Species) (Fauna) Order 2022.

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Priority species (P)

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Definition
Priority 1	P1	Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	P2	Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	P3	Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	P4	Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix C Likelihood of occurrence assessment criteria

Likelihood rating	Criteria
Recorded	The species has previously been recorded within the survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
Likely	The species has not previously been recorded from within the survey area. However, (to qualify requires one or more criteria to be met): • the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area; • core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present; and • there is a medium to high probability that a species uses the survey area.
Potential	The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met): • targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area; • the survey area has been assessed as having potentially suitable habitat through habitat modelling; • the species is known to be cryptic and may not have been detected despite extensive surveys; • the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys; The species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met): • doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution); and • coordinates are doubtful.
Unlikely	The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and: • it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded • it is unlikely to occur due to few historic record/s and no other current collections in the local area. The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches.The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.
Does not occur (one or more criteria requires to be met).	The species is not known to occur within the IBRA bioregion based on current literature and distribution.The conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat.The survey area lacks important habitat for a species that has highly selective habitat requirements. The species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators.

Appendix D PMST database search results

Appendix E Flora likelihood of occurrence assessment

Species	Conservation status		Source*	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post-Survey
Synaphea sp. Fairbridge Farm (D.Papenfus 696)	CR	CR	DCCEEW 2023	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow, Oct.	Selena's Synaphea occurs on grey, clayey sand with lateritic pebbles in low woodland areas near winter-wet flats.	**Unlikely** Suitable habitat may be present but all records on SCP.	**Unlikely** Some suitable habitat present. This is a SCP species.
Caladenia bryceana subsp. *bryceana*	EN	EN	Alcoa 2023	Tuberous, perennial, herb, 0.05-0.1 m high. Fl. green-yellow, Aug to Oct.	Sand, loam. Adjacent to watercourses, winter-wet sites.	**Unlikely** Suitable habitat likely to be present. No nearby records.	**Unlikely** Some suitable habitat present. No nearby records; nearest record ~100km SE (1985), all other records NE of Albany.
Caladenia leucochila	EN	EN	Alcoa 2023	Perennial orchid which produces a single hirsute leaf from an underground tuber in late autumn and grows through winter and spring. The leaf dehisces at the end of spring and the plant spends summer and early autumn as a dormant tuber. Flower stem to 0.4m high, 1-2 flowers that are 5-10cm across. Fl. Cream-pale yellow-greenish yellow-maroon, mid Sep-late Oct.	Jarrah, Marri and Sheoak forest over Xanthorrhoea preissii and dwarf scrub of Bossiaea ornata, Banksia nivea and Lechenaultia biloba in well-drained sandy slopes. Frequently occur under Allocasuarina fraseriana in leaf litter. Found in open woodland, tends to be in the lower parts of the valley between 230-245m ASL and slightly upslope of seasonally damp areas.	**Unlikely** Suitable habitat likely to be present. No nearby records.	**Unlikely** Some suitable habitat present. No nearby records; all records ~55km SE (2008-2012) near Collie.
Diuris purdiei	EN	EN	DCCEEW 2023	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct.	Sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent Melaleuca preissiana, Eucalyptus calophylla, E. marginata and Nuytsia floribunda.	**Unlikely** Suitable habitat may be present. All nearby records on SCP.	**Unlikely** No suitable habitat present. This shrub is a SCP species.
Grevillea rara	EN	EN	Alcoa 2023	Dense, prickly shrub, to 2 m high. Fl. white-pink/white, Oct.	Lateritic loam. Creeklines.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. A cluster of recent records near Worsley refinery ~40km S.	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.
Jacksonia velveta	EN	EN	Alcoa 2023	Open, upright, sometimes sprawling shrub, to 1.9 m high. Fl. yellow-orange, Dec.	Brown gravelly loam, dry grey sand, ironstone. Slight hillslopes, ridges.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~30km E (2017).	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Banksia mimica	EN	VU	DCCEEW 2023	Prostrate, lignotuberous shrub, 0.15-0.4 m high. Fl. yellow-brown, Dec or Jan to Feb.	Flat to gentle slopes, on grey and white sand in open woodlands.	**Unlikely** Suitable habitat may be present but all records on SCP.	**Unlikely** Some suitable habitat present. This shrub is a SCP species.
Anthocercis gracilis	VU	VU	DCCEEW 2023	Erect, spindly shrub, to 0.6(-1) m high. Fl. yellow-green, Sep to Oct.	Sandy or loamy soils. Granite outcrops.	**Unlikely** Suitable habitat likely to be present. No nearby records.	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.
Diuris drummondii	VU	VU	DBCA 2023	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan.	Low-lying depressions and swamps.	**Unlikely** Suitable habitat may be present. All nearby records on SCP.	**Unlikely** No suitable habitat present. This shrub is a SCP species.
Diuris micrantha	VU	VU	Alcoa 2023, DCCEEW 2023	A tuberous, perennial herb that grows 0.3-0.6 m high. Fl. yellow and brown, Sep-Oct.	Brown loamy clay areas, Winter-wet swamps and in shallow water.	**Unlikely** Suitable habitat may be present. No nearby records - all within 100km are on SCP.	**Unlikely** No suitable habitat present. This shrub is a SCP species.
Eleocharis keigheryi	VU	VU	Alcoa 2023, DCCEEW 2023	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov.	Small clumps in a substrate of clay or sandy loam. This species is emergent in freshwater creeks, and transient waterbodies such as drainage lines and claypans in water to approximately 15 cm deep.	**Unlikely** Suitable habitat may be present. All nearby records on SCP.	**Unlikely** Some suitable habitat present. This shrub is a SCP species.

Species	Conservation status		Source*	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post-Survey
Morelotia australiensis	VU	VU	DBCA 2023, DCCEEW 2023	Perennial sedge 0.3-1.3m high, 0.1-0.6m across. Rhizome short, thick, woody, 8-15mm diam. Culms terete, 2.0-5.5mm diam, multi-striate, glabrous. Leaves mostly basal and 3-4 cauline; lamina of basal leaves 12-18cm long, 2-6mm wide, linear, finely- multi-striate, pubescent when young, green to blue-green, margins sparsely scabrous. Inflor narrow panicle-like, 15-27cm long, 10-20mm wide. Fl. Oct-Feb, usually one year post-fire.	East side of SCP; historical populations near Armadale and Canning appraently now extinct. Usually in winter-wet swampy depressions, drainage lines or sandy rises adjacent swamps. Grey sand over clay or yellow and sandy or clayey lateritic soils. Open Corymbia calophylla oor Eucalyptus marginata woodland over low shrubs, herbs and sedges.	**Potential** Suitable habitat likely to be present. Several recent (2008-2010) nearby records 4-25km away in foothills.	**Unlikely** Some suitable habitat present. This sedge is of a size that it would have been observed if present.
Tribonanthes purpurea	VU	VU	Alcoa 2023	Tuberous, perennial, herb, 0.03-0.04 m high. Fl. pink-purple, Aug.	Seasonally wet soils in moss swards & herbfields among granite rocks.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~85km SE (1999).	**Unlikely** No suitable habitat present. No nearby records.
Caladenia uliginosa subsp. *patulens*	-	P1	DBCA 2023	Tuberous, perennial, herb, 0.2-0.35 m high. Fl. green-cream, Sep to Oct.	Clay loam and gravel. Well drained soils amongst dense shrubs.	**Unlikely** Suitable habitat may be present but all nearby records on SCP.	**Unlikely** Some suitable habitat present. This herb is a SCP species.
Caladenia validinervia	-	P1	Alcoa 2023	Plants solitary. Leaf 5–16 cm long, 3–6 mm wide, linear, erect, incurved in cross section, pale green, the basal 1/5 irregularly blotched with red-purple. Scape 12–21 cm tall. Flowers 1 or 2, 5–8 cm across, pale yellow to pale creamy yellow with prominent, dull red stripes, Sep-early Oct.	Between Collie and Manjimup and eastward to near Rocky Gully, growing in sandy gravelly soil in Corymbia calophylla-E. marginata forest with Anigozanthos manglesii, Persoonia and Lechenaultia species.	**Unlikely** Suitable habitat likely to be present. No nearby records.	**Unlikely** Some suitable habitat present. No nearby records; nearest record ~45km SE (1965) near Collie.
Calytrix simplex subsp. *simplex*	-	P1	Alcoa 2023	Shrub, ca 0.2 m high. Fl. purple, Oct to Nov.	Jarrah woodland over heath. Slopes, flats. Granitic and lateritic soils.	**Unlikely** Suitable habitat likely to be present. No nearby records.	**Unlikely** Some suitable habitat present. Nearest record ~30km E (2020).
Deyeuxia inaequalis	-	P1	DBCA 2023	Erect, tufted annual, grass-like or herb, 0.75 m high. Leaves mostly basal. Leaf-sheaths scaberulous, glabrous on surface. Ligule an eciliate membrane, 3–5 mm long, membranous, lacerate, truncate. Leaf-blades linear, 5–12 cm long, 1–5 mm wide. Inflorescence solid, a panicle. Panicle linear or oblong, dense, 1–6 cm long.	Slopes, flats. Gravelly sandy loam. Forest of Eucalyptus marginata and Corymbia calophylla.	**Potential** Suitable habitat likely to be present. One recent record (2021) nearby (<25km) record to N. All other records S of Margaret River.	**Unlikely** Suitable habitat was present. This grass is of a size that it would have been observed if present.
Hemigenia rigida	-	P1	ALA 2023	Upright or spreading shrub, 0.1-0.6(-1) m high. Fl. blue-purple/violet, Aug to Dec or Jan.	Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops, flats, ironstone ridges.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. All records >100km to SE.	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.
Hibbertia acrotoma	-	P1	DBCA 2023	Lax, openly-branched, spreading shrubs with stems to 0.5 m. Fl. Yellow, Aug-Sep.	Steep slopes, gravelly loam, granite boulders/outcrops. Jarrah-marri forest.	**Potential** Suitable habitat likely to be present. One recent (2005) nearby record 16km to N on scarp. All other records not nearby, on scarp.	**Potential** Some suitable habitat present. Given previous records are on scarp, and these survey areas were not covered in the Spring 2023 survey period, this species cannot be discounted as occurring within the project area.
Hibbertia ambita	-	P1	Alcoa 2023	Shrub to 80cm. Fl. Yellow, Aug-Oct.	Slopes. Lateritic soils. Jarrah-marri forest.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. All records ~40km NE.	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	-	P1	DBCA 2023	Perennial, caespitose sedge to 0.9m.	Valley floors, creeklines. Damp sand, loam, clay. Woodland and tall shrubland.	**Potential** Suitable habitat likely to be present. 1 nearby record (1997) between areas L23-127 and L23_123. All other records S of Busselton.	**Recorded**

Species	Conservation status		Source*	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post-Survey
Cardamine paucijuga	-	P2	DBCA 2023	Slender erect annual, herb, to 0.4 m high. Usually glabrous; leaves petiolate, pinnate, with 1-4 pairs of pinnae, ovate to linear. Sepals 1.5-2 mm long, sometimes purple, margins white; petals 2.5-3.5 mm long, white, rarely pink; stamens 6. Siliqua linear, 10-30 mm long, 0.7-1 mm wide, erect; style slender or obtuse, to 1 mm long; pedicels in fruit spreading, 3-15 mm long. Fl. white, Sep to Oct.	Winter-wet depressions and flats, drainage lines. Rich soils in moist to dry habitats. Marri, karri forest. Eucalyptus rudis, Melaleuca rhaphiophylla. Melaleuca tall shrubland.	**Potential** Suitable habitat likely to be present. One recent (2016) nearby (<25km) record, at base of foothills.	**Unlikely** Very little suitable habitat present. Nearby record is on SCP.
Gonocarpus keigheryi	-	P2	Alcoa 2023, DBCA 2023	Erect or decumbent shrub to 20cm high. Fl. Green, Dec-Feb.	Watercourses, seasonally wet areas. Lateritic gravelly or clayey sand. Jarrah, Marri, Karri forest.	**Unlikely** Suitable habitat may be present. One nearby record ~21km SE but not recent (1997). All other records further S.	**Unlikely** Some suitable habitat present. No recent, nearby records.
Grevillea ornithopoda	-	P2	Alcoa 2023, DBCA 2023	Slender erect shrub to 3 m high by 2 m wide. Fl. cream-white, Jun-Oct.	Riverbanks. Eucalyptus rudis, E. patens.	**Potential** Suitable habitat likely to be present. Several recent (2017-2019) nearby (<25km) records to N.	**Unlikely** No suitable habitat present. This shrub is of a size that it would have been observed if present.
Leucopogon extremus	-	P2	Alcoa 2023	Low, spreading shrub to 40cm high. Fl. Greenish-white, Sep-Oct.	Valley bottoms, creeks. Sandy clay, sandy loam. Callitris pyramidalis tall shrubland over Myrtaceous mid shrubland and sedges.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~35km SE (2006).	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.
Logania sylvicola	-	P2	Alcoa 2023	Erect to spreading compact multi-branched shrub 50 cm high, up to 50 cm wide. Leaves opposite, subsessile; linear, 3–5 mm long, 0.5–0.6 mm wide. Fl. White-cream, Aug-Sep.	Woodland to open forest vegetation on the mid-slope of laterite rises associated with brown clay to clayey sand.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest recent record ~60km SE (2005).	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Melaleuca viminalis	-	P2	Alcoa 2023	Small tree to 10 m with pendulous foliage. Fl. Red, Nov-May.	Watercourses. Sandy clay.	**Potential** Suitable habitat likely to be present. One recent (2005) nearby record 10km NW on scarp.	**Unlikely** Suitable habitat was present. This small tree is of a size that it would have been observed if present.
Millotia tenuifolia var. *laevis*	-	P2	Alcoa 2023, DBCA 2023	Ascending to erect annual, herb, 0.02-0.1 m high. Fl. yellow, Sep to Oct.	Granite or laterite soils. Jarrah and Allocasuarina woodland.	**Unlikely** Suitable habitat may be present. No nearby (<25km) recent records. Nearest record ~10km N (1965) on scarp.	**Unlikely** Some suitable habitat present. No nearby records.
Schizaea rupestris	-	P2	ALA 2023, Alcoa 2023, DBCA 2023	Rhizomatous, perennial, herb or grass-like or (fern), 0.1-0.2 m high, fronds simple, glossy; sporangia-bearing segments in pinnately arranged `cock's comb'.	Sand. Gullies, creek banks, shaded moist rock faces.	**Potential** Suitable habitat likely to be present. 1 recent (2000) nearby record 4km N. 1 older (1997) record immediately adjacent areas L23_127 and L23_123.	**Unlikely** Very little suitable habitat present. This fern is of a distinctive appearance that it would have been observed if present.
Stylidium acuminatum subsp. *acuminatum*	-	P2	Alcoa 2023	Perennial herb to 20cm high, scape to 40cm. Basal rosette. Fl. Pale yellow, Nov-Dec.	Disturbed areas, hillslopes. Lateritic gravelly loam. Jarrah-marri forest.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~30km S (1967).	**Unlikely** Suitable habitat was present. No nearby records.
Stylidium korijekup	-	P2	DBCA 2023	Perennial, herb, 0.18-0.34 m high. Leaves in a spreading rosette, spathulate (lamina ovate–elliptic), apex obtuse–subacute, margin entire, 4–6 cm long (petioles 3–4 mm long, lamina 1.4–2 cm long), 9–16 mm wide, glabrous. Scape c. 18–34 cm high. Fl. Cream, Oct.	Well-drained grey-brown sandy loam with laterite. Upland ridges. Eucalyptus marginata and E. haematoxylon woodland with Xanthorrhoea acanthostachya and X. gracilis.	**Potential** Suitable habitat likely to be present. Two recent (2005-2006) nearby (<25km) records.	**Potential** Some suitable habitat present. This small, perennial herb with leaves in a basal rosette may not have been observable if not in flower.
Thysanotus sp. Badgingarra (E.A. Griffin 2511)	-	P2	Alcoa 2023	Perennial, herb (with tuberous roots), ca 0.35 m high. Fl. blue, Dec.	Gentle slopes and flats. Grey sand with lateritic gravel. Eucalypt woodland.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~60km E (1960).	**Unlikely** Suitable habitat was present. No nearby records.

Species	Conservation status		Source*	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post-Survey
Acacia oncinophylla subsp. *oncinophylla*	-	P3	Alcoa 2023	Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Fl. yellow, Aug to Oct.	Granitic soils, with boulders and outcrops. In heath and open woodland.	**Unlikely** Suitable habitat likely to be present. No nearby (<25km) records. Nearest recent record 75km N (2013).	**Unlikely** Some suitable habitat present. This shrub is of a size and distinctive appearance that it would have been observed if present.
Actinotus repens	-	P3	ALA 2023, DBCA 2023	Prostrate perennial herb to 5cm high, 20cm wide. Fl. White, Jan-Mar.	Sandy clay and mud in valleys along creeklines and edges of watercourses. Eucalyptus or Melaleuca dominated woodland.	**Likely** Suitable habitat likely to be present. 3 nearby records: one in area L23_039 (2020); one ~100m SE of L23_131 (2003); one ~7km N (2000).	**Potential** Some suitable habitat present. This very small herb may not have been observed because it was not in flower during the time of the survey and due to the extremely dense nature of the creekline vegetation within the survey areas.
Adenanthos cygnorum subsp. *chamaephyton*	-	P3	Alcoa 2023	Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Fl. white-cream-pink-green/green, Jul or Sep to Dec or Jan.	Grey sand, lateritic gravel.	**Unlikely** Suitable habitat likely to be present. No nearby (<25km) records.	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Angianthus drummondii	-	P3	ALA 2023, Alcoa 2023, DBCA 2023	Erect annual, herb, to 0.1 m high. Fl. yellow, Oct to Dec.	Grey or brown clay soils, ironstone. Seasonally wet flats.	**Unlikely** Suitable habitat likely to be present. All nearby (<25km) records on SCP and foothills.	**Unlikely** Some suitable habitat present. This herb is a SCP/foothills species.
Asteridea gracilis	-	P3	Alcoa 2023	Annual, herb, 0.15-0.35 m high. Fl. white-pink, Sep to Dec.	Slopes, flats. Sand, clay, gravelly soils. Eucalypt woodland over heath.	**Unlikely** Suitable habitat likely to be present. No nearby records.	**Unlikely** Some suitable habitat present. Nearest record ~30km E (1980), all recent records >100km N.
Calytrix pulchella	-	P3	Alcoa 2023	Shrub, 0.3-0.7(-1) m high. Fl. pink, Aug to Nov.	Grey or white sand over laterite. Ridges, flats.	**Unlikely** Suitable habitat likely to be present. No nearby records.	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Carex tereticaulis	-	P3	DBCA 2023	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown, Sep to Oct.	Damp flats, edges of watercourses. Black peaty sand.	**Unlikely** Suitable habitat likely to be present. One recent (2005) nearby (<25km) record but is on SCP, as are all other records.	**Unlikely** Some suitable habitat present. This sedge is of a size that it would have been observed if present.
Chamaescilla gibsonii	-	P3	DBCA 2023	Clumped tuberous, herb. Fl. blue, Sep.	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	**Unlikely** Suitable habitat likely to be present. One recent (2012) nearby (<25km) record but is on SCP, as are all other records.	**Unlikely** No suitable habitat present. This herb is a SCP species.
Cyathochaeta teretifolia	-	P3	ALA 2023, Alcoa 2023, DBCA 2023	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown.	Grey sand, sandy clay. Swamps, creek edges.	**Potential** Suitable habitat likely to be present. One older (1997) nearby (<25km) record just outside L23_127.	**Unlikely** Some suitable habitat present. This sedge is of a size that it would have been observed if present.
Dillwynia dillwynioides	-	P3	DBCA 2023	Decumbent or erect, slender shrub, 0.3-1.2 m high. Fl. red & yellow/orange, Aug to Dec.	Sandy soils. Winter-wet depressions.	**Unlikely** Suitable habitat may be present. All nearby records on SCP.	**Unlikely** Some suitable habitat present. This shrub is a SCP species.
Eryngium sp. Ferox (G.J. Keighery 16034)	-	P3	Alcoa 2023	Perennial herb to 30cm high. Fl. Purple, blue, Dec-Jan	Winter-wet flats, clay. Eucalypt woodland, Melaleuca shrubland over herbs and sedges.	**Unlikely** Suitable habitat may be present. One nearby record but on SCP and not recent.	**Unlikely** Some suitable habitat present. This shrub is a SCP species.
Grevillea prominens	-	P3	ALA 2023, Alcoa 2023, DBCA 2023	Spreading shrub, 0.5-1.7 m high, 0.3-1 m wide. Fl. cream-white, Sep to Oct.	Gravelly loam. Along creeklines.	**Potential** Suitable habitat likely to be present. Multiple nearby (<25km) records to SE & SW, incl two ~1km S, but none are recent (1979-1997).	**Recorded**

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Species	Conservation status		Source*	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post-Survey
Hakea oldfieldii	-	P3	Alcoa 2023	Open, straggling shrub, up to 2.5 m high. Fl. white-cream/yellow, Aug to Oct.	Red clay or sand over laterite. Seasonally wet flats.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Three recent records ~35km NE.	**Unlikely** No suitable habitat present. This shrub is of a size that it would have been observed if present.
Hemigenia microphylla	-	P3	Alcoa 2023, DBCA 2023	Slender shrub, 0.4-1.8 m high. Fl. blue-purple, Sep to Dec.	Sandy clay, peaty clay, granite. Winter-wet depressions.	**Unlikely** Suitable habitat may be present. Several nearby (<25km) records but none recent. Nearest recent record ~35km NE.	**Unlikely** No suitable habitat present. This shrub is of a size that it would have been observed if present.
Juncus meianthus	-	P3	Alcoa 2023	Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Fl. brown, Nov to Dec or Jan.	Black sand, sandy clay. Creeks, seepage areas.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~35km S (2005).	**Unlikely** Some suitable habitat present. This sedge is of a size that it would have been observed if present.
Lepyrodia heleocharoides	-	P3	Alcoa 2023	Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Fl. Dec.	Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~70km N (2003).	**Unlikely** Suitable habitat was present. No nearby records.
Meionectes tenuifolia	-	P3	Alcoa 2023	Annual semi-aquatic herb. Flowering in October to December.	Seasonally wet poorly drained flat and granite flats, ironstone gravel, hilltop on grey sand, loam, clay.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~27km NE (2007).	**Unlikely** Very little habitat present. No nearby records.
Netrostylis sp. Blackwood River (A.R. Annels 3043)	-	P3	Alcoa 2023	Sprawling sedge to 1.5m high.	Creeklines, swamps. Sandy or peaty clay loam. Eucalyptus patens, E. megacarpa woodand, Melaleuca tall shrubland.	**Likely** Suitable habitat likely to be present. 1 nearby record in area L23_039 (2020). Next nearest record ~27km NE (2018).	**Unlikely** Some suitable habitat present. This sedge is of a size that it would have been observed if present.
Stylidium aceratum	-	P3	Alcoa 2023, DBCA 2023	Fibrous rooted annual, herb, 0.05-0.09 m high, leaves spathulate. Fl. pink/white, Oct to Nov.	Sandy soils. Swamp heathland.	**Potential** Suitable habitat likely to be present. Two recent (2003-2013) nearby records 14km NW in foothills.	**Unlikely** No suitable habitat present.
Stylidium paludicola	-	P3	ALA 2023	Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. pink, Oct to Dec.	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	**Unlikely** Suitable habitat may be present but all records on SCP.	**Unlikely** No suitable habitat present. This is a SCP species.
Tetratheca parvifolia	-	P3	Alcoa 2023, DBCA 2023	Small shrub, 0.2-0.3 m high. Fl. pink, Oct.	Slopes. Gravelly, sandy loam over granite. Jarrah-Marri forest over heath.	**Potential** Suitable habitat likely to be present. 1 recent (2005) nearby record 10km S. All other records further S.	**Unlikely** Suitable habitat was present. This shrub is of a size and distinctive appearance that it would have been observed if present.
Tetratheca pilifera	-	P3	Alcoa 2023	Spreading shrub, 0.1-0.3 m high. Fl. purple, Aug to Oct.	Rocky slopes, rocky drainage lines. Gravelly and sandy loam. Eucalyptus wandoo woodland.	**Unlikely** Suitable habitat may be present. No nearby (<25km) recent records. Nearest record ~25km N (1997). All other records >100km N.	**Unlikely** No suitable habitat present. No nearby records.
Acacia oncinophylla subsp. *patulifolia*	-	P4	Alcoa 2023	Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Fl. yellow, Aug to Nov or Nov to Dec.	Granitic soils, occasionally on laterite.	**Unlikely** Suitable habitat likely to be present. Only nearby (<25km) record from 1992 and on SCP. All recent records >100km N (2005-2015).	**Unlikely** Some suitable habitat present. This shrub is of a size and distinctive appearance that it would have been observed if present.
Acacia semitrullata	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream-white, May to Oct.	White/grey sand in open heath, frequently fringing seasonally dry swamps, and in sand over laterite in shallow depressions in open Jarrah (Eucalyptus marginata) forest.	**Unlikely** Suitable habitat likely to be present. All nearby (<25km) records on SCP and foothills.	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.

Species	Conservation status		Source*	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post-Survey
Calothamnus graniticus subsp. *leptophyllus*	-	P4	DBCA 2023	Erect, multi-stemmed shrub that grows 1-2 m high. Fl. red, Jun-Aug.	Clay over granite, lateritic soils. Hillsides.	**Potential** Suitable habitat likely to be present. One old (1979) nearby (<25km) record.	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Chorizema ulotropis	-	P4	Alcoa 2023	Sprawling, open, semi-prostrate shrub, to 0.45 m high. Fl. orange-yellow, Jul to Sep.	Moist to dry soils, white sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats.	**Unlikely** Suitable habitat likely to be present. No nearby (<25km) records.	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.
Conostylis pauciflora subsp. *pauciflora*	-	P4	ALA 2023	Rhizomatous, stoloniferous perennial, grass-like or herb, 0.1-0.35 m high. Fl. yellow, Aug to Oct.	Grey sand, limestone. Hillslopes, consolidated dunes. SCP only.	**Unlikely** Suitable habitat unlikely to be present. All nearby records on SCP.	**Unlikely** No suitable habitat present. This herb is a SCP species.
Cyanothamnus tenuis	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Erect, slender shrub to 40cm high. Fl. Blue, pink, white, Aug-Nov.	Slopes, flats. Granitic or lateritic stony soils. Eucalypt woodland, Myrtaceous shrubland.	**Potential** Suitable habitat likely to be present. One recent (2005) nearby (<25km) record.	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Drosera occidentalis	-	P4	Alcoa 2023	Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Fl. pink/white, Oct to Dec or Jan.	In swampy flats. White/black sand over yellow clay.	**Unlikely** Suitable habitat may be present. All nearby records on SCP, none recent.	**Unlikely** No suitable habitat present. This shrub is a SCP species.
Eucalyptus x graniticola	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Erect-stemmed lignotuberous mallee to 4 m tall; bark smooth, cream, powdery, sometimes rough–grey and flaky at base. Adult leaves petiolate, lanceolate with lamina averaging 11 cm long × 2.5 cm wide, alternate, concolorous, dull, grey-green. Inflorescence axillary, unbranched, 7-flowered. Buds pedicellate, ovoid to globular, to 9 mm long x 6 mm wide; operculum obtusely conical. Stamens erect of inflexed, all fertile, cream. Fruit pedicillate, subcampanulate, 6 mm long × 7 mm wide. Fl. May-Nov. Hybrid btween E. rudis and E. drummondii.	Granite outcrops on Darling Scarp. Soil pocket surrounded by westward sloping sheet granite rock as an isolated emergent mallee over closed shrubland/sedgeland.	**Potential** Suitable habitat likely to be present. One recent (2006) nearby record <2km to N. All other nearby (<25km) records historical.	**Potential** Some suitable habitat present, but on scarp at western end of project area - these survey areas were not covered in the Spring 2023 survey period so cannot be discounted as occurring within the project area.
Hydrocotyle lemnoides	-	P4	Alcoa 2023	Aquatic, floating annual, herb. Fl. purple, Aug to Oct.	Swamps.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~45km SE (2011).	**Unlikely** No suitable habitat present. No nearby records.
Lasiopetalum bracteatum	-	P4	ALA 2023	Erect, open shrub, 0.4-1.5 m high. Fl. pink-purple, Aug to Nov.	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	**Unlikely** Suitable habitat likely to be present. No recent nearby (<25km) records.	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.
Lasiopetalum cardiophyllum	-	P4	Alcoa 2023	Erect, multi-stemmed shrub, 0.2-0.5 m high. Fl. pink, Aug to Dec or Jan.	Lateritic gravelly soils, sandy clay. Flats, hillslopes.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest recent record ~35km E (2007).	**Unlikely** Suitable habitat was present. This shrub is of a size that it would have been observed if present.
Microtis quadrata	-	P4	Alcoa 2023	Orchid to 40cm high. Fl. Cream-white, Oct-Dec.	Winter-wet flats, drainage lines. Sand, loam, clay over laterite. Jarrah-Marri forest, Melaleuca shrubland.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~40km NW (1984) on Swan Coastal Plain.	**Unlikely** Some suitable habitat present. No nearby records.
Ornduffia submersa	-	P4	Alcoa 2023	An aquatic herb growing in water 60 cm deep with leaves and flowers floating on the surface. Fl. White-cream-yellow, Oct-Nov.	Wetlands, open depressions, winter wet flats. Sandy clay. Melaleuca rhaphiophylla, M. preissiana, M. incana over sedges.	**Unlikely** Suitable habitat may be present. One nearby (~17km NW) recent (2000) record but on Swan Coastal Plain.	**Unlikely** No suitable habitat present. No nearby relevant records (nearest record in JAF ~40km SE).

Species	Conservation status		Source*	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post-Survey
Parsonsia diaphanophleba	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Woody climber, to 10 m high. Fl. white/cream & pink, Jan to Feb or Apr to Jun or Sep.	Alluvial soils. Along rivers.	**Potential** Suitable habitat likely to be present. 1 recent (2015) nearby records 20km N. Several older records in same area.	**Unlikely** Some suitable habitat present. This woody climber is of a size and appearance that it would have been observed if present.
Pimelea rara	-	P4	Alcoa 2023, DBCA 2023	Shrub, 0.2-0.35 m high. Glabrous except for inflorescence. Leaf lamina bluish-green (when dry). Fl. white, Dec or Jan.	Slopes. Lateritic soils. Jarrah-marri forest.	**Unlikely** Suitable habitat may be present. No nearby (<25km) recent records. Nearest record ~14km N (1998).	**Unlikely** Some suitable habitat present. This shrub is of a size that it would have been observed if present.
Pultenaea skinneri	-	P4	Alcoa 2023	Slender shrub, 1-2 m high. Fl. yellow/orange & red, Jul to Sep.	Sandy or clayey soils. Winter-wet depressions.	**Unlikely** Suitable habitat may be present. No nearby (<25km) records. Nearest record ~35km S (2006).	**Unlikely** No suitable habitat present. This shrub is of a size that it would have been observed if present.
Schoenus natans	-	P4	Alcoa 2023	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown, Oct.	Winter-wet depressions.	**Unlikely** Suitable habitat may be present. Nearest record ~14km NW (2012) but on Swan Coastal Plain. Nearest JAF records ~35km SE.	**Unlikely** No suitable habitat present. No relevant nearby records (nearest record in JAF ~35km SE).
Senecio leucoglossus	-	P4	ALA 2023, Alcoa 2023, DBCA 2023	Erect annual, herb, to 1.3 m high. Fl. white, Aug to Dec.	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	**Potential** Suitable habitat likely to be present. 1 recent (2002) nearby record 14km SE. Several older (1967-1997) nearby records.	**Recorded**
Stylidium ireneae	-	P4	Alcoa 2023, DBCA 2023	Lax perennial, herb, (0.06-) 0.1-0.28 m high. Basal rosette of leaves, leaves oblanceolate, 0.4-2 cm long, 1-3 (-5) mm wide, apex subacute to acuminate, margin entire, glandular. Scape glandular. Inflorescence racemose. Fl. pink, Oct to Dec.	Sandy loam. Valleys near creek lines, woodland, often with Agonis.	**Potential** Suitable habitat likely to be present. Multiple recent (2000) nearby records 8-18km N.	**Potential** Some suitable habitat present. This small, perennial herb with leaves in a basal rosette may not have been observable if not in flower.
Stylidium longitubum	-	P4	ALA 2023	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec.	Sandy clay, clay. Seasonal wetlands.	**Unlikely** Suitable habitat may be present but all records on SCP.	**Unlikely** No suitable habitat present. This is a SCP species.
Trithuria australis	-	P4	Alcoa 2023	Aquatic annual herb to 2cm high.	Edges of wetlands, seasonally wet flats. Silty clay. Melaleuca shrubland, sedgeland, herbland.	**Unlikely** Suitable habitat may be present. Nearest record ~14km NW (2004) but on Swan Coastal Plain.	**Unlikely** No suitable habitat present. This is a SCP species.

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Appendix F DBCA Threatened and Priority Flora report forms

- *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (listed as P1 by DBCA)
- *Grevillea prominens* (P3)
- *Senecio leucoglossus* (P4)

Appendix G Locations of Conservation Significant Flora

Species	Status	Date	Survey area	# individuals	Easting*	Northing
Boronia stricta	Range extension	23/10/2023	LR23_18	4	411388.0	6349063.5
Boronia stricta	Range extension	23/10/2023	LR23_18	12	411424.9	6349058.6
Boronia stricta	Range extension	23/10/2023	LR23_18	5	411439.3	6349052.3
Boronia stricta	Range extension	23/10/2023	LR23_18	2	411466.9	6349029.8
Boronia stricta	Range extension	23/10/2023	LR23_18	7	411469.7	6349010.7
Grevillea prominens	P3	22/10/2023	outside LR23_6	1	415125.1	6349026.6
Grevillea prominens	P3	23/10/2023	LR23_20	1	414293.3	6350992.2
Grevillea prominens	P3	24/10/2023	LR23_24	1	413895.6	6353090.6
Grevillea prominens	P3	26/10/2023	LR23_32	1	413836.0	6355263.0
Grevillea prominens	P3	27/10/2023	LR23_27	1	412690.2	6353482.9
Grevillea prominens	P3	30/10/2023	LR23_27	1	412611.3	6353552.2
Grevillea prominens	P3	30/10/2023	outside LR23_P2_62	1	411159.3	6356922.1
Grevillea prominens	P3	30/10/2023	LR23_P2_62	1	411216.5	6356765.7
Grevillea prominens	P3	01/11/2023	LR23_P2_22	1	412854.5	6352925.9
Grevillea prominens	P3	02/11/2023	LR23_P2_33	1	410553.3	6354102.0
Grevillea prominens	P3	03/11/2023	Turbidity-b	1	414622.3	6347947.9
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	P1	23/10/2023	LR23_23	1	414777.0	6352720.1
Senecio leucoglossus	P4	22/10/2023	LR23_20	5	414505.8	6350809.2
Senecio leucoglossus	P4	22/10/2023	LR23_4	1	414416.7	6348986.7
Senecio leucoglossus	P4	22/10/2023	LR23_11	1	413858.9	6350291.1
Senecio leucoglossus	P4	22/10/2023	LR23_11	1	413748.3	6350330.9
Senecio leucoglossus	P4	22/10/2023	LR23_P2_6	2	413880.5	6350274.7
Senecio leucoglossus	P4	22/10/2023	LR23_20	5	414500.6	6350781.1
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414452.7	6351035.7
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414441.2	6351052.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	3	414420.4	6351247.1
Senecio leucoglossus	P4	23/10/2023	LR23_20	2	414429.1	6351026.3
Senecio leucoglossus	P4	23/10/2023	LR23_20	16	414433.2	6351012.9
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414434.3	6350967.6
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414421.4	6350808.1

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	23/10/2023	LR23_20	12	414365.1	6351026.9
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414363.0	6351038.1
Senecio leucoglossus	P4	23/10/2023	LR23_20	17	414369.8	6351044.6
Senecio leucoglossus	P4	23/10/2023	LR23_20	12	414369.4	6351050.3
Senecio leucoglossus	P4	23/10/2023	LR23_20	30	414370.8	6351304.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	22	414338.1	6351076.0
Senecio leucoglossus	P4	23/10/2023	LR23_20	4	414283.5	6350917.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414293.1	6350983.3
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414262.4	6350985.0
Senecio leucoglossus	P4	23/10/2023	LR23_20	2	414203.9	6351043.3
Senecio leucoglossus	P4	23/10/2023	LR23_20	4	414205.5	6351281.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	70	414204.5	6351298.9
Senecio leucoglossus	P4	23/10/2023	LR23_20	40	414203.1	6351314.4
Senecio leucoglossus	P4	23/10/2023	LR23_20	2	414197.4	6351327.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	6	414199.9	6351371.8
Senecio leucoglossus	P4	23/10/2023	LR23_20	6	414180.2	6351333.1
Senecio leucoglossus	P4	23/10/2023	LR23_20	2	414181.9	6351329.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	9	414180.7	6351307.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	3	414175.6	6351276.4
Senecio leucoglossus	P4	23/10/2023	LR23_20	10	414176.6	6351098.6
Senecio leucoglossus	P4	23/10/2023	LR23_20	2	414185.4	6351048.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	5	414117.7	6351261.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	7	414119.1	6351271.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	10	414113.0	6351298.0
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414122.4	6351311.8
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414121.6	6351311.8
Senecio leucoglossus	P4	23/10/2023	LR23_20	12	414118.1	6351341.4
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414111.9	6351348.8
Senecio leucoglossus	P4	23/10/2023	LR23_20	3	414098.3	6351319.1
Senecio leucoglossus	P4	23/10/2023	LR23_18	1	412708.4	6350750.2
Senecio leucoglossus	P4	23/10/2023	LR23_18	1	411766.2	6350740.1
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	1	411401.7	6350696.9
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	5	411404.1	6350699.8
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	1	411458.0	6350578.2
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	3	411487.3	6350513.5
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	1	411490.1	6350501.1

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	1	411421.7	6350238.5
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	1	411409.9	6350096.8
Senecio leucoglossus	P4	23/10/2023	LR23_P2_62	10	411421.8	6350044.6
Senecio leucoglossus	P4	23/10/2023	LR23_18	2	411415.6	6350010.6
Senecio leucoglossus	P4	23/10/2023	LR23_18	2	411391.8	6349939.1
Senecio leucoglossus	P4	23/10/2023	LR23_18	3	411371.1	6349922.1
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	2	411829.1	6349228.1
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	5	411817.9	6349348.3
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	5	411808.0	6349347.0
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	1	411479.5	6349347.7
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	1	411473.8	6349348.8
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	10	411451.2	6349353.6
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	3	411401.9	6349349.1
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	4	411721.9	6349417.3
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	3	411784.7	6349422.3
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	4	411779.1	6349428.2
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	10	411283.4	6349526.0
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	5	411369.7	6349519.6
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	5	411379.8	6349519.0
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	4	411379.3	6349535.5
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	1	411364.9	6349536.6
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	1	411315.5	6349537.6
Senecio leucoglossus	P4	23/10/2023	LR23_18	5	411408.6	6349929.5
Senecio leucoglossus	P4	23/10/2023	LR23_18	2	411423.8	6349935.7
Senecio leucoglossus	P4	23/10/2023	LR23_18	1	411441.6	6349988.8
Senecio leucoglossus	P4	23/10/2023	LR23_18	1	411702.1	6350349.3
Senecio leucoglossus	P4	23/10/2023	LR23_18	1	411837.9	6350454.7
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	1	411375.0	6350692.4
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	2	411433.3	6350580.1
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	5	411465.4	6350475.1
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	2	411462.6	6350455.8
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	1	411430.0	6350359.8
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	2	411435.3	6350339.5
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	5	411438.5	6350335.6
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	4	411377.7	6350148.7
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	1	411373.5	6350138.2

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	3	411403.9	6350063.0
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	5	411407.6	6350063.2
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	6	411402.8	6350058.2
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	10	411400.9	6350049.8
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	4	411405.4	6350033.3
Senecio leucoglossus	P4	23/10/2023	LR23_P2_6	7	411401.7	6350023.0
Senecio leucoglossus	P4	23/10/2023	LR23_18	8	411403.4	6350004.5
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	3	411841.1	6349201.2
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	4	411767.3	6349285.9
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	3	411748.9	6349287.4
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	11	411360.7	6349305.6
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	1	411876.7	6349300.4
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	4	411839.7	6349374.2
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	2	411803.7	6349367.8
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	1	411795.8	6349366.3
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	5	411404.3	6349390.3
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	2	411432.8	6349478.5
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	1	411232.3	6349471.7
Senecio leucoglossus	P4	23/10/2023	LR23_P2_2	6	411219.2	6349474.3
Senecio leucoglossus	P4	23/10/2023	LR23_18	2	411411.3	6349922.0
Senecio leucoglossus	P4	23/10/2023	LR23_18	3	411431.9	6349928.9
Senecio leucoglossus	P4	23/10/2023	LR23_18	6	411510.1	6349991.4
Senecio leucoglossus	P4	23/10/2023	LR23_18	2	411531.1	6350035.6
Senecio leucoglossus	P4	23/10/2023	LR23_18	6	411636.5	6350222.8
Senecio leucoglossus	P4	23/10/2023	LR23_18	1	411727.2	6350317.7
Senecio leucoglossus	P4	23/10/2023	LR23_18	5	411734.1	6350322.0
Senecio leucoglossus	P4	23/10/2023	LR23_18	8	411742.1	6350322.8
Senecio leucoglossus	P4	23/10/2023	LR23_18	4	411800.2	6350358.1
Senecio leucoglossus	P4	23/10/2023	LR23_18	1	411917.3	6350484.2
Senecio leucoglossus	P4	23/10/2023	LR23_18	7	412085.2	6350631.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	18	414471.4	6350890.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	6	414411.1	6351292.0
Senecio leucoglossus	P4	23/10/2023	LR23_20	8	414393.9	6351093.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	3	414331.9	6350750.7
Senecio leucoglossus	P4	23/10/2023	LR23_20	5	414233.8	6350953.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	94	414167.9	6351323.5

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	23/10/2023	LR23_20	77	414165.2	6351306.6
Senecio leucoglossus	P4	23/10/2023	LR23_20	23	414163.7	6351288.9
Senecio leucoglossus	P4	23/10/2023	LR23_20	13	414164.3	6351279.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	13	414170.2	6351061.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	1	414164.2	6351004.5
Senecio leucoglossus	P4	23/10/2023	LR23_20	20	414146.0	6350912.1
Senecio leucoglossus	P4	23/10/2023	LR23_20	4	414150.6	6351281.0
Senecio leucoglossus	P4	23/10/2023	LR23_20	34	414145.4	6351290.7
Senecio leucoglossus	P4	23/10/2023	LR23_20	26	414142.6	6351304.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	8	414152.1	6351314.9
Senecio leucoglossus	P4	23/10/2023	LR23_20	3	414146.5	6351334.2
Senecio leucoglossus	P4	23/10/2023	LR23_20	2	414108.4	6351366.6
Senecio leucoglossus	P4	23/10/2023	LR23_21	1	413473.0	6351801.6
Senecio leucoglossus	P4	24/10/2023	LR23_25	1	414226.4	6352629.3
Senecio leucoglossus	P4	24/10/2023	LR23_24	22	413982.2	6352894.7
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	30	414011.6	6352380.9
Senecio leucoglossus	P4	24/10/2023	LR23_24	2	413969.0	6352897.9
Senecio leucoglossus	P4	24/10/2023	LR23_24	1	413973.4	6352910.0
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	1	413882.4	6352855.1
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	1	413826.0	6352826.3
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	21	413815.7	6352808.5
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	10	413819.7	6352805.3
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	4	413819.9	6352534.4
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	1	413817.9	6352478.4
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	17	413759.8	6352943.7
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	11	413723.4	6352868.9
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	2	413629.9	6352611.6
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	2	413624.7	6352611.0
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	1	410822.5	6350376.8
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	1	410836.2	6350308.2
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	3	410853.1	6350268.6
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	1	410859.9	6350281.1
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	4	410858.4	6350288.3
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	2	410845.5	6350331.9
Senecio leucoglossus	P4	24/10/2023	LR23_18	2	410717.4	6350685.6
Senecio leucoglossus	P4	24/10/2023	LR23_18	3	410568.8	6350729.2

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	24/10/2023	LR23_18	1	410558.5	6350736.7
Senecio leucoglossus	P4	24/10/2023	LR23_18	1	410555.5	6350734.7
Senecio leucoglossus	P4	24/10/2023	LR23_P2_7	10	410536.4	6350765.7
Senecio leucoglossus	P4	24/10/2023	LR23_P2_7	1	410656.7	6350785.5
Senecio leucoglossus	P4	24/10/2023	LR23_P2_7	5	410515.9	6350792.2
Senecio leucoglossus	P4	24/10/2023	LR23_P2_7	1	410753.8	6350862.1
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	2	410814.4	6350528.8
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	3	410812.9	6350517.3
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	3	410815.2	6350360.9
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	1	410825.8	6350308.2
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	1	410827.1	6350306.2
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	2	410833.6	6350268.0
Senecio leucoglossus	P4	24/10/2023	LR23_P2_4	4	410879.1	6350255.7
Senecio leucoglossus	P4	24/10/2023	LR23_18	2	410556.8	6350718.0
Senecio leucoglossus	P4	24/10/2023	LR23_P2_7	1	410692.7	6350906.7
Senecio leucoglossus	P4	24/10/2023	LR23_P2_7	3	410709.3	6351000.0
Senecio leucoglossus	P4	24/10/2023	LR23_28	2	411421.8	6352876.5
Senecio leucoglossus	P4	24/10/2023	LR23_24	7	413981.5	6352871.7
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	6	413988.1	6352383.9
Senecio leucoglossus	P4	24/10/2023	LR23_24	4	413970.4	6352849.4
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	1	413977.6	6352780.8
Senecio leucoglossus	P4	24/10/2023	LR23_24	11	413971.6	6352468.9
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	2	413972.3	6352399.6
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	5	413968.3	6352367.9
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	3	413949.5	6352587.7
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	2	413951.8	6352607.1
Senecio leucoglossus	P4	24/10/2023	LR23_24	2	413930.5	6352956.6
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	5	413924.8	6352910.6
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	3	413867.4	6352437.0
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	4	413869.7	6352664.0
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	3	413841.2	6352547.0
Senecio leucoglossus	P4	24/10/2023	LR23_P2_18	4	413680.6	6352698.7
Senecio leucoglossus	P4	25/10/2023	LR23_P2_41	1	415018.6	6355321.1
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	415068.9	6354746.1
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	414752.4	6354711.8
Senecio leucoglossus	P4	25/10/2023	LR23_32	21	414819.7	6354678.0

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	414971.6	6354624.0
Senecio leucoglossus	P4	25/10/2023	LR23_32	8	415061.9	6354744.7
Senecio leucoglossus	P4	25/10/2023	LR23_7	1	412968.3	6349040.6
Senecio leucoglossus	P4	25/10/2023	LR23_5	1	413860.7	6348992.5
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	414829.3	6354660.9
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	414938.7	6354662.8
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	414765.9	6354640.4
Senecio leucoglossus	P4	25/10/2023	LR23_18	3	412961.6	6348955.7
Senecio leucoglossus	P4	25/10/2023	LR23_P2_41	2	414936.9	6355103.3
Senecio leucoglossus	P4	25/10/2023	LR23_P2_41	3	414946.9	6355101.3
Senecio leucoglossus	P4	25/10/2023	LR23_P2_41	4	414891.4	6355106.6
Senecio leucoglossus	P4	25/10/2023	LR23_32	2	415362.0	6355030.1
Senecio leucoglossus	P4	25/10/2023	LR23_32	2	415277.2	6355000.1
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	414756.5	6354725.1
Senecio leucoglossus	P4	25/10/2023	LR23_32	2	414822.3	6354700.6
Senecio leucoglossus	P4	25/10/2023	LR23_32	1	414939.3	6354669.6
Senecio leucoglossus	P4	26/10/2023	LR23_32	1	414659.1	6354716.1
Senecio leucoglossus	P4	26/10/2023	LR23_32	4	414690.2	6354712.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411566.6	6349951.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411581.2	6349944.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	4	411589.8	6349940.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411586.5	6349937.2
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411634.0	6349947.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	15	411663.8	6349946.2
Senecio leucoglossus	P4	26/10/2023	LR23_18	12	411699.7	6349944.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	35	411710.7	6349942.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	21	411719.7	6349939.4
Senecio leucoglossus	P4	26/10/2023	LR23_18	14	411728.5	6349931.5
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411743.8	6349926.3
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411749.1	6349921.5
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411772.5	6349911.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	13	411830.5	6349857.0
Senecio leucoglossus	P4	26/10/2023	LR23_18	5	411824.4	6349843.3
Senecio leucoglossus	P4	26/10/2023	LR23_18	3	411859.3	6349852.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411827.9	6349853.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	5	411807.3	6349908.3

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	26/10/2023	LR23_18	40	411861.7	6349918.8
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411880.5	6349913.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	25	411853.2	6349929.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	5	411751.7	6349996.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411811.7	6349980.8
Senecio leucoglossus	P4	26/10/2023	LR23_18	5	411550.5	6349987.0
Senecio leucoglossus	P4	26/10/2023	LR23_18	3	411595.3	6349976.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411635.3	6349981.3
Senecio leucoglossus	P4	26/10/2023	LR23_18	6	411718.7	6349979.3
Senecio leucoglossus	P4	26/10/2023	LR23_18	13	411738.7	6349968.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	20	411734.4	6349960.5
Senecio leucoglossus	P4	26/10/2023	LR23_18	50	411525.8	6349972.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411499.5	6349980.2
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411453.2	6350104.6
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411421.6	6350690.6
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	5	411500.9	6350553.9
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411493.3	6350341.2
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411474.6	6350261.2
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411452.0	6350186.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411712.7	6350242.8
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411629.2	6350237.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411619.7	6350237.9
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	10	411563.5	6350243.7
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	3	411536.9	6350242.6
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411529.0	6350240.2
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	4	411542.3	6350260.7
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	50	411568.3	6350255.9
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	3	411594.4	6350273.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411793.8	6350335.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411740.5	6350330.8
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411676.6	6350352.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411700.8	6350350.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	5	411796.1	6350355.3
Senecio leucoglossus	P4	26/10/2023	LR23_18	3	411842.3	6350353.4
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411897.9	6350428.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411926.7	6350477.4

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411662.8	6350504.2
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411610.1	6350504.3
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411564.6	6350504.8
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	30	411560.8	6350505.5
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	5	411541.0	6350527.2
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411574.1	6350522.7
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411741.0	6350526.8
Senecio leucoglossus	P4	26/10/2023	LR23_18	6	411572.6	6349941.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411580.9	6349931.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	4	411594.3	6349924.5
Senecio leucoglossus	P4	26/10/2023	LR23_18	3	411595.2	6349932.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411629.6	6349937.5
Senecio leucoglossus	P4	26/10/2023	LR23_18	8	411639.2	6349932.7
Senecio leucoglossus	P4	26/10/2023	LR23_18	5	411663.8	6349935.5
Senecio leucoglossus	P4	26/10/2023	LR23_18	6	411696.6	6349935.0
Senecio leucoglossus	P4	26/10/2023	LR23_18	4	411707.0	6349933.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	7	411726.6	6349932.3
Senecio leucoglossus	P4	26/10/2023	LR23_18	4	411902.2	6349880.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411848.8	6349953.3
Senecio leucoglossus	P4	26/10/2023	LR23_18	1	411746.9	6349954.4
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411729.6	6349960.4
Senecio leucoglossus	P4	26/10/2023	LR23_18	9	411740.1	6349960.8
Senecio leucoglossus	P4	26/10/2023	LR23_P2_33	1	412127.0	6350264.0
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411623.4	6350102.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	5	411537.0	6350071.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	4	411433.8	6349994.9
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	2	411440.8	6350687.1
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	3	411501.1	6350595.6
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	1	411529.4	6350536.6
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	2	411510.3	6350322.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	6	411589.3	6350195.9
Senecio leucoglossus	P4	26/10/2023	LR23_18	4	411623.3	6350203.4
Senecio leucoglossus	P4	26/10/2023	LR23_18	7	411752.6	6350226.2
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411705.2	6350225.1
Senecio leucoglossus	P4	26/10/2023	LR23_18	9	411587.8	6350222.6
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	5	411555.8	6350224.3

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	3	411579.5	6350280.2
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	4	411634.0	6350285.8
Senecio leucoglossus	P4	26/10/2023	LR23_18	8	411808.6	6350312.3
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	5	411600.0	6350301.0
Senecio leucoglossus	P4	26/10/2023	LR23_18	2	411828.7	6350381.6
Senecio leucoglossus	P4	26/10/2023	LR23_18	10	411836.3	6350396.4
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	4	411581.5	6350547.1
Senecio leucoglossus	P4	26/10/2023	LR23_P2_6	7	411668.3	6350561.2
Senecio leucoglossus	P4	26/10/2023	LR23_10	2	412653.8	6349958.1
Senecio leucoglossus	P4	26/10/2023	LR23_32	1	414680.9	6354751.8
Senecio leucoglossus	P4	26/10/2023	LR23_32	1	414627.1	6354683.5
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	3	411559.6	6350613.4
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	1	411593.8	6350613.3
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	1	411595.4	6350615.6
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	4	411707.2	6350618.5
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	1	411721.1	6350613.8
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	1	411763.4	6350639.9
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	1	411602.5	6350638.1
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	1	411581.2	6350643.2
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	1	411569.0	6350642.5
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	3	411562.4	6350641.9
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	2	411756.7	6350659.5
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	3	411775.0	6350660.0
Senecio leucoglossus	P4	27/10/2023	LR23_18	3	411723.5	6350722.1
Senecio leucoglossus	P4	27/10/2023	LR23_18	5	411655.0	6350726.0
Senecio leucoglossus	P4	27/10/2023	LR23_10	1	412670.3	6350042.8
Senecio leucoglossus	P4	27/10/2023	LR23_10	8	412667.7	6350030.9
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	2	411457.0	6350313.5
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	4	411501.2	6350186.7
Senecio leucoglossus	P4	27/10/2023	LR23_18	1	411649.1	6350190.2
Senecio leucoglossus	P4	27/10/2023	LR23_18	3	411618.2	6350238.0
Senecio leucoglossus	P4	27/10/2023	LR23_18	5	411739.9	6350308.7
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	6	411557.6	6350689.5
Senecio leucoglossus	P4	27/10/2023	LR23_18	9	411657.5	6350704.2
Senecio leucoglossus	P4	27/10/2023	LR23_18	1	411631.7	6350707.5
Senecio leucoglossus	P4	27/10/2023	LR23_18	6	411625.1	6350708.8

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Species	Status	Date	Survey area	# individuals	Easting*	Northing
Senecio leucoglossus	P4	27/10/2023	LR23_P2_6	11	411578.5	6350706.6
Senecio leucoglossus	P4	27/10/2023	LR23_27	1	412653.2	6353493.7
Senecio leucoglossus	P4	30/10/2023	outside LR23_28	1	413217.0	6351945.8
Senecio leucoglossus	P4	30/10/2023	LR23_28	1	412915.8	6352067.7
Senecio leucoglossus	P4	30/10/2023	LR23_28	2	413254.7	6351588.3
Senecio leucoglossus	P4	01/11/2023	LR23_P2_22	2	412973.0	6352937.5
Senecio leucoglossus	P4	01/11/2023	outside LR23_P2_22	1	413185.6	6352614.0
Senecio leucoglossus	P4	01/11/2023	LR23_P2_5	1	410349.4	6350689.4
Senecio leucoglossus	P4	02/11/2023	LR23_P2_5	1	409345.6	6349826.2
Senecio leucoglossus	P4	02/11/2023	LR23_P2_5	7	409539.6	6349614.9
Senecio leucoglossus	P4	02/11/2023	LR23_P2_5	2	409523.0	6349614.9
Senecio leucoglossus	P4	30/10/2023	outside LR23_28	1	413217.0	6351945.8
Senecio leucoglossus	P4	30/10/2023	LR23_28	1	412915.8	6352067.7
Senecio leucoglossus	P4	30/10/2023	LR23_28	2	413254.7	6351588.3
Senecio leucoglossus	P4	01/11/2023	LR23_P2_22	2	412973.0	6352937.5
Senecio leucoglossus	P4	01/11/2023	outside LR23_P2_22	1	413185.6	6352614.0
Senecio leucoglossus	P4	01/11/2023	LR23_P2_5	1	410349.4	6350689.4
Senecio leucoglossus	P4	02/11/2023	LR23_P2_5	1	409345.6	6349826.2
Senecio leucoglossus	P4	02/11/2023	LR23_P2_5	7	409539.6	6349614.9
Senecio leucoglossus	P4	02/11/2023	LR23_P2_5	2	409523.0	6349614.9

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Appendix H Locations of Key weed species

Species	Common Name	Status	Survey area	# individuals	Easting*	Northing
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414608	6347968
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414622	6347923
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414630	6347916
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414628	6347913
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414635	6347906
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414639	6347902
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414640	6347902
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414645	6347896
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414648	6347881
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414654	6347877
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414635	6347860
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414634	6347863
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414636	6347849
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414629	6347858
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414624	6347866
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414612	6347884
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414611	6347891
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414610	6347896
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414611	6347899
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414555	6347908

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Species	Common Name	Status	Survey area	# individuals	Easting*	Northing
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414632	6347952
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414635	6347944
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414641	6347938
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414642	6347929
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414654	6347920
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414653	6347912
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414658	6347903
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414657	6347897
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414658	6347868
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414652	6347862
**Rubus sp.*	Blackberry	Declared Pest - s22(2) (C3 Exempt), WoNS	Turbidity b	10	414649	6347861
**Zantedeschia aethiopica*	Arum lily	Declared Pest - s22(2) (Exempt)	Turbidity b	1	414626	6347924

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ALCOA OF AUSTRALIA LTD
HUNTLY MINE ADDITIONAL AREAS
SIGNIFICANT FLORA LIKELIHOOD OF OCCURRENCE ASSESSMENT

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1 INTRODUCTION

Alcoa of Australia Limited's (Alcoa) Western Australian (WA) mining operations comprise the Huntly and Willowdale bauxite mines, which are located in Alcoa's Mining Lease 1SA (ML1SA) within the Northern Jarrah Forest (NJF) IBRA subregion. Alcoa has approval to mine within ML1SA subject to submitting draft five-year mine plans and associated environmental management programmes known as the Mining and Management Program (MMP). The MMP is submitted to the State's Mining and Management Program Liaison Group (MMPLG) on an annual basis.

Alcoa has committed to undertaking pre-clearance ecological surveys for the Huntly Mine, Myara region and Willowdale Mine, Larego region as part its MMP assessment by the MMPLG. Targeted flora surveys within parts of the Huntly Mine area were undertaken in spring 2023 (Biologic 2024; Ecologia 2024).

To help prioritise areas within the Huntly Mine area that may require targeted surveys in spring 2024, a likelihood of occurrence assessment was requested for an area consisting of 106 sections, ranging from <0.01 ha to 17.4 ha, totalling 126.3 hectares (ha) (collectively referred to as the study area) (Map 1).

2 DESKTOP ASSESSMENT

2.1 METHODOLOGY

The methodology adopted for the desktop assessment was in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). Searches of the databases listed in Table 1 were undertaken to determine the significant species previously recorded within 20 km of the study area. The criteria listed in Table 2 were then applied to determine the likelihood of occurrence of these species within the study area, taking into consideration results of the targeted surveys undertaken in the vicinity of the study area in 2023. Habitat preferences were sourced, where available, from relevant taxonomic literature, FloraBase (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.

Two assessments were undertaken:

1. a general likelihood of occurrence assessment for the study area that included all significant species recorded within 20 km.
2. to prioritise areas for future surveys, a section-specific assessment to determine individual sections that:
    a. have any significant species records occurring within 500 m (i.e., 'High Likely').
    b. have Threatened or Priority 1 species records within approx. 2 km (i.e., 'Likely').

Table 1: Databases and datasets used for the desktop assessment.

Database/dataset	Search details
DBCA Threatened and Priority Flora (TPFL) and WAHERB database	Significant plant species records within 20 km of the survey area (search reference: 64-0223FL)
Targeted survey data (Biologic 2024; Ecologia 2024)	Significant plant species recorded during 2023 targeted surveys.

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

Rating	Criterion
Recorded	The species has been recorded within the study area.
Highly Likely	Suitable habitat is likely to be present and there are existing records within 500 m.
Likely	Suitable habitat is likely to be present and there are existing records within 2 km.
Possible	Suitable habitat is likely to be present and there are existing records within 20 km.
Unlikely	Suitable habitat is not likely to be present; or Suitable habitat is potentially present but the species has not been found in the vicinity of the study area despite adequate recent survey effort.

2.2 LIKELIHOOD OF OCCURRENCE ASSESSMENT

2.2.1 Overall Assessment

The study area consists of 106 sections with a total extent of approximately 126 ha. Based on aerial imagery and on field observations made during targeted surveys in 2023, almost the entirety of the study area is likely to consist of jarrah-marri forest on rocky slopes. There are apparently no granite outcrops, creeks, or swamps within the study area.

Fifty-five significant plant taxa occurring within 20 km of the survey area (excluding records from the Swan Coastal Plain) were identified from DBCA database searches and recent targeted survey data. These included six Threatened taxa, six Priority 1 taxa, six Priority 2 taxa, 21 Priority 3 taxa, and 16 Priority 4 taxa (Table 3, Map 2).

Four significant species were recorded by Ecologia and Biologic during systematic targeted surveys of nearby areas in 2023: *Senecio leucoglossus* (P4), *Tetratheca phoenix* (P2), *Stylidium ireneae* (P4), and *Thysanotus anceps* (P3) (Biologic 2024; Ecologia 2024). No other taxa were recorded despite a significant amount of survey effort.

Four species were assessed as 'Highly Likely' based on the potential presence of suitable habitat and records occurring within 500 m of the survey area, most of which were recorded during the recent surveys:

- *Pimelea rara* (P4)
- *Senecio leucoglossus* (P4)
- *Tetratheca phoenix* (P2)
- *Thysanotus anceps* (P3)

Three taxa were assessed as 'Likely' based on the potential presence of suitable habitat and records occurring 0.5 – 2 km from the survey area:

- *Acacia drummondii* subsp. *affinis* (P3)
- *Grevillea pimeleoides* (P3)
- *Hibbertia hortiorum* (P1)

Seventeen taxa were assessed as 'Unlikely' as, although suitable habitat is potentially present, they were not recorded during the recent nearby targeted surveys. This includes one Threatened species, *Grevillea flexuosa*. The remaining 31 taxa were assessed as 'Unlikely' as suitable habitat is unlikely to be present; these are mostly taxa confined to granite outcrops, wetlands, or riparian habitats.

Table 3: Likelihood of occurrence assessment for significant plant species known to occur within 20 km of the study area.

Taxon	WA status	Habitat	Approximate flowering period	Growth form	Recorded in vicinity of study area during 2023 surveys	Potentially suitable habitat	Nearest records to survey area	Likelihood of occurrence
Pimelea rara	P4	Lateritic soils.	J----------D	Perennial shrub	Yes	Suitable habitat possibly present.	<0.5 km	Highly Likely
Senecio leucoglossus	P4	Gravelly lateritic or granitic soils. Granite slopes.	-------ASOND	Annual herb	Yes	Suitable habitat possibly present.	<0.5 km	Highly Likely
Tetratheca phoenix	P2	Brown gravelly loam over granite. Mid-upper slopes.	--------SOND	Perennial shrub	Yes	Suitable habitat possibly present.	<0.5 km	Highly Likely
Thysanotus anceps	P3	White or grey sand, lateritic gravel, laterite.	---------OND	Perennial herb	Yes	Suitable habitat possibly present.	<0.5 km	Highly Likely
Acacia drummondii subsp. *affinis*	P3	Grows in laterite or sand over laterite, in jarrah , jarrah-marri and sometimes wandoo forest and woodland.	------JA----	Perennial shrub	Yes	Suitable habitat possibly present.	0.5 - 2 km	Likely
Grevillea pimeleoides	P4	Gravelly soils over granite. Rocky hillsides.	----MJJASON-	Perennial shrub	Yes	Suitable habitat possibly present.	0.5 - 2 km	Likely
Hibbertia hortiorum	P1	Jarrah–marri forests over laterite.	--------SO--	Perennial shrub	No	Suitable habitat possibly present.	0.5 - 2 km	Likely
Acacia horridula	P3	Gravelly soils over granite, sand. Rocky hillsides.	----MJJA----	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Acacia oncinophylla subsp. *patulifolia*	P4	Granitic soils, occasionally on laterite.	-------ASOND	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Bossiaea modesta	P2	Soils derived from granite. Damp areas close to streams.	---------OND	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Calothamnus graniticus subsp. *leptophyllus*	P4	Clay over granite, lateritic soils. Hillsides.	-----JJA----	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Chorizema ulotropis	P4	White sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats.	------JAS---	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Cyanothamnus tenuis	P4	Gritty brown sandy clay over granite. Creeks, slopes.	-------ASON-	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Gastrolobium sp. Asperum (F. Hort 2864)	P3	Slope, flat. Dry, brown loam, gravel over laterite.	--------S---	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Grevillea dissectifolia	P3	Sand/loam and laterite along creeks and road verges.	-----J--S-N-	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Grevillea flexuosa	T	Red-brown sand with laterite & gravel, sand over granite. Ridgetops, breakaways.	------JASO--	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Halgania corymbosa	P3	Gravelly soils, soils over granite.	-------ASON-	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Hemigenia platyphylla	P4	Sandy & loamy soils. Slopes.	--------SON-	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Lasiopetalum bracteatum	P4	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	J------ASOND	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Millotia tenuifolia var. laevis	P2	Granite or laterite soils.	--------SO--	Annual herb	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Petrophile filifolia subsp. *laxa*	P3	Winter-wet sites, flats, slopes, swamps, drainage lines.	J---------ND	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Stackhousia sp. Red-blotched corolla (A. Markey 911)	P3	Light grey gritty clay, with surface granitic cobbles, on a gentle southern upper slope.	-----JJAS---	Perennial herb	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Synaphea pandurata	P3	Yellowish sands and sandy loams, dark brown loam, laterite gravel, granite.	--------SOND	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Tetratheca similis	P3	Sandy clay with lateritic boulders.	-------AS---	Perennial shrub	No	Suitable habitat possibly present.	2 - 20 km	Unlikely
Acacia cuneifolia	P4	Sand, clay or loam over granite. Granite outcrops.	------JASO--	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Acacia oncinophylla subsp. *oncinophylla*	P3	Fringing granite outcrops.	-------ASO--	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	P3	Granitic heath. Granite outcrops.	J--------OND	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Andersonia sp. Saxatilis (F. & J. Hort 3324)	T	Granitic heath. Granite outcrops.	--------SO--	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Anthocercis gracilis	T	Sandy or loamy soils. Granite outcrops.	--------SO--	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Banksia recurvistylis	P2	Granite outcrops.	----------N-	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Boronia capitata subsp. *gracilis*	P3	White/grey or black sand. Winter-wet swamps, hillslopes.	-----JJASON-	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Byblis gigantea	P3	Sandy-peat swamps.	J-------SOND	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Caladenia speciosa	P4	White, grey or black sand. Sandplains.	--------SO--	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Cyathochaeta teretifolia	P3	Grey sand, sandy clay. Swamps, creeks.	UNKNOWN	Perennial herb	No	Suitable habitat unlikely to be present.	0.5 - 2 km	Unlikely
Darwinia hortiorum	P1	Brown loam/clay/gravel laterite. Granite outcrops.	-------ASON-	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Darwinia thymoides subsp. St Ronans (J.J. Alford & G.J. Keighery 64)	P4	Sandy or gravelly clay-loam soils. Slopes and Flats. Granite outcrops.	J---------N-	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Dicrastylis reticulata	P3	Granite outcrops, heath.	--------SOND	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely

Taxon	WA status	Habitat	Approximate flowering period	Growth form	Recorded in vicinity of study area during 2023 surveys	Potentially suitable habitat	Nearest records to survey area	Likelihood of occurrence
Drosera occidentalis	P4	White-yellow sand, clayey soils. Swamps, seasonally wet depressions and slopes.	J--------OND	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Grevillea ornithopoda	P2	Riverbanks. Primarily Swan Coastal Plain.	--------SOND	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Grevillea thelemanniana	T	Sand, sandy clay. Winter-wet low-lying flats.	----MJJASON-	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Hakea oldfieldii	P3	Red clay or sand over laterite. Seasonally wet flats.	-------ASO--	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Hibbertia acrotoma	P1	Brown loam. Granite outcrops.	-------AS---	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Lasiopetalum glutinosum subsp. *glutinosum*	P3	Granite outcrops and creeks.	--------SOND	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Lasiopetalum pterocarpum	T	On sloping banks near creeks.	-------ASOND	Perennial shrub	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Lepyrodia curvescens	P2	Wetlands and swamps.	--------SON-	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Lepyrodia heleocharoides	P3	Moist peaty sand. Wetlands and swamps.	----------D	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Meionectes tenuifolia	P3	Sand or clay. Wetlands and swamps.	--------SOND	Annual herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Morelotia australiensis	T	Winter-wet, swampy depressions, drainage lines or rises surrounding swamps in Corymbia calophylla woodland.	----------D	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Paracaleana gracilicordata	P1	Moss mats on granite outcrops.	---------ON-	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Paracaleana granitica	P1	Moss mats on granite outcrops.	---------OND	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Parsonsia diaphanophleba	P4	Alluvial soils. Along rivers.	JF-AMJ--S---	Perennial climber	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Pithocarpa corymbulosa	P3	Gravely or sandy loam. Granite outcrops.	JFMA--------	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Stylidium ireneae	P4	Sandy loam. Valleys near creeks.	---------OND	Perennial herb	No	Suitable habitat unlikely to be present.	<0.5 km	Unlikely
Thysanotus formosus	P1	Jarrah low forest, in heavy clay soils, often inundated in winter.	J---------ND	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	Grey, black, or peaty sand. Winter-wet flats.	---------ON-	Perennial herb	No	Suitable habitat unlikely to be present.	2 - 20 km	Unlikely

2.2.2 Area Specific Assessment

A section-specific likelihood of occurrence assessment was undertaken to assist prioritisation of future surveys (**Map 3**). Many of these sections are immediately adjacent to areas that were surveyed in 2023. Based on their proximity to significant species records (within ca. 500 m), 18 sections totalling 24.9 ha are likely to support either *Pimelea rara* (P4), *Senecio leucoglossus* (P4), *Tetratheca phoenix* (P2), or *Thysanotus anceps* (P3) (Table 4). Although *Stylidium ireneae* has been recorded within 500 m of sections '32', '52', and '71', none these are likely to support this species, which is typically restricted to the banks of creeks.

There is one historical record of *Hibbertia hortiorum* (P1) just over 2 km southwest of section 67 in which suitable habitat ('jarrah–marri forests over laterite') is likely to be present (**Map 3**). Biologic (2024) systematically surveyed an area approximately 1 km north of this record, but only the similar species *Hibbertia ovata* was found. Biologic (2024) also noted, based on communication with staff at the Western Australian Herbarium, that the collection of *H. hortiorum* here is only tentatively identified as this species. The overall likelihood of occurrence of *H. hortiorum* within the study area was 'Likely' based on the assessed criteria but given the small size of section 67 (0.41 ha), and since no records of *H. hortiorum* were found in its vicinity in 2023, it is unlikely that it occurs here.

Table 4: Area specific likelihood of occurrence assessment.

Section No.	Area (ha)	Species	Suitable habitat possible present	Likelihood of occurrence
2	1.743	*Pimelea rara* (P4)	Yes	Highly Likely
8	5.638	*Senecio leucoglossus* (P4)	Yes	Highly Likely
9	0.036	*Thysanotus anceps* (P3)	Yes	Highly Likely
10	0.101	*Thysanotus anceps* (P3)	Yes	Highly Likely
11	1.248	*Thysanotus anceps* (P3)	Yes	Highly Likely
13	0.267	*Senecio leucoglossus* (P4)	Yes	Highly Likely
20	0.864	*Senecio leucoglossus* (P4)	Yes	Highly Likely
32	0.053	*Stylidium ireneae* (P4)	No	Unlikely
34	1.615	*Senecio leucoglossus* (P4)	Yes	Highly Likely
35	0.398	*Senecio leucoglossus* (P4)	Yes	Highly Likely
36	0.479	*Senecio leucoglossus* (P4)	No	Unlikely
52	0.916	*Stylidium ireneae* (P4)	Yes	Highly Likely
65	0.204	*Senecio leucoglossus* (P4)	Yes	Highly Likely
67	0.42	*Thysanotus anceps* (P3)	Yes	Highly Likely
70	0.448	*Senecio leucoglossus* (P4)	Yes	Highly Likely
71	1.074	*Stylidium ireneae* (P4)	No	Unlikely
90	0.678	*Tetratheca phoenix* (P2)	Yes	Highly Likely
94	1.833	*Tetratheca phoenix* (P2)	Yes	Highly Likely
95	0.225	*Tetratheca phoenix* (P2)	Yes	Highly Likely
102	4.486	*Senecio leucoglossus* (P4)	Yes	Highly Likely
103	3.869	*Senecio leucoglossus* (P4)	Yes	Highly Likely

3 CONCLUSIONS

Four significant plant species were assessed as 'Highly Likely' to occur within the study area and three species were assessed as 'Likely' to occur within the study area. The remaining species were assessed as 'Unlikely' as either no suitable habitat is likely to be present within the study area, or suitable habitat is present but the species was not recorded in nearby areas in 2023. All the Threatened and Priority 1 species (excluding *Hibbertia hortiorum*) that have been recorded within 20 km of the study area were assessed as 'Unlikely' to occur.

Three of the four species recorded by Ecologia and Biologic at the Huntly Mine in 2023 (*Senecio leucoglossus*, *Tetratheca phoenix*, and *Thysanotus anceps*) and *Pimelea rara* are 'Highly Likely' to occur within 18 sections of the study area. *Stylidium ireneae*, which was recorded in 2023, is unlikely to be preset at all due to probable absent of suitable habitat. The 18 individual sections, totalling 24.9 ha, may be prioritised during future surveys if required.

A tentatively identified record of *Hibbertia hortiorum* (P1) is present approximately 2 km from the study area but this species was not found after reasonable nearby survey effort by Biologic in 2023. Although this species was assessed as 'Unlikely' to occur, Alcoa may consider surveying sections in the vicinity of this record (e.g., within 5 km), to be certain that it is not present.

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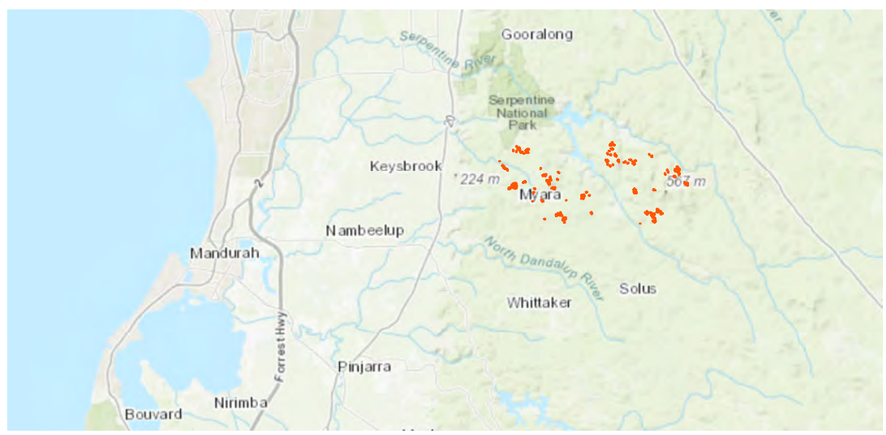
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Study area



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Project No.: 1979b
Date: 12 April 2024
Author: AC
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:50,287 @A3

Map 1: Location of the study area.

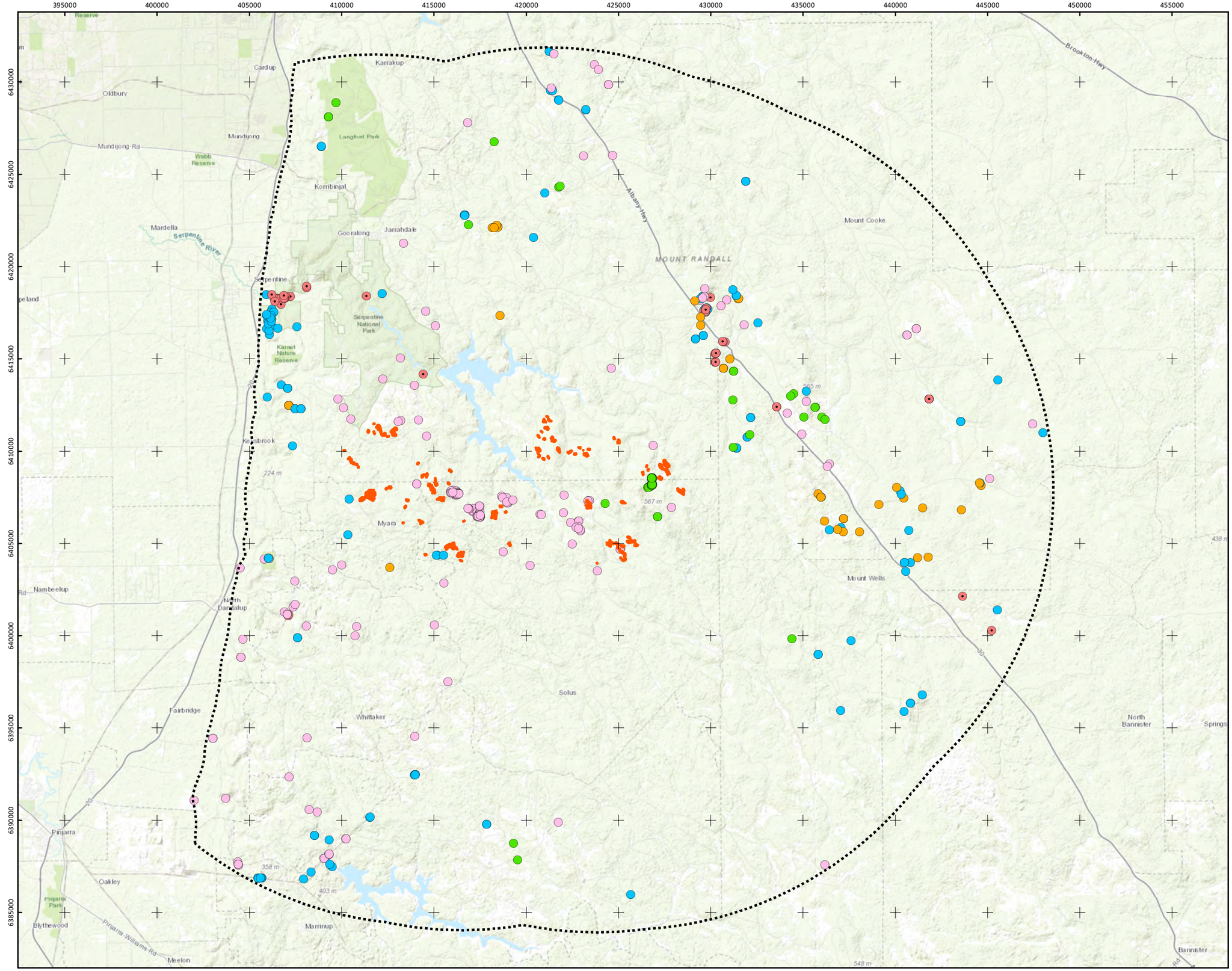
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Kilometers

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Study area
Study area 20 km buffer

Significant species record

- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

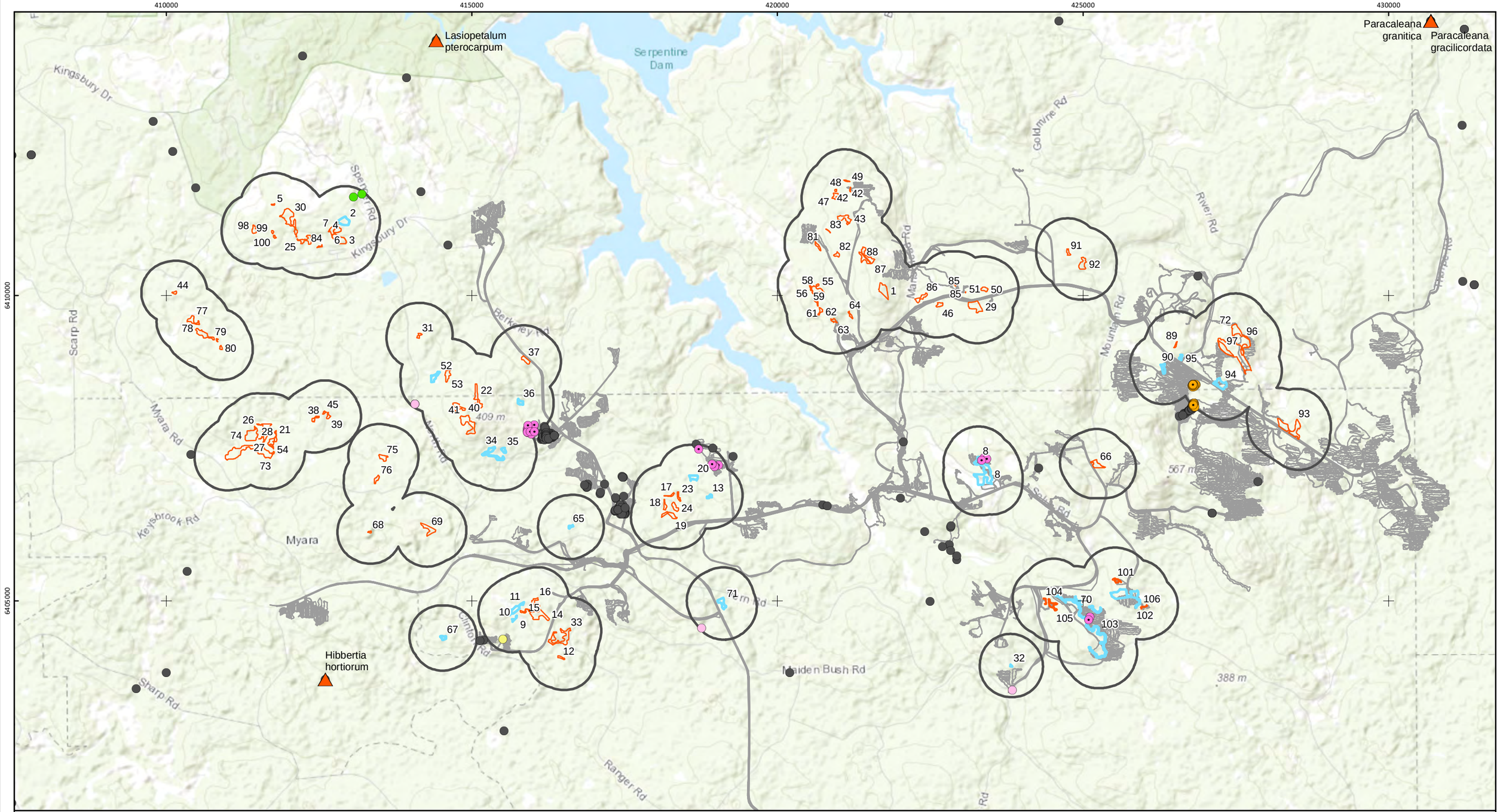


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Author: AC
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:200,000 @A3

Map 2: Significant plant species records within 20 km of the study area.

0 1.75 3.5 7 10.5
Kilometers

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Study area

- No
- Records within 500 m
- 500 m buffer
- Targeted survey transects 2023

Significant species record (<2 km)

- P1, Hibbertia hortiorum
- P2, Tetratheca phoenix
- P3, Thysanotus anceps
- P4, Pimelea rara
- P4, Senecio leucoglossus
- P4, Stylidium ireneae

- Threatened or Priority 1 species record
- Significant species record >500 m from study area

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Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:60,000 @A3

Map 3: Significant plant species records within 500 m of the study area.

0 0.5 1 2 3
Kilometers

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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HUNTLY MINE PRE-CLEARANCE SURVEYS - THREATENED FLORA AND DECLARED WEEDS 2023 – DESKTOP ASSESSMENT AND MEMO REPORT

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2	A. Craigie	S. Grein	9/5/2024	S. Grein	S. Boys	9/5/2024

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EXECUTIVE SUMMARY

Alcoa of Australia Limited's (Alcoa) Western Australian (WA) mining operations comprise the Huntly and Willowdale bauxite mines, which are located in Alcoa's Mining Lease 1SA (ML1SA) within the Northern Jarrah Forest (NJF) IBRA subregion. Alcoa has committed to undertaking pre-clearance ecological surveys for the Huntly Mine, Myara region and Willowdale Mine, Larego region as part its MMP assessment by the MMPLG. These surveys will be based on conceptual clearing alignments which will be submitted as part of the MMP. Ecologia Environment (ecologia) was engaged by Alcoa to undertake targeted flora surveys for the Huntly Mine survey area in 2023, totalling 673.81 ha, which were undertaken over 25 days primarily in spring 2023 (late August and early December).

Based on the proximity of previous records and the potential presence of suitable habitat, 29 conservation significant plant species were assessed as potentially occur within the survey area. Targeted searches for these species, as well as Weeds of National Significance (WONS) and Declared Pests, were conducted along systematic transects at 20 m or 10 m spacings within the survey area.

Three DBCA listed Priority species were recorded within the survey area: *Tetratheca phoenix* (P2), *Senecio leucoglossus* (P4), and *Stylidium ireneae* (P4). The likelihood of occurrence of the remaining species identified during the desktop assessment was reassessed for the surveyed areas based on survey effort, the presence of suitable habitat, and vegetation condition, and all species initially assessed with a 'High' or 'Moderate' likelihood of occurrence were reassessed as 'Low'. There were no WONS or Declared Pests recorded.

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APPENDICES

Appendix A Likelihood of Occurrence Assessment.

ABBREVIATIONS

BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
BOM	Bureau of Meteorology
CALM	Department of Conservation and Land Management (now DBCA and DWER)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWE	Department of Agriculture, Water and the Environment (now DCCEEW)
DAWR	Department of Agriculture and Water Resources (now DCCEEW)
DBCA	Department of Biodiversity, Conservation and Attractions (previously DPaW)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation (now DBCA)
DER	Department of Environment Regulation (now DWER)
DWER	Department of Water and Environmental Regulation
DoEE	Department of Environment and Energy (previously DSEWPaC, now DAWE)
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industry and Regional Development
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DAWE)
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESCAVI	Executive Steering Committee for Australian Vegetation Information
Ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
m	Metre
P	Priority
WA	Western Australia
WAOL	Western Australian Organism List
WC Act	*Wildlife Conservation Act 1950*
WAOL	Western Australian Organism List
WONS	Weed of National Significance

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Alcoa of Australia Limited's (Alcoa) Western Australian (WA) mining operations comprise the Huntly and Willowdale bauxite mines, which are located in Alcoa's Mining Lease 1SA (ML1SA) within the Northern Jarrah Forest (NJF) IBRA subregion. Alcoa has approval to mine within ML1SA subject to submitting draft five-year mine plans and associated environmental management programmes known as the Mining and Management Program (MMP). The MMP is submitted to the State's Mining and Management Program Liaison Group (MMPLG) on an annual basis.

Alcoa has committed to undertaking pre-clearance ecological surveys for the Huntly Mine, Myara region and Willowdale Mine, Larego region as part its MMP assessment by the MMPLG. These surveys will be based on conceptual clearing alignments which will be submitted as part of the MMP and will be used to:

- Amend the conceptual alignment to avoid significant flora and vegetation.
- Create management plans to ensure any identified Weeds of National Significance (WONS) or declared and invasive weeds are not spread.
- Inform translocation and environmental management plans as required.
- Assist Alcoa in preparing MMP submission to the MMPLG.

1.2 SCOPE OF WORK

Alcoa required a suitably qualified consultant to undertake targeted surveys for Threatened and Priority Flora and significant weeds species (primarily Weeds of National Significance and Declared Pests) within the Huntly Mine survey area, which, as of December 2023, occupies an area of 673.81 ha (Map 1).

The following were provided as part the biological assessment of the survey area:

- A desktop assessment to evaluate biological values of the survey area and surrounds, relating to significant plants species and weeds.
- Targeted surveys within designated survey areas as per EPA guidance:
    - In 10 or 20 m traverses in a grid pattern to identify Threatened and Priority species presence or absence. If a Threatened or Priority species is found, the survey effort is modified to delineate the impacted population.
    - Other conservation significant flora species will be recorded when identified.
    - Record any WONS, Declared Pests, and invasive weeds.

1.3 DEFINITIONS

1.3.1 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).

1.3.2 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 [their] 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.

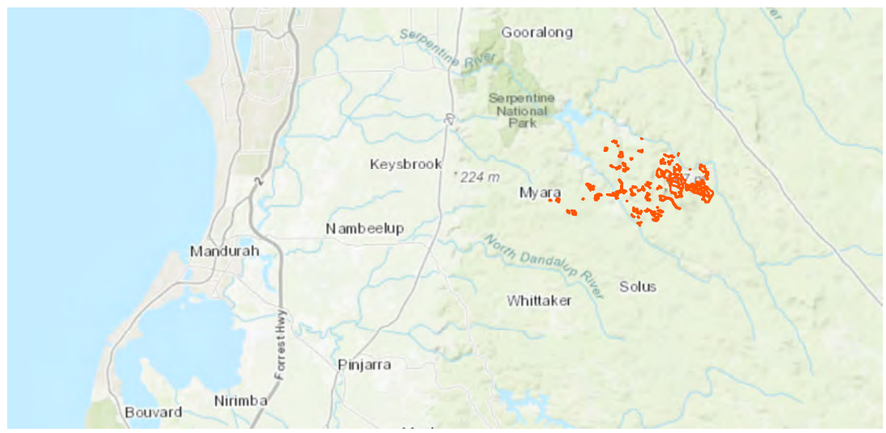
Regional Weed Prioritisation Process

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).

415000 417500 420000 422500 425000 427500 430000 432500

6412500 6410000 6407500 6405000

Survey area



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Project No.: 1979
Date: 6 February 2024
Author: AC
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:50,000 @A3

Map 1: Location of the Huntly Mine survey area.

0 0.5 1 2 3
Kilometers

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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 *et al.* 2002).

Searches of the databases listed in Table 1 were undertaken to determine the significant species and ecological communities previously recorded within 20 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 20 km of the survey area
DBCA Threatened and Priority Ecological Communities Database	Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) within 20 km of the survey area
DBCA Threatened and Priority Flora (TPFL) and WAHERB database	Significant plant species records within 20 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 previously or during the current survey.
High	The species/community is likely to occur within the survey area as suitable habitat is known to be present and there are existing records very close to the survey area (within 5 km).
Moderate	The species/community possibly occurs within the survey area as there are existing records in the vicinity of the survey area (ca. 6 – 20 km) and suitable habitat is likely to be present; or The species/community possibly occurs within the survey area as there is insufficient information available to exclude the possibility of occurrence.
Low	The species/community is unlikely to occur within the survey area as suitable habitat is not present or is not likely to be present; or Suitable habitat is present within the survey area, but the taxon/community has not been recorded despite reasonable survey effort.
Does not occur	The community is an existing regionally mapped vegetation association (e.g. Shepherd et al. 2002) or land system 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 CLIMATE

The survey area is in the Jarrah Forest region of Western Australia, which experiences Mediterranean climate with two distinct seasons: a warm to hot dry summer from December to February and a mild to cool wet winter from June to August. Rainfall data from the nearest long-term Bureau of Meteorology (BOM) weather station (since 1963) were obtained from Karnet (Station No. 9111), located approximately 7 km to the west of the survey area. Winter rainfall at Karnet in 2023 was approximately 35% lower than average (Figure 1). Temperature data were also obtained from Karnet (Station No. 9111) (BoM 2023) which is located 7 km to the west of the survey area (Figure 1). Maximum daytime temperature at Karnet is frequently above 30°C between January and February, and minimum temperatures can drop below 7°C between July and August.

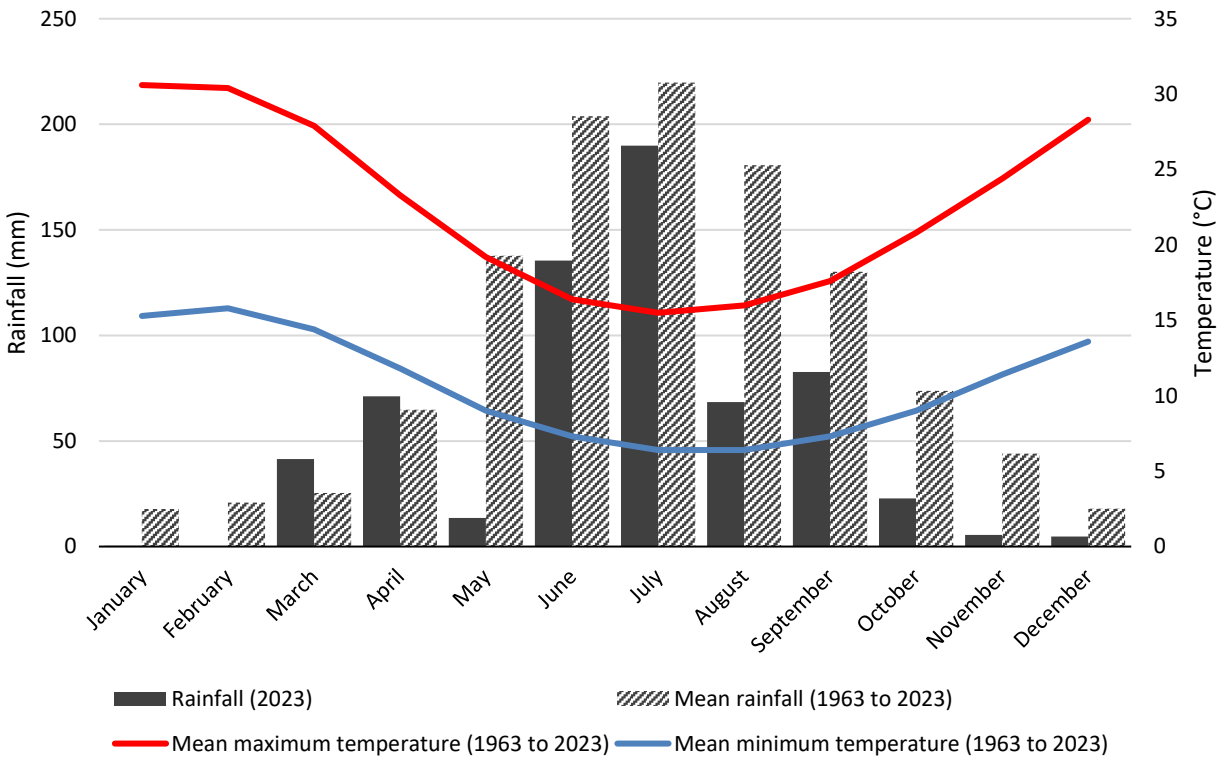


Figure 1: Monthly mean rainfall and temperature for Karnet (rainfall and temperature).

2.3 INTERIM BIOGEOGRAPHIC REGIONALISATION FOR AUSTRALIA

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the Australian continent into bioregions on the basis of similar geology, landform, vegetation, fauna and climate characteristics (DSEWPaC 2012). The survey area is in the Jarrah Forest bioregion according to IBRA 7. The Jarrah Forest region is further divided into two subregions: Northern Jarrah Forest and Southern Jarrah Forest. The survey area is in the Northern Jarrah Forest subregion.

A description of the Northern Jarrah Forest from *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002* (Williams and Mitchell 2001) is as follows:

"The Northern Jarrah Forest incorporates the area east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of an average elevation of 300 m, capped by an extensive lateritic duricrust, dissected by later drainage and broken by occasional granite hills. In the east the laterite becomes deeply dissected until it compresses isolated remnants. Rainfall is from 1300 mm on the scarp to approximately 700 mm in the east and north. Vegetation comprises Jarrah-Marri forest in the west with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east with Powder bark on breakaways. There are extensive but localised sand sheets with *Banksia* low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east. Most the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions. Subregional area for JF1 is 2,255,904 ha."

2.4 LAND SYSTEMS

In 2016 the Department of Primary Industries and Regional Development consolidated soil-landscape mapping of Western Australia from two technical reports created by the Department of Agriculture and Food (Department of Agriculture Resource Management Technical Reports RMTR No. 280 (Purdie *et al.* 2016) and RMTR No. 313 (Tille 2006)). The resulting spatial dataset, *Soil Landscape Mapping - Best Available (Version 05.01)* (DPIRD-027) (DPIRD 2022), is a compilation of various surveys at different scales varying between 1:20,000 and 1:3,000,000. Mapping conforms to a nested hierarchy established to deal with the varying levels of information resulting from the variety of scales in mapping to provide soil-landscape data for all Western Australia. Five soil-landscape units are associated with the survey area (Table 3, Map 2).

2.5 SURFACE GEOLOGY

The Surface Geology of Australia 1:1,000,000 scale spatial dataset is a seamless national coverage of outcrop and surficial geology (Geoscience Australia 2012). Three surface geological units are associated with the survey area (Table 4, Map 3).

2.6 SOILS

The Atlas of Australian Soils (Northcote *et al.* 1960-1968) was compiled by the CSIRO in the 1960's to provide a consistent national description of Australia's soils. The original maps used scales from 1:250,000 to 1:500,000. In 1991 the National Resource Information Centre used these maps to create the Digital Atlas of Australian Soils which describes over 14,000 soil units and their distribution across Australia. Three soil types of the Atlas of Australian Soils are associated with the survey area (Table 5, Map 4).

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

Unit name	Description	Extent within survey area (ha)	Percent of survey area
Cooke subsystem	Crests and upper slopes dominated by granite outcrop and very shallow yellow duplex soils, and yellow and brown massive earths	208.89	31.00
Dwellingup subsystem	Divides, lower to upper slopes and hillcrests. Duplex sandy gravels and loamy gravels with minor areas of shallow gravels, deep sandy gravels, yellow deep sands and yellow and pale deep sands, often gravelly	332.25	49.31
Murray subsystem	Deeply incised valley of the Murray River; red and yellow earths and minor duplex soils; occasional rock outcrops; narrow sandy terrace	26.78	3.97
Yarragil DpYGh phase	Very gentle to moderately inclined (<20%) concave valley sideslopes. Moderately well drained yellow duplex soils and yellow and brown massive earths	6.16	0.91
Yarragil subsystem	Shallow, narrow, upper valleys of the deeply dissected Murray, Bindoon and Helena units. Alluvial, clay and loam soils, moderately well drained, often gravelly, with some sands and loams. Salt prone. Woodland of E. wandoo, E. accedens	99.73	14.81
Total		673.81	100

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

Map Symbol	Soil unit	Description	Extent within survey area (ha)	Percent of 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	415.32	61.64
An	gneiss, granulite, migmatite 74310	Banded granitic gneiss (monzogranitic to granodioritic), quartzofeldspathic gneiss with mafic bands, migmatite, granofels, mafic and felsic granulites, hypersthene-plagioclase-quartz granulite; schist, pelitic or mafic granofels	0.19	0.03
Czl	ferruginous duricrust 38498	Ferruginous duricrust, laterite; pisolitic, nodular, vuggy; may include massive to pisolitic ferruginous subsoil, mottled clays, magnesite, reworked products of ferruginous and siliceous duricrusts, calcrete, gossan; residual ferruginous saprolite	258.3	38.33
Total			673.81	100

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

Name	Description	Extent within survey area (ha)	Percent of survey area
JJ14	Steep granitic ranges and hills with bare rock walls: chief soils are shallow sands (Uc4.11) and leached sands (Uc2.2) in colluvial positions.	34.6	5.14
JZ1	Dissected plateau having a strongly undulating relief, and with some moderately incised valleys. The unit comprises much of the western part of the Darling Range south of the Swan River. It is characterized by lateritic gravels and block laterite.	634.56	94.17
Mw31	Deeply incised, steep scarp and valley side slopes of the Darling scarp and its more deeply incised tributary valleys: chief soils of the steep scarp and valley side slopes, on which massive rock outcrops are a feature, seem to be acid red earths (Gn2.14) on the colluvial slope deposits.	4.65	0.69
Total		673.81	100

415000 417500 420000 422500 425000 427500 430000 432500

6412500 6410000 6407500 6405000 6402500

Survey area

Soil-landcape system

- Cooke subsystem
- Dwellingup subsystem
- Murray subsystem
- Pindalup hillslope phase
- Pindalup subsystem
- Pindalup swampy valley floor phase
- Yarragil DpYGh phase
- Yarragil Swamp phase
- Yarragil subsystem

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Projection: Transverse Mercator
Absolute Scale: 1:50,000 @A3

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Map 2: Soil-landscape systems within the survey area (DPIRD-027).

Service Layer Credits:

0 0.5 1 2 3
Kilometers

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6412500 6410000 6407500 6405000 6402500

ferruginous duricrust 38498

felsic intrusives 74292

colluvium 38491

gneiss, granulite, migmatite 74310

Survey area

Unit

- colluvium 38491
- felsic intrusives 74292
- ferruginous duricrust 38498
- gneiss, granulite, migmatite 74310

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

Map 3: Surface geology (1:1,000,000) of the survey area (Geoscience Australia 2012).

Service Layer Credits:

0 0.5 1 2 3
Kilometers

415000 417500 420000 422500 425000 427500 430000 432500

6412500
6410000
6407500
6405000
6402500

Mw31
JZ1
JJ14
JZ2

Survey area

Map unit

- JJ14
- JZ1
- JZ2
- Mw31

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Project No.: 1979
Date: 6 February 2024
Author: AC
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:50,000 @A3

Map 4: Atlas of Australian Soils map units associated with the survey area (Northcote et al. 1960-1968).

Service Layer Credits:

0 0.5 1 2 3
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). One vegetation association (Association 3, *Eucalyptus marginata*, *Corymbia calophylla*, *Allocasuarina fraseriana* mid open forest) is mapped within the survey area (Table 6, Map 5).

2.7.2 Vegetation mapping of Mattiske (2022)

Vegetation for the Myara area was mapped by Mattiske (spatial data and descriptions provided by Alcoa in 2023). Twenty-two of these units (including cleared and rehabilitated areas) are present within the survey area (Table 7, Map 6). These consists primarily of *Eucalyptus marginata* and/or *Corymbia calophylla* dominated forests with a variable understorey occurring on steep slopes and plains, accounting for over 90% of the survey area (Table 7).

Two units representing vegetation fringing granite outcrops account for 1.11 ha (0.17%) of the survey area:

- G and G1 (Mosaic of Open Woodland of *Eucalyptus marginata* – *Corymbia calophylla* on the fringes of outcrops ranging to open heath communities of Proteaceae-Myrtaceae species and lithic complexes on the outcrop areas, 1.02 ha, 0.16%)

Two vegetation units accounting for 4.37 ha (0.66% of the survey area) are associated with creeks and water courses:

- CW (Woodland to Open Forest of *Eucalyptus patens* – *Eucalyptus megacarpa* - *Corymbia calophylla* - *Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses, 3.23 ha, 0.47%).
- AC (Open Woodland of *Eucalyptus rudis* – *Melaleuca preissiana* – *Eucalyptus patens* - *Banksia* littoralis with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses, 1.04 ha, 0.15%).

Note that the provided description of vegetation unit T (Table 7), which accounts for 2.28% of the survey area, appears to be erroneous as the mapped areas are not consistent with creeks or water-courses, and are more likely to represent typical *Eucalyptus marginata* – *Corymbia calophylla* forest or similar.

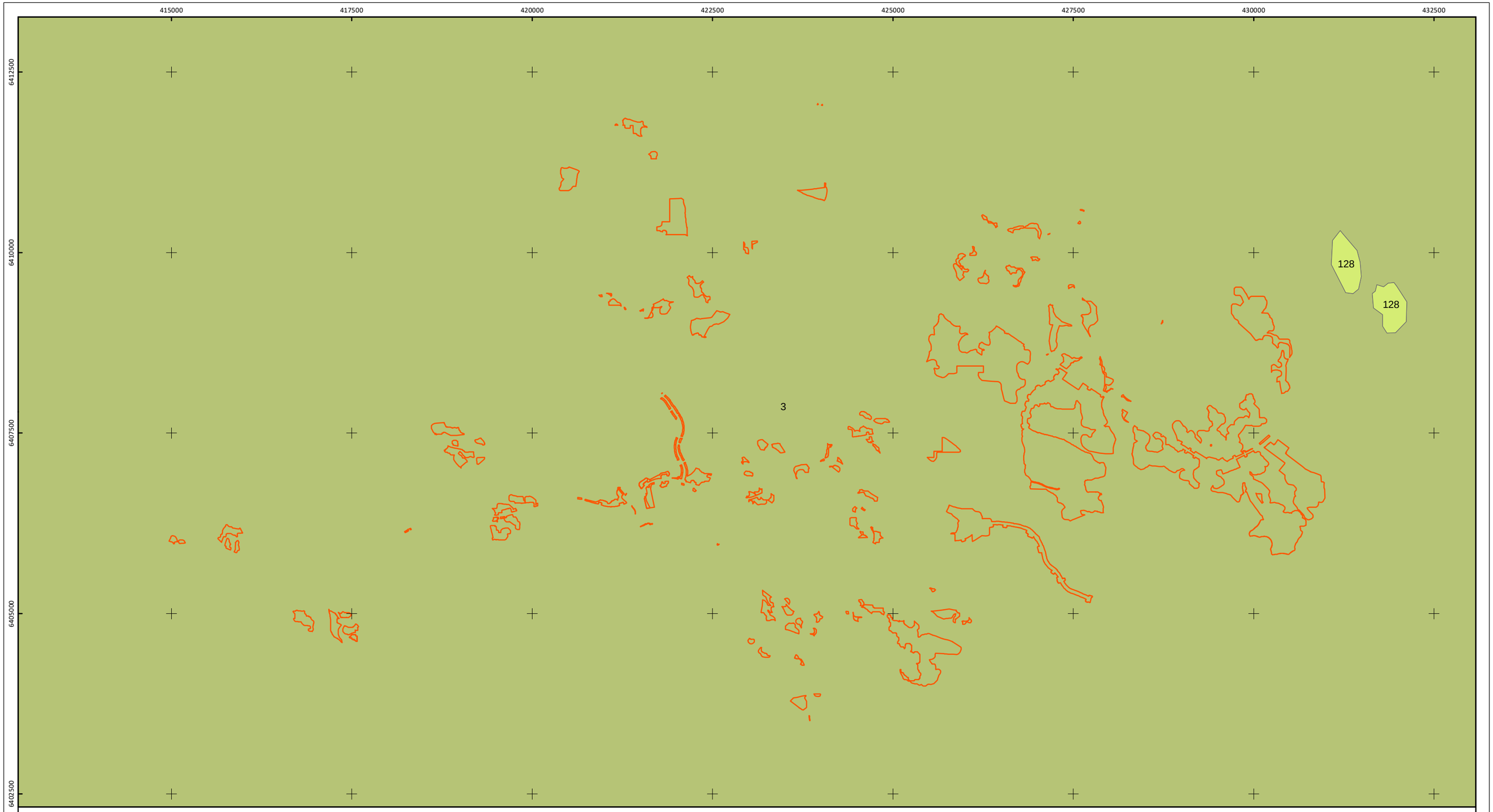
Table 6: Pre-European vegetation associations mapped with the survey area (Shepherd *et al.* 2002).

Association	Description	NVIS V	Extent within survey area (ha)	Percent of survey area
3	Medium forest; jarrah-marri	U *Eucalyptus marginata*,^*Corymbia calophylla*, *Allocasuarina fraseriana*\tree\7\c;M *Acacia urophylla*, *Bossiaea aquifolium*, *Hakea cyclocarpa*\shrub\4\i;G *Macrozamia riedlei*, *Styphelia tenuiflora*, *Lepidosperma angustatum*\cycad,forb,shrub,sedge\2\i	673.81	100.00

Table 7: Myara vegetation association mapped with the survey area (Mattiske 2022).

Code	Description	Extent within survey area (ha)	Percent of survey area
A	Tall shrubland of *Melaleuca lateritia*, *Hakea varia*, *Melaleuca viminea* and *Melaleuca incana* subsp. *incana* on clay-loams in seasonally wet valley floors.	1.37	0.2
AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana – Eucalyptus patens - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	1.15	0.17
CL	Cleared	1.14	0.17
CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	3.24	0.48
D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae* and *Acacia extensa* on clay loams to gravelly clay-loams.	5.35	0.8
DG	Open forest of *Corymbia calophylla* and *Eucalyptus marginata* over *Hakea lissocarpha*, *Macrozamia riedlei*, *Pericalymma ellipticum*, *Grevillea bipinnatifida*, *Allocasuarina humilis*, *Acacia alata*, *Babingtonia camphorosmae*, *Hypocalymma angustifolium* and *Phyllanthus calycinus* on clay-loams on lower slopes with localized patches of outcropping.	0	0
E	Open woodland of *Eucalyptus marginata* and *Corymbia calophylla* over *Mesomelaena tetragona*, *Kingia australis*, *Leptospermum erubescens* and *Babingtonia camphorosmae* on sandy to sandy-loam soils on slopes.	17.14	2.54
G	Mosaic of Open Woodland of *Eucalyptus marginata – Corymbia calophylla* on the fringes of outcrops ranging to open heath communities of Proteaceae-Myrtaceae species and lithic complexes on the outcrop areas.	0.2	0.03
G1	Mosaic of Open Woodland of *Eucalyptus marginata – Corymbia calophylla* on the fringes of outcrops ranging to open heath communities of Proteaceae-Myrtaceae species and lithic complexes on the outcrop areas.	0.92	0.14
P	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger*, *Styphelia nitens*, *Grevillea wilsonii*, *Leucopogon capitellatus* on sandy gravels.	55.4	8.22

Code	Description	Extent within survey area (ha)	Percent of survey area
PS	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger*, *Leucopogon capitellatus* on gravels and sandy gravels.	175.83	26.1
PT	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger*, *Leucopogon verticillatus*, *Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	5.75	0.85
PW	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii*, *Adenanthos barbiger*, *Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels.	92.34	13.7
R	Open Woodland of *Eucalyptus marginata - Corymbia calophylla* on fringes of granite outcrops or shallow soils over mixed understorey species reflecting shallow soils over granite.	4.69	0.7
Rehab	Rehabilitation Areas	0.08	0.01
S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger*, *Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy gravels.	213.26	31.65
SP	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger*, *Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	38.89	5.77
ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus*, *Leucopogon verticillatus*, *Pteridium esculentum*, *Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	6.04	0.9
SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger*,	12.26	1.82
T	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	16.78	2.49
TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus*, *Pteridium esculentum*, *Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	18.17	2.7
W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Acacia extensa* and *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	3.81	0.56
Total		673.81	100



Survey area

Vegetation association

3: Medium forest; jarrah-marri

128: Bare areas; rock outcrops

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Map 5: Pre-European vegetation associations (Shepherd et al. 2002).

Service Layer Credits:

0 0.5 1 2 3
Kilometers

415000 417500 420000 422500 425000 427500 430000 432500

6412500 6410000 6407500 6405000 6402500

Survey area

Granite
- G
- G1

Creeks
- AC
- CW

Hills/flats/valleys
- A
- C
- D
- DA
- DAM
- DG
- E
- P
- PG
- PS
- PT
- PW
- Q
- R
- S
- SP
- ST
- SW
- T
- TP
- TS
- W

Cleared/rehab
- CL
- CL_Other
- Rehab

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Map 6: Vegetation associations mapped by Mattiske (2022).

Service Layer Credits:

0 0.5 1 2 3
Kilometers

2.8 FLORA

2.8.1 Significant Species

DBCA database searches identified 58 significant plant taxa within 20 km of the survey area (excluding records from the Swan Coastal Plain), including six Threatened taxa, six Priority 1 taxa, six Priority 2 taxa, 22 Priority 3 taxa, and 18 Priority 4 taxa (Appendix A, Map 7, Map 8).

Based on the proximity of previous records and the potential presence of suitable habitat, 29 taxa were assessed as potentially occurring within the survey area ('High' and 'Moderate' ratings) (Appendix A). Taxa were considered unlikely to occur ('Low' rating) within the survey area if suitable habitat was considered unlikely to be present. These include taxa confined to granite outcrops, of which only 1.02 ha has been mapped within the survey area. Twenty-nine taxa were assessed with a 'Low' likelihood of occurrence (Appendix A).

The optimal targeted search period for most 'High' and 'Moderate' taxa is from approximately August to December, during their cited flowering periods, when they are likely to be most visible. However, while flowering material would be required to confidently identify many of these taxa, non-flowering material is likely to be suitable for identifying material at least tentatively. Therefore, spring surveys (September to November) are preferable for detecting all these species, regardless of flowering period.

2.8.2 Introduced Species

A search of the Atlas of Living Australia database (ALA 2023) identified eighty-five introduced plant species within 20 km of the survey area (Table 8). *Rubus anglocandicans* (part of the *Rubus fruticosus* aggregate) is a Weed of National Significance (WONS) (DAWR 2017). Two species (*Gomphocarpus fruticosus* and *Rubus anglocandicans*) are Declared Pests according to the BAM Act and listed on the WAOL (DPIRD 2007–). Six species have high ecological impact rating and rapid invasiveness rating according to the Weed Prioritisation Process for the region (*Avena barbata, Bromus diandrus, Bromus hordeaceus, Centranthus macrosiphon, Chamaecytisus palmensis,* and *Pittosporum undulatum*).

Table 8: Introduced plant species recorded within 20 km of the survey area including BAM Act status and Weed Prioritisation Process rating.

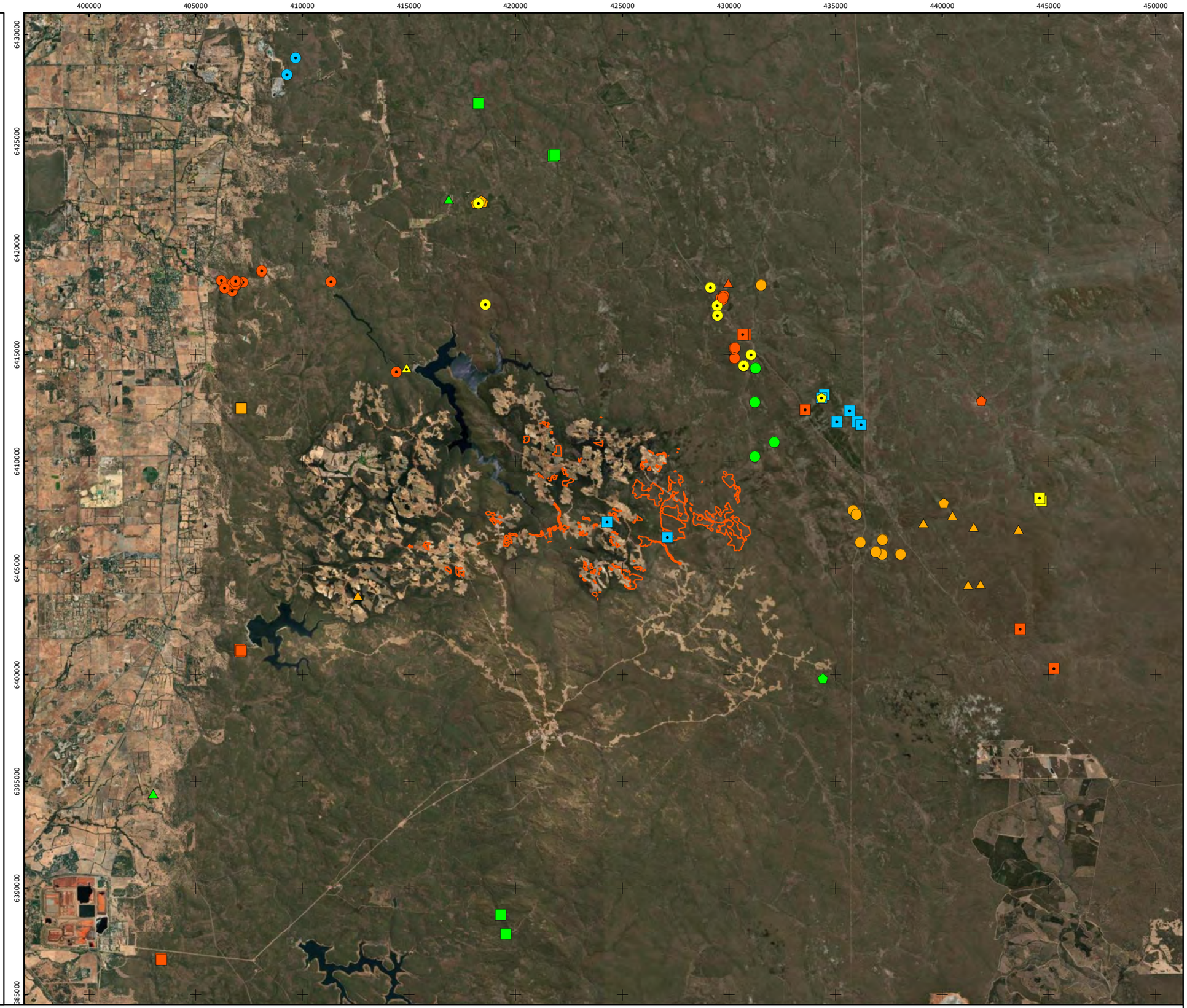
Species	Common name	BAM Act status and WONS	Ecological impact	Invasiveness
Acacia baileyana	Cootamundra wattle	Permitted - s11	Low	Slow
Acacia decurrens	Black wattle	Permitted - s11	Low	Slow
Acacia iteaphylla	Flinders range wattle	Permitted - s11	Unknown	Rapid
Acacia longifolia	Sydney golden wattle	Permitted - s11	Unknown	Moderate
Acacia podalyriifolia	Queensland silver wattle	Permitted - s11	Low	Slow
Acaena echinata	Sheep's burr	Permitted - s11	Unknown	Unknown
Aira caryophyllea	Silvery hairgrass	Permitted - s11	Unknown	Rapid
Aira cupaniana	Hairgrass	Permitted - s11	Unknown	Rapid
Allium neapolitanum	Naples onion	Permitted - s11	Unknown	Unknown
Arctotheca calendula	Capeweed, cape weed	Permitted - s11	Moderate	Moderate
Aristida ramosa	Purple wiregrass	Permitted - s11	Unknown	Unknown
Avena barbata	Bearded oat	Permitted - s11	High	Rapid
Bellardia trixago	Bartsia	Permitted - s11	Unknown	Rapid
Bellardia viscosa	Yellow glandweed	Permitted - s11	Unknown	Unknown
Brachypodium distachyon	False brome	Permitted - s11	Unknown	Unknown
Briza maxima	Blowfly grass	Permitted - s11	Unknown	Rapid
Briza minor	Shivery grass	Permitted - s11	Unknown	
Bromus diandrus	Great brome	Permitted - s11	High	Rapid
Bromus hordeaceus	Soft brome	Permitted - s11	High	Rapid
Buddleja madagascariensis	Smokebush or Madagascan butterfly bush	Permitted - s11	Unknown	Unknown
Cannabis sativa	Hemp	Permitted, Requires Permit - r73	Unknown	Unknown
Centaurium erythraea	Centaury, common centaury	Permitted - s11	Unknown	Rapid
Centranthus macrosiphon	Pretty Betsy	Permitted - s11	High	Rapid
Chamaecytisus palmensis	Tree lucerne, tagasaste	Permitted - s11	High	Rapid
Chasmanthe floribunda	African cornflag	Permitted - s11	High	Slow
Cicendia filiformis	Cicendia, slender cicendia	Permitted - s11	Low	Rapid
Cotula coronopifolia	Waterbuttons	Permitted - s11	Unknown	Rapid
Cotula turbinata	Funnel weed	Permitted - s11	Unknown	Rapid
Cyathea cooperi	Rough tree fern	Permitted - s11	Moderate	Rapid
Cyperus brevifolius	Mullumbimby couch, kyllinga weed	Permitted - s11	High	Moderate
Cyperus tenellus	Tiny flat sedge, tiny flatsedge	Permitted - s11	Unknown	Rapid
Digitaria sanguinalis	Crabgrass, crab grass	Permitted - s11	Low	Rapid
Disa bracteata	South African orchid	Permitted - s11	Unknown	Rapid
Ehrharta longiflora	Annual veldtgrass, annual veldt grass	Permitted - s11	Unknown	Rapid
Erigeron sumatrensis	Tall fleabane	Permitted - s11	Unknown	Unknown
Fumaria capreolata	Climbing fumitory, whiteflower fumitory	Permitted - s11	Moderate	Unknown
Galium divaricatum	Slender goosegrass	Permitted - s11	Low	Unknown

Species	Common name	BAM Act status and WONS	Ecological impact	Invasiveness
Gladiolus caryophyllaceus	Pink gladiolus	Permitted - s11	Unknown	Unknown
Glyceria declinata	Sweetgrass	Permitted - s11	Moderate	Rapid
Gomphocarpus fruticosus	Swan plant, narrowleaf cottonbush	Declared Pest - s22(2)	Unknown	Rapid
Gomphocarpus physocarpus	Balloon cottonbush	Permitted - s11	Unknown	Rapid
Hedera helix	Ivy	Permitted - s11	Low	Slow
Hypochaeris glabra	Flatweed, smooth catsear	Permitted - s11	Moderate	Rapid
Ixia polystachya	Variable ixia	Permitted - s11	Low	Moderate
Jacaranda mimosifolia	Blue jacaranda	Permitted - s11	Unknown	Unknown
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
Lagurus ovatus	Hare's tail grass	Permitted - s11	Unknown	Moderate
Lathyrus tingitanus	Tangier pea	Permitted - s11	Low	Slow
Linum trigynum	French flax	Permitted - s11	Low	Unknown
Lolium perenne	Ryegrass	Permitted - s11	Moderate	Rapid
Lonicera japonica	Japanese honeysuckle	Permitted - s11	Unknown	Slow
Lotus angustissimus	Slender birdsfoot trefoil, narrowleaf trefoil	Permitted - s11	Unknown	Rapid
Lotus subbiflorus	Hairy birdsfoot trefoil	Permitted - s11	Unknown	Rapid
Lysimachia arvensis	Scarlet pimpernel, blue pimpernel	Permitted - s11	Unknown	Rapid
Moenchia erecta	Erect chickweed	Permitted - s11	Unknown	Unknown
Orobanche minor	Broom rape, lesser broomrape	Permitted - s11	Unknown	Rapid
Parentucellia latifolia	Red bartsia, common bartsia	Permitted - s11	Unknown	Rapid
Passiflora filamentosa	Passionflower	Permitted - s11	Low	Slow
Pentameris airoides	False hairgrass	Permitted - s11	Unknown	Unknown
Pittosporum undulatum	Sweet pittosporum	Permitted - s11	High	Rapid
Populus alba	White poplar	Permitted - s11	High	Slow
Prunus cerasifera	Cherry plum	Permitted - s11	Low	Slow
Romulea rosea	Guildford grass	Permitted - s11	High	Unknown
Rubus anglocandicans	European blackberry	Declared Pest - s22(2) (WONS)	High	Moderate
Rubus x loganobaccus	Loganberry	Permitted - s11	High	Moderate
Rumex acetosella	Red sorrel	Permitted - s11	Unknown	Unknown
Senecio diaschides	Shingle fireweed	Permitted - s11	Unknown	Unknown
Sonchus oleraceus	Common sowthistle	Permitted - s11	Moderate	Rapid
Symphyotrichum squamatum	Bushy starwort	Permitted - s11	Unknown	Rapid
Tolpis barbata	Tolpis, yellow hawkweed	Permitted - s11	Unknown	Rapid
Tribulus terrestris	Bindii	Permitted - s11	Unknown	Unknown
Trifolium campestre	Hop trefoil	Permitted - s11	Unknown	Unknown

Species	Common name	BAM Act status and WONS	Ecological impact	Invasiveness
Trifolium dubium	Suckling clover	Permitted - s11	Unknown	Unknown
Trifolium hirtum	Rose clover	Permitted - s11	Unknown	Unknown
Trifolium ligusticum	Ligurian clover	Permitted - s11	Unknown	Unknown
Tritonia gladiolaris	Tritonia, lined tritonia	Permitted - s11	Unknown	Unknown
Ursinia anthemoides	Ursinia	Permitted - s11	Unknown	Rapid
Vellereophyton dealbatum	White cudweed	Permitted - s11	Moderate	Rapid
Vinca major	Blue periwinkle	Permitted - s11	High	Slow
Viola odorata	Violet	Permitted - s11	Low	Slow
Vulpia bromoides	Squirrel's tail fescue, squirrel tail fescue	Permitted - s11	Unknown	Rapid
Vulpia myuros	Rat's-tail fescure	Permitted - s11	Unknown	Rapid
Ursinia anthemoides	Ursinia	Permitted - s11	Unknown	Rapid
Vellereophyton dealbatum	White cudweed	Permitted - s11	Moderate	Rapid
Vinca major	Blue periwinkle	Permitted - s11	High	Slow
Viola odorata	Violet	Permitted - s11	Low	Slow
Vulpia bromoides	Squirrel's tail fescue, squirrel tail fescue	Permitted - s11	Unknown	Rapid
Vulpia myuros	Rat's-tail fescure	Permitted - s11	Unknown	Rapid

Significant species

- T, *Andersonia* sp. Saxatilis
- T, *Anthocercis gracilis*
- T, *Grevillea flexuosa*
- T, *Grevillea thelemanniana*
- T, *Lasiopetalum pterocarpum*
- T, *Morelotia australiensis*
- P1, *Darwinia hortiorum*
- P1, *Hibbertia acrotoma*
- P1, *Hibbertia hortiorum*
- P1, *Paracaleana gracilicordata*
- P1, *Paracaleana granitica*
- P1, *Thysanotus formosus*
- P1, *Xanthoparmelia darlingensis*
- P1, *Xanthoparmelia sammyi*
- P2, *Banksia recurvistylis*
- P2, *Bossiaea modesta*
- P2, *Grevillea ornithopoda*
- P2, *Lepyrodia curvescens*
- P2, *Millotia tenuifolia* var. *laevis*
- P2, *Tetratheca phoenix*
- Survey area



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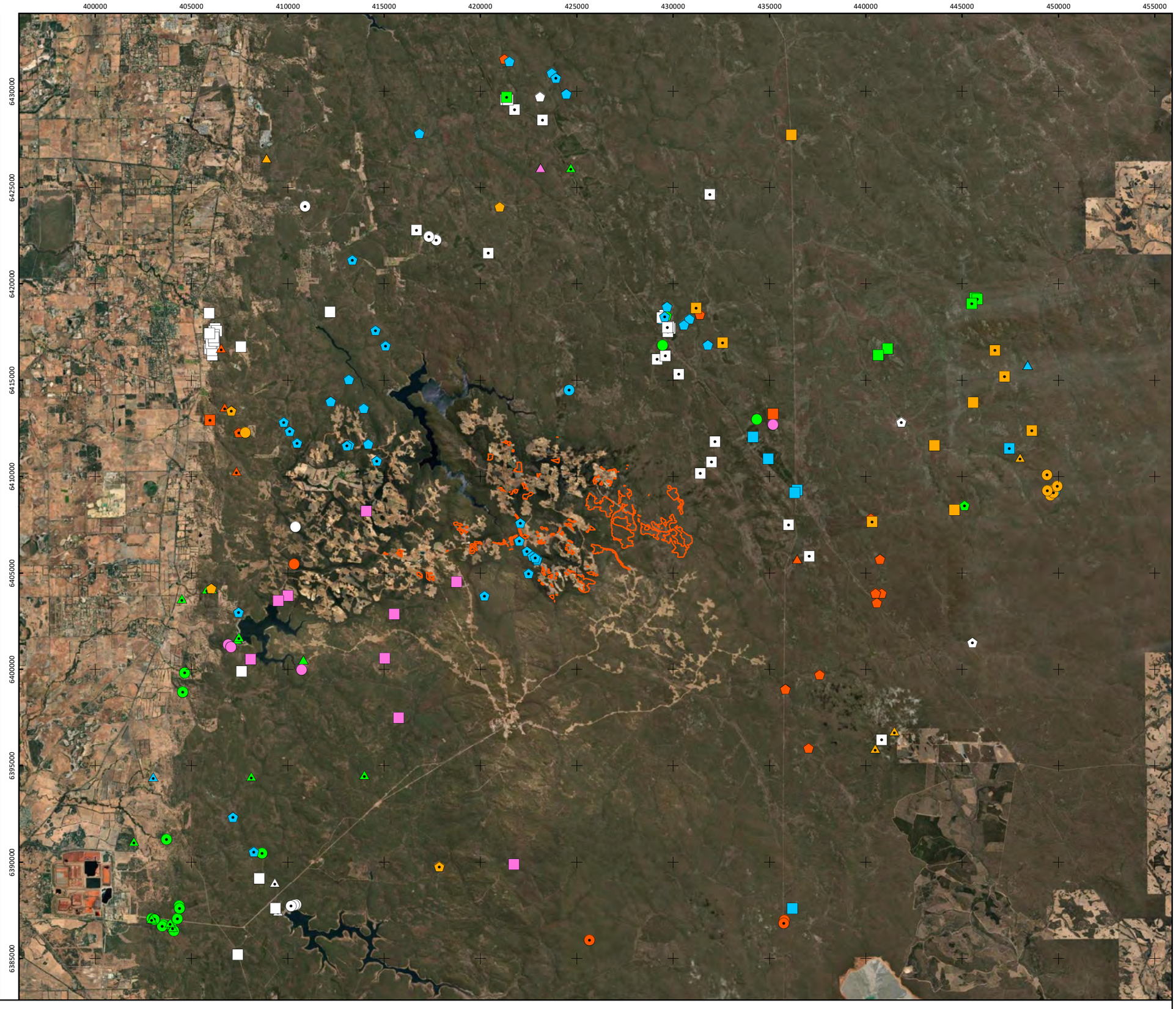
Map 7: Significant plant species recorded within 20 km of the survey area (Threatened, Priority 1, and Priority 2).

0 2 4 8 12
Kilometers

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

Significant species

- P3, *Acacia drummondii* subsp. *affinis*
- P3, *Acacia horridula*
- P3, *Acacia oncinophylla* subsp. *oncinophylla*
- P3, *Amanita fibrillopes*
- P3, *Amanita kalamundae*
- P3, *Andersonia* sp. Audax
- P3, *Boronia capitata* subsp. *gracilis*
- P3, *Byblis gigantea*
- P3, *Cyathochaeta teretifolia*
- P3, *Dicrastylis reticulata*
- P3, *Gastrolobium* sp. Asperum
- P3, *Grevillea dissectifolia*
- P3, *Hakea oldfieldii*
- P3, *Halgania corymbosa*
- P3, *Lasiopetalum glutinosum* subsp. *glutinosum*
- P3, *Lepyrodia heleocharoides*
- P3, *Meionectes tenuifolia*
- P3, *Petrophile filifolia* subsp. *laxa*
- P3, *Pithocarpa corymbulosa*
- P3, *Stackhousia* sp. Red-blotched corolla
- P3, *Stylidium marradongense*
- P3, *Synaphea pandurata*
- P3, *Tetratheca similis*
- P3, *Thysanotus anceps*
- P3, *Xanthoparmelia subimitatrix*
- P4, *Acacia cuneifolia*
- P4, *Acacia oncinophylla* subsp. *oncinophylla*
- P4, *Caladenia speciosa*
- P4, *Calothamnus graniticus* subsp. *leptophyllus*
- P4, *Chorizema ulotropis*
- P4, *Cyanothamnus tenuis*
- P4, *Darwinia thymoides* subsp. St Ronans
- P4, *Darwinia* sp. Dryandra
- P4, *Drosera occidentalis*
- P4, *Eucalyptus exilis*
- P4, *Grevillea pimeleoides*
- P4, *Hemigenia platyphylla*
- P4, *Lasiopetalum bracteatum*
- P4, *Parsonsia diaphanophleba*
- P4, *Pimelea rara*
- P4, *Senecio leucoglossus*
- P4, *Stylidium ireneae*
- P4, *Tripterococcus* sp. Brachylobus
- Survey area



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Map 8: Significant plant species recorded within 20 km of the survey area (Priority 3 and Priority 4).

0 2.25 4.5 9 13.5
Kilometers

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

3 METHODOLOGY

3.1 FIELD SURVEY TIMING

The targeted flora assessment of the survey area was conducted by four *ecologia* botanists over five separate field surveys in 2023, totalling 25 days: 28 August – 1 September; 4 – 8 September; 23 – 27 October; 20 -24 November; and 27 October – 1 December.

3.2 TARGETED FLORA SURVEY

Targeted searches for conservation significant plant species, Weeds of National Significance, and Declared Pests were conducted along systematic transects within the survey area. Transect were walked at approximately 20 m spacings, but 10 m infill spacings were done in some cases to record additional plants within detected populations. Approximately 673.81 ha of the Huntly mine area was surveyed in 2023 (Map 9). Specimens of all species that resembled potential significant species were collected for confirmation.

When significant or potentially significant species were observed the following information was recorded:

- GPS location.
- Number of plants (count, for individual or localised plants) or estimated number of plants for more extensive populations.
- Reproductive state.
- Reference collection and photograph of representative specimens.

3.3 SPECIMEN IDENTIFICATION

Specimen identification was undertaken by Dr Andrew Craigie with reference to current taxonomic literature and reference specimens. Scientific names used in this report follow the species concepts currently adopted by the Western Australian Herbarium.

3.4 STUDY TEAM AND LICENCES

The personnel undertaking this assessment and project roles are listed in Table 9.

3.5 LIMITATIONS AND CONSTRAINTS

An assessment of survey-specific issues and limitations is shown in Table 10.

Table 9: 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, field survey, QA	30+
Andrew Craigie	B.Sc (Hons.) (Botany); PhD (Botany)	Principal Botanist and Taxonomist	Field survey, specimen identification, reporting	15+
Sam Hall	B.Sc. (Hons.) (Botany and Cons. Biol.)	Level 2 Botanist	Field survey	5+
Lydia Ellwood	B.Sc (Env. Mgmt. & Sust., Cons. & WildlifeBiol.)	Level 1 Botanist	Field survey	2+
Sandra Ng	B.Sc. (Cons. & WildlifeBiol., Marine Biol.)	Level 1 Botanist	Field survey, desktop assessment	1+
Licences				
Lydia Ellwood	Flora Taking (Biological Assessment) Licence: FB62000392 (exp. 06/02/2025); Authorisation to Take or Disturb Threatened Species: TFL 135-21221 (exp. 28/02/2025)			
Andrew Craigie	Flora Taking (Biological Assessment) Licence: FB62000135-2 (exp. 30/04/2025); Authorisation to Take Threatened Flora: TFL 54-1920 (exp. 30/4/2026)			
Shaun Grein	Flora Taking (Biological Assessment) Licence: FB62000085-2 (exp. 09/05/2026); Authorisation to Take or Disturb Threatened Species: TFL 55-1920 (exp. 15/12/2022)			
Sam Hall	Flora Taking (Biological Assessment) Licence: FB62000450 (exp. 3/07/2025)			
Sandra Ng	Flora Taking (Biological Assessment) Licence: FB62000543 (exp. 23/03/2026)			

Table 10: Flora and vegetation survey limitations.

Aspect	Assessment	Constraint
Availability of contextual information at a regional and local scale	Vegetation, land system, soil, and geology mapping, and significant species records, were available for the survey area. 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	Key personnel leading the field survey and undertaking specimen identification have extensive experience undertaking flora surveys in the South-West, including in the Jarrah Forest bioregion.	Nil
Proportion of flora recorded and/or collected, any identification issues	Representative specimens of all significant species and potentially significant species recorded in the field were collected for confirmation. There were no identification issues.	Nil
Was the appropriate area fully surveyed (effort and extent)	The survey area was sufficiently surveyed.	Nil
Access restrictions within the survey area	Although fires prevented access to parts of the survey area in 2023, the project is ongoing, and these areas will be surveyed in 2024.	Nil
Survey timing, rainfall, season of survey	The survey was undertaken primarily in spring 2023 (late August to early December), during the primary survey season for botanical surveys in the South-West botanical province. Conditions were dryer than average (mean winter rainfall for 2023 was approximately 35% lower than average), although rainfall in July, just prior to the first survey, was close to average. Lower winter rainfall may reduce the prevalence of ephemeral species, including perennial geophytes. However, there are no geophytic perennials (including orchids) considered likely to occur in the survey area, and of the two annual herbs considered 'likely' to occur within the survey area, *Senecio leucoglossus* was recorded at numerous locations and was often flowering. Consequently, the dryer than average conditions is not considered to be a significant limitation.	Nil
Disturbance that may have affected the results of survey such as fire, flood or clearing	No parts of the surveyed area were significantly disturbed or affected by recent fires.	Nil

4 RESULTS AND DISCUSSION

4.1 SIGNIFICANT SPECIES

Three DBCA listed Priority species were recorded within the survey area: *Tetratheca phoenix* (P2), *Senecio leucoglossus* (P4), and *Stylidium ireneae* (P4) (Table 11, Figure 2, Map 9).

Tetratheca phoenix (Elaeocarpaceae) (P2) was recorded from a localised area immediately east of Solus Road on mid-slopes and foot-slopes in brown sandy loam with laterite (Map 9). Approximately 151 individuals were recorded within the survey area, primarily from vegetation unit PW (Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii*, *Adenanthos barbiger*, *Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels) and within the Dwellingup subsystem (Table 11). *Tetratheca phoenix* has been recorded close to the survey area previously (Map 7) and it is likely to occur more widely outside the survey area in similar suitable habitat.

Senecio leucoglossus (Asteraceae) (P4) was recorded sporadically across the survey area, primarily on lateritic slopes, within six vegetation units of Mattiske (2022) (mostly *Eucalyptus marginata* and *Corymbia calophylla* forest/woodland), and primarily within the Dwellingup subsystem (Table 11). Individual plants were usually isolated, occurring as solitary or few plants at each location; twenty-nine individuals were recorded within the survey area . *Senecio leucoglossus* has been recorded close to the survey area previously (the previous closest records are ca. 6 km from the survey area), and it is likely to occur more widely outside the survey area in similar suitable habitat.

Stylidium ireneae (Stylidiaceae) (P4) was recorded from a single location within the survey area from a sandy loam bank of a small stream (approx. 10 individuals) (Map 9). A second group of approximately 20 plants was recorded opportunistically outside of the survey area. There are numerous records of this species just to the to the west of the survey area and is likely to occur more frequently outside of the survey area along creeks. This habitat is not common within the survey area.

The likelihood of occurrence of the remaining species identified during the desktop assessment was reassessed for the surveyed areas based on survey effort, the presence of suitable habitat, and vegetation condition (Appendix A). Seasonal conditions were suitable for detecting annual and ephemeral species, vegetation was mostly in 'Excellent' condition, and the areas surveyed had not been affected by recent fires. All areas were systematically surveyed at 20 m or 10 m intervals. Consequently, all species initially assessed with a 'High' or 'Moderate' likelihood of occurrence were reassessed as 'Low'.

Table 11: Summary of significant plant species recorded within the survey area and distribution within vegetation associations and land systems.

Name	Vegetation association (Mattiske 2022)								Total
	AC	**CL**	**E**	**PS**	**PW**	**S**	**T**	**TS**	
Tetratheca phoenix (P2)	-	-	17	20	114	-	-	-	151
Senecio leucoglossus (P4)	-	2	-	1	7	2	12	5	29
Stylidium ireneae (P4)	10	-	-	-	-	-	-	-	10

Name	Landform	Soil-landscape system				Total
		Cooke subsystem	Dwellingup subsystem	Murray subsystem	Yarragil subsystem	
Tetratheca phoenix (P2)	Midslopes, footslopes	1	150	-	-	151
Senecio leucoglossus (P4)	Slopes	4	18	3	4	29
Stylidium ireneae (P4)	Creek banks	-	-	10	-	10

4.2 INTRODUCED SPECIES

There were no Weeds of National Significance or Declared Pests recorded within the survey area.

4.3 ADDITIONAL AREAS – LIKELIHOOD OF OCCURRENCE ASSESSMENT

Spatial data for several additional areas were provided in February 2024 for a likelihood of occurrence assessment (Map 10). These areas are all immediately adjacent to areas that were surveyed in 2023. Many of these are of negligible size (<0.02 ha) and were therefore excluded from further assessment. Based on their proximity to significant species records from 2023 (within ca. 500 m), 18 areas that were individually greater than 0.02 ha potentially contain either *Senecio leucoglossus* or *Tetratheca phoenix* (Table 12). *Senecio leucoglossus* has already been recorded in one of these areas (E23_088). None of the areas are likely to support *Stylidium ireneae*, which is typically restricted to the banks of creeks.

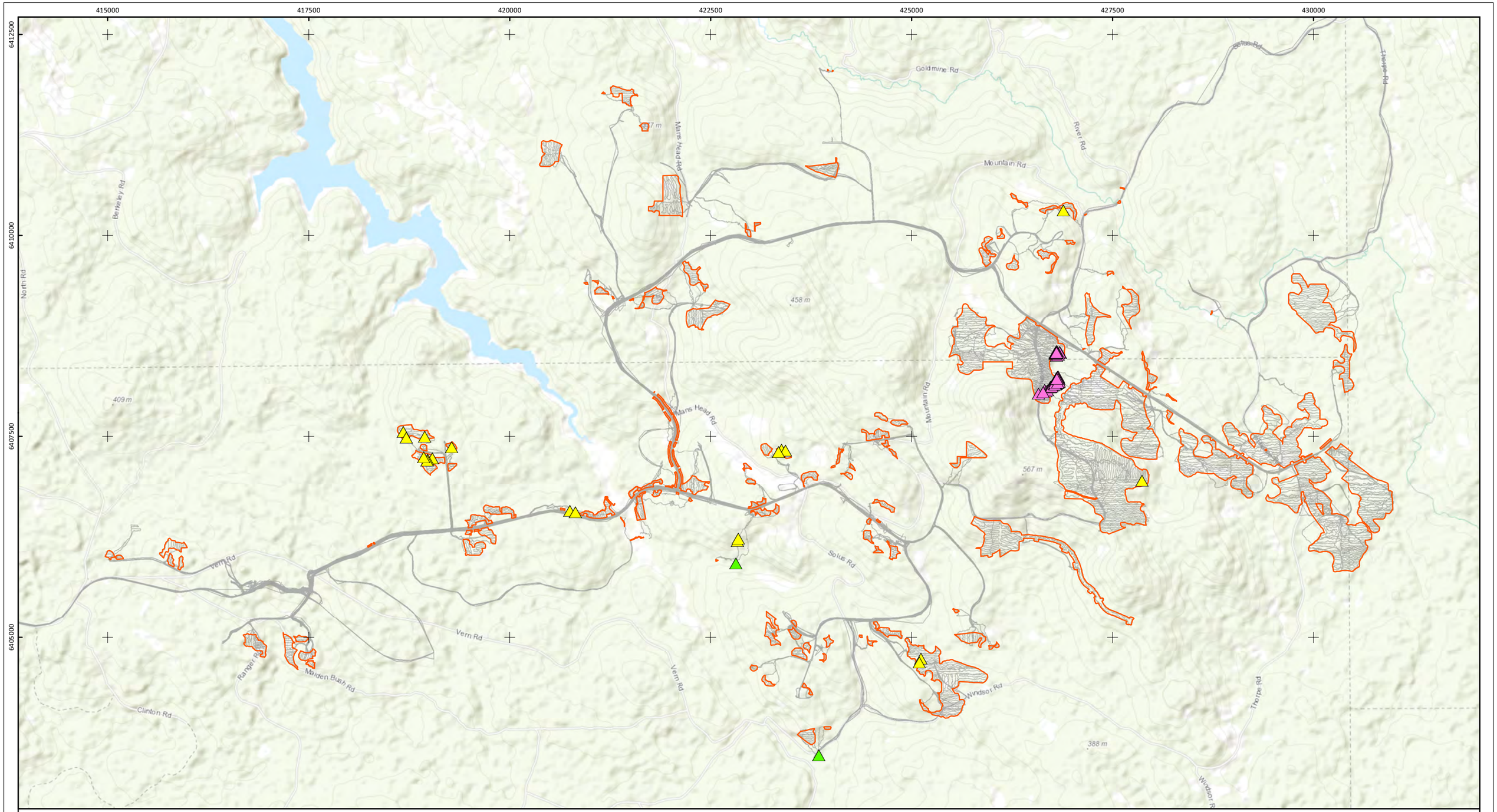
Table 12: Likelihood of occurrence assessment for additional survey areas.

Asset name	Likelihood of occurrence	Area (ha)
B23_176a	*Senecio leucoglossus* - moderate	0.02
B23_176b	*Senecio leucoglossus* - moderate	0.02
B23_189	*Senecio leucoglossus* - moderate	0.02
B23_191a	*Senecio leucoglossus* - moderate	0.02
B23_191b	*Senecio leucoglossus* - moderate	0.04
B23_162	*Senecio leucoglossus* - moderate	0.11
E23_019	*Senecio leucoglossus* - moderate	0.12
B23_163a	*Senecio leucoglossus* - moderate	0.15
E23_059	*Senecio leucoglossus* - moderate	0.25
E23_123	*Senecio leucoglossus* - moderate	0.32
B23_163b	*Senecio leucoglossus* - moderate	0.37
E23_086	*Senecio leucoglossus* - moderate	0.48
E23_017	*Senecio leucoglossus* - moderate	0.49
E23_089	*Senecio leucoglossus* - moderate	0.52
E23_040	*Senecio leucoglossus* - moderate	0.58
E23_016	*Senecio leucoglossus* - moderate	0.74
E23_088	*Senecio leucoglossus* - moderate	0.98
E23_074	*Tetratheca phoenix* - moderate	0.43



Figure 2: Photographs of significant species recorded within the survey area.

Top left, *Tetratheca phoenix* (P2); top right, *Senecio leucoglossus* (P4); bottom left, *Stylidium ireneae* (P4).



Targeted survey GPS track log

Survey area

Species

- *Senecio leucoglossus* (P4)
- *Stylidium ireneae* (P4)
- *Tetratheca phoenix* (P2)

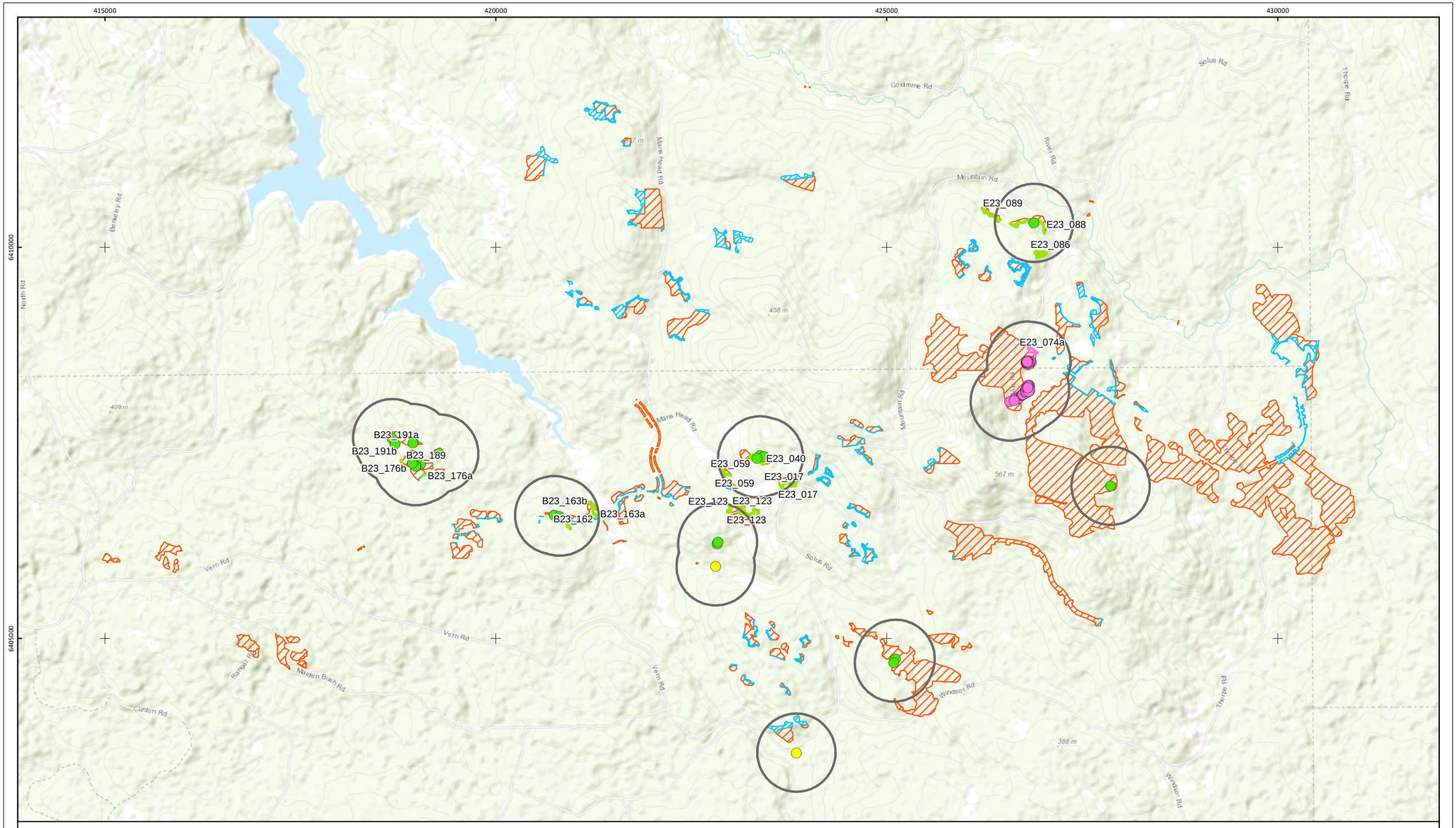
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Date: 6 February 2024
Author: AC
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:45,000 @A3

Map 9: Locations of significant plant species recorded within the survey area.

0 0.5 1 2 3
Kilometers

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



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Date: 8 February 2024
Author: AC
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:45,000 @A3

Map 10: Additional areas - likelihood of occurrence assessment.

0 0.4 0.8 1.6 2.4
Kilometers

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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6 APPENDICES

Appendix A Likelihood of Occurrence Assessment.

Taxon	WA status	Habitat	Approximate flowering period	Growth form	Records in close vicinity of survey area (5 km)	**Desktop assessment**	Desktop likelihood of occurrence	Post-survey likelihood of occurrence[1]
Acacia drummondii subsp. *affinis*	P3	Lateritic gravelly soils.	------JA----	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Acacia oncinophylla subsp. *patulifolia*	P4	Granitic soils, occasionally on laterite.	-------ASOND	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Cyanothamnus tenuis	P4	Gritty brown sandy clay over granite. Creeks, slopes.	-------ASON-	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Grevillea pimeleoides	P4	Gravelly soils over granite. Valleys, hillsides.	----MJJASON-	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Hemigenia platyphylla	P4	Sandy & loamy soils. Slopes.	--------SON-	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Hibbertia hortiorum	P1	Jarrah–marri forests over laterite.	--------SO--	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Lasiopetalum pterocarpum	T	On sloping banks near creeks.	-------ASOND	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Morelotia australiensis	T	Flat. Light brown sand clay loam.	----------D	Perennial herb	YES	Suitable habitat possibly present.	HIGH	LOW
Pimelea rara	P4	Lateritic soils.	J----------D	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	LOW
Senecio leucoglossus	P4	Gravelly lateritic or granitic soils. Granite slopes.	-------ASOND	Annual herb	YES	Suitable habitat possibly present.	HIGH	RECORDED
Stylidium ireneae	P4	Sandy loam. Valleys near creeks.	---------OND	Perennial herb	YES	Suitable habitat possibly present.	HIGH	RECORDED
Tetratheca phoenix	P2	Brown gravelly loam over granite. Mid-upper slopes.	--------SOND	Perennial shrub	YES	Suitable habitat possibly present.	HIGH	RECORDED
Acacia horridula	P3	Gravelly soils over granite, sand. Rocky hillsides.	----MJJA----	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Bossiaea modesta	P2	Soils derived from granite. Damp areas close to streams.	---------OND	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Calothamnus graniticus subsp. *leptophyllus*	P4	Clay over granite, lateritic soils. Hillsides.	-----JJA----	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Chorizema ulotropis	P4	White sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats.	------JAS---	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Gastrolobium sp. Asperum (F. Hort 2864)	P3	Slope, flat. Dry, brown loam, gravel over laterite.	--------S---	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Grevillea dissectifolia	P3	Sand/loam and laterite along creeks and road verges.	-----J--S-N-	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Grevillea flexuosa	T	Red-brown sand with laterite & gravel, sand over granite. Ridgetops, breakaways.	------JASO--	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Halgania corymbosa	P3	Gravelly soils, soils over granite.	-------ASON-	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Lasiopetalum bracteatum	P4	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	J------ASOND	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Millotia tenuifolia var. *laevis*	P2	Granite or laterite soils.	--------SO--	Annual herb		Suitable habitat possibly present.	MODERATE	LOW
Petrophile filifolia subsp. *laxa*	P3	Winter-wet sites, flats, slopes, swamps, drainage lines.	J---------ND	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Stackhousia sp. Red-blotched corolla (A. Markey 911)	P3	Light grey gritty clay, with surface granitic cobbles, on a gentle southern upper slope.	-----JJAS---	Perennial herb		Suitable habitat possibly present.	MODERATE	LOW
Stylidium marradongense	P3	Sand over laterite. Jarrah-Marri forest.	--------SON-	Perennial herb		Suitable habitat possibly present.	MODERATE	LOW
Synaphea pandurata	P3	Yellowish sands and sandy loams, dark brown loam, laterite gravel, granite.	--------SOND	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Tetratheca similis	P3	Sandy clay with lateritic boulders.	-------AS---	Perennial shrub		Suitable habitat possibly present.	MODERATE	LOW
Thysanotus anceps	P3	White or grey sand, lateritic gravel, laterite.	---------OND	Perennial herb		Suitable habitat possibly present.	MODERATE	LOW
Thysanotus formosus	P1	Clayey sand, sandy loam.	J---------ND	Perennial herb		Suitable habitat possibly present.	MODERATE	LOW
Acacia cuneifolia	P4	Sand, clay or loam over granite. Granite outcrops.	------JASO--	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW
Acacia oncinophylla subsp. *oncinophylla*	P3	Fringing granite outcrops.	-------ASO--	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW
Andersonia sp. Audax (F. Hort, B. Hort …)	P3	Granitic heath. Granite outcrops.	J--------OND	Perennial shrub	YES	Suitable habitat unlikely to be present.	LOW	LOW
Andersonia sp. Saxatilis (F. & J. Hort 3324)	T	Granitic heath. Granite outcrops.	--------SO--	Perennial shrub	YES	Suitable habitat unlikely to be present.	LOW	LOW
Anthocercis gracilis	T	Sandy or loamy soils. Granite outcrops.	--------SO--	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW
Banksia recurvistylis	P2	Granite outcrops.	----------N-	Perennial shrub	YES	Suitable habitat unlikely to be present.	LOW	LOW
Boronia capitata subsp. *gracilis*	P3	White/grey or black sand. Winter-wet swamps, hillslopes.	-----JJASON-	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW
Byblis gigantea	P3	Sandy-peat swamps.	J-------SOND	Perennial herb		Suitable habitat unlikely to be present.	LOW	LOW
Caladenia speciosa	P4	White, grey or black sand. Sandplains.	--------SO--	Perennial herb		Suitable habitat unlikely to be present.	LOW	LOW
Cyathochaeta teretifolia	P3	Grey sand, sandy clay. Swamps, creeks.	UNKNOWN	Perennial herb	YES	Suitable habitat unlikely to be present.	LOW	LOW
Darwinia hortiorum	P1	Brown loam/clay/gravel laterite. Granite outcrops.	-------ASON-	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW
Darwinia sp. Dryandra (G.J. Keighery 9295)	P4	Lateritic outcrops.	----M-J---N-	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW
Darwinia thymoides subsp. St Ronans	P4	Sandy or gravelly clay-loam soils. Slopes and Flats. Granite outcrops.	J---------N-	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW
Dicrastylis reticulata	P3	Granite outcrops, heath.	--------SOND	Perennial shrub		Suitable habitat unlikely to be present.	LOW	LOW

Taxon	WA status	Habitat	Approximate flowering period	Growth form	Records in close vicinity of survey area (5 km)	**Desktop assessment**	Desktop likelihood of occurrence	Post-survey likelihood of occurrence[1]
Drosera occidentalis	P4	White-yellow sand, clayey soils. Swamps, seasonally wet depressions and slopes.	J--------OND	Perennial herb	YES	Suitable habitat unlikely to be present.	**LOW**	**LOW**
Eucalyptus exilis	P4	Grey sand, gravelly loam. Lateritic ridges.	-------ASO--	Perennial shrub		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Grevillea ornithopoda	P2	Riverbanks. Primarily Swan Coastal Plain.	--------SOND	Perennial shrub		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Grevillea thelemanniana	T	Sand, sandy clay. Winter-wet low-lying flats.	----MJJASON-	Perennial shrub		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Hakea oldfieldii	P3	Red clay or sand over laterite. Seasonally wet flats.	-------ASO--	Perennial shrub		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Hibbertia acrotoma	P1	Brown loam. Granite outcrops.	-------AS---	Perennial shrub		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Lasiopetalum glutinosum subsp. *glutinosum*	P3	Granite outcrops and creeks.	--------SOND	Perennial shrub	YES	Suitable habitat unlikely to be present.	**LOW**	**LOW**
Lepyrodia curvescens	P2	Wetlands and swamps.	--------SON-	Perennial herb		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Lepyrodia heleocharoides	P3	Moist peaty sand. Wetlands and swamps.	----------D	Perennial herb	YES	Suitable habitat unlikely to be present.	**LOW**	**LOW**
Meionectes tenuifolia	P3	Sand or clay. Wetlands and swamps.	--------SOND	Annual herb	YES	Suitable habitat unlikely to be present.	**LOW**	**LOW**
Paracaleana gracilicordata	P1	Moss mats on granite outcrops.	---------ON-	Perennial herb	YES	Suitable habitat unlikely to be present.	**LOW**	**LOW**
Paracaleana granitica	P1	Moss mats on granite outcrops.	---------OND	Perennial herb	YES	Suitable habitat unlikely to be present.	**LOW**	**LOW**
Parsonsia diaphanophleba	P4	Alluvial soils. Along rivers.	JF-AMJ--S---	Perennial climber		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Pithocarpa corymbulosa	P3	Gravely or sandy loam. Granite outcrops.	JFMA--------	Perennial herb		Suitable habitat unlikely to be present.	**LOW**	**LOW**
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	Grey, black, or peaty sand. Winter-wet flats.	---------ON-	Perennial herb		Suitable habitat unlikely to be present.	**LOW**	**LOW**

[1]Post-survey likelihood of occurrence rating is for surveyed areas only.

OCTOBER 2024



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ALCOA OF AUSTRALIA LTD

O'NEIL REGION TARGETED FLORA SURVEY - SEPTEMBER 2024

MEMO REPORT

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Alcoa of Australia Limited's (Alcoa) Western Australian (WA) mining operations comprise the Huntly and Willowdale bauxite mines, which are in Alcoa's Mining Lease 1SA (ML1SA) within the Northern Jarrah Forest (NJF) IBRA subregion. Alcoa has approval to mine within ML1SA subject to submitting draft five-year mine plans and associated environmental management programmes known as the Mining and Management Program (MMP). The MMP is submitted to the State's Mining and Management Program Liaison Group (MMPLG) on an annual basis.

Alcoa required a suitably qualified consultant to undertake targeted surveys for significant plant species (primarily for the Priority 1 species *Hibbertia hortiorum*, which was recently confirmed to be present in the vicinity) and weeds species (Weeds of National Significance and Declared Pests) within an area associated with the O'Neil Region of the Huntly Mine, occupying an area of 321.53 ha (Map 1).

1.2 DEFINITIONS

1.2.1 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).

1.2.2 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 [their] 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.



Survey area

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Project No.: 1979
Author: AC
Created Date: 17 September 2023
Coordinate System: AGD 1984 AMG Zone 50
Projection: Transverse Mercator
Scale: 1:35,000 @A3

Map 1: Location of the survey area.

Maxar

0 0.3 0.7 1 2 Kilometers

2 METHODOLOGY

2.1 SURVEY TIMING AND EFFORT

The primary survey was conducted within the survey area by three *ecologia* botanists over eight days from 2–13 September 2024 (Table 1). A second survey to record additional locations of *Hibbertia hortiorum* outside of the survey area, primarily in areas of rehab, was undertaken by seven Alcoa staff (Table 1) over seven days between 25 September and 5 October 2024.

2.2 TARGETED FLORA SURVEY

Targeted searches for conservation significant plant species, Weeds of National Significance, and Declared Pests were conducted along systematic traverses within the survey area. Traverses were walked at approximately 20 m spacings, but 10 m infill spacings were done in some cases to record additional plants within detected populations. Some additional traverses were undertaken just outside of the survey area. The survey was undertaken in accordance with *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b).

When target species were observed the following information was recorded:

- GPS location.
- Number of plants (count, for individual or localised plants) or estimated number of plants for more extensive populations.
- Reproductive state.
- Photograph of representative specimens.

2.3 SPECIMEN IDENTIFICATION

Specimen identification was undertaken in the field by Dr Andrew Craigie with reference to current taxonomic literature. Scientific names used in this report follow the species concepts currently adopted by the Western Australian Herbarium.

2.4 STUDY TEAM AND LICENCES

The personnel undertaking this assessment and project roles are listed in Table 1.

2.5 LIMITATIONS AND CONSTRAINTS

An assessment of survey-specific issues and limitations is shown in Table 2.

Table 1: Project staff and licences.

Project staff				
Name	Qualification	Role	Project role	Experience
Shaun Grein (Ecologia)	B.App. Sc (Biol.); Grad. Dip. Nat. Resources; MBA	Managing Director/Senior Principal Scientist	Project management, field survey, QA	30+
Andrew Craigie (Ecologia)	B.Sc (Hons.) (Botany); PhD (Botany)	Principal Botanist and Taxonomist	Field survey, specimen identification, reporting	15+
Sandra Ng (Ecologia)	B.Sc. (Cons. & WildlifeBiol., Marine Biol.)	Level 1 Botanist	Field survey	2+
Amelia Shepherdson (Ecologia)	B.Sc. (Botany)	Level 1 Botanist	Field survey	2+
James Tsakalos (Alcoa)	B. Sc (Hons) (Botany) PhD (Botany/Plant Biology)	Environmental Specialist – Restored Ecosystem Monitoring (Botanist)	Field Survey	5+
Sarah Boys (Alcoa)	B. Sc (Hons.) (Conservation Biology)	Environmental Specialist – Biological Assessments	Field Survey	3+
Jamie Crotty (Alcoa)	B. Sc (Conservation & Wildlife Biology)	Biodiversity Advisor	Field Survey	1
Suzanne Fletcher (Alcoa)	-	Environmental Advisor – Rehabilitation Handback	Field Survey	<1
Felicity Hart (Alcoa)	B. Sc (Hons) (Marine and Environmental Sciences)	Biodiversity Specialist	Field Survey	6+
Savuti Henningsen	B. Sc, MSc (Environmental Science)	Alcoa/Murdoch University PhD candidate	Field Survey	1
Verity Carscadden (Alcoa)	B. Sc (Hons.) (Conservation Biology)	Environmental Research Technician	Field Survey	1
Licences				
Andrew Craigie	Flora Taking (Biological Assessment) Licence: FB62000135-2 (exp. 30/04/2025)			
Sandra Ng	Flora Taking (Biological Assessment) Licence: FB62000543 (exp. 23/03/2026)			
Amelia Shepherdson	Flora Taking (Biological Assessment) Licence: FB62000723 (exp. 28/08/2025)			
Sarah Boys	Flora Taking (Biological Assessment) Licence: FB62000386			

Table 2: Flora and vegetation survey limitations.

Aspect	Assessment	Constraint
Availability of contextual information at a regional and local scale	Vegetation, land system, soil, and geology mapping, and significant species records, were available for the survey area. 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	Key personnel leading the field survey and undertaking specimen identification have extensive experience undertaking flora surveys in the South-West, including in the Jarrah Forest bioregion.	Nil
Proportion of flora recorded and/or collected, any identification issues	Plants were able to be identified in the field. There were no identification issues.	Nil
Was the appropriate area fully surveyed (effort and extent)	The survey area was fully surveyed at 20 m spacings, and parts of the survey area were surveyed at 10 m spacings.	Nil
Access restrictions within the survey area	All parts of the survey area were accessible.	Nil
Survey timing, rainfall, season of survey	The survey was undertaken in early September 2024, during the primary survey season for botanical surveys in the South-West botanical province. Rainfall at Dwellingup (BOM station 9538) over the three months preceding the survey 2024 was only slightly below average, and not considered to be a significant constraint.	Nil
Disturbance that may have affected the results of survey such as fire, flood or clearing	Parts of the surveyed area were affected by recent fires, but there was sufficient regeneration in most of these areas to be able to detect and identify relevant species.	Nil

3 RESULTS AND DISCUSSION

3.1 SIGNIFICANT SPECIES

Two DBCA listed Priority species were recorded within the survey area: *Hibbertia hortiorum* (Dilleniaceae) (P1) and *Senecio leucoglossus* (Asteraceae) (P4). *Hibbertia hortiorum* was recorded primarily within the western part of the survey area and is discussed further below (Map 2, Map 3, Map 4). *Senecio leucoglossus* was recorded from two locations (two individuals) within the survey area in jarrah (*Eucalyptus marginata*) forest (Map 3).

3.1.1 Notes on *Hibbertia hortiorum* in the Huntly Mine area

Distribution

Hibbertia hortiorum is restricted to a relatively narrow section of the Northern Jarrah Forest IBRA subregion, occurring from near Myara in the west to near Wandering in the east (Map 2). There are 10 vouchered Western Australian Herbarium records within approximately 50 km of the Huntly Mine (Map 2) and a single record (not shown on map) near Wandering (Western Australian Herbarium 1998–). The new records from this survey fit within this general distribution.

Within the survey area, *H. hortiorum* is mostly distributed in the western section where it was mostly associated with rehabilitated sites on lateritic gravel (Map 3). It was recorded much less frequently from jarrah forest in the eastern section of the survey area, where there are fewer rehabilitation sites (Map 4). The plants recorded ranged from apparently juvenile plants (< ca. 10 cm diam.) to mature plants, or possibly groups of plants, forming mats up to ca. 100 cm wide. Most of the individuals recorded were well-established mature plants.

Survey Timing

Surveys for *H. hortiorum* are ideally undertaken in spring during its cited flowering period (approx. late September to early October), but due to its distinctive mat-forming habit it can be identified with reasonable confidence outside of this period.

Identification

Hibbertia hortiorum is diagnosed within the *H. commutata* species group by its prostrate mat-forming habit (to 10 cm high), 3–5 densely pubescent carpels, yellow petals, sessile flowers, leaves with sparse long pilose hairs over short erect hairs, and sepals with very short (to ca. 0.2 mm long) appressed hairs on the lower surface, except for long pilose hairs to 2 mm long on the margins in the lower half (Thiele 2019). Some flowering material was available at the time of the survey to confirm the presence *H. hortiorum*. The prostrate mat-forming habit distinguishes *H. hortiorum* from the similar species *H. ovata* (Thiele 2019). Although not all plants were flowering during the survey, all of those recorded as *H. hortiorum* had a prostrate mat-forming habit and were usually less than ca. 10 cm high (Figure 1). These were therefore consistent with *H. hortiorum* and not *H. ovata*.

Although described as having sessile flowers (Thiele 2019), some plants within the survey area that otherwise had all the above diagnostic features of *H. hortiorum* have some flowers with short (to ca. 6 mm long) indistinct pedicels. According to Thiele (2019), *Hibbertia lasiopus* is the only other species in the *H. commutata* group that has a (sometimes) prostrate habit, pedicellate flowers, densely pubescent carpels, yellow petals, and leaves with sparse long pilose hairs over short erect hairs. *H. lasiopus* is clearly distinct from the shortly pedicellate plants here as it is not mat forming, generally has larger leaves and distinctly pedicellate flowers, and has sepals with dense spreading pilose hairs to 3 mm long (Thiele 2019). Therefore, these plants are consistent with *H. hortiorum*, though with shortly pedicellate flowers in some cases. The similar species *H. ovata* is noted as having usually sessile flowers by occasionally with short indistinct pedicels (Thiele 2019), so this is not considered to be especially unusual.

Abundance

Population data for *H. hortiorum* associated with the Huntley Mine were derived from records from this survey (Ecologia and Alcoa records) and from recent surveys by Mattiske Consulting (for Alcoa) in 2023 and 2024. The currently recorded population size of *H. hortiorum* in the Huntly Mine area is 74,967 individuals, of which 7,577 (10.11%) are within the survey area (Table 3).

Table 3: Summary of *Hibbertia hortiorum* surveys and recorded abundance.

Source	Number of records	Estimated abundance[1]	Number of plants within survey area	% within survey area
WA Herbarium (Search ref: 64-0223FL)	10	–	0	0.00%
Ecologia (2024)	709	10,635	7,570	71.18%
Mattiske (2023/2024)	184	1,912	0	0.00%
Alcoa (2024)	3,001	62,420	7	0.01%
Total	**3,904**	**74,967**	**7,577**	**10.11%**

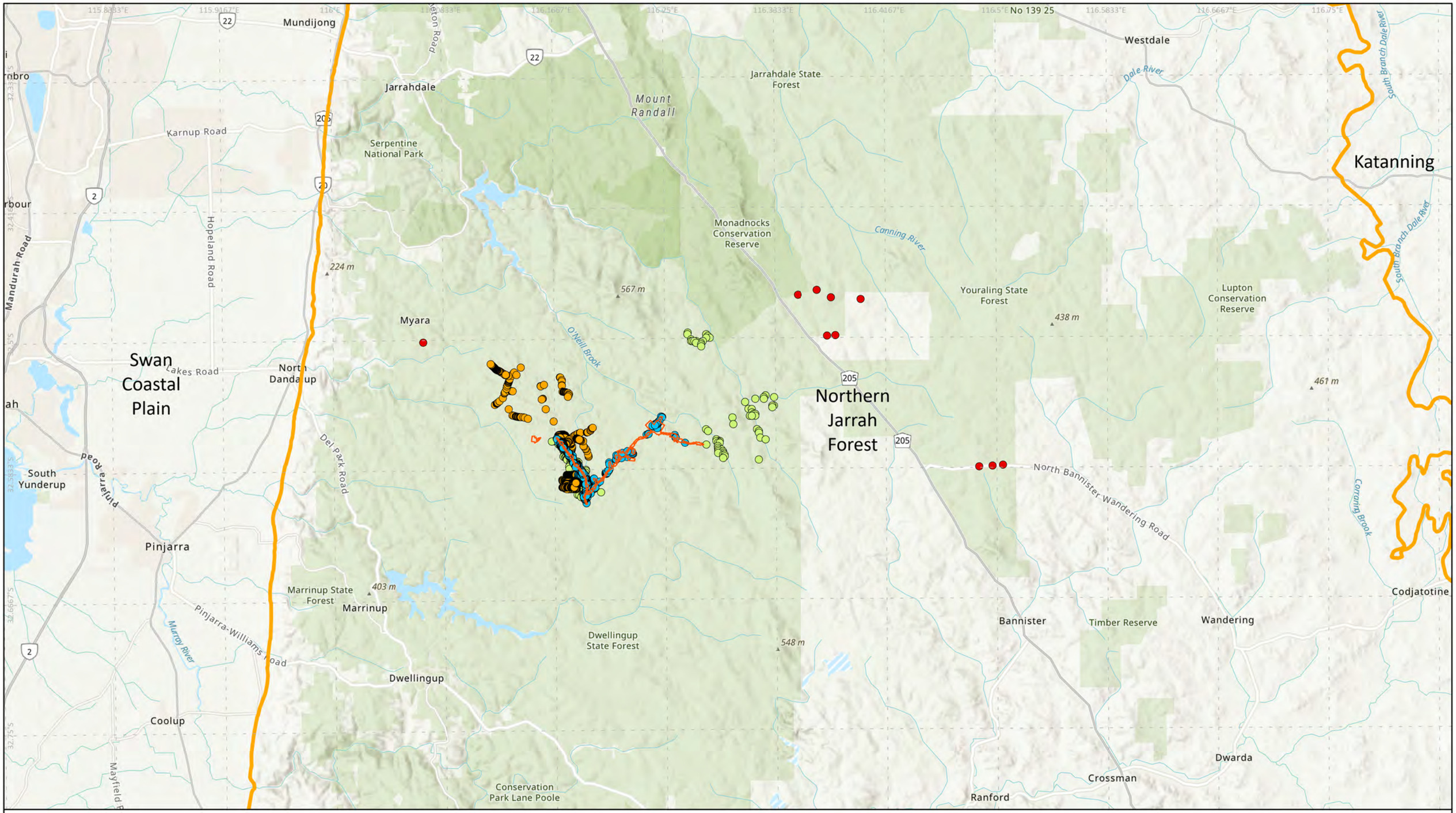
[1]There are no abundance data associated with these WA Herbarium records, but frequency is noted mostly as 'common' or 'frequent'.

3.2 INTRODUCED SPECIES

There were no Weeds of National Significance or Declared Pests recorded within the survey area.



Figure 1: Photographs of *Hibbertia hortiorum* (P1) from the survey area.
Top: *H. hortiorum* on an area of waste rock forming dense prostrate mats. Bottom: *H. hortiorum* in a rehabilitation area with new growth and larger leaves forming more diffuse mats.



Survey area

IBRA7 subregion boundary

- *Hibbertia hortiorum* (WAHERB, Ref: 64-0223FL)
- *Hibbertia hortiorum* (Ecologia 2024)
- *Hibbertia hortiorum* (Alcoa 2024)
- *Hibbertia hortiorum* (Mattiske 2023/24))

ecologia ENVIRONMENT

Project No.: 1979
Author: AC
Created Date: 17 September 2023
Coordinate System: AGD 1984 AMG Zone 50
Projection: Transverse Mercator
Scale: 1:250,000 @A3

Map 2: Overview of *Hibbertia hortiorum* (P1) records in the Huntley Mine area..

0 3.3 6.7 10 20 Kilometers

Esri, TomTom, Garmin, Fourscuare, METI/NASA, USGS, Esri, Geoscience Australia, NASA, NGA, USGS

116.16°E

116.19°E

32.55°S

32.58°S

Survey area

Rehabilitation

Targeted survey traverse

Hibbertia hortiorum (P1) (Ecologia 2024)

Hibbertia hortiorum (P1) (Alcoa 2024)

Hibbertia hortiorum (P1) (Mattiske 2023/24)

Senecio leucoglossus (P4) (Ecologia 2024)

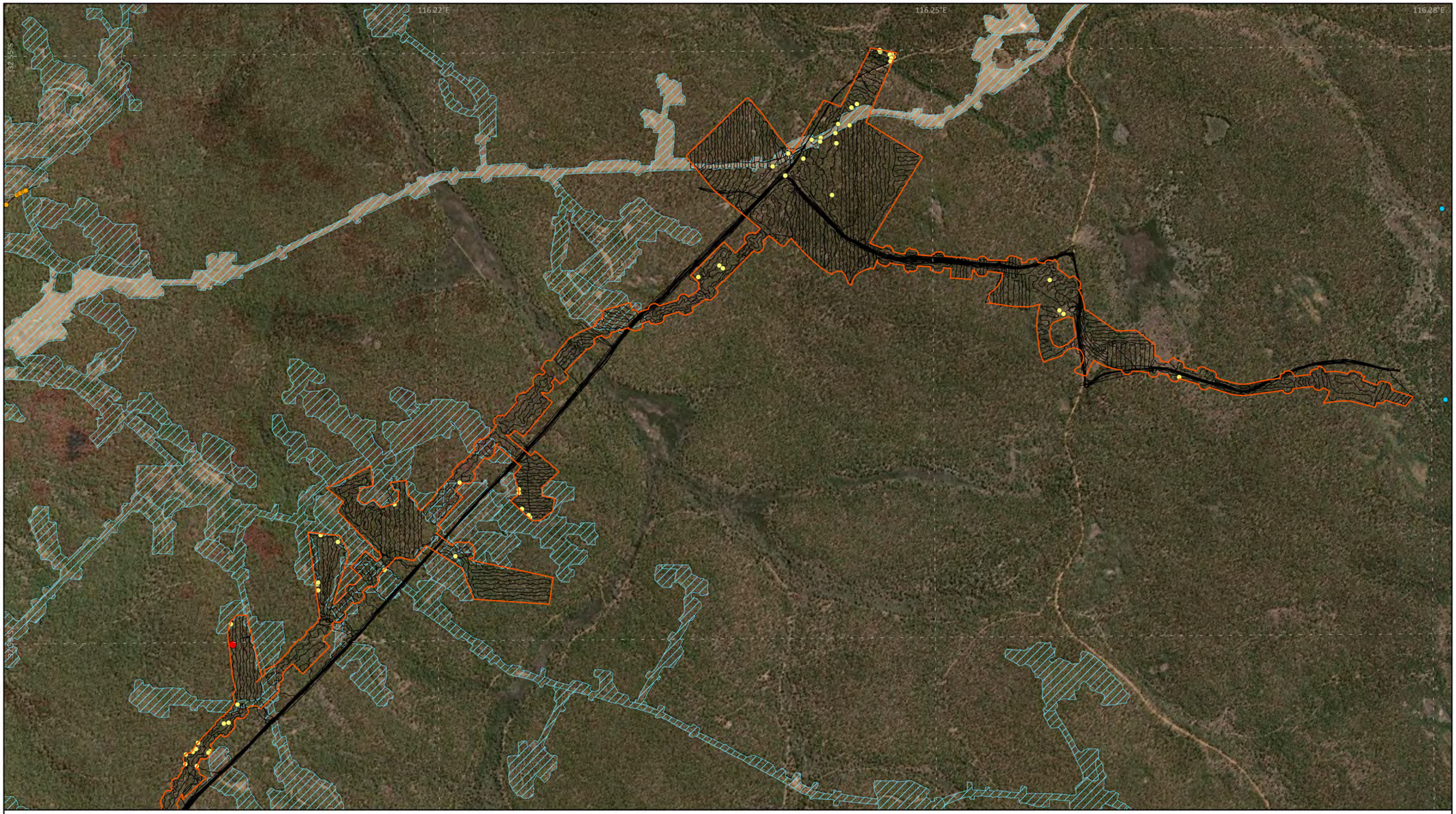
ecologia ENVIRONMENT

Project No.: 1979
Author: AC
Created Date: 17 September 2023
Coordinate System: AGD 1984 AMG Zone 50
Projection: Transverse Mercator
Scale: 1:20,000 @A3

Map 3: Targeted survey traverses and locations of significant plant species (western survey area).

Maxar

0 0.2 0.4 0.6 1.1 Kilometers



Survey area
Rehabilitation
Targeted survey traverse

Hibbertia hortiorum (P1) (Ecologia 2024)
Hibbertia hortiorum (P1) (Mattiske 2023/24)
Senecio leucoglossus (P4) (Ecologia 2024)

ecologia ENVIRONMENT

Project No.: 1979
Author: AC
Created Date: 17 September 2023
Coordinate System: AGD 1984 AMG Zone 50
Projection: Transverse Mercator
Scale: 1:20,000 @A3

Map 4: Targeted survey traverses and locations of significant plant species (eastern survey area).

Earthstar Geographics

0 0.2 0.4 0.7 1.3 Kilometers

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ASSESSMENT OF FLORA AND VEGETATION VALUES

KINGSBURY WEST, WA

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

Alcoa of Australia Limited

June 2023






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LIST OF ABBREVIATIONS

BAM Act: *Biosecurity and Agriculture Management Act 2007* (WA)

BC Act: *Biodiversity Conservation Act 2016* (WA)

BOM: Bureau of Meteorology

DCCEEW: Department of Climate Change, Energy, the Environment and Water

DBCA: Department of Biodiversity, Conservation and Attractions

EP Act: *Environmental Protection Act 1986* (WA)

EPA: Environmental Protection Authority

EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

MCPL: Mattiske Consulting Pty Ltd

IBRA: Interim Biogeographical Regionalisation for Australia

PEC: Priority ecological community

TEC: Threatened ecological community

WAH: Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned in 2023 by Alcoa of Australia Ltd (Alcoa) to initially conduct a desktop and field assessment to evaluate the flora and vegetation values in the Kingsbury West survey area approximately 50 km south east of Perth, WA. The Kingsbury West survey area consists of an area west of Jarrahdale located in the Huntly Mine bauxite mining operation within tenement ML 1SA. The Kingsbury WEST survey area has been assessed by Mattiske Consulting Pty Ltd at a regional mapping scale as part of the Regional Forest Agreement (RFA) project by Mattiske and Havel (1998).

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the Kingsbury West survey area.

The Kingsbury West survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite outcrops. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System by Heddle *et al.* (1980) and Mattiske and Havel (1998).

Potential Flora Values

A total of 1098 vascular plant taxa, representative of 308 genera and 87 families, have the potential to occur within the Kingsbury West survey area. The most commonly represented families within the potential plant taxa were Fabaceae (137 taxa), Proteaceae (104 taxa) and Myrtaceae (93 taxa). The most commonly represented genera in the wider survey areas were *Acacia* (47 taxa), *Stylidium* (38 taxa) and *Hibbertia* (27 taxa).

A total of 84 introduced taxa or planted trees have the potential to occur in the Kingsbury West survey area. One species (**Gomphocarpus fructicosus*) is a declared pest organisms pursuant to section 22 of the BAM Act. None of the weeds are listed Weeds of National Significance. Another 9 of the introduced plant taxa with the potential to occur in the Kingsbury West areas have a High ecological impact and a further potential 33 species have a Rapid invasiveness ratings.

Recorded Flora Values

The survey efforts were undertaken over several months and in view of the extensive work undertaken over multiple decades in the Jarrahdale and Huntly areas it was considered to exceed the EPA (2016a and 2016b) guidance statements expectations; although targeted searches of the more extreme gullies and outcrop areas is recommended in the spring months of 2023.

No Threatened or Priority flora species were recorded in the Kingsbury West survey area.

A total of 236 taxa from 47 families and 117 genera was recorded in the Kingsbury West survey area and as such partly reflects the smaller survey area. Of the 236 species, 6 were introduced or planted species. The introduced species included two planted **Pinus pinaster* and the four weeds - *Asteraceae sp., **Pentameris airoides, *Hypochaeris glabra, *Leptospermum laevigatum.* All occur more widely in the Jarrah forest and are not listed as WONS weeds at the National scale or as Declared pests at the State level.

Potential Vegetation Values

No Threatened Ecological Communities (TECs) occur in the Kingsbury West survey area. The desktop assessment highlighted several potential TECs; however these are restricted to the Swan Coastal Plain and as such do not extend into the Jarrah forest area on the Darling Ranges.

One of the priority ecological communities (PECs), as listed at State level by DBCA (2022b) occurs east and northeast of the survey area, namely:

- Granite communities of the northern Jarrah forest (P3)
    - Jarrahdale area – Monadnocks, Blue Rock; insufficient information to distinguish discrete community type/s (DBCA 2020a).

There is a potential that the site-vegetation types associated with granite outcrops (site-vegetation types G (including variant G1) and R) as defined by Havel (1975a and b) will have affinities with the PEC.

The Kingsbury West survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023b) and as such was considered during the RFA process.

Recorded Vegetation Values

A total of 20 site-vegetation types have been recorded on the Kingsbury West survey area. The site-vegetation types were subdivided into six main groupings associated with site conditions which reflected landforms, soils and soil moisture levels. The site-vegetation types on the extreme sites such as outcrops and broad valley systems and swamps differ markedly from the forest and woodland areas on the slopes and ridges.

The condition of the vegetation has been impacted by cleared properties (outside State Forest), dieback and tracks. The vast majority of the area is excellent in condition, but in impacted areas it is either very good, degraded or completely degraded.

Potential Groundwater Dependent Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the site-vegetation types. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils on the swamps and lower slopes of the valley systems. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Other Key Biological Values

On the basis of data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Kingsbury West survey area.

On the basis of stumps and also potential habitat trees there are some areas of Kingsbury West that have some potential to reflecting lower logging rates.

1. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned in 2023 by Alcoa of Australia Ltd (Alcoa) to initially conduct a desktop and field assessment to evaluate the flora and vegetation values in the Kingsbury West survey area approximately 50 km south east of Perth, WA, Figure 1. The Kingsbury West survey area consists of an area west of Jarrahdale located in the Huntly Mine bauxite mining operation within tenement ML 1SA, Figure 2. The Kingsbury WEST survey area has been assessed by Mattiske Consulting Pty Ltd at a regional mapping scale as part of the Regional Forest Agreement (RFA) project by Mattiske and Havel (1998).

1.1. Location and Scope of Project

The Kingsbury West survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province (Beard 1990), approximately 30 km south east of Perth, WA (Figure 1). The Kingsbury West survey area is located in the Huntly Mine bauxite mining operation within tenement ML 1SA and located West and south-west of the Serpentine Dam (Figure 2).

Parts of this region have previously been surveyed by Mattiske Consulting Pty Ltd at a regional mapping scale as part of the Regional Forest Agreement (RFA) project by Mattiske and Havel (1998). These studies built on the earlier work of Havel (1975a and 1975b) in the northern Jarrah forest.

This report describes the potential and recorded flora and vegetation values of the Kingsbury West survey area and places them within a local and regional context.

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

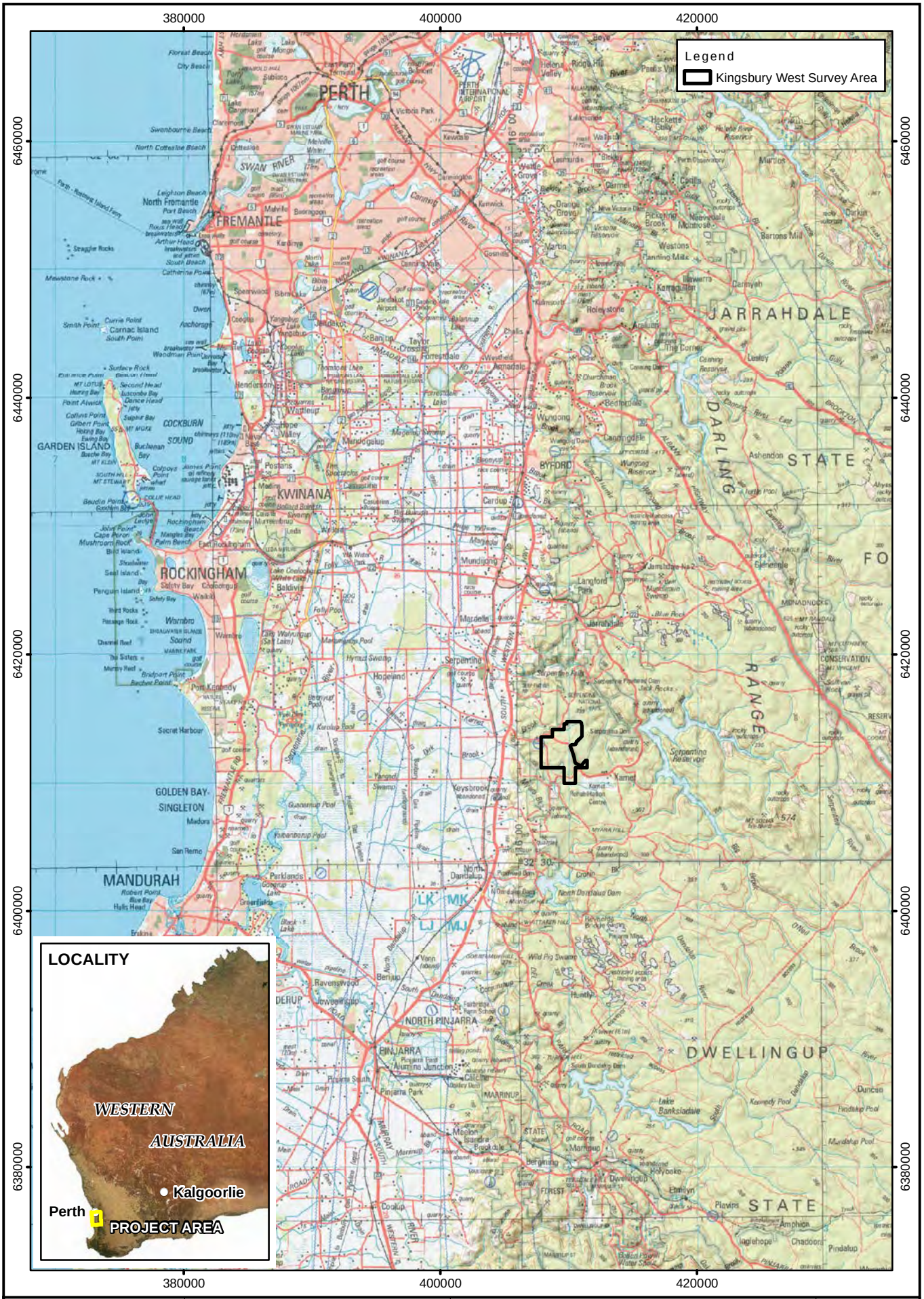
The following key Western Australian (state) legislation relevant to this survey includes the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) and *Regulations 2013*;
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

Furthermore, key Western Australian guidelines relevant to this survey are the:

- *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority [EPA] 2016a); and
- *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b); and.
- *Commonwealth of Australia (2013) - Survey Guidelines for Australia's Threatened Orchids. Guidelines for detecting Orchids listed as "Threatened" under the Environment Protection and Biodiversity Conservation Act 1999.*

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-A5.



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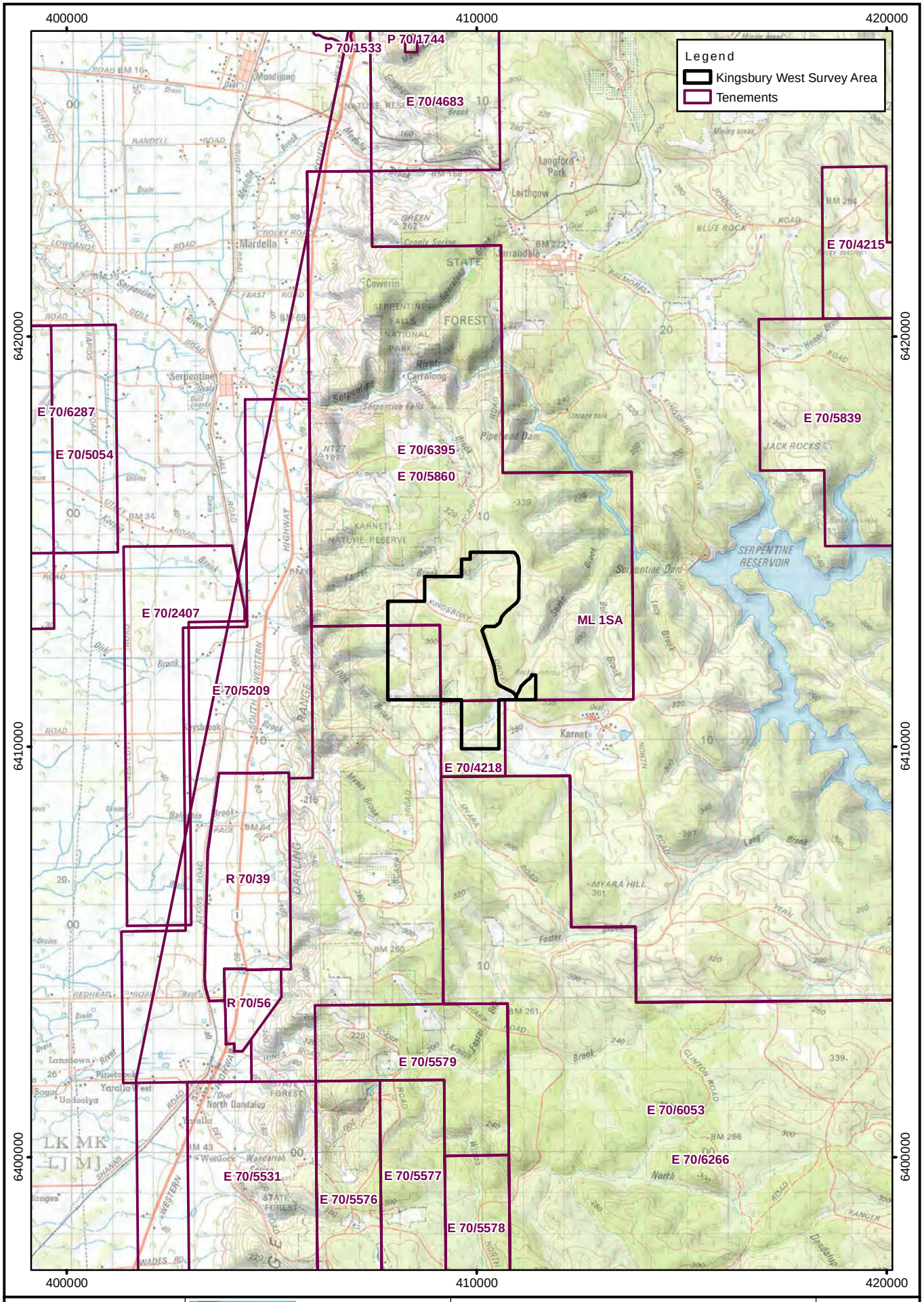
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Date: May 2023 | Rev: A | A4

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Kingsbury West Survey Area
Location

Figure: **1**



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F019_02

Date: May 2023 | Rev: A | A4

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Kingsbury West Survey Area
Tenements

Figure: **2**

2. OBJECTIVES

The objective of this assessment was to undertake the desktop component of a detailed flora and vegetation survey of the Kingsbury West survey area, including:

- Undertake a desktop assessment of the flora and vegetation of the Kingsbury West survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Undertake a detailed assessment of the flora and vegetation of the Kingsbury West survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Review previous literature and current databases associated with the Kingsbury West survey area;
- Review the conservation status of the vascular plant species and vegetation recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA 2022a, 2023) and plant collections held at the Western Australian Herbarium ([WAH] 1998 -), and plants listed by the Department of Climate Change, Energy, the Environment and Water [DCCEEW] (2023a) under the EPBC Act;
- Prepare a report summarising the findings.

3. METHODS

3.1. Desktop Assessment

The NatureMap (DBCA 2007-) and *EPBC Act* Protected Matters Search Tool (DAWE 2020b) databases were used to identify the possible occurrence of flora (including threatened and priority taxa) and threatened and priority ecological communities within the Kingsbury West survey area. The vascular plant species recorded through this database search are summarized in Appendices B and C.

The TPFL database of threatened and priority flora and ecological communities and the Western Australian Herbarium (WAH) database (DBCA 2023a) were arranged by CAD Resources (Carine, WA). In addition, any flora recorded by Mattiske Consulting Pty Ltd (1991-2022) within or adjacent to the survey area were included.

In addition, historical documentation and vegetation mapping of the Northern Jarrah forest subregion that provide resource material for the floristics and vegetation of the areas near Jarrahdale and Huntly were reviewed, including Mattiske Consulting Pty Ltd's (1991-2022) reports on their flora and vegetation surveys in the nearby survey areas. Nomenclature of flora species was checked against and is consistent with Florabase (WAH 1998-).

3.2 Field Studies

Field studies were undertaken at 572 sites on the 120m grid systems within the 982.73 ha of the Kingsbury West survey area. Data was recorded for the following parameters:

To maintain consistency with previous mapping of the area, enabling spatial and temporal comparisons, flora and vegetation were assessed using site-type classification based on Heddle *et al.* (1980). Sites were pre-designated using a 120 x 120 m grid system overlaid on the survey area. A total of 572 sites within the 1134.01 ha area were assessed with recordings on the trees (20m radius) and understorey (5m radius). Additional targeted work was undertaken on the areas between the recording sites and also on specific areas such as the outcrop and sandier valley systems and creeklines.

This data was then used in combination with aerial imagery and field observations to map the vegetation of the survey area. Furthermore, searches for threatened, priority or Declared (plant) pests species were undertaken whilst walking between survey sites.

The following information was recorded at each vegetation assessment site:

GPS location	Easting, Northing and datum;
Soil types	gravels, sandy-gravels, sandy-loam-gravels, sandy-loams, loams, clay-loams, clays and peat;
Topography	ridge, upper slope, mid-slope, lower slope, valley floor and swamp;
Outcropping	type – granite, laterite, dolerite, and quantity – few, moderate, numerous;
Logging history	light, moderate or heavy, together with number of stumps within a 20 m radius;
Fire history	years since last fire; and
Dieback occurrence	*Phytophthora* spp. demarcation – field blazing, coloured flagging on trees, vegetation deaths, either old or recent.

At each site species were ranked according to the scale developed by Havel (1975a, 1975b). Tree and understorey species were assessed separately using the following method.

Tree species

Tree species (*Allocasuarina fraseriana, Banksia grandis, B. littoralis, B. seminuda, Corymbia calophylla, Eucalyptus marginata, E. megacarpa, E. patens, E. rudis, E. wandoo, Melaleuca preissiana, M. rhaphiophylla, Nuytsia floribunda, Persoonia elliptica, P. longifolia* and *Xylomelum occidentale*) were assessed within a 20 m radius from the observation point using the following scale:

0 absent;
1 one or two trees;
2 three to five trees;
3 more than five trees, but contributing less than one third of the total stand;
4 between one third and one half of the total stand; or
5 more than one half of the total stand.

Understorey species

Understorey species were assessed within a 5 m radius from the observation point using the following scale:

0 absent;
1 very rarely seen, only after a careful search;
2 present, observable, but in small numbers only;
3 common locally, but not uniform over the whole area;
4 common over the whole area; or
5 completely dominating the understorey.

The physiological stress was determined for each species within a 20 m radius from the observation point and ranked according to the following scale.

0 healthy, no evidence of stress;
1 odd plant showing signs of stress, not dead;
2 one or two dead plants, near death;
3 scattered stressed plants, (2-4) dead plants around survey site;
4 susceptible plants dying or dead (> 4 plants); or
5 “graveyard” death

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH). All plant specimens were identified through comparisons with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with

specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

4. DESKTOP FINDINGS

The climate, geology, soils and landforms all influence the vegetation of the area and are described in this section. Potential flora, including threatened, priority and introduced species are described, along with possible vegetation communities, and placed within a local and regional context.

4.1. Climate

The survey area lies at the southern end of the Northern Jarrah Forest subregion. Beard (1990) described the climate of this area as being warm Mediterranean, with rainfall of 600 – 1200 mm per annum and 5 - 6 dry months per year. The closest weather station is the Jarrahdale and Karnet weather stations, approximately 1.6km and 11.1km from Jarrahdale town. Annual average rainfall at Jarrahdale (1991-2022) is 980.6 mm (Bureau of Meteorology [BOM] 2023). Rainfall in 2022 was higher than the longer term mean for July and August and the rainfall in March and April 2023 was higher than the longer term mean. The summer months were again drier (Figure 3). The monthly temperatures were similar to the longer term temperatures at Karnett.

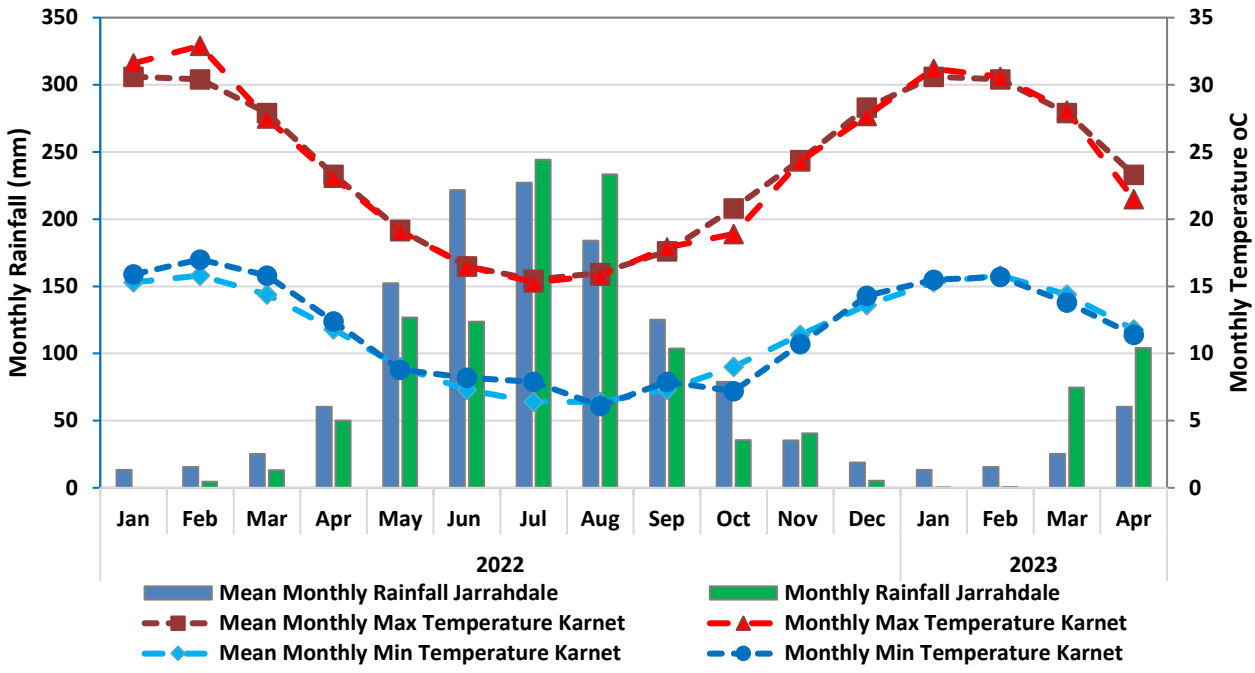
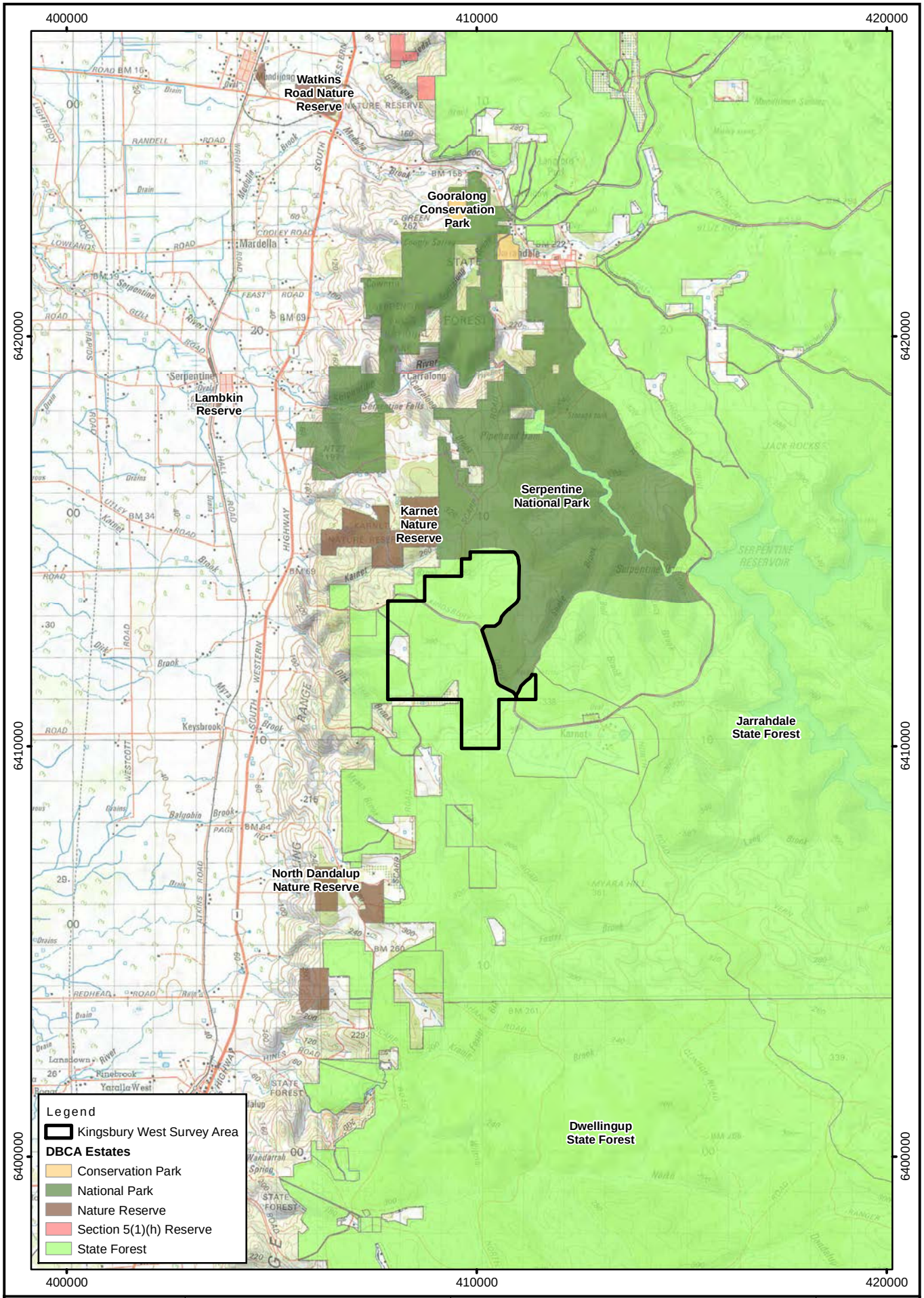


Figure 3: Climatic data for the Kingsbury West survey area
Long term average rainfall and temperature from the Jarrahdale and Karnet weather stations respectively (ID 009023 and 009111 respectively, years 1991-2023) (BOM 2023).

4.2. DBCA Estates

The Kingsbury West survey area is situated in State Forest, and as such occurs west of the Serpentine National Park (Figure 4).



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

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Kingsbury West Survey Area
DBCA Estates

Figure: **4**

4.3. Geology, Soils and Topography

The Kingsbury West survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion encompasses the area to the east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of the Yilgarn Craton at an average elevation of 300 m (Beard 1990). The area is capped by extensive lateritic duricrust, dissected by drainage lines and broken by occasional granite hills. In the eastern section, the laterite becomes deeply dissected until it compresses isolated remnants. The duricrusted plateau of the Yilgarn Craton is characterised by lateritic gravels, consisting of 5 m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon. These overlay mottled yellow-brown clay subsoils and hard setting loamy soils, which become evident in the east (Beard 1990).

Furthermore, Western Australia is divided into twelve Systems, separated by natural and demographic boundaries (Department of Conservation and Environment 1980). The survey area lies within the Darling System (as known as System 6), which is further divided into provinces, with the survey area lying in The Darling Plateau province (Department of Conservation and Environment 1980).

The underlying geological units of The Darling Plateau province have been defined by Churchward and McArthur (1980), with four main landform and soil units occurring within the survey areas, these are:

Dwellingup: Gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions.

Murray: Deeply incised valleys with red and yellow earths on slopes; narrow alluvial terraces.

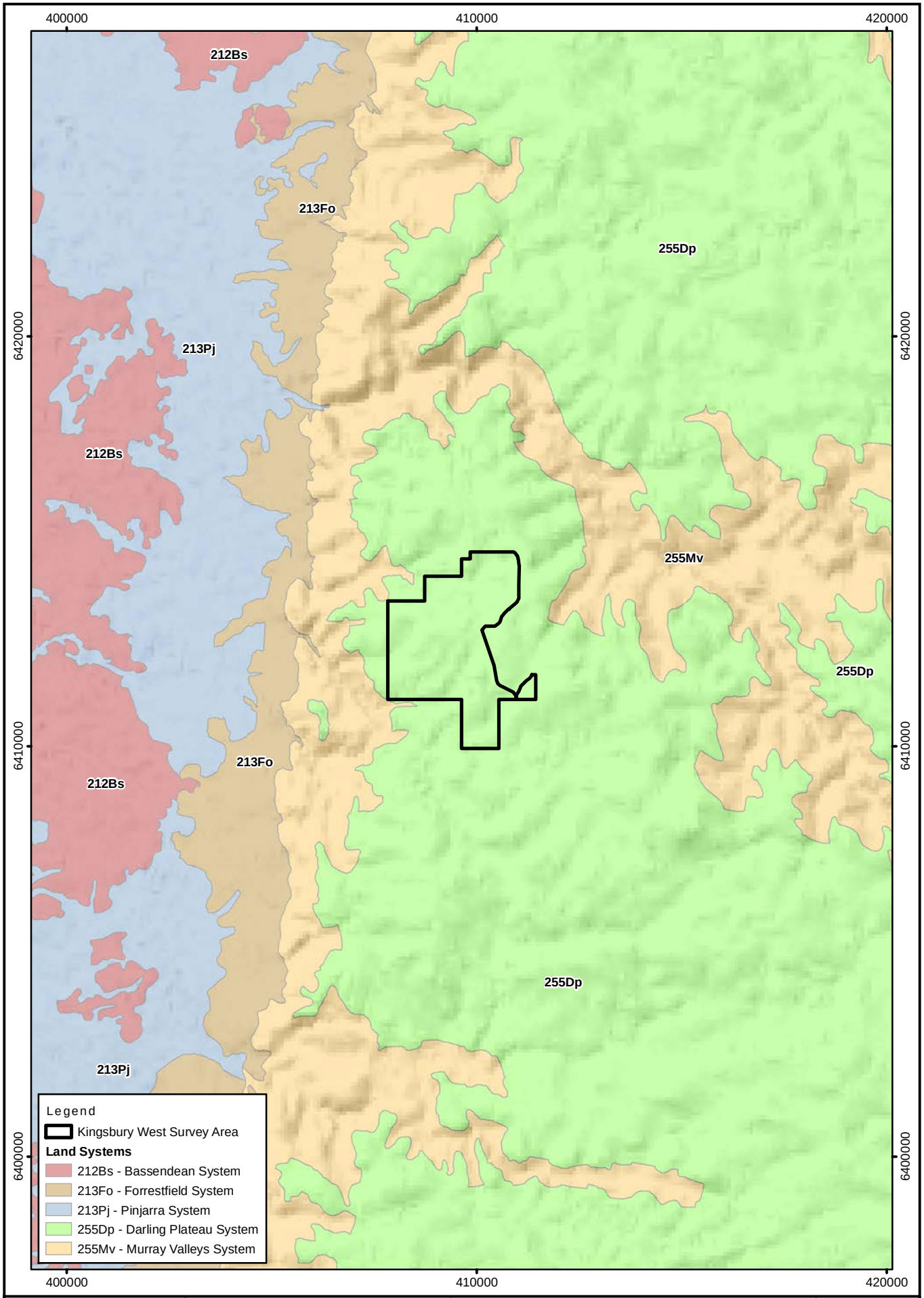
Yarragil: Valleys of the western part of the plateau; sandy gravels on the slopes; orange earth in swampy floors.

The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the Kingsbury West survey area (Figure 5, Table 1) includes:

Darling Plateau System (255Dp): Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah-marri-wandoo forest and woodland.

Table 1: Extent of Land Systems intersecting the Kingsbury West survey area

Land System	Mapping Unit	Total Extent (ha)	Area of Intersection with the Kingsbury West survey area	Proportion of Current Extent (%)
Darling Plateau System	255Dp	820265.76	982.73	0.120



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

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Kingsbury West Survey Area
Land Systems

Figure: **5**

4.4. Regional Vegetation

The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent. In lower rainfall areas towards the east trees decrease in size, forming woodlands or low forests. This dry sclerophyllous forest typically comprises a dominant *Eucalyptus marginata* and *Corymbia calophylla* overstorey, a mid-storey of *Allocasuarina fraseriana* (Sheoak), *Banksia grandis* (Bull Banksia), *Persoonia longifolia* (Snottygobble), *Persoonia elliptica* (Spreading Snottygobble), and a groundcover of woody shrubs with grass trees *Xanthorrhoea preissii*, *Kingia australis* and the cycad *Macrozamia riedlei* (Dell and Havel 1989).

The Pre-European vegetation systems present within the Kingsbury West survey area (Figure 6, Table 2) include:

1. **West Darling System - Vegetation Association 3.3:** Mainly jarrah and marri *Eucalyptus marginata, Corymbia calophylla*
2. **West Darling System - Vegetation Association 4.4:** Jarrah, marri and Wandoo *Eucalyptus marginata, Corymbia calophylla, Eucalyptus wandoo*

Table 2: Extent of pre-European vegetation associations intersecting the Kingsbury West survey area

System	Vegetation Association	State-wide Pre-European Extent (ha)	Area of Intersection with the Kingsbury West survey area (ha)	Proportion of Current Extent (%)
West Darling	3.3	485225.883	978.50	0.202%
West Darling	4.4	52122.777	4.23	0.008%

Heddle *et al*. (1980) defined and described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes as part of the System 6 studies. Mattiske and Havel (1998) updated this initial more restricted mapping coverage to the wider south-west forest region as (Regional Forest Agreement vegetation complexes). Havel, J.J. (2000) summarized in greater detail the relationships between the landforms, soils and climatic conditions. Mattiske and Havel (1998) defined and described three vegetation complexes in the Kingsbury West survey area (Figure 7, Table 3). These include:

Dwellingup 1 (D1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.

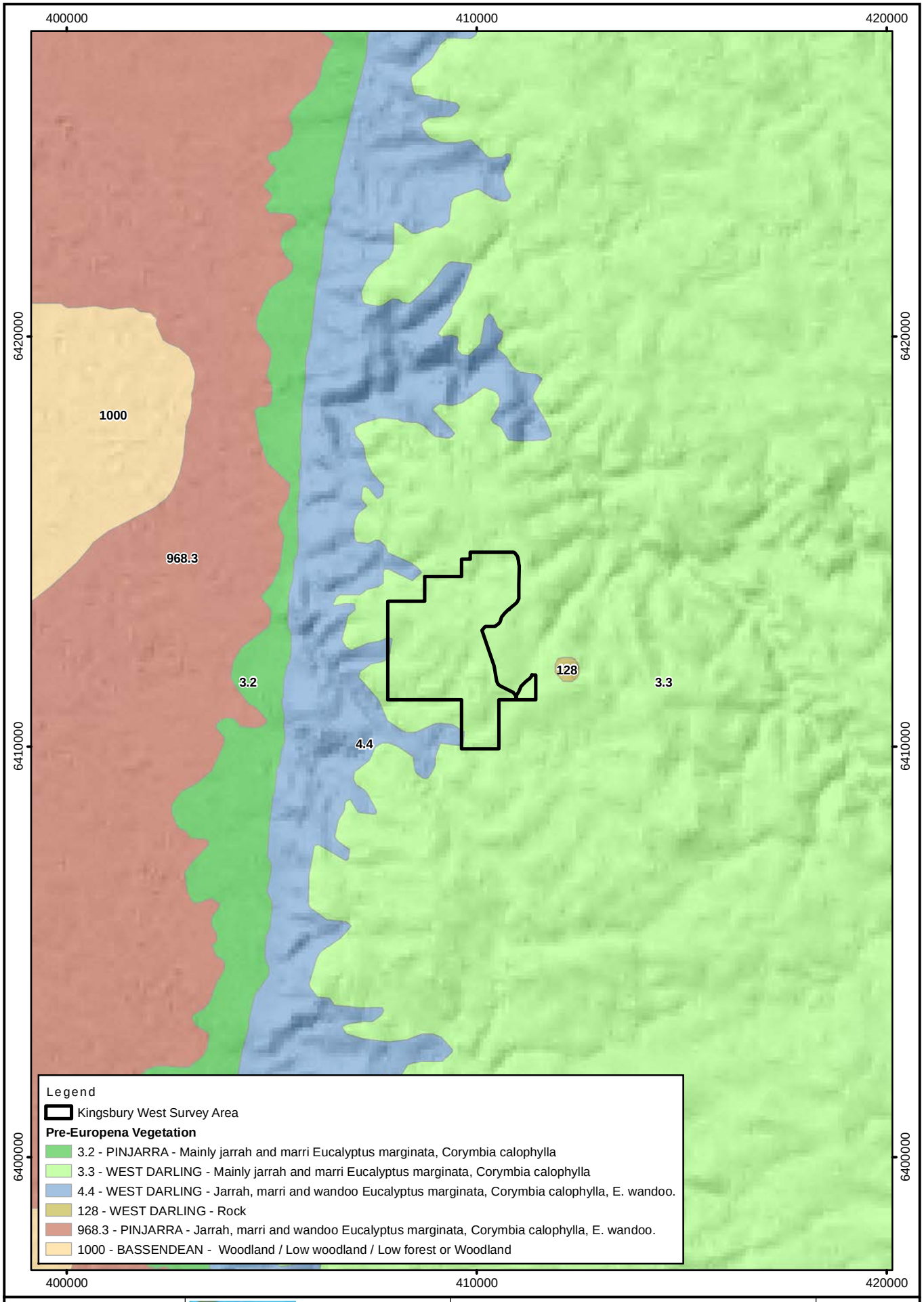
Murray 1 (My1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* - *Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis* – *Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones.

Yarragil 1 (Yg1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.

Table 3: Extent of Vegetation Complexes intersecting the Kingsbury West survey area

Vegetation Complex	Vegetation Class	Total Extent (ha)	Area of Intersection with the Kingsbury West survey area (ha)	Proportion of Current Extent (%)
Dwellingup 1	D1	297624.85	716.1948	0.241%
Murray 1	My1	97562.81	15.6318	0.016%
Yarragil 1	Yg1	113828.12	250.9038	0.220%

More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area falling within the Northern Jarrah Forest subregion (JF1) of the Jarrah Forest (JAF) Region (DCCEEW 2023c). The vegetation of the Northern Jarrah Forest subregion consists of Jarrah – Marri forest, with Bullich and Blackbutt in the valleys to the west, grading to Wandoo and Marri woodlands to the east. Heath vegetation is the common understorey of forests and woodlands and occurs on granite rocks. The majority of the diversity between communities in this subregion occurs on lower slopes and near granite soils (Williams and Mitchell 2001).



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

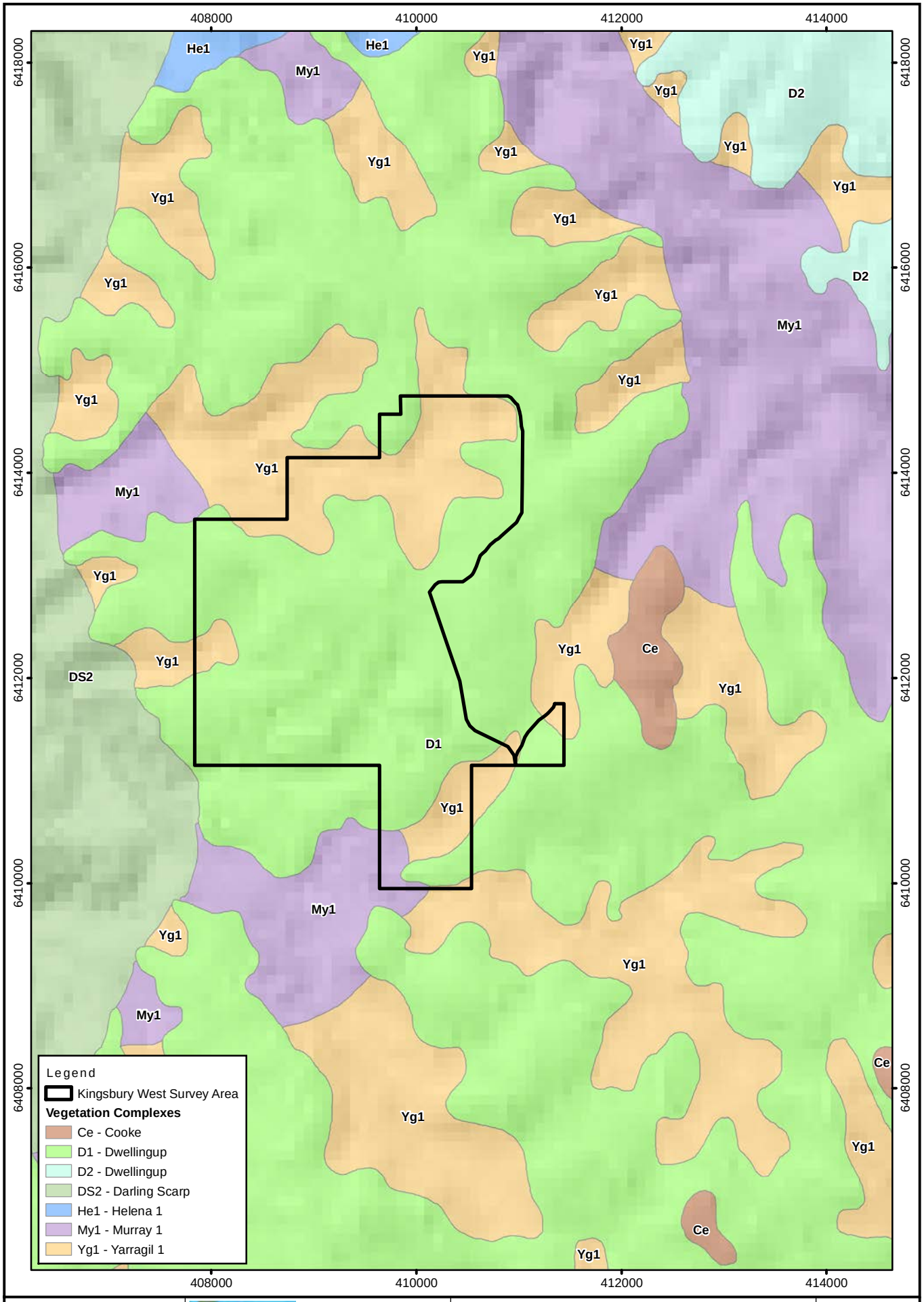
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Kingsbury West Survey Area
Pre-European Vegetation

Figure: **6**



N

0 400 800 m

Scale: 1:50,000
MGA94 (Zone 50)

CAD Ref: a1992_F019_06

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Kingsbury West Survey Area
Vegetation Complexes

Figure: **7**

4.5. Potential Flora

A total of 1098 vascular plant taxa, representative of 308 genera and 87 families, have the potential to occur within the Kingsbury West survey area. The most commonly represented families within the potential plant taxa were Fabaceae (137 taxa), Proteaceae (104 taxa) and Myrtaceae (93 taxa). The most commonly represented genera in the wider survey areas in the northern Jarrah forest were *Acacia* (47 taxa), *Stylidium* (38 taxa) and *Hibbertia* (27 taxa).

A total of 84 introduced taxa or planted trees have the potential to occur in the Kingsbury West survey area. One species (**Gomphocarpus fructicosus*) is a declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2023). None of the weeds are listed Weeds of National Significance (DCCEEW 2023d). Another 9 of the introduced plant taxa with the potential to occur in the Kingsbury West areas have a High ecological impact and a further potential 33 species have a Rapid invasiveness ratings

4.6. Potential Threatened and Priority Flora

Initially a 10km search highlighted some 19 threatened flora species, pursuant to section 179 of the *EPBC Act* and as listed by DCCEEW (2023a) or pursuant to Part 2, Division 1 and Subdivision 2 of the *BC Act* and as listed by DBCA (2022a) have the potential to occur in the Kingsbury West survey area. Of the 19 potential threatened species, 14 have a very low potential due to the lack of suitable landforms and soils present in the Kingsbury West survey area. Some of this very low categorisation relates to the proximity of the Swan Coastal Plain which has very different site conditions. The remaining five threatened flora species have a low or moderate potential, *Anthocercis gracilis* (T & V), *Banksia mimica* (T & E), *Thelymitra stellata* (T & E), *Lasiopetalum pterocarpum* (T & E) and *Morelotia australiensis* (T & V) of occurring in the Kingsbury West survey area (T – Threatened, V – Vulnerable and E - Endangered) due to their current known patterns of distribution.

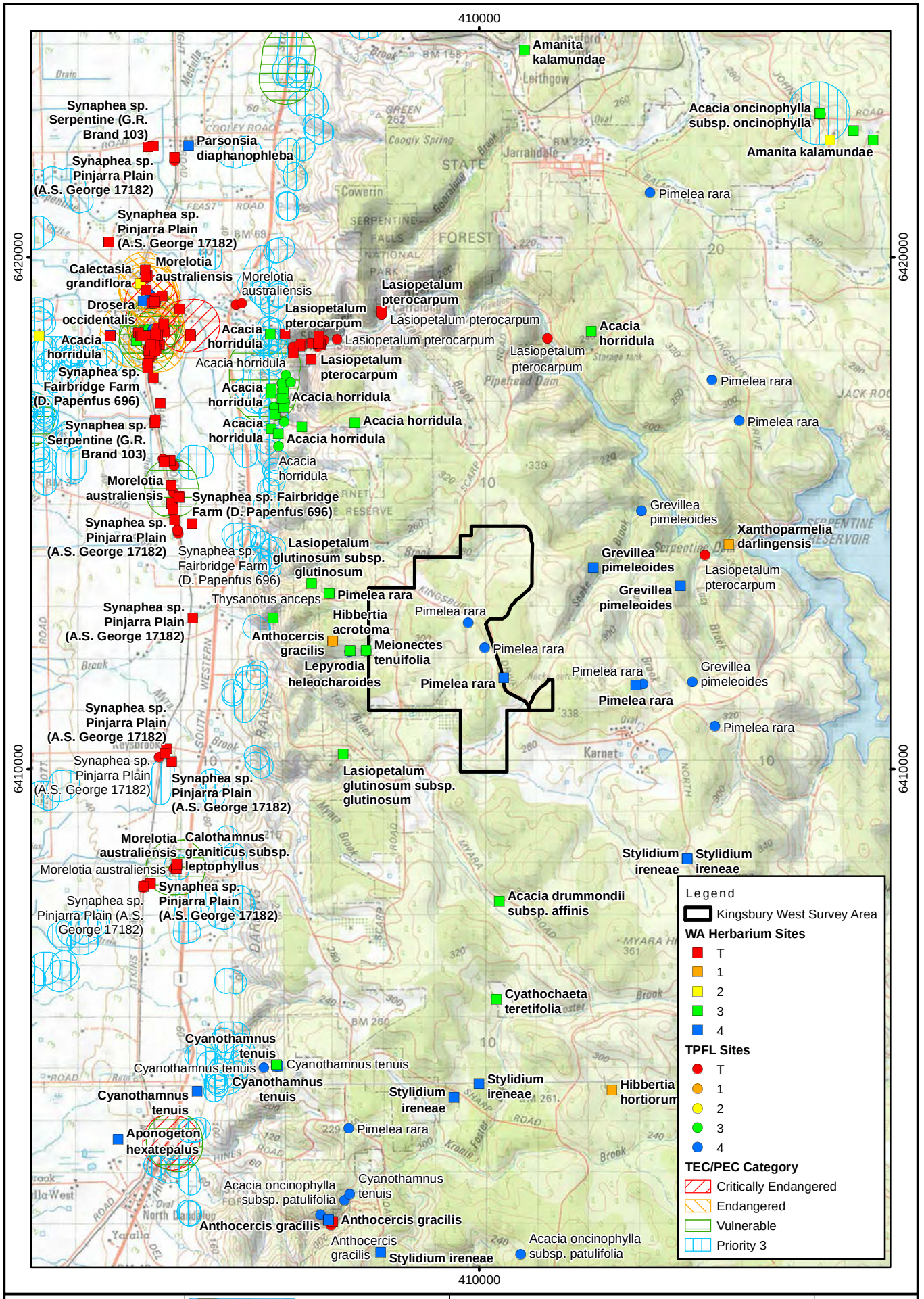
A total of 37 priority flora species as listed by DBCA (2022a) have the potential to occur within the Kingsbury West survey area (Appendices B and C, Figure 8). All potential threatened and priority flora are listed in Appendix C, along with their State and Federal Conservation Codes (see Appendix A for definitions), a description and an assessment of the likelihood of their occurrence in the Kingsbury West survey area.

The likelihood that these species would occur within the survey area was determined using the following criteria:

- Known records within a 10m and 20 km radius of the centre of the survey area (as described above). More recent, proximal and numerous records were ranked higher. the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation). The 20km search highlighted many species on the Swan Coastal Plain that do not occur on the Darling Ranges and as such the 10km was used in this instance to review species.

The likelihood was ranked Very Low, Low, Moderate or High, Appendix C. Records that have been documented either within or in close proximity of the Kingsbury West survey area were ranked as Low, Moderate or High.

Of the 37 Priority flora species, one Priority 2, five Priority 3 and five Priority 4 flora species had a high likelihood of occurrence, mainly due to previous records in the area and suitable habitat; whilst two Priority 1, one Priority 2 and seven Priority 3 flora species had a moderate likelihood of occureence (Appendix C). The remaining five Priority 1 are considered to have a very low potential, two Priority 2 are considered to have a very low potential, one Priority 3 is considered to have a low potential and two Priority 3 are considered to have a very low potential and 3 Priority 4 are considered to have a very low potential and 3 Priority 4 are considered to have a low potential.



N

0 0.75 1.5 km

Scale: 1:100,000
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Kingsbury West Survey Area
Threatened and Priority Flora

Figure: **8**

4.7. Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

A total of 84 introduced taxa or planted trees have the potential to occur in the Kingsbury West survey area. One species (**Gomphocarpus fructicosus*) is a declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2023). None of the weeds are listed Weeds of National Significance (DCCEEW 2023d). Another 9 of the introduced plant taxa with the potential to occur in the Kingsbury West areas have a High ecological impact and a further potential 33 species have a Rapid invasiveness ratings (DPAW 2014).

4.8. Groundwater Dependant Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes and site-vegetation types, and in the Kingsbury West survey area this includes Yarragil 1 and Murray 1 vegetation complexes and site-vegetation types associated with creeklines and lower valley slopes. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Acacia divergens, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Eucalyptus patens, Eucalyptus megacrapa, Hypocalymma angustifolium, Hypocalymma cordifolium, Melaleuca preissiana,* and *Taxandria linearifolia.*

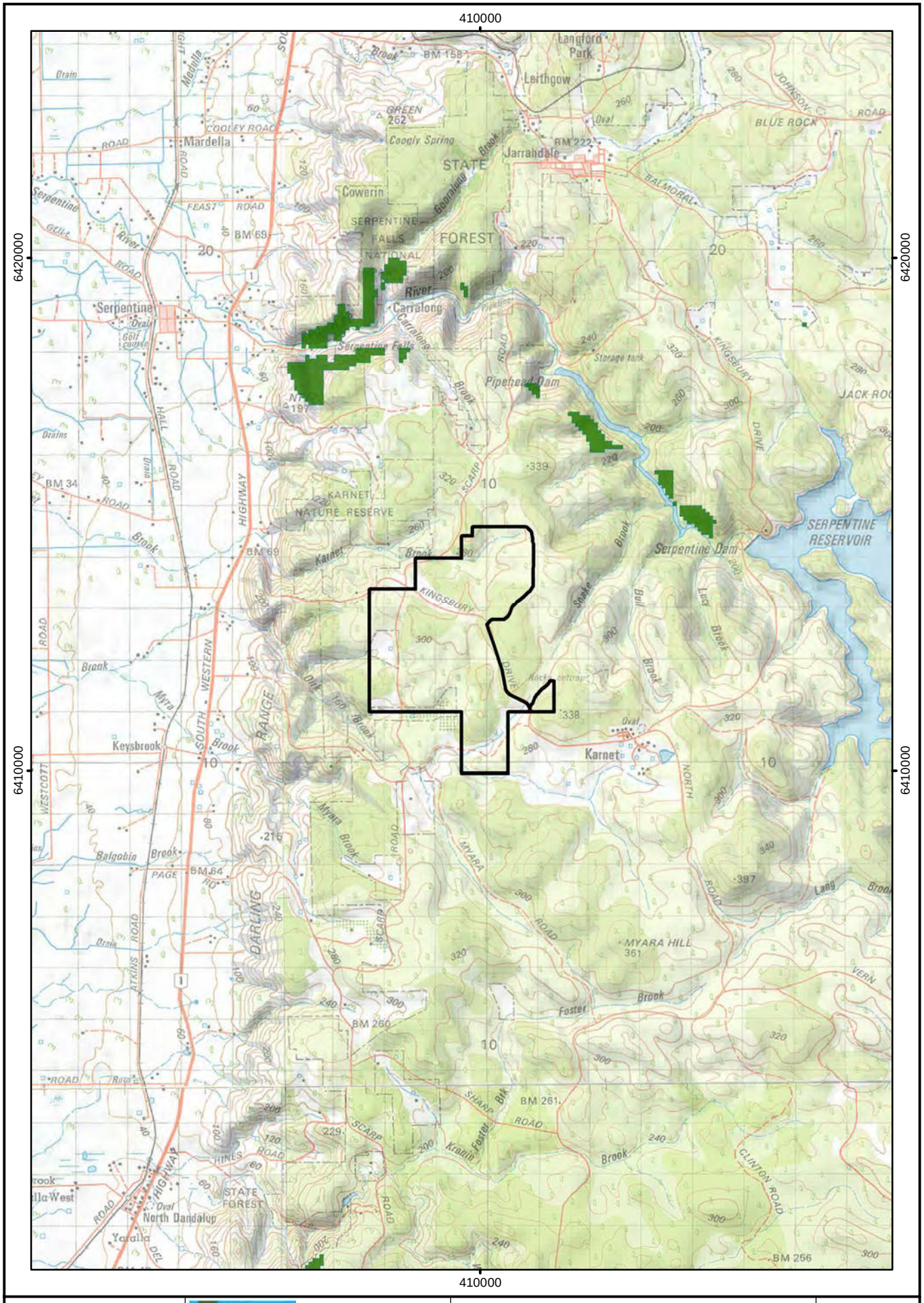
4.9. Old Growth Forests and Harvesting Records

On the basis of data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Kingsbury West survey area, Figure 9.

The data as presented on the history of harvesting in the area as available reflects the age of logging on the Kingsbury West survey area, see Figure 10. These results as supplied by DBCA were restricted to the eastern side of the survey area.

4.10. Dieback Mapping

On the basis of data supplied by the Department of Biodiversity, Conservation and Attractions the dieback areas were concentrated around the main valley systems and lower slopes in the northern and southern sections of the Kingsbury West survey area, Figure 11.



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 50)

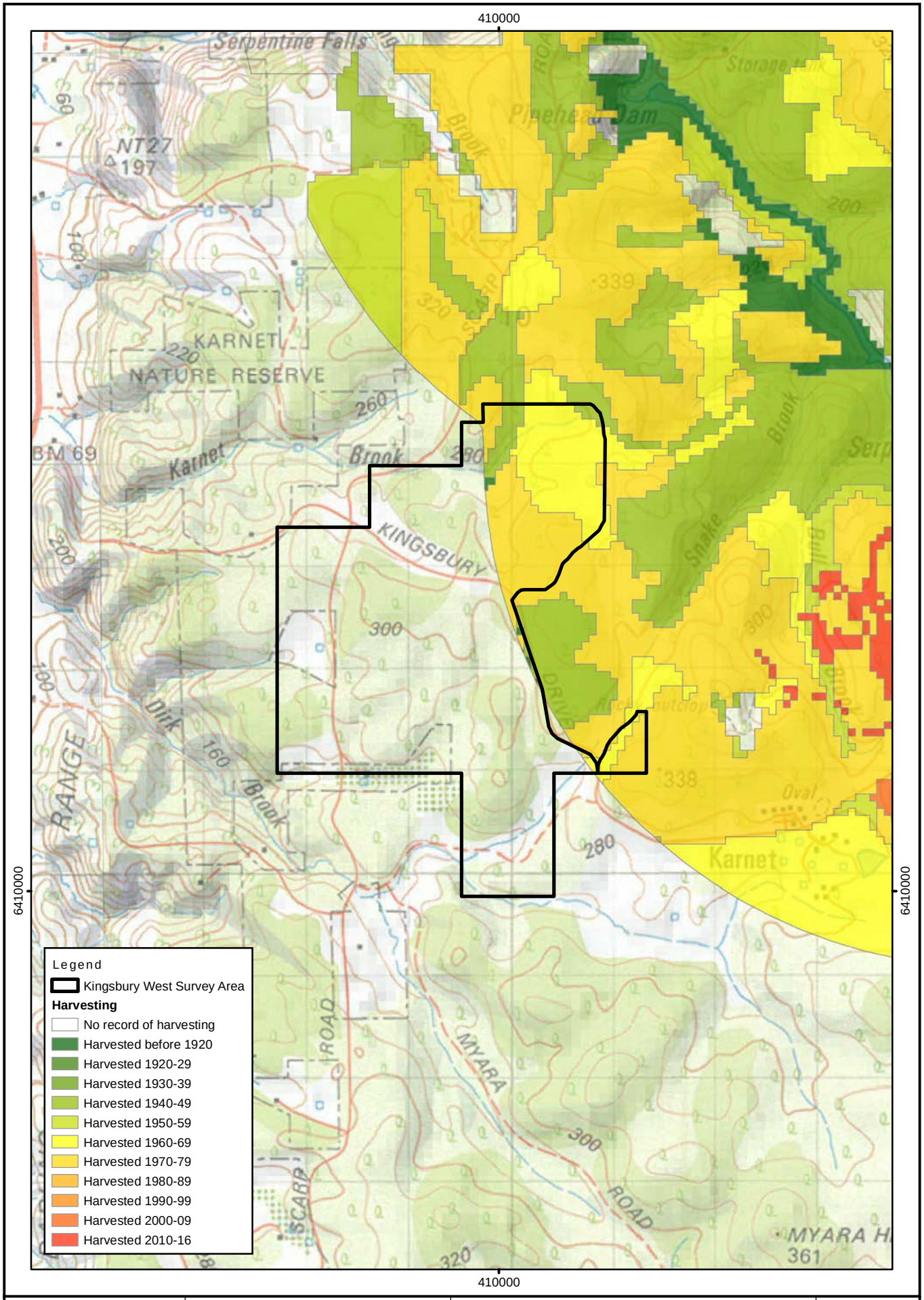
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Kingsbury West Survey Area
Old Growth Forest

Figure: **10**



N

0 400 800 m

Scale: 1:50,000
MGA94 (Zone 50)

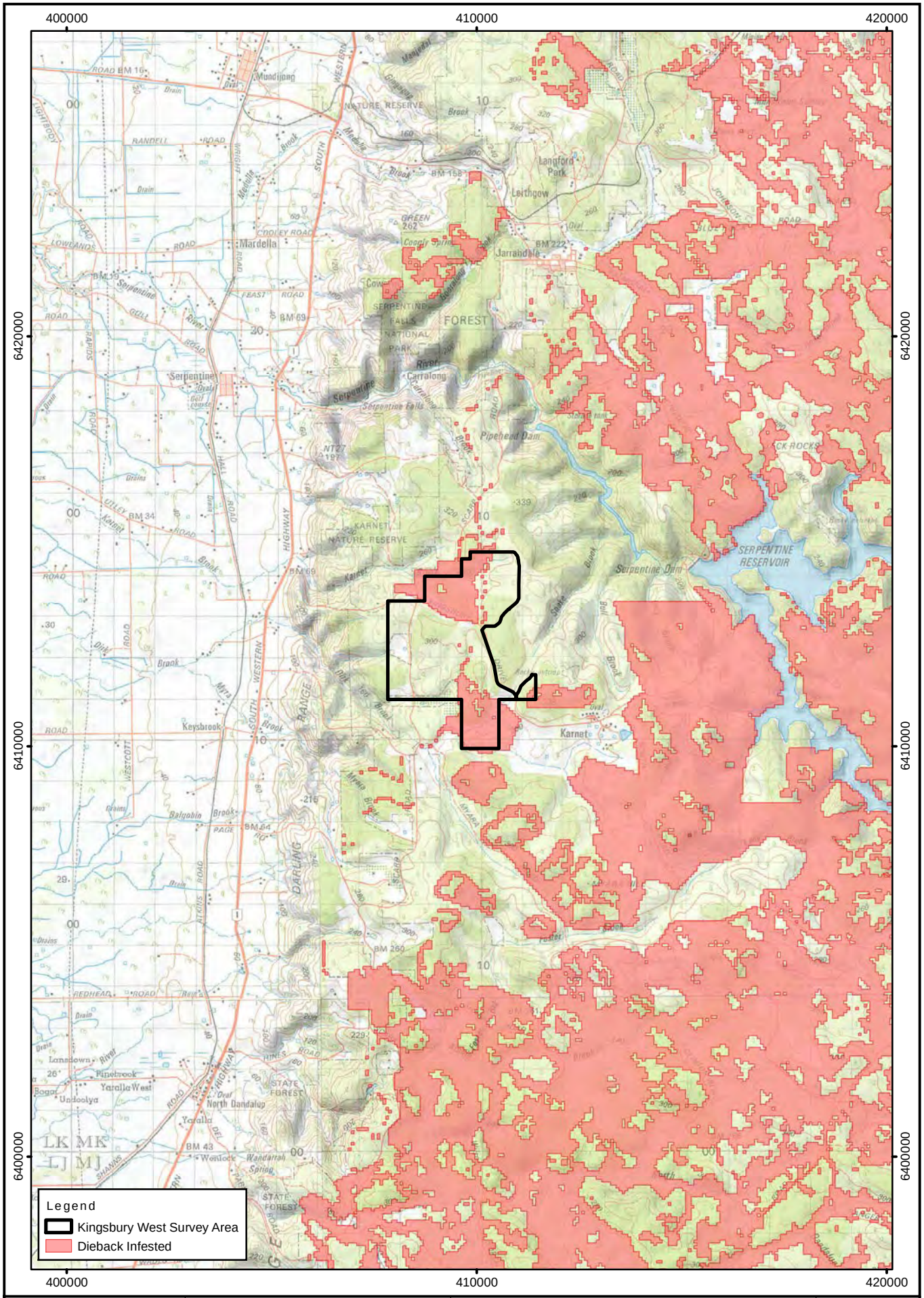
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Kingsbury West Survey Area
Harvest Year

Figure: **11**



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

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Kingsbury West Survey Area
Dieback

Figure: **12**

4.11. Previous Surveys

Over the past forty years, Mattiske Consulting has previously mapped the vegetation associated with the Jarrahdale, Huntly (including previous eastern Myara extensions) (E.M. Mattiske and Associates 1988, 1992, 1993 and Mattiske Consulting Pty Ltd 2009, 2011, 2012, 2019, 2020, 2021).

4.12. Potential Threatened and Priority Ecological Communities

No threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* and listed by the DCCEEW (2023e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2022a) occur within the Kingsbury West survey area. The closest TECs occur either on the Swan Coastal Plain or in the Western Australian Wheatbelt which do not occur in the Kingsbury West survey area.

There are two priority ecological communities (PECs), as listed at State level by DBCA (2022a) that occur in the wider survey areas near Jarrahdale: only one of these is a botanical PEC.

The priority ecological communities that occur in the wider Jarrahdale areas are:

- Granite communities of the northern Jarrah forest (P3)
    - Jarrahdale area – Monadnocks, Blue Rock; insufficient information to distinguish discrete community type/s (DBCA 2022b).
- Litter Dependant Invertebrate Community of the northern Jarrah Forest (P2)
    - Chandler Block, Northern Jarrah Forest; insufficient evidence that this is a discrete community type (DBCA 2022b).

4.13. Wetlands of International Importance (Ramsar)

No wetlands of international importance listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* and listed by the DCCEEW (2023f) or at State level pursuant to Part 2 of the *BC Act* and occur within the Kingsbury West survey area. The closest wetlands of international importance occur on the Swan Coastal Plain.

5. FIELD STUDIES FINDINGS

The following text summarizes the key findings from recent studies in 2023 within the Kingsbury West survey area; which includes recording sites for vegetation mapping and opportunistic and targeted assessments.

5.1 Survey Effort

The survey efforts has been undertaken over a decade from multiple studies within the Jarrahdale and Huntly areas. The major effort in 2021 and 2022 which when combined with the depth of previous studies in adjacent areas for both Alcoa and also other clients leads to the conclusion that the work exceeds the current EPA Guidance Statement (2016a and 2016b) expectations for flora and vegetation studies.

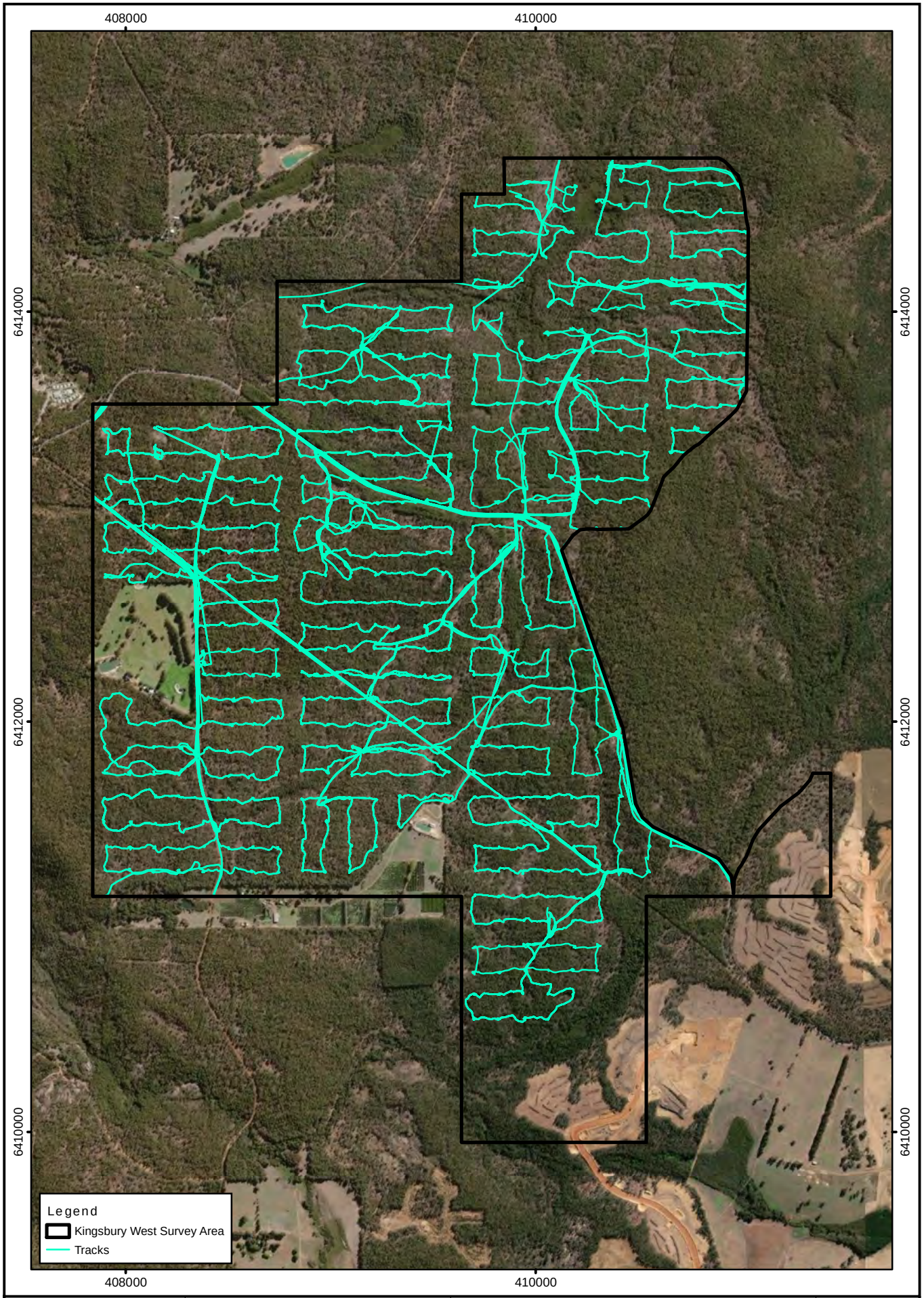
The survey effort to date has included (see Figure 12):

- More than 225 kilometres of foot transects which includes the mapping efforts and targeted searches undertaken to date;
- 572 recording sites in 2023 on a grid system which varied slightly from 120m x 120m with some sites closer than this average and some slightly wider. This pattern of recording is consistent with previous ecological studies in the northern Jarrah forest for both Alcoa and other clients in nearby areas;
- targeted searches of additional extreme sites that are variable within the broader Yarragil vegetation complexes as well as the variable communities on the granite and outcropping areas in the Kingsbury West survey area. The coverage of the flora on the granite and valley areas relied on the recording sites and targeted searching;
- detailed and consistent data collection on position in the landscape, soils, flora, vegetation and vegetation condition.
- consistent interpretation in line with previous site-vegetation studies where there is a greater reliance on key indicator species and a series of site parameters rather than the accepted clustering and groupings. Such an approach differs from the EPA guidance statement, but if the latter was followed the dominance of some tree and understorey species in the analyses would lead to a less comprehensive delineation of biodiversity values and also be inconsistent with the approach adopted on all other Alcoa leases where detailed flora and vegetation studies have been undertaken in the past by the Mattiske team and site personnel. In summary, the survey effort easily exceeds the expectations of the EPA Guidance Statement (2016a, 2016b).

A general assessment was made of the current survey against a range of factors that may have limited the outcomes and conclusions of this report (Table 4).

Table 4: Potential flora and vegetation survey limitations for the Kingsbury West survey area

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Reference resources such as mapping by Beard (1979), Mattiske and Havel (1998), previous vegetation mapping completed for Alcoa by E.M Mattiske and Associates together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora, which were the focus of the present survey was sampled on a close grid pattern within the survey area. In addition to the regular sampling sites, searches were undertaken to assess the likelihood of threatened and priority flora species.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Potential constraint:** The survey areas near Jarrahdale, Huntly and Myara have been sampled over multiple years, with the more recent work on the detailed records on the grid system and targeted searches between sites. The recent survey effort in the majority of the areas was undertaken in summer and autumn 2023. The botanists undertaking the field surveys have had extensive experience working with the flora of the Jarrah forest. Any flora which could not be identified in the field was collected for subsequent identification. A potential constraint relates to the need to undertake targeted surveys in the spring months to enable coverage of the annual species.
Mapping reliability alley	**Not a constraint:** The vegetation was mainly assessed on a 120m x 120m grid pattern within the survey area. Over 120 kilometres were surveyed within the survey area. This together with 572 recording sites and the targeted and opportunistic survey sites (particularly near the granites and valley areas) enabled intensive coverage of the values on the Kingsbury West survey area and therefore the associated mapping of key flora values and the site-vegetation types with a high level of confidence.
Timing, weather, season, cycle	**Minor constraint:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). A minor constraint relates to the need to undertake targeted surveys in the spring months to enable coverage of the annual species.
Disturbances (fire flood, accidental human intervention, *etc.*)	**Not a constraint:** With the exception of previous logging activities and occasional old forestry tracks, the vegetation of the survey area is largely undisturbed. In view of the 40 years of experience by Dr Mattiske in northern Jarrah forest vegetation mapping the latter is not considered to lead to any constraints.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** Vehicle access through the Kingsbury West survey area was only restricted in small sections.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** All botanists had direct and recent experience working in the Jarrah Forest and working for Alcoa and a range of other clients, and thus were familiar with the local flora and vegetation values. Dr Mattiske has more than 40 years of ecological experience in flora and vegetation studies in the southwest forests at a detailed floristic level, as well as detailed and regional vegetation assessment level.



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Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a1992_F019_16

Date: June 2023 | Rev: A | A4

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Kingsbury West Survey Area

Survey Effort

Figure: **12**

5.2 Flora

The survey efforts were undertaken over several months and in view of the extensive work undertaken over multiple decades in the Kingsbury West area was considered to exceed the EPA (2016a and 2016b) guidance statements expectations.

A total of 287 taxa from 47 families and 119 genera was recorded in the Kingsbury West survey area and as such partly reflects the smaller survey area.

The range of flora collected on the Kingsbury West survey area is summarized in Table 5 and Appendix B. The recordings on the grids was undertaken over a 2 month period the coverage of the flora in more diverse and spatially more complex areas such as the broad valley systems and the outcrops was considered to be comprehensive.

Table 5: Summary of Flora Species on the Kingsbury West survey area (see Appendix B)

Source	Families	Genera	Native Taxa	Introduced Taxa
Myara/Huntly Regional Mapping	73	246	731	38
Kingsbury West survey area	46	115	236	5
Nature Map and Additional Potential and recorded Species (see Appendix B)	87	308	1099	84

5.3 Introduced Flora Species

Of the 236 species, 6 were introduced or planted species. The introduced species included two planted **Pinus pinaster* and the four weeds - *Asteraceae sp., **Pentameris airoides, *Hypochaeris glabra, *Leptospermum laevigatum.* All occur more widely in the Jarrah forest and are not listed as WONS weeds at the National scale or as Declared pests at the State level.

5.4 Threatened and Priority Flora

No Threatened flora species, pursuant to section 179 of the *EPBC Act* and as listed by DCCEW (2023a) or pursuant to Part 2, Division 1 and Subdivision 2 of the *BC Act* and as listed by DBCA (2022a) were recorded during recent assessments of the Kingsbury West survey area.

5.5 Site-vegetation Types

A total of 20 site-vegetation types were defined and mapped in the Kingsbury West survey area, Table 6 and Figure 13. The site-vegetation types were subdivided into four main groupings associated with site conditions which reflected landforms, soils and soil moisture levels, Table 6. The site-vegetation types on the extreme sites such as outcrops and broad valley systems, creeklines and swamps differ markedly from the forest and woodland areas on the slopes and ridges. The delineation of the site-vegetation types was based on the earlier work of Havel (1975a and 1975b) and as such rely on key site and species indicators. Whilst Mattiske has refined these initial site-vegetation types there is still a reliance on the original work of Havel (1975a and 1975b). The initial code is the dominant site-vegetation type code and the second

code (where added) reflects some local influence of secondary key stone species. These site-vegetation types were developed in consultation with Dr David Goodall (formerly CSIRO at the time). In the 1970's Dr Havel and Dr Goodall undertook extensive analyses to delineate and differentiate the key species and site parameters that assist in the division of the continuum of the dominant trees of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri). This approach has been used for some 45 years and as such to deviate from such an approach and rely on other approaches would negate the effort to date and the ability to align the findings with other areas in the northern Jarrah forest. So whilst such an approach might be perceived by assessors to deviate from the EPA guidance statements, to not adopt the site-vegetation approach would diminish the delineation of the biodiversity values in the Kingsbury West survey area. In addition the ranking of species and condition of species in the field has increased the intensity and coverage of the sites within the Kingsbury West survey area.

The dominant site-vegetation types were S and PS (50.948%) on the slopes ad ridges and D and PW on the moister slopes (21.04%). The more extreme sites associated with swamps (types A, AC, AW and CW) or granite outcrops (types G (including variant G1) and R) covered less than 6.99% and 2.31% of the area respectively, Table 6.

The series of site-vegetation types associated with the broader valley systems which dominate the Yarragil 1 vegetation complex as defined by Mattiske and Havel (1998) provide a spatial diversity that supports a range of species. The site-vegetation types associated with these broader valleys (A, AC, AW, CW, D, DA, DG, E, W, PW and SW) and lower slopes have the potential to be groundwater dependent ecosystems.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Hypocalymma angustifolium, Hypocalymma cordifolium, Melaleuca preissiana* and *Taxandria linearifolia.*

The site-vegetation types of PW and SW reflect the moister soils that may influence the spread and intensification of *Phytophthora cinnamomi.* The site-vegetation types supporting stands of *Kingia australis* (E) are locally restricted in extent and this pattern of occurrence generally occurs in the northern Jarrah forest on the lower slopes.

Whilst some of these values have been highlighted, the only current Priority Ecological Community is associated with the G (and variant G1) and R site-vegetation types. There is a lack of clarity on the values that determine the presence of the Priority Ecological Community other than the association with the outcrops.

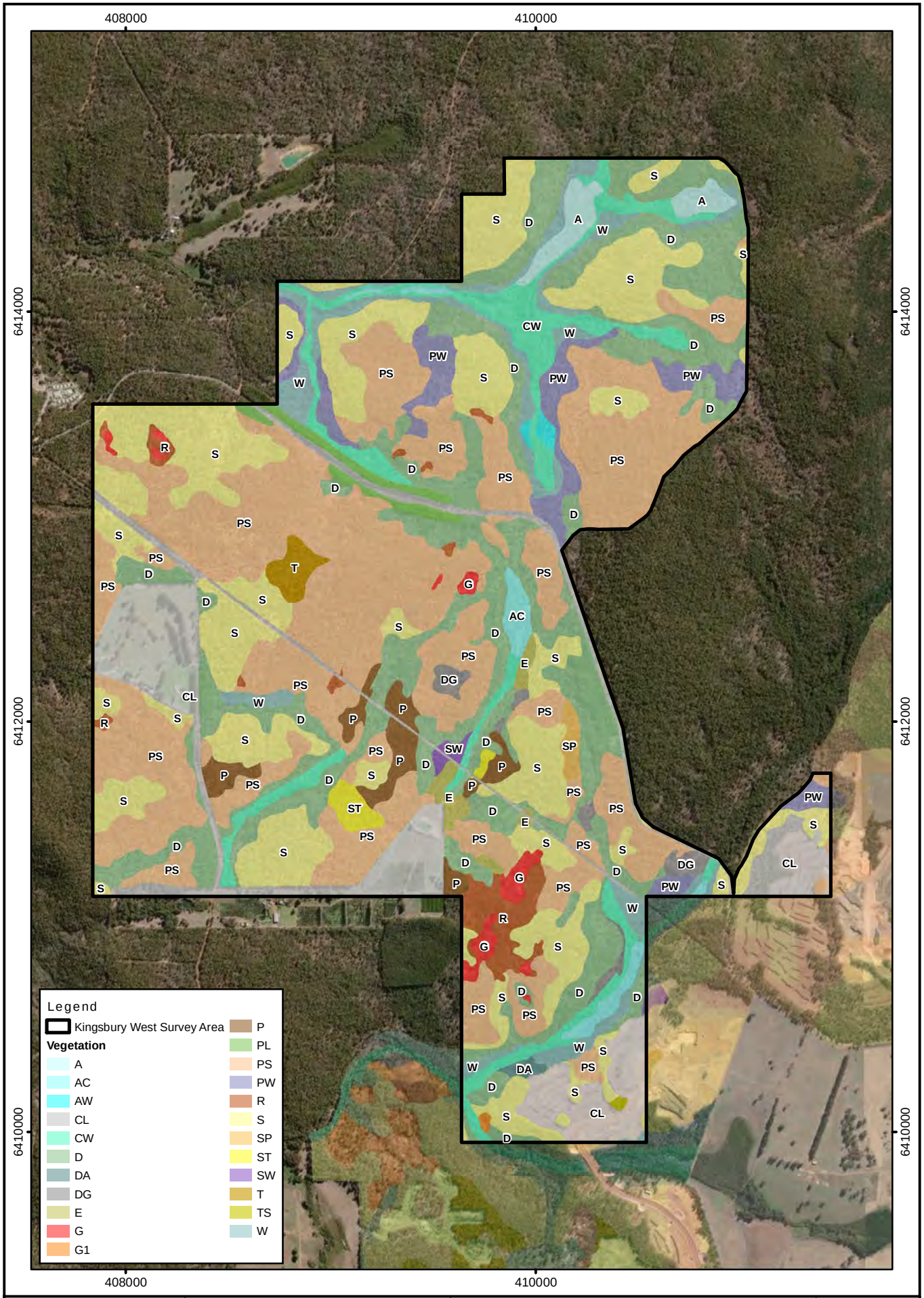
5.6. Vegetation Condition

The majority of the vegetation was ranked as very good to excellent despite historical harvesting activities and some established tracks in the area, Figure 14.

The condition of the vegetation has been impacted by cleared properties (outside State Forest), dieback and tracks. The vast majority of the area is excellent in condition, but in impacted areas it is either very good, degraded or completely degraded.

Table 6: Summary of Site-vegetation Types (SVT) on Kingsbury West the survey area

SVT Code	Description	Area Ha	% Total
Swamps (A, AC, AW) and Creeklines (CW)			
A	Tall shrubland of *Melaleuca lateritia, Hakea varia, Melaleuca viminea* and *Melaleuca incana* subsp. *incana* on clay-loams in seasonally wet valley floors.	10.05	1.02
AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	9.24	0.94
AW	Low open woodland of *Eucalyptus patens* and *Melaleuca preissiana* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	1.57	0.16
CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	47.84	4.87
Lower Slopes (D, DA, DG, E, W) and Moister Slopes (PW and SW)			
D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae* and *Acacia extensa* on clay loams to gravelly clay-loams.	176.52	17.96
DA	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Hakea prostrata* on lower slopes with patches of *Melaleuca preissiana, Banksia littoralis* and *Hakea varia* over mixed low understorey species, including *Babingtonia camphorosmae* and *Acacia extensa* on clay loams to gravelly clay-loams. Local variant also includes *Xylomelum occidetale (*Woody Pear).	1.39	0.14
DG	Open forest of *Corymbia calophylla* and *Eucalyptus marginata* over *Hakea lissocarpha, Macrozamia riedlei, Pericalymma ellipticum, Grevillea bipinnatifida, Allocasuarina humilis, Acacia alata, Babingtonia camphorosmae, Hypocalymma angustifolium* and *Phyllanthus calycinus* on clay-loams on lower slopes with localized patches of outcropping.	7.06	0.72
E	Open woodland of *Eucalyptus marginata* and *Corymbia calophylla* over *Mesomelaena tetragona, Kingia australis, Leptospermum erubescens* and *Babingtonia camphorosmae* on sandy to sandy-loam soils on slopes.	5.85	0.60
W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Acacia extensa* and *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	36.24	3.69
PW	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels.	30.25	3.08
SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	1.77	0.18
Outcrop Areas (G, R)			
G/G1	Mosaic of Open Woodland of *Eucalyptus margnata – Corymbia calophylla* on the fringes of outcrops ranging to open heath communities of Proteaceae-Myrtaceae species and lithic complexes on the outcrop areas.	7.98	0.81
R	Open Woodland of *Eucalyptus marginata - Corymbia calophylla* on fringes of granite outcrops or shallow soils over mixed understorey species reflecting shallow soils over granite.	14.74	1.50
Slopes and Upper Ridges (P, PS, S, SP, ST, TS, T)			
P	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Styphelia nitens, Grevillea wilsonii, Leucopogon capitellatus* on sandy gravels.	16.50	1.68
PS	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	300.45	30.57
S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy-gravels.	200.18	20.37
SP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	2.83	0.29
ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus, Leucopogon verticillatus, Pteridium esculentum, Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	4.74	0.48
TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	0.40	0.04
T	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly soils.	5.06	0.52
Disturbed areas			
CL	Cleared	93.70	9.54
PL	Plantation7	8.36	0.85



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Scale: 1:25,000
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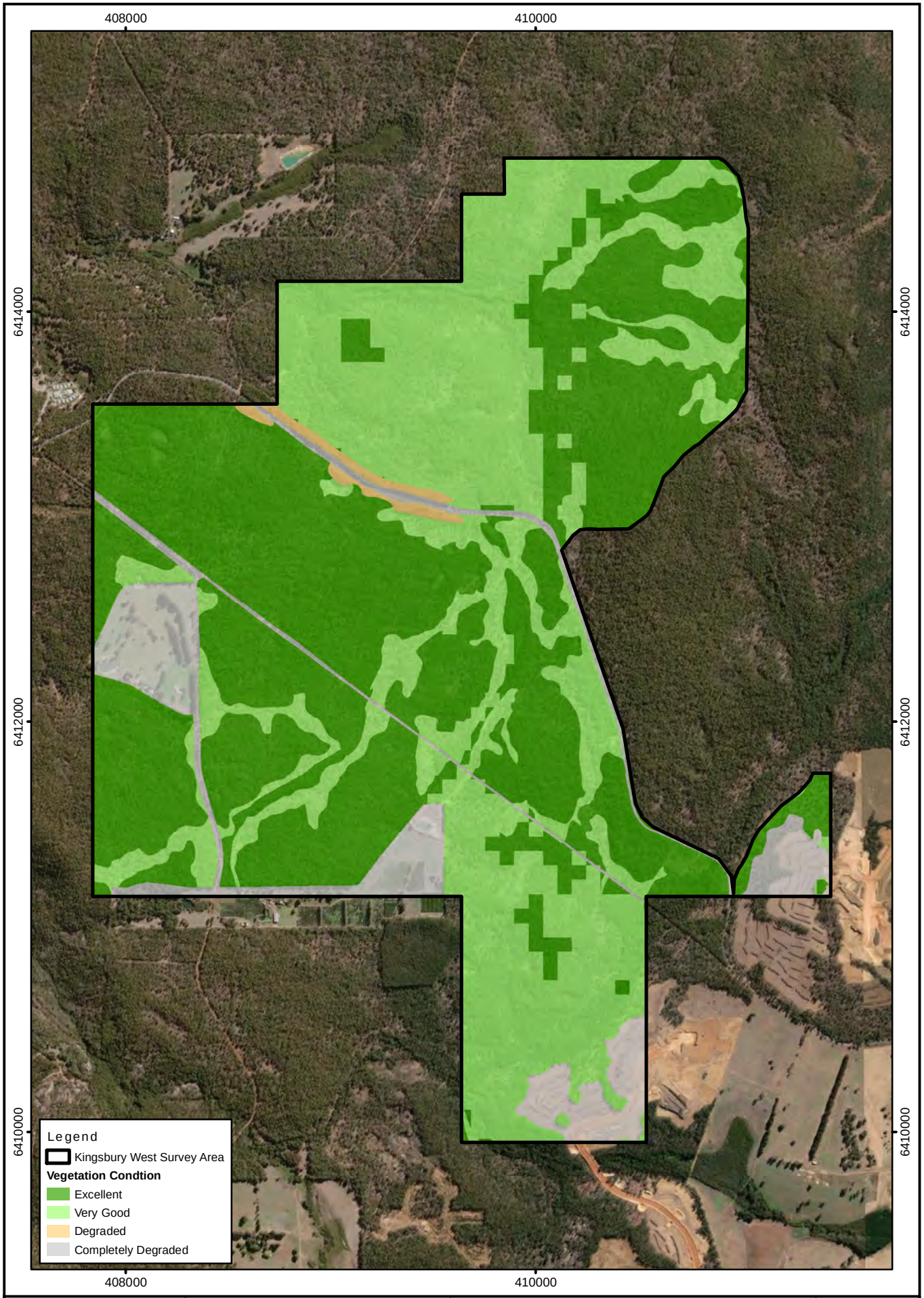
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Date: May 2023 | Rev: A | A4

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Kingsbury West Survey Area
Site-Vegetation Types

Figure:
13



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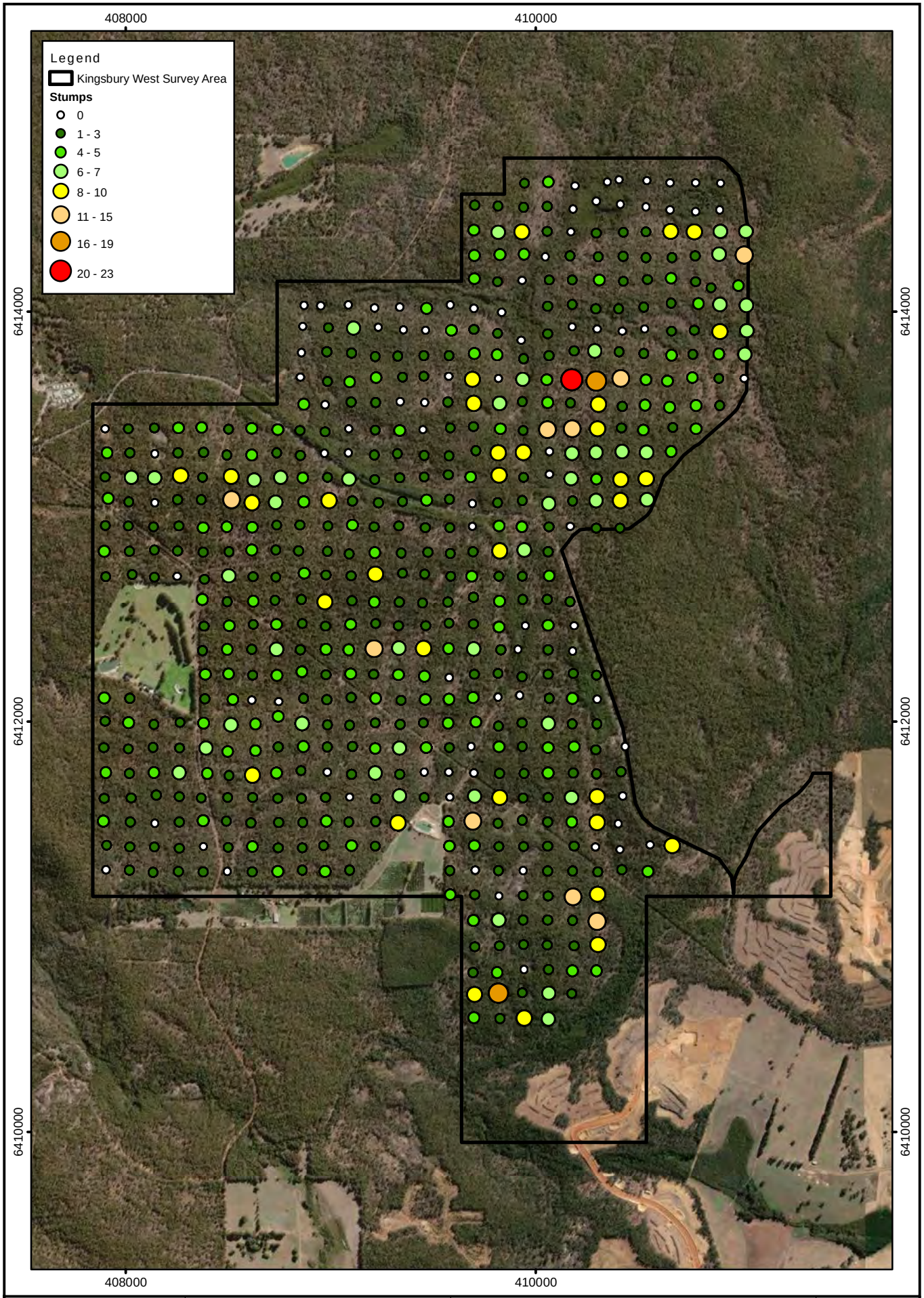
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Kingsbury West Survey Area
Vegetation Condition

Figure:
14



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0 200 400 m

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Kingsbury West Survey Area
Number of Stumps recorded

Figure:
15

5.7. Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) occur in the Kingsbury West survey area. The desktop assessment highlighted several potential TECs; however these are restricted to the Swan Coastal Plain and as such do not extend into the Jarrah forest area on the Darling Ranges.

One of the priority ecological communities (PECs), as listed at State level by DBCA (2020a) occurs near the Kingsbury West survey area, namely:

- Granite communities of the northern Jarrah forest (P3)

There is a potential that the site-vegetation types associated with granite outcrops (site-vegetation types G (including variant G1) and R) will have affinities with the PEC.

The Kingsbury West survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023b) and as such was considered during the RFA process.

5.8. Old Growth Forests

There are a number of patches of old growth forests occurring in the area surrounding the Kingsbury West survey area; however based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Kingsbury West survey area (Figure 9). Not the number of stumps is primarily related to the site-vegetation types with lower numbers on the creeklines and swamps and higher numbers on the uplands or slopes of the valleys (see above, Figure 15).

5.9 Potential Habitat Trees

On the basis of the number of potential habitat trees (>50cm in diameter) there are some areas of Kingsbury West that have numbers above 4 in localised areas, although the majority have 0-2 larger trees) (Figures 16 and 17).

In reviewing the data as collected within the Kingsbury West survey area it is apparent that the swamp and creekline areas (A, AC, CW and DA) supported few larger trees and the site-vegetation types (P, PW, S, SP and W) supported proportionally higher number of larger potential habitat trees (Diameter at Breast Height (DBH) > 50cm) (Note: the results were in part influenced by the number of sites), Figure 16.

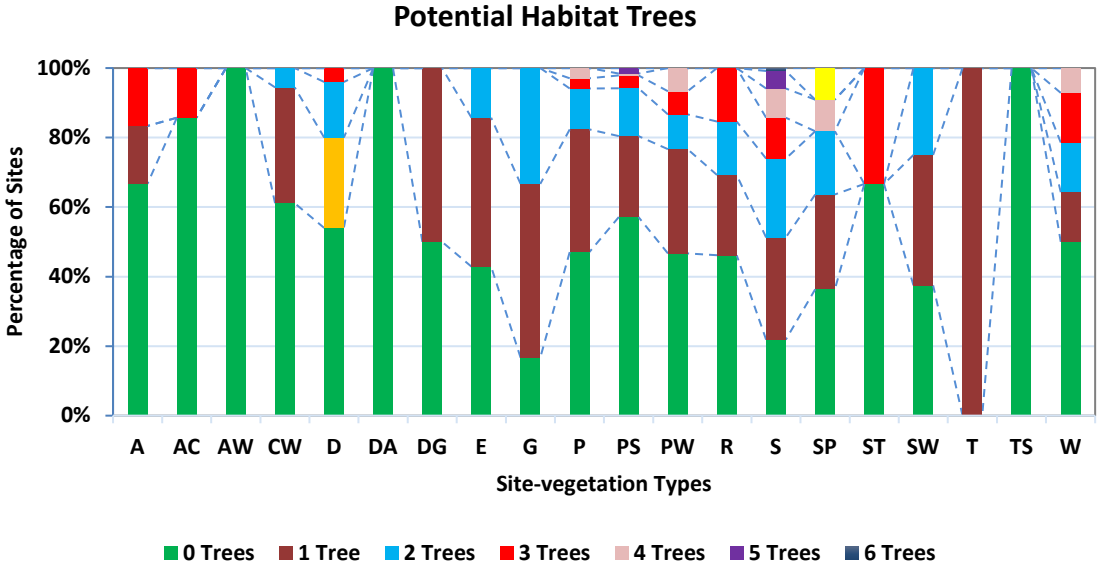
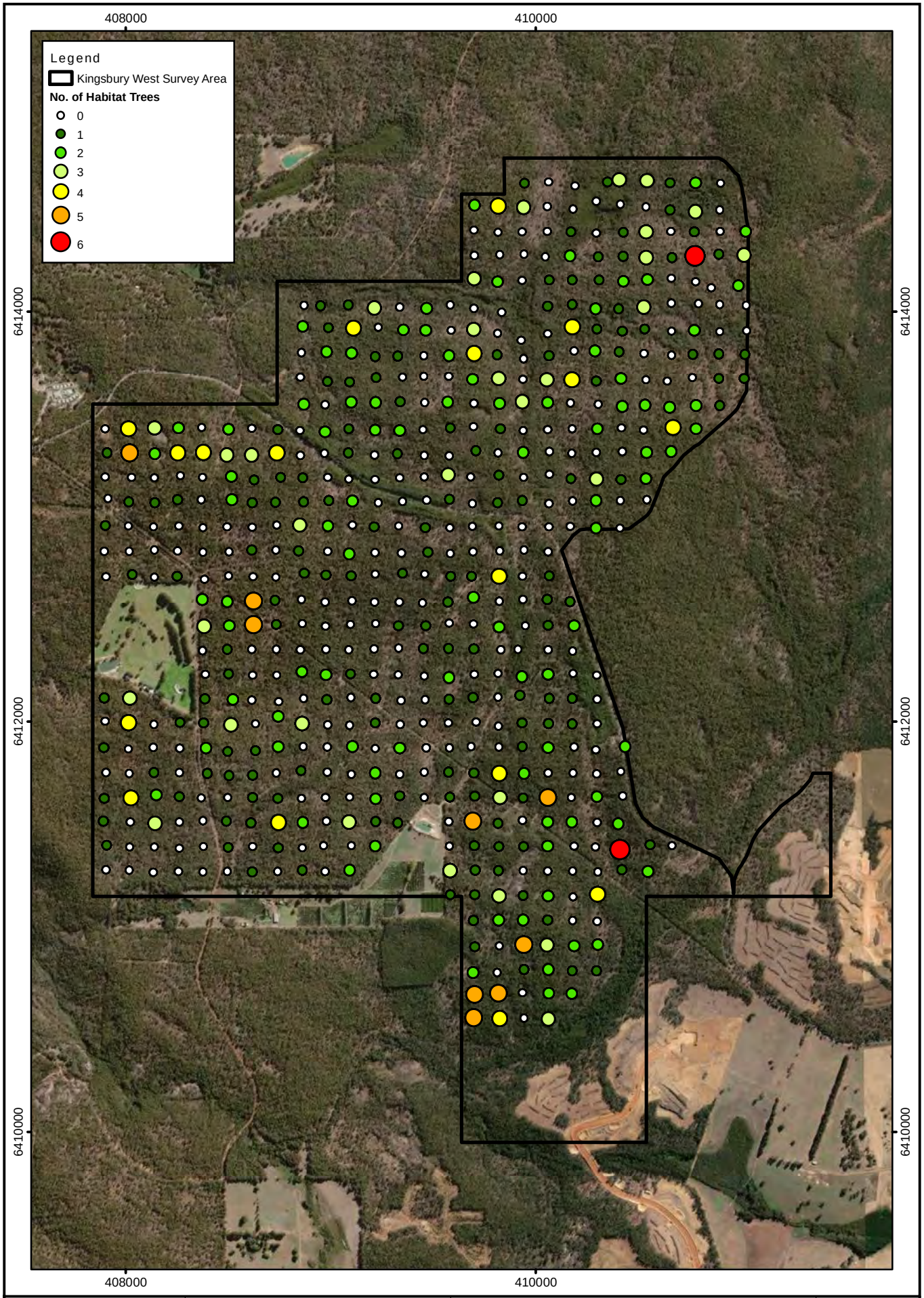


Figure 16: Summary of Number of Potential Habitat Trees (>50cm DBH) in the respective Site-vegetation Types on Kingsbury West survey area



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Scale: 1:25,000
MGA94 (Zone 50)

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Kingsbury West Survey Area
Potential Habitat Trees

Figure:
17

6. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

6.1. Flora

The survey efforts were undertaken over several months and in view of the extensive work undertaken over multiple decades in the Jarrahdale and Huntly areas it was considered to exceed the EPA (2016a and 2016b) guidance statements expectations; although targeted searches of the more extreme gullies and outcrop areas is recommended in the spring months of 2023.

No Threatened or Priority flora species were recorded in the Kingsbury West survey area.

A total of 236 taxa from 47 families and 117 genera was recorded in the Kingsbury West survey area and as such partly reflects the smaller survey area.

Of the 236 species, 6 were introduced or planted species. The introduced species included two planted **Pinus pinaster* and the four weeds - *Asteraceae sp., **Pentameris airoides, *Hypochaeris glabra, *Leptospermum laevigatum.* All occur more widely in the Jarrah forest and are not listed as WONS weeds at the National scale or as Declared pests at the State level.

6.2. Vegetation

The vegetation in and around the Kingsbury West survey area has been described by several authors with slightly different perspectives, including botanical subdistricts, soil-landscape zones, land systems and vegetation communities. In general, the vegetation can be summarised as being dry sclerophyllous forest typically comprising a dominant *Eucalyptus marginata* and *Corymbia calophylla* over *Allocasuarina fraseriana*, *Banksia grandis*, *Xanthorrhoea preissii*, and *Macrozamia riedlei*. The topography throughout the survey area consists of granite ridges, swamps and slopes; a variety of habitats contributing to the high level of species diversity.

A total of 20 site-vegetation types were defined and mapped in the Kingsbury West survey area. The site-vegetation types were subdivided into four main groupings associated with site conditions which reflected landforms, soils and soil moisture levels, Table 6. The site-vegetation types on the extreme sites such as outcrops and broad valley systems, creeklines and swamps differ markedly from the forest and woodland areas on the slopes and ridges. The delineation of the site-vegetation types was based on the earlier work of Havel (1975a and 1975b) and as such rely on key site and species indicators. Whilst Mattiske has refined these initial site-vegetation types there is still a reliance on the original work of Havel (1975a and 1975b). The initial code is the dominant site-vegetation type code and the second code (where added) reflects some local influence of secondary key stone species. These site-vegetation types were developed in consultation with Dr David Goodall (formerly CSIRO at the time). In the 1970's Dr Havel and Dr Goodall undertook extensive analyses to delineate and differentiate the key species and site parameters that assist in the division of the continuum of the dominant trees of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri). This approach has been used for some 45 years and as such to deviate from such an approach and rely on other approaches would negate the effort to date and the ability to align the findings with other areas in the northern Jarrah forest. So whilst such an approach might be perceived by assessors to deviate from the EPA guidance statements, to not adopt the site-vegetation approach would diminish the delineation of the biodiversity values in the Kingsbury West survey area. In addition the ranking of species and condition of species in the field has increased the intensity and coverage of the sites within the Kingsbury West survey area.

The dominant site-vegetation types were S and PS (50.948%) on the slopes ad ridges and D and PW on the moister slopes (21.04%). The more extreme sites associated with swamps (types A, AC, AW and CW) or granite outcrops (types G (including variant G1) and R) covered less than 6.99% and 2.31% of the area respectively, Table 6.

The series of site-vegetation types associated with the broader valley systems which dominate the Yarragil 1 vegetation complex as defined by Mattiske and Havel (1998) provide a spatial diversity that supports a

range of species. The site-vegetation types associated with these broader valleys (A, AC, AW, CW, D, DA, DG, E, W, PW and SW) and lower slopes have the potential to be groundwater dependent ecosystems.

The site-vegetation types of PW and SW reflect the moister soils that may influence the spread and intensification of *Phytophthora cinnamomi.* The site-vegetation types supporting stands of *Kingia australis* (E) are locally restricted in extent and this pattern of occurrence generally occurs in the northern Jarrah forest on the lower slopes.

The majority of the vegetation was ranked as excellent despite historical harvesting activities in the westerns section and local influences of tracks. The biodiversity values have persisted in many areas instances. Some areas have been influence by the Jarrah Dieback disease and although the composition of the understorey has been modified as a result of the *Phytophthora cinnanomi* infections these areas still provide a range of native species towards the forest values.

6.3. Potential Groundwater Dependent Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the vegetation complexes. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils on the swamps and lower slopes of the valley systems. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

6.4. Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) occur in the Kingsbury West survey area. The desktop assessment highlighted several potential TECs; however these are restricted to the Swan Coastal Plain and as such do not extend into the Jarrah forest area on the Darling Ranges.

One of the priority ecological communities (PECs), with botanical values as listed at State level by DBCA (2022b) occurs north-east of Kingsbury West,, namely the Granite communities of the northern Jarrah forest (P3). There is a potential that the site-vegetation types associated with granite outcrops (site-vegetation types G (including local variant G1) and R).

The Kingsbury West survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023b) and as such was considered during the RFA process.

6.5. Other Key Values

There are a number of patches of old growth forests occurring in the area surrounding the Kingsbury West survey area; however based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Kingsbury West survey area. The number of stumps is primarily related to the site-vegetation types with lower numbers on the creeklines and swamps and higher numbers on the uplands or slopes of the valleys.

On the basis of the number of potential habitat trees (>50cm in diameter) there are some areas of Kingsbury West that have numbers above 4 in localised areas, although the majority have lower number of larger trees (as recorded within the recording sites on the grid system.

In reviewing the data as collected within the Kingsbury West survey area it is apparent that the swamp and creekline areas (A, AC, CW and DA) supported few larger trees and the site-vegetation types (P, PW, S, SP and W) supported proportionally higher number of larger potential habitat trees (Diameter at Breast Height (DBH) > 50cm).

7. ACKNOWLEDGEMENTS

The authors would like to thank Alcoa of Australia Ltd for their assistance with this project.

8. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

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A. Pereira	Experienced Botanist	Field Studies	FB62000145-4
D. Rubick	Botanist	Field Studies	FB62000328-3
A. Rowe	Botanist	Data Collation	FB62000329-3
Z. Gates	Botanist	Field Studies	FB62000426-2
M. Pollock	Botanist	Field Studies	FB62000524
K. Tribbeck	Botanist	Field Studies, Data collation	FB62000467
J. Wescombe	Botanist	Data collation, reporting	N/A
R. Jones	Botanist	Data collation and Assisting with Reporting	N/A
T. Gregory	Technical Support	Data Collation and Assisting with Reporting	N/A

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions [DBCA] (2018a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act (DBCA 2019). Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from DBCA (2019).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (DBCA 2019). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from DBCA (2019).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (28 June 2018)* (under Part 2, Division 2, Subdivision 1 of the BC Act; DBCA 2018b). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the DBCA (and former equivalent departments) have been identifying and informally listing TECs since 1994. Some of these TECs are also endorsed by the Federal Minister as threatened, and some of these are listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2020a) in the *Priority Ecological Communities for Western Australia – Version 29 (05 May 2020)*. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2020).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- 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; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: VEGETATION CONDITION SCALE (adapted from Keighery 1994 and Trudgen 1988 and as summarized in EPA Guidance Statement 2016b and modified to adjust to "forest" areas)

Vegetation Condition	EPA Definition (2016b) - South West and Interzone Botanical Provinces	Comments reflecting condition ratings for "Forest" areas (including diversity of structural and floristic composition areas)	Clearing Agriculture Residential	Post-Mining & Rehabilitation	Tracks & Roads	Logging Harvest Records, Stumps	Dieback	Introduced Flora Species
Pristine	Pristine or nearly so, no obvious signs of disturbances caused by human activities since European settlement.	Very restricted areas as most areas been subject to some disturbance.	None	None	None	No Logging (old growth forest)	None obvious, limited / no vulnerable species	Limited / no presence
Excellent	Vegetation Structure intact, disturbance affecting individual species and weeds are non-aggressive. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional tracks.	Very little evidence of logging in past. Occasional tracks, past burning, no obvious dieback, presence of short-lived non-aggressive weed.	None	None	Occasional tracks	Predominantly mature forest (last harvest > 70 years ago)	None obvious, limited / no vulnerable species	Non aggressive weeds
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.	Some modification to structural components through past logging activities, repeated fires. Grazing only by native animals in forests. No obvious dieback, presence of short-lived non-aggressive weed.	None	None	Occasional tracks	Immature forest (last harvest > 20, < 70 years ago)	Limited dieback infestation on localised areas, limited vulnerable species	Non-aggressive weeds
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 frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	Some modification to structural and floristic components through past mining and logging activities. Occurrence of repeated fires that have impacted vegetation. Grazing mainly by native animals in forests and occasional feral animal (e.g. pigs).	Localised partial clearing near past logging activities and tracks and previous facilities	Rehabilitation areas with structural and/or floristic components developing and persisting (post 2000, Grant and Koch 2007)	Occasional tracks and informal roads	Juvenile forest (last harvest < 20 years ago)	Extensive dieback infestation, prevalent vulnerable species, some structural impact	Aggressive weeds and non-aggressive weeds reflecting disturbance
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.	Basic vegetation structure severely impacted by disturbance. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Partial clearing near past logging activities and tracks and previous facilities	Rehabilitation areas with lower species diversity (pre 2000, Grant and Koch 2007) and/or early phases of regrowth and establishment of tree species with potential for shift to Good	Extensive tracks, informal roads	Logged land is expected to recover to Good (juvenile forest)	Extensive dieback infestation, dominant vulnerable species, severe structure impact	High density of aggressive weeds or presence of introduced crop species or plantation species
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 crops species with isolated native trees and shrubs.	Mostly cleared areas supporting only occasional native trees or planted trees, mainly small agricultural holdings or residential and highly modified areas.	Cleared agricultural and residential areas.	Recently cleared mine areas, rehabilitation not completed.	Extensive tracks and roads	Logged land is expected to recover to Good if rehabilitation undertaken	Extensive dieback infestation, dominant vulnerable species, structure no longer intact.	Plantations, understorey is predominantly introduced species.

APPENDIX B: SUMMARY OF POTENTIAL AND RECORDED PLANT SPECIES RECORDED IN KINGSBURY WEST AND NEARBY FORESTED AREAS

Note : * denotes alien species; PL denotes planted species. T, P1 to P4 reflect Threatened and Priority species (DBCA 2019).

SCC = State Conservation Code; FCC= Federal Conservation Code; CE = Critically Endangered; E = Endangered;

V= Vulnerable. Treatened & Priority[A] (DBCA, 2023), EPBC[B] (DCCEEW, 2023), Dandjoo[C] (DBCA, 2023), MCPL[D] (MCPL, 2020), MCPL[E] (MCPL, 2021), O'Neill[F] (MCPL, 2009), MCPL [G] (2022)

Search includes all potential species within the noted buffer, individual species have not been assessed for likelihood of occurance in this list.

Family	Species	Data source																
		SCC	FCC	T&P[A] 10km	EPBC[B] 10km	Dandjoo[C] 10km	MCPL[D] 2006	MCPL[D] 2011	MCPL[D] 2019	MCPL[E] 2008	MCPL[E] 2009	MCPL[E] 2010	MCPL[E] 2012	O'Neill[F] 2009	Mapping Myara North[E] 2019/20	Plots Myara North[E] 2019/20	MCPL[G] 2022	MCPL[H] 2023
Amaranthaceae	*Ptilotus drummondii*												x		x			
	Ptilotus drummondii var. *drummondii*																x	
	Ptilotus esquamatus					x												
	Ptilotus manglesii					x	x	x		x	x		x	x	x	x	x	
	Ptilotus sp.						x						x	x				
Anarthriaceae	*Lyginia barbata*						x	x		x	x	x	x	x	x		x	x
	Lyginia imberbis														x			
	Lyginia sp.							x										
	Anarthriaceae sp.																x	
Apiaceae	*Actinotus leucocephalus*					x												
	Apium prostratum							x			x		x					
	Centella asiatica														x			
	Daucus glochidiatus					x	x			x					x			
	Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	P3		x														
	Homalosciadium homalocarpum					x	x											
	Pentapeltis peltigera					x	x	x	x	x	x	x	x	x	x	x	x	x
	Platysace compressa							x	x	x	x		x	x	x	x	x	
	Platysace filiformis					x		x	x	x	x	x	x	x			x	x
	Platysace juncea					x												
	Platysace tenuissima							x	x	x	x	x	x	x	x		x	x
	Platysace sp.									x								
	Schoenolaena juncea					x												
	Xanthosia atkinsoniana						x	x	x	x	x	x	x	x	x	x	x	x
	Xanthosia candida					x	x	x	x	x	x	x	x	x	x	x	x	x
	Xanthosia ciliata					x									x		x	
	Xanthosia fruticulosa					x				x								
	Xanthosia huegelii					x	x	x	x	x	x	x	x	x	x	x	x	x

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Apiaceae (continued)	*Xanthosia singuliflora*							x		x			x	x	x			x
	Xanthosia tasmanica						x			x			x		x			
	Xanthosia sp.						x								x		x	
	Apiaceae sp.							x			x							
Apocynaceae	* *Gomphocarpus fruticosus*														x			
	Parsonsia diaphanophleba	P4		x														
Aponogetonceae	*Aponogeton hexatepalus*	P4		x														
Araliaceae	*Hydrocotyle alata*					x												
	Hydrocotyle callicarpa					x	x								x			
	Hydrocotyle diantha						x											
	Trachymene pilosa					x	x	x		x	x		x	x	x	x	x	x
Asparagaceae	*Dichopogon capillipes*					x	x								x			
	Dichopogon preissii								x									
	Laxmannia grandiflora								x									
	Laxmannia sessiliflora														x			
	Laxmannia sessiliflora subsp. *australis*														x			
	Laxmannia squarrosa					x	x	x		x	x		x	x	x		x	
	Laxmannia sp.													x	x		x	
	Lomandra brittanii					x	x	x		x	x	x	x		x	x		
	Lomandra caespitosa					x	x	x		x	x	x	x	x	x	x	x	x
	Lomandra drummondii							x	x	x	x	x	x	x	x	x		
	Lomandra effusa														x			
	Lomandra hermaphrodita					x	x	x	x	x	x	x	x	x	x	x	x	x
	Lomandra integra							x		x	x			x	x	x	x	
	Lomandra micrantha					x		x	x	x	x	x		x	x	x	x	
	Lomandra micrantha subsp. *micrantha*						x	x		x	x		x	x	x			

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Asparagaceae (continued)	*Lomandra nigricans*					x	x	x		x			x	x	x	x	x	x
	Lomandra odora					x	x			x				x	x	x		
	Lomandra pauciflora							x				x						
	Lomandra preissii					x	x	x	x	x	x		x	x	x	x	x	x
	Lomandra purpurea							x	x	x	x		x	x	x	x		x
	Lomandra sericea							x	x	x	x	x	x	x	x		x	x
	Lomandra sonderi						x	x	x	x	x	x	x	x	x	x	x	x
	Lomandra spartea					x	x	x	x	x	x	x	x	x	x	x	x	x
	Lomandra suaveolens						x								x			
	Lomandra sp.						x	x	x	x	x	x	x	x	x		x	x
	Sowerbaea laxiflora					x	x								x			x
	Thysanotus anceps	P3		x														
	Thysanotus arbuscula													x				
	Thysanotus dichotomus					x	x	x	x	x	x	x	x		x	x	x	x
	Thysanotus fastigiatus					x		x	x	x	x	x	x	x	x		x	x
	Thysanotus manglesianus					x	x	x		x	x		x	x	x			
	Thysanotus multiflorus					x	x	x	x	x	x	x	x		x	x	x	x
	Thysanotus patersonii														x	x		
	Thysanotus scaber														x			
	Thysanotus sparteus							x				x	x			x		x
	Thysanotus tenellus					x	x	x		x	x							
	Thysanotus thyrsoideus					x	x	x		x	x				x	x	x	
	Thysanotus triandrus									x			x					
	Thysanotus sp.						x	x		x	x	x	x		x			
	Asparagaceae sp.						x								x			
Asphodelaceae	*Bulbine semibarbata*					x												
Asteraceae	* *Arctotheca calendula*							x			x							
	Brachyscome iberidifolia						x	x				x						

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Asteraceae (continued)	*Cotula australis*					x												
	* *Cotula coronopifolia*					x												
	* *Cotula turbinata*									x								
	Craspedia variabilis					x	x	x		x	x		x	x	x			
	* *Dittrichia graveolens*								x									
	* *Erigeron sumatrensis*															x		
	* *Erigeron* sp.								x						x			
	Euchiton sphaericus					x										x		
	Gnephosis tenuissima						x											
	Hyalosperma cotula					x	x	x		x	x	x	x	x	x		x	
	Hyalosperma demissum					x	x											
	* *Hypochaeris glabra*					x	x	x		x	x	x	x		x	x		x
	* *Hypochaeris radicata*									x			x					
	* *Hypochaeris* sp.												x					
	Lagenophora huegelii					x	x	x		x	x	x	x	x	x	x	x	x
	Lagenophora platysperma					x												
	* *Logfia gallica*					x												
	Millotia tenuifolia														x	x		
	Millotia tenuifolia var. *tenuifolia*					x	x			x								
	Olearia paucidentata						x			x				x	x			x
	Panaetia lessonii							x				x			x			
	Podolepis gracilis						x	x		x	x	x						
	Podolepis sp.						x								x			
	Podotheca angustifolia					x	x								x			
	Podotheca gnaphalioides							x			x				x			
	Podotheca sp.														x			
	# *Pseudognaphalium luteoalbum*						x	x		x					x	x		
	Pterochaeta paniculata					x	x	x	x	x	x	x	x	x	x		x	x
	Pterochaeta sp.									x								
	Quinetia urvillei					x									x			

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Asteraceae	*Rhodanthe citrina*					x	x	x		x	x							
(continued)	* *Senecio diaschides*					x	x	x	x	x	x		x	x	x	x	x	
	Senecio hispidulus						x	x		x	x	x	x	x	x	x		x
	Senecio leucoglossus	P4		x				x	x	x	x	x	x			x	x	
	Senecio pinnatifolius						x	x			x							
	Senecio quadridentatus					x	x	x	x	x	x	x	x	x	x	x	x	
	* *Senecio vulgaris*							x		x	x	x	x	x				
	Senecio sp.						x	x	x	x	x	x	x	x	x		x	
	Siloxerus filifolius						x											
	Siloxerus humifusus					x	x	x		x	x	x			x			
	Siloxerus multiflorus														x			
	* *Sonchus oleraceus*					x	x	x				x				x		
	* *Tolpis barbata*													x				
	* *Ursinia anthemoides*					x		x		x	x				x			
	* *Vellereophyton dealbatum*					x	x											
	Trichocline spathulata						x	x	x	x	x	x	x	x	x	x	x	x
	Waitzia suaveolens var. *suaveolens*						x					x	x					
	Waitzia sp.							x										
	Xerochrysum macranthum					x												
	* Asteraceae sp.						x	x	x		x	x		x	x		x	x
Boraginaceae	*Halgania corymbosa*	P3		x														
Boryaceae	*Borya scirpoidea*												x					
	Borya sphaerocephala					x	x		x	x			x	x	x		x	x
Brassicaceae	* *Brassica tournefortii*							x			x							
Campanulaceae	*Isotoma hypocrateriformis*					x	x	x		x	x		x		x	x	x	
	Lobelia anceps					x												

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Campanulaceae (continued)	*Lobelia gibbosa*					x		x				x	x					x
	Lobelia heterophylla							x			x							
	Lobelia rarifolia					x												
	Lobelia rhombifolia					x		x		x	x							
	Lobelia tenuior						x											
	Lobelia sp.								x									
	* *Monopsis debilis* var. *depressa*					x												
	Wahlenbergia preissii					x								x		x		
	Wahlenbergia sp.						x											
Casuarinaceae	*Allocasuarina fraseriana*							x	x	x	x	x	x	x	x	x	x	x
	Allocasuarina huegeliana					x							x					
	Allocasuarina humilis						x	x	x	x	x	x	x	x	x		x	x
	Allocasuarina microstachya														x			
	Allocasuarina sp.								x				x					
Celastraceae	*Stackhousia monogyna*					x		x		x	x		x	x	x	x	x	
	Stackhousia pubescens					x												
	Stackhousia sp. Red-blotched corolla (A. Markey 911)	P3		x														
	Stackhousia sp.						x											
	Tripterococcus brunonis					x	x	x		x	x		x	x	x	x	x	x
Centrolepidaceae	*Aphelia cyperoides*					x	x									x		
	Centrolepis aristata						x								x	x		
	Centrolepis drummondiana					x												
	Centrolepis pilosa						x											
	Centrolepis sp.						x		x									
Colchicaceae	*Burchardia congesta*					x	x	x	x	x	x		x	x	x	x		x
	Burchardia multiflora					x									x			

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Colchicaceae (continued)	*Burchardia* sp.														x			
	Wurmbea dioica														x			
	Wurmbea dioica subsp. *alba*					x	x											
	Wurmbea sp.						x								x			
Crassulaceae	*Crassula closiana*					x												
Cupressaceae	*Callitris pyramidalis*														x			
Cyatheaceae	* *Sphaeropteris cooperi*									x								
Cyperaceae	*Caustis dioica*														x	x		
	Chorizandra enodis						x								x			
	Cyathochaeta avenacea					x	x	x	x	x	x	x	x	x	x	x	x	x
	Cyathochaeta teretifolia	P3		x						x								
	* *Cyperus tenellus*					x												
	Eleocharis keigheryi	T	V		x													
	Gahnia aristata								x					x	x			
	Gahnia decomposita					x	x	x	x	x	x	x	x	x	x	x	x	x
	Gahnia trifida						x	x		x								
	Isolepis cernua														x			
	Isolepis cernua var. *setiformis*						x											
	Isolepis cyperoides					x												
	* *Isolepis marginata*					x	x	x			x				x	x		
	Isolepis sp.					x	x											
	Lepidosperma asperatum														x			
	Lepidosperma costale												x					
	Lepidosperma drummondii									x				x				
	Lepidosperma effusum												x					
	Lepidosperma gracile							x			x	x	x		x			x

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Cyperaceae (continued)	*Lepidosperma leptostachyum*					x		x		x	x	x	x	x	x			
	Lepidosperma longitudinale					x	x								x	x		
	Lepidosperma pubisquameum					x	x	x		x	x		x	x	x	x		x
	Lepidosperma pubisquameum sens. lat.								x									
	Lepidosperma squamatum					x	x	x	x	x	x	x	x	x	x	x	x	x
	Lepidosperma striatum					x				x				x				
	Lepidosperma tenue						x	x	x	x	x	x	x	x	x	x	x	x
	Lepidosperma tetraquetrum					x	x	x	x	x	x	x	x	x	x		x	x
	Lepidosperma tuberculatum					x			x	x			x	x				
	Lepidosperma sp.														x	x	x	x
	Machaerina articulata												x					
	Machaerina juncea						x											
	Machaerina vaginalis							x			x				x			
	Mesomelaena graciliceps					x				x				x	x	x		
	Mesomelaena stygia															x		
	Mesomelaena tetragona					x	x	x	x	x	x		x	x	x	x	x	x
	Morelotia australiensis	T	V	x	x													
	Morelotia octandra					x	x	x	x	x	x	x	x	x	x	x	x	x
	Netrostylis sp. Jarrah Forest (R. Davis 7391)					x	x	x	x	x	x	x	x	x	x	x	x	x
	Schoenus armeria					x												
	Schoenus bifidus						x											
	Schoenus clandestinus						x			x				x	x			
	Schoenus discifer														x			
	Schoenus grammatophyllus					x												
	Schoenus laevigatus					x												
	Schoenus nanus					x	x											
	Schoenus odontocarpus					x	x											
	Schoenus subfascicularis						x							x				
	Schoenus unispiculatus					x	x											

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Cyperaceae	*Schoenus* sp.						x	x				x		x	x			
(continued)	Cyperaceae sp.						x							x	x			x
Dasypogonaceae	*Calectasia grandiflora*	P2		x														
	Dasypogon bromeliifolius							x			x				x			
	Kingia australis								x	x			x	x	x		x	x
Dennstaedtiaceae	*Pteridium esculentum*						x	x	x	x	x	x	x	x	x	x	x	x
Dilleniaceae	*Hibbertia acerosa*					x	x	x	x	x	x	x	x	x	x	x	x	x
	Hibbertia acrotoma	P1		x														
	Hibbertia amplexicaulis					x	x	x	x	x	x	x	x	x	x	x	x	x
	Hibbertia aurea					x												
	Hibbertia commutata					x	x	x	x	x	x	x	x	x	x	x	x	x
	Hibbertia diamesogenos						x	x			x		x	x				
	Hibbertia glomerata subsp. *glomerata*									x								
	Hibbertia hortiorum	P1		x														
	Hibbertia huegelii					x		x		x	x		x	x	x	x		x
	Hibbertia hypericoides					x	x	x		x	x	x	x	x	x	x	x	x
	Hibbertia lasiopus							x		x	x	x	x	x	x		x	
	Hibbertia lineata															x		
	Hibbertia mylnei					x								x				
	Hibbertia ovata						x	x	x	x	x	x	x		x		x	x
	Hibbertia perfoliata							x	x	x	x		x	x	x	x	x	x
	Hibbertia pilosa					x		x			x			x	x			
	Hibbertia polystachya													x				
	Hibbertia prolata					x												
	Hibbertia quadricolor						x	x		x					x	x		
	Hibbertia silvestris								x	x			x		x		x	x
	Hibbertia spectabilis					x												

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Dilleniaceae (continued)	*Hibbertia spicata*					x												
	Hibbertia stellaris														x			
	Hibbertia striata															x		
	Hibbertia subvaginata					x	x			x								
	Hibbertia vaginata							x			x							
	Hibbertia sp.								x						x	x	x	x
Dioscoreaceae	*Dioscorea hastifolia*					x												
Droseraceae	*Drosera bulbosa*						x											
	Drosera collina					x											x	
	Drosera erythrorhiza						x			x			x	x	x	x		
	Drosera gigantea					x	x	x			x		x					
	Drosera glanduligera														x			
	Drosera hyperostigma							x			x			x				
	Drosera leucoblasta						x											
	Drosera macrantha					x	x						x		x			
	Drosera menziesii						x						x					
	Drosera microphylla					x												
	Drosera occidentalis	P4		x														
	Drosera paleacea	P1					x											
	Drosera pallida						x			x	x			x				
	Drosera platystigma						x	x			x		x	x				
	Drosera porrecta					x												
	Drosera pulchella					x	x									x		
	Drosera rosulata					x	x											
	Drosera silvicola												x					
	Drosera stolonifera					x	x			x				x	x	x		
	Drosera sp.						x	x	x	x				x	x	x	x	x

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Droseraceae	*Drosera* sp. (climbing)																x	
	Drosera sp. 2																x	
Elaeocarpaceae	*Platytheca galioides*									x					x			
	Tetratheca hirsuta						x	x	x	x	x	x	x	x	x	x	x	x
	Tetratheca hirsuta subsp. *viminea*					x												
	Tetratheca hispidissima					x		x				x	x					
	Tetratheca nuda						x											
	Tetratheca phoenix	P2												x				
	Tetratheca setigera							x			x							
	Tetratheca sp.														x			
	Tremandra diffusa									x			x					
Ericaceae	*Andersonia aristata*					x							x	x	x			x
	Andersonia gracilis	T	E		x													
	Andersonia involucrata													x				
	Andersonia lehmanniana												x	x	x	x	x	
	Andersonia lehmanniana subsp. *lehmanniana*									x			x	x	x			
	Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	P3		x														
	Andersonia latiflora													x				
	Andersonia sp.								x	x			x					
	Astroloma sp.						x						x					
	Conostephium pendulum							x			x							
	Leucopogon australis							x			x			x	x		x	
	Leucopogon capitellatus					x	x	x	x	x	x	x	x	x	x	x	x	
	Leucopogon glabellus					x		x		x	x		x	x	x			x
	Leucopogon gracillimus					x				x								
	Leucopogon hirsutus							x			x							
	Leucopogon parviflorus															x		
	Leucopogon polymorphus													x				

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Ericaceae (continued)	*Leucopogon pulchellus*					x		x		x	x	x	x					
	Leucopogon sprengelioides						x									x		
	Leucopogon tenuis														x			
	Leucopogon verticillatus					x		x	x	x	x	x	x	x	x	x	x	x
	Leucopogon sp.						x	x	x	x			x	x	x			
	Lysinema ciliatum														x			
	Lysinema elegans														x			
	Lysinema pentapetalum														x			
	Styphelia discolor					x	x	x	x	x	x	x	x	x	x	x	x	x
	Styphelia epacridis														x			
	Styphelia erectifolia														x			
	Styphelia erubescens									x								
	Styphelia nitens					x	x	x	x	x	x	x	x	x	x	x	x	x
	Styphelia pallida					x	x	x	x	x	x	x	x	x	x	x	x	x
	Styphelia propinqua					x	x	x	x	x	x	x	x	x	x	x	x	x
	Styphelia prostrata						x											
	Styphelia stricta					x	x						x	x	x			
	Styphelia tenuiflora					x	x	x	x	x	x	x	x	x	x	x	x	x
	Styphelia tortifolia					x												x
	Styphelia sp.								x						x		x	x
	Ericaceae sp.						x			x					x			
Euphorbiaceae	*Amperea simulans*							x		x	x				x			
	Monotaxis grandiflora							x			x			x				
	Monotaxis grandiflora var. *grandiflora*						x							x		x		
	Monotaxis occidentalis						x	x	x	x	x		x	x	x		x	x
	Stachystemon vermicularis					x							x	x			x	
	Stachystemon virgatus														x			

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Fabaceae (continued)	*Acacia alata*					x		x	x	x	x	x		x	x	x	x	
	Acacia alata var. *alata*						x	x		x	x		x		x			x
	Acacia applanata												x	x	x	x	x	x
	Acacia barbinervis						x	x	x	x	x				x	x		x
	Acacia barbinervis subsp. *barbinervis*							x		x	x				x			x
	Acacia browniana							x		x	x	x	x	x	x		x	x
	Acacia browniana var. *endlicheri*												x	x	x			
	Acacia browniana var. *intermedia*													x	x			
	Acacia browniana var. *obscura*													x	x			
	Acacia celastrifolia					x		x		x	x		x	x	x			x
*	*Acacia dealbata* subsp. *dealbata*								x									
	Acacia dentifera							x		x		x	x					
	Acacia divergens					x	x	x	x	x	x	x	x	x	x	x	x	x
	Acacia drummondii									x						x		
	Acacia drummondii subsp. *affinis*	P3		x						x	x							
	Acacia drummondii subsp. *candolleana*						x	x	x	x	x		x	x	x	x	x	x
	Acacia drummondii subsp. *drummondii*							x		x			x	x			x	x
	Acacia ephedroides					x			x	x			x	x	x			
	Acacia extensa					x	x	x	x	x	x	x	x	x	x	x	x	x
*	*Acacia floribunda*					x												
	Acacia gemina														x			
	Acacia horridula	P3		x											x			
	Acacia incurva						x							x	x		x	
	Acacia lateriticola						x	x	x	x	x	x	x	x	x	x	x	x
*	*Acacia longifolia*									x					x			
*	*Acacia longifolia* subsp. *longifolia*														x			
	Acacia multispicata					x				x			x		x			
	Acacia nervosa					x	x	x	x	x	x	x	x	x	x		x	x
	Acacia obovata					x			x	x			x	x	x			x
	Acacia oncinophylla														x			

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Fabaceae (continued)	*Acacia oncinophylla* subsp. *patulifolia*	P4		x														
	Acacia oncinophylla subsp. *oncinophylla*	P3		x														
*	*Acacia podalyriifolia*									x								
	Acacia preissiana						x	x		x	x	x	x	x	x			
	Acacia pulchella					x	x	x	x	x	x	x	x	x	x	x	x	x
	Acacia pulchella var. *glaberrima*					x	x	x		x		x			x			
	Acacia pulchella var. *pulchella*						x								x			
	Acacia saligna						x		x						x	x	x	
	Acacia stenoptera						x						x	x	x	x		
	Acacia ?sulcata var. *platyphylla*												x					
	Acacia teretifolia					x												
	Acacia trigonophylla					x								x	x			
	Acacia urophylla					x		x	x	x	x	x	x		x	x	x	x
	Acacia varia									x			x	x			x	
	Acacia varia var. *varia*							x		x				x				
	Acacia willdenowiana					x	x	x	x	x	x	x	x		x		x	x
	Acacia sp.						x	x	x	x	x	x			x			
	Aotus cordifolia					x	x			x				x		x		
	Aotus gracillima														x			
	Bossiaea angustifolia					x											x	
	Bossiaea aquifolium							x		x	x	x	x		x	x	x	x
	Bossiaea aquifolium subsp. *aquifolium*						x		x	x				x				
	Bossiaea eriocarpa					x		x		x			x		x		x	
	Bossiaea ornata					x	x	x	x	x	x	x	x	x	x	x	x	x
	Bossiaea pulchella														x			
	Bossiaea rufa					x												
	Bossiaea spinescens															x		
	Bossiaea sp.									x								
	Callistachys lanceolata							x			x	x	x	x	x		x	
	Chorizema cordatum							x	x	x	x		x	x	x	x	x	x

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Fabaceae (continued)	*Chorizema dicksonii*					x	x			x					x			
	Chorizema ilicifolium						x											
	Chorizema rhombeum					x		x		x	x							
	Chorizema retrorsum													x				
	Cristonia biloba					x												
	Cristonia biloba subsp. *biloba*					x												
	Daviesia cordata					x		x	x		x				x		x	
	Daviesia decurrens							x	x	x	x	x	x	x	x	x	x	x
	Daviesia decurrens subsp. *decurrens*					x												
	Daviesia divaricata									x								
	Daviesia horrida					x	x	x	x	x		x	x	x	x	x	x	
	Daviesia incrassata						x	x		x	x	x	x	x	x		x	
	Daviesia inflata													x				
	Daviesia longifolia												x	x				
	Daviesia physodes							x			x		x	x				
	Daviesia preissii					x		x	x	x	x		x	x	x		x	
	Daviesia rhombifolia							x			x		x	x	x		x	
	Daviesia sp.							x	x			x			x			
	Dillwynia laxiflora						x								x			
	Dillwynia sp.							x			x							
	Eutaxia parvifolia													x				
	Eutaxia virgata												x					
	Gastrolobium bilobum												x	x	x			
	Gastrolobium calycinum												x	x	x		x	
	Gastrolobium capitatum						x											
	Gastrolobium dilatatum					x								x				
	Gastrolobium ebracteolatum					x		x			x	x						
	Gastrolobium retusum														x			
	Gastrolobium spinosum					x	x			x			x	x	x	x	x	
	Gastrolobium villosum								x				x		x	x	x	

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Fabaceae (continued)	*Gastrolobium* sp.														x			
	Gompholobium capitatum					x									x			
	Gompholobium confertum						x											x
	Gompholobium cyaninum									x			x	x	x		x	
	Gompholobium knightianum					x		x	x	x	x	x	x	x	x	x	x	x
	Gompholobium marginatum					x	x	x	x	x	x	x	x	x		x	x	x
	Gompholobium polymorphum					x	x	x	x	x	x	x	x	x	x	x	x	x
	Gompholobium preissii					x	x	x	x	x	x		x	x	x	x	x	x
	Gompholobium scabrum														x			
	Gompholobium tomentosum								x	x			x		x	x	x	
	Gompholobium sp.						x			x				x	x	x		x
	Hardenbergia comptoniana							x		x		x	x		x			
	Hardenbergia sp.							x						x				
	Hovea chorizemifolia						x	x	x	x	x	x	x	x	x	x	x	x
	Hovea pungens					x									x			
	Hovea trisperma					x		x	x	x	x	x	x	x	x	x		x
	Hovea trisperma var. *grandiflora*														x			
	Hovea trisperma var. *trisperma*						x											
	Hovea sp.						x								x			
	Isotropis cuneifolia															x		
	Isotropis cuneifolia subsp. *cuneifolia*						x		x						x			
	Jacksonia alata					x		x			x					x		
	Jacksonia furcellata							x			x				x		x	
	Kennedia carinata									x								
	Kennedia coccinea					x	x	x	x	x	x	x	x	x	x	x	x	x
	Kennedia prostrata					x	x	x	x	x	x		x	x	x	x	x	x
	Labichea punctata					x	x	x	x	x	x		x		x	x	x	x
	Latrobea tenella						x											
	* *Medicago* sp.						x											
	Mirbelia dilatata					x	x	x	x	x	x	x	x	x	x	x	x	x

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Fabaceae		*Mirbelia floribunda*					x												
(continued)		*Mirbelia spinosa*					x								x				
		Paraserianthes lophantha							x	x		x	x		x	x			x
		Paraserianthes lophantha subsp. *lophantha*						x	x		x	x		x					
	*	*Robinia pseudoacacia*												x					
		Sphaerolobium linophyllum							x			x							
		Sphaerolobium macranthum															x		
		Sphaerolobium medium					x	x	x	x	x	x	x	x		x	x	x	x
		Sphaerolobium vimineum						x	x			x							
		Sphaerolobium sp.						x									x		
		Templetonia drummondii						x											
	PL	*Tipuana tipu*									x								
	*	*Trifolium arvense*						x											
	*	*Trifolium repens*									x								
	*	*Trifolium* sp.												x					
		Viminaria juncea					x	x	x			x	x	x		x			
		Fabaceae sp.						x								x			
Gentianaceae	*	*Centaurium erythraea*						x	x		x		x	x					
	*	*Cicendia filiformis*					x												
Geraniaceae		*Erodium* sp.								x									
		Geranium sp.						x											
		Pelargonium littorale					x								x	x			
Goodeniaceae		*Dampiera alata*					x	x	x		x	x			x	x		x	x
		Dampiera hederacea						x	x	x	x	x		x				x	x
		Dampiera linearis					x	x	x	x	x	x	x	x	x	x	x	x	x
		Dampiera sp.														x		x	
		Goodenia claytoniacea					x												

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Goodeniaceae (continued)	*Goodenia coerulea*					x	x											
	Goodenia ?filiformis						x											
	Goodenia pulchella														x			
	Goodenia trinervis														x		x	
	Lechenaultia biloba					x	x	x	x	x	x	x	x	x	x	x	x	x
	Lechenaultia formosa									x								
	Scaevola calliptera					x	x	x	x	x	x	x	x	x	x	x	x	x
	Scaevola glandulifera					x	x							x				
	Scaevola pilosa												x			x		
	Scaevola sp.						x							x				
	Goodeniaceae sp.						x								x			
Haemodoraceae	*Anigozanthos manglesii*					x				x					x	x	x	x
	Anigozanthos sp.							x			x			x	x			
	Conostylis aculeata					x									x			x
	Conostylis aculeata subsp. *aculeata*							x		x	x							
	Conostylis androstemma					x												
	Conostylis caricina subsp. *caricina*														x			
	Conostylis pusilla							x	x		x		x	x	x	x	x	x
	Conostylis serrulata					x	x	x	x	x	x	x	x	x	x	x	x	x
	Conostylis setigera							x	x	x	x	x	x	x	x	x	x	x
	Conostylis setigera subsp. *setigera*						x							x	x			
	Conostylis setosa					x	x	x	x	x	x	x	x	x	x	x	x	x
	Conostylis sp.						x	x	x	x	x			x	x		x	
	Haemodorum discolor							x		x	x			x				
	Haemodorum laxum					x									x	x		
	Haemodorum simplex					x	x											
	Haemodorum sparsiflorum																x	
	Haemodorum spicatum														x			
	Haemodorum sp.					x	x	x		x	x	x	x		x	x	x	

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Haemodoraceae (continued)	*Phlebocarya ciliata*												x					
	Tribonanthes australis						x								x			
	Tribonanthes longipetala					x	x											
	Haemodoraceae sp.							x			x	x						x
Haloragaceae	*Glischrocaryon angustifolium*							x			x							x
	Glischrocaryon aureum					x			x				x	x	x	x		
	Gonocarpus benthamii						x	x	x	x	x	x		x				
	Gonocarpus cordiger					x	x			x				x	x		x	
	Gonocarpus diffusus					x		x			x				x			
	?*Gonocarpus* sp.												x					
	Meionectes tenuifolia	P3		x			x											
Hemerocallidaceae	*Agrostocrinum hirsutum*							x	x	x	x	x	x	x	x		x	
	Agrostocrinum scabrum					x	x									x	x	x
	Agrostocrinum sp.							x			x							
	Caesia micrantha					x	x								x			
	Caesia occidentalis						x											
	Caesia sp.						x			x								
	Chamaescilla corymbosa							x		x	x		x	x	x	x	x	x
	Chamaescilla corymbosa var. *corymbosa*						x	x			x			x				
	Corynotheca elongata													x				
	Corynotheca micrantha							x		x			x		x			
	Dianella revoluta					x	x	x	x	x	x	x	x	x	x	x	x	x
	Dianella revoluta var. *divaricata*									x			x					
	Johnsonia lupulina									x					x			
	Johnsonia pubescens subsp. *cygnorum*	P2		x														
	Stypandra glauca					x							x	x	x			
	Tricoryne elatior					x	x	x		x	x	x		x	x	x	x	

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Hemerocallidaceae	*Tricoryne humilis*					x	x	x		x	x		x	x		x		
(continued)	*Tricoryne* sp.						x		x						x			
Hydrocharitaceae	*Ottelia ovalifolia*					x												
Hypericaceae	* *Hypericum perforatum*							x				x						
Hypoxidaceae	*Hypoxis* sp.						x											
	Pauridia glabella						x											
	Pauridia occidentalis					x												
	Pauridia occidentalis ?var. *occidentalis*						x											
	Pauridia occidentalis var. *quadriloba*						x											
	Pauridia gardneri									x								
	Pauridia sp.														x			
Iridaceae	* *Romulea rosea*						x											
	* *Watsonia meriana*														x			
	Orthrosanthus laxus														x			
	Patersonia babianoides					x	x	x		x	x	x	x	x		x	x	
	Patersonia juncea						x								x	x		
	Patersonia occidentalis						x	x	x	x	x	x	x	x	x	x	x	x
	Patersonia occidentalis var. *occidentalis*					x												
	Patersonia pygmaea					x	x	x	x	x	x	x	x	x	x	x	x	x
	Patersonia rudis					x		x	x	x	x	x	x	x	x	x	x	x
	Patersonia rudis subsp. *rudis*						x			x			x					
	Patersonia umbrosa												x					
	Patersonia sp.												x		x		x	x
	Iridaceae sp.														x			

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Juncaceae	* *Juncus articulatus*					x												
	* *Juncus bufonius*					x												
	Juncus holoschoenus					x												
	Juncus pallidus					x	x											
	Juncus planifolius					x												
	Juncus subsecundus					x												
	Juncus sp.												x		x			
Lamiaceae	* *Lavandula stoechas*														x			
	Hemiandra pungens									x			x		x	x		
	Hemiandra sp.														x			
	Hemigenia barbata													x				
	Hemigenia humilis					x												
	Hemigenia incana					x			x	x			x		x			
	Hemigenia parviflora					x												
	Hemigenia pritzelii						x	x	x	x	x	x	x	x	x		x	x
	Hemigenia viscida														x			
	Hemigenia rigida	P1																
	Hemigenia sp.														x			
	Hemiphora bartlingii								x				x				x	
Lauraceae	*Cassytha glabella*					x	x	x				x			x			x
	Cassytha glabella forma glabella							x			x							
	Cassytha pomiformis					x							x					
	Cassytha racemosa					x	x	x		x		x						
	Cassytha racemosa forma pilosa							x			x							
	Cassytha racemosa forma racemosa							x		x	x			x				
	Cassytha sp.						x	x	x		x	x	x	x	x	x	x	x

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Lentibulariaceae		*Utricularia inaequalis*						x											
		Utricularia multifida						x	x			x				x			
		Utricularia tenella						x											
		Utricularia sp.						x											
Liliaceae		Liliaceae sp.						x											
Linaceae	*	*Linum trigynum*					x												
Lindsaeaceae		*Lindsaea linearis*					x	x	x	x	x	x		x	x	x	x	x	x
Loganiaceae		*Orianthera campanulata*												x					
		Orianthera serpyllifolia							x		x		x	x	x	x		x	
		Orianthera serpyllifolia subsp. *angustifolia*						x	x		x								
		Orianthera serpyllifolia subsp. *serpyllifolia*							x				x						
		Phyllangium paradoxum					x	x	x		x	x							
Loranthaceae		*Amyema miquelii*					x												
		Amyema sp.												x					
		Nuytsia floribunda							x		x	x				x			
Malvaceae		*Lasiopetalum cardiophyllum*	P4							x								x	
		Lasiopetalum floribundum					x	x	x	x	x	x	x	x	x	x	x	x	x
		Lasiopetalum glabratum						x	x	x		x	x	x	x	x	x	x	x
		Lasiopetalum glutinosum					x								x				
		Lasiopetalum glutinosum subsp. *glutinosum*	P3		x														
		Lasiopetalum glutinosum subsp. *latifolium*													0			x	
		Lasiopetalum pterocarpum	T	E	x	x													
		Lasiopetalum sp.														x			
		Thomasia foliosa					x									x			

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Malvaceae (continued)	*Thomasia grandiflora*					x												
	Thomasia ?*macrocalyx*								x									
	Thomasia macrocarpa					x												
	Thomasia paniculata					x	x	x		x	x	x	x	x	x	x	x	x
	?*Thomasia* sp.								x									
	Malvaceae sp.								x									
Menyanthaceae	*Ornduffia parnassifolia*						x	x			x							
Montiaceae	*Calandrinia* sp.						x											
Myrtaceae	*Agonis flexuosa*							x			x							
	Astartea affinis													x				
	Astartea leptophylla												x					
	Astartea scoparia					x	x	x	x	x	x	x	x	x	x	x	x	x
	Babingtonia camphorosmae					x	x	x	x	x	x	x	x	x	x	x	x	x
	Beaufortia macrostemon												x					x
	Callistemon glaucus							x			x							
	Calothamnus graniticus subsp*. leptophyllus*	P4		x														
	Calothamnus lateralis					x									x			
	Calothamnus planifolius						x											
*	*Calothamnus quadrifidus*							x	x	x	x				x			
*	*Calothamnus quadrifidus* subsp. *homalophyllus*					x												
	Calothamnus rupestris					x		x		x	x				x			x
	Calothamnus sanguineus					x			x						x			x
	Calothamnus sp.												x			x		
	Calytrix acutifolia					x												
	Calytrix angulata																x	
	Calytrix depressa					x			x	x			x		x			
	Calytrix flavescens							x				x			x		x	x

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Myrtaceae (continued)		*Calytrix variabilis*					x									x			
		Calytrix sp.								x						x		x	
		Corymbia calophylla					x	x	x	x	x	x	x	x	x	x	x	x	x
		Corymbia haematoxylon					x												
	PL	*Corymbia maculata*														x			
		Darwinia citriodora					x		x	x	x	x		x		x			x
		Darwinia thymoides					x											x	
		Darwinia thymoides subsp. *thymoides*									x				x			x	
		Darwinia sp.																x	
	PL	*Eucalyptus cypellocarpa*														x			
		Eucalyptus drummondii									x			x		x			
		Eucalyptus laeliae					x												
		Eucalyptus lane-poolei					x												
	PL	*Eucalyptus maculata*									x								
		Eucalyptus marginata					x		x	x	x	x	x	x	x	x	x	x	x
		Eucalyptus marginata subsp. *marginata*						x											
		Eucalyptus marginata subsp. *thalassica*					x												
		Eucalyptus megacarpa							x	x	x	x	x	x	x	x		x	x
	PL	*Eucalyptus microcorys*									x								
		Eucalyptus patens						x	x	x	x	x	x	x	x	x	x	x	x
	PL	*Eucalyptus resinifera*																x	
		Eucalyptus rudis							x	x		x	x	x	x	x		x	
		Eucalyptus rudis subsp. *rudis*						x	x				x						
		Eucalyptus wandoo					x		x			x			x	x			x
		Eucalyptus x *balanites*	T	E		x													
	PL	*Eucalyptus* sp.						x								x			x
		Hypocalymma angustifolium						x	x	x	x	x	x	x	x	x	x	x	x
		Hypocalymma cordifolium							x	x	x	x	x	x		x		x	x
		Hypocalymma robustum					x		x	x	x	x	x	x	x	x		x	x
		Hypocalymma strictum													x				

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Myrtaceae (continued)	*Kunzea ericifolia*						x	x		x	x							
	Kunzea glabrescens					x		x	x			x	x			x		
	Kunzea micrantha						x							x	x			
	Kunzea micrantha subsp. *micrantha*														x			
	Kunzea pulchella														x			
	Kunzea recurva					x	x			x				x	x	x		x
	Kunzea sp.														x			
	Leptospermum erubescens					x		x	x	x	x		x	x	x	x	x	x
*	*Leptospermum laevigatum*								x	x					x			x
	Leptospermum oligandrum																x	
*	*Melaleuca armillaris*																x	
*	*Melaleuca armillaris* subsp. *armillaris*														x			
	Melaleuca incana subsp. *incana*						x	x		x	x		x	x	x		x	
	Melaleuca lateritia						x	x			x		x	x	x		x	
	Melaleuca parviceps					x		x	x	x	x		x	x	x	x	x	x
	Melaleuca pauciflora						x	x		x	x				x			
	Melaleuca preissiana					x	x	x		x	x	x	x	x	x	x	x	x
	Melaleuca radula					x	x											
	Melaleuca rhaphiophylla							x			x	x		x	x		x	
	Melaleuca scabra						x											
	Melaleuca trichophylla					x			x				x	x	x			
	Melaleuca viminea							x	x	x	x	x	x	x	x	x	x	
	Melaleuca viminea subsp. *viminea*						x							x			x	
	Melaleuca sp.					x	x			x					x		x	x
	Paragonis grandiflora					x												
	Pericalymma ellipticum							x	x	x	x	x	x	x	x	x	x	x
	Pericalymma ellipticum var. *ellipticum*						x			x								
	Pericalymma ellipticum var. *floridum*									x				x				
	Regelia ciliata					x	x											
	Taxandria linearifolia					x	x	x	x	x	x	x	x	x	x	x	x	x

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Myrtaceae	*Verticordia densiflora*														x		x	x
(continued)	*Verticordia densiflora* var. *densiflora*												x	x	x			
	Verticordia huegelii													x			x	
	Verticordia huegelii var. *decumbens*																	x
	Verticordia huegelii var. *huegelii*							x			x		x					
	Verticordia lindleyi subsp. *lindleyi*	P4		x														
	Verticordia pennigera					x				x			x		x		x	
	Verticordia plumosa												x		x	x	x	
	Verticordia plumosa var. *ananeotes*	T	E	x	x													
	Verticordia plumosa var. *brachyphylla*												x					
	Verticordia plumosa var. *plumosa*							x	x	x	x	x	x	x	x			x
	Verticordia ?*serrata*													x				
	Verticordia sp.												x		x			
	Myrtaceae sp.							x				x		x	x		x	
Olacaceae	*Olax benthamiana*					x	x	x		x		x	x				x	
Orchidaceae	*Caladenia flava*														x	x		
	Caladenia flava subsp. *flava*						x			x								
	Caladenia huegelii	T	E	x	x													
	Caladenia latifolia					x				x				x				
	Caladenia marginata					x												
	Caladenia reptans														x			
	Caladenia reptans subsp. *reptans*						x								x			
	Caladenia splendens					x												
	Caladenia sp.					x	x	x		x	x	x	x	x	x	x	x	x
	Cryptandra sp.														x			
	Cryptostylis ovata													x				
	Cyanicula gemmata						x											
	Cyanicula sericea														x			

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Orchidaceae (continued)	*Cyrtostylis huegelii*													x				
	Cyrtostylis robusta						x											
	Cyrtostylis sp.						x						x					
	* *Disa bracteata*						x										x	
	Diuris brumalis					x												
	Diuris corymbosa													x				
	Diuris drummondii	T	V		x													
	Diuris longifolia					x									x			
	Diuris micrantha	T	V		x													
	Diuris purdiei	T	E		x													
	Diuris sp.									x				x	x			
	Drakaea elastica	T	E		x													
	Drakaea micrantha	T	V		x													
	Drakaea sp.									x	x	x	x	x				
	Elythranthera brunonis					x		x		x	x				x	x		
	Elythranthera emarginata					x												
	Eriochilus dilatatus						x										x	x
	Leporella fimbriata					x												
	Leptoceras menziesii						x											
	Microtis media					x	x											
	Microtis sp.						x											
	Paracaleana granitica	P1		x														
	Pheladenia deformis						x								x			
	Prasophyllum brownii					x												
	Prasophyllum fimbria					x												
	Prasophyllum parvifolium					x												
	Prasophyllum sp.						x								x	x		
	Pterostylis aspera					x												
	Pterostylis barbata						x			x					x			
	Pterostylis dilatata					x												

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Orchidaceae (continued)	*Pterostylis recurva*					x	x			x				x	x			
	Pterostylis sanguinea									x								
	Pterostylis vittata						x			x				x				
	Pterostylis sp.						x	x		x	x		x	x	x	x	x	x
	Pyrorchis nigricans						x			x				x	x			x
	Pyrorchis sp.							x			x		x	x				
	Spiculaea ciliata					x												
	Thelymitra antennifera					x									x			
	Thelymitra benthamiana					x												
	Thelymitra cornicina						x											
	Thelymitra crinita					x	x								x	x		
	Thelymitra flexuosa					x												
	Thelymitra graminea					x												
	Thelymitra macrophylla						x	x			x							
	Thelymitra stellata	T	E		x													
	Thelymitra vulgaris					x												
	Thelymitra sp.						x	x		x	x		x	x	x	x		
	Orchidaceae sp.						x	x		x	x	x	x	x	x	x	x	x
Orobanchaceae	* *Bellardia trixago*					x	x											
	* *Bellardia viscosa*					x												
	* *Orobanche minor*					x		x		x								
	* *Parentucellia latifolia*					x	x								x			
Oxalidaceae	* *Oxalis pes-caprae*						x						x	x	x			
	Oxalis perennans						x											
	* *Oxalis* sp.						x						x		x			
Philydraceae	*Philydrella drummondii*						x	x			x					x		
	Philydrella pygmaea subsp. *pygmaea*						x											

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Phyllanthaceae		*Lysiandra calycina*					x	x	x	x	x	x	x	x	x	x	x	x	x
		Poranthera huegelii													x				
		Poranthera microphylla					x	x	x			x				x	x		
Phytolaccaceae	*	*Phytolacca octandra*												x					
Pinaceae	PL	*Pinus pinaster*									x					x			x
	PL	*Pinus radiata*									x								
Pittosporaceae		*Billardiera floribunda*					x		x		x	x	x	x					
		Billardiera fraseri						x			x								
		Billardiera fusiformis					x	x	x	x	x	x	x	x	x	x	x	x	x
		Billardiera heterophylla							x		x		x			x			
		Billardiera variifolia					x		x	x		x	x	x	x			x	
		Billardiera sp.						x	x	x			x	x		x	x		
		Cheiranthera preissiana					x												
		Marianthus coeruleopunctatus									x								
		Marianthus drummondianus						x	x	x	x	x	x	x	x	x		x	x
		Marianthus tenuis					x			x				x					
		Marianthus sp.														x			x
Plantaginaceae		?*Veronica* sp.						x											
Poaceae	*	*Aira caryophyllea*					x	x	x			x	x	x			x	x	
	*	*Aira cupaniana*							x			x							
		Amphipogon amphipogonoides					x	x	x	x	x	x	x	x	x	x	x	x	x
		Amphipogon debilis					x	x											
		Amphipogon laguroides					x	x								x			
		Amphipogon laguroides subsp. *laguroides*												x		x		x	
		Amphipogon strictus					x												

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Poaceae (continued)	*Amphipogon turbinatus*					x												
	Amphipogon sp.						x	x			x							
	Amphipogon turbinatus							x				x						
	Austrostipa campylachne					x	x							x				
	Austrostipa compressa					x												
	Austrostipa flavescens							x			x							
	Austrostipa mollis															x		
	Austrostipa sp.						x	x	x		x				x	x		
	* *Briza maxima*					x							x					
	* *Briza minor*					x	x								x	x		
	Bromus sp.						x											
	* ?*Cynodon dactylon*						x											
	Dichelachne crinita					x		x			x							
	* *Ehrharta* sp.									x								
	Lachnagrostis filiformis					x												
	* *Lagurus ovatus*					x												
	* *Lolium* sp.						x											
	Microlaena stipoides					x												
	Microlaena stipoides var. *stipoides*						x											
	Neurachne alopecuroidea					x	x	x	x	x	x	x	x		x	x	x	x
	Neurachne sp.							x						x				
	Paspalidium sp.?															x		
	* *Pentameris airoides*						x										x	x
	Poa drummondiana					x												
	Poa porphyroclados					x												
	Rytidosperma acerosum									x				x		x		
	Rytidosperma caespitosum					x	x	x	x	x	x	x	x	x	x	x	x	x
	Rytidosperma occidentale												x					
	Rytidosperma pilosum					x												
	Rytidosperma setaceum																x	

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Poaceae (continued)	*Rytidosperma* sp.						x	x		x	x	x		x		x		
	Spartochloa scirpoidea												x					
	Tetrarrhena laevis					x	x	x	x	x	x	x	x	x	x	x	x	x
	* *Vulpia bromoides*					x												
	* *Vulpia myuros*					x	x											
	Vulpia sp.						x											
	Poaceae sp.						x	x		x	x	x	x	x	x		x	x
Podocarpaceae	*Podocarpus drouynianus*												x	x				
Polygalaceae	*Comesperma calymega*					x	x	x	x	x	x	x	x	x			x	x
	Comesperma ciliatum					x	x	x		x	x							
	Comesperma confertum												x					
	Comesperma polygaloides						x	x			x							
	Comesperma virgatum					x	x	x	x	x	x	x	x	x	x	x	x	x
	Comesperma volubile						x							x				
	Comesperma sp.													x	x	x		
Pottiaceae	*Weissia controversa*					x												
Primulaceae	* *Lysimachia arvensis*						x	x		x	x		x		x	x		
	Samolus junceus						x						x					
	Samolus ?repens var. *floribundus*													x				
Proteaceae	*Adenanthos barbiger*					x		x	x	x	x	x	x	x	x	x	x	x
	Adenanthos cygnorum													x				
	Adenanthos cygnorum subsp. *chamaephyton*	P3												x				
	Adenanthos obovatus							x	x	x	x	x		x	x		x	
	Banksia armata					x			x						x			
	Banksia armata var. *armata*									x			x	x				

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Proteaceae (continued)	*Banksia attenuata*						x											
	Banksia bipinnatifida					x									x	x	x	x
	Banksia bipinnatifida subsp. *bipinnatifida*									x			x	x	x			
	Banksia dallanneyi					x												
	Banksia dallanneyi subsp. *dallanneyi*									x	x	x	x	x				
	Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*						x	x	x						x	x	x	x
	Banksia dallanneyi subsp. *sylvestris*									x			x					
	Banksia grandis						x	x	x	x	x	x	x	x	x	x	x	x
	Banksia littoralis						x	x	x	x	x	x	x	x	x	x	x	x
	Banksia mimica	T	E		x													
	Banksia seminuda							x		x	x			x	x			
	Banksia sessilis							x	x	x	x	x	x	x	x	x	x	x
	Banksia sessilis var. *sessilis*							x			x							
	Banksia sphaerocarpa								x				x	x	x		x	
	Banksia sphaerocarpa var. *sphaerocarpa*													x				
	Banksia squarrosa subsp. *squarrosa*							x		x	x	x	x	x	x			
	Banksia undata					x			x				x	x				
	Banksia undata var. *undata*														x			
	Banksia sp.						x		x									
	Conospermum canaliculatum subsp. *canaliculatum*														x			
	Conospermum capitatum							x		x	x		x	x	x			x
	Conospermum capitatum subsp. *glabratum*							x		x			x		x			
	Conospermum huegelii					x									x			
	Conospermum scaposum	P3														x		
	Conospermum stoechadis														x		x	
	Conospermum stoechadis subsp. *sclerophyllum*														x		x	
	Grevillea bipinnatifida					x		x	x	x		x		x	x	x	x	
	Grevillea bipinnatifida subsp. *bipinnatifida*						x			x			x	x				
	Grevillea centristigma									x								
	Grevillea diversifolia					x		x				x						

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Proteaceae (continued)	*Grevillea diversifolia* subsp. *diversifolia*						x	x		x	x		x		x			
	Grevillea endlicheriana																x	
	Grevillea manglesii								x				x		x		x	
	Grevillea ornithopoda	P2		x														
	Grevillea pilulifera					x				x								x
	Grevillea pimeleoides	P4		x					x									
	Grevillea preissii												x					
	Grevillea pulchella							x	x	x		x	x	x		x	x	x
	Grevillea pulchella subsp. *ascendens*					x				x			x	x	x			
	Grevillea pulchella subsp. *pulchella*													x				
	Grevillea quercifolia					x		x			x		x	x	x			
	Grevillea trifida							x				x		x				
	Grevillea wilsonii					x		x	x	x	x	x	x	x	x	x	x	x
	Grevillea sp.													x	x	x		
	Hakea amplexicaulis					x		x	x	x	x	x	x	x	x		x	x
	Hakea ceratophylla													x	x			
	Hakea cyclocarpa					x		x	x		x		x	x	x	x	x	
	Hakea erinacea												x					
	Hakea gilbertii														x			
	Hakea incrassata						x	x	x	x		x	x	x	x		x	
	Hakea lissocarpha					x	x	x	x	x	x	x	x	x	x	x	x	x
	Hakea marginata						x			x				x	x			
	Hakea neospathulata					x												
	Hakea petiolaris								x									
	Hakea petiolaris subsp. *petiolaris*												x	x	x			
	Hakea prostrata						x	x			x	x	x	x	x	x	x	x
	Hakea ruscifolia					x	x	x	x	x	x	x	x	x	x	x	x	x
	Hakea stenocarpa					x		x		x	x		x	x	x		x	x
	Hakea sulcata														x			
	Hakea trifurcata					x		x		x	x		x	x	x		x	x

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Proteaceae (continued)	*Hakea undulata*					x		x	x	x	x	x	x	x	x		x	x
	Hakea varia						x	x	x		x	x	x	x	x	x	x	
	Hakea sp.														x			
	Isopogon asper					x												
	Isopogon autumnalis	P3		x														
	Isopogon dubius								x	x			x	x	x		x	x
	Isopogon sphaerocephalus								x	x			x	x				x
	Isopogon teretifolius													x				
	Isopogon sp. Darling Range (F. Hort 1662)								x				x	x			x	
	Persoonia angustiflora					x	x		x					x	x		x	x
	Persoonia elliptica							x	x	x	x	x	x	x	x		x	x
	Persoonia longifolia					x	x	x	x	x	x	x	x	x	x	x	x	x
	Persoonia saccata														x			
	Petrophile biloba					x				x			x					
	Petrophile heterophylla							x			x							
	Petrophile linearis					x				x			x					
	Petrophile macrostachya														x	x		
	Petrophile serruriae					x			x	x			x	x	x		x	
	Petrophile squamata														x			
	Petrophile squamata subsp. *squamata*														x			
	Petrophile striata					x	x		x	x			x	x	x		x	x
	Petrophile sp.								x						x			
	Stirlingia latifolia					x							x		x	x		x
	Stirlingia simplex								x						x			
	Synaphea cuneata														x			
	Synaphea damopsis												x	x				
	Synaphea gracillima					x	x			x			x		x			
	Synaphea odocoileops	P1		x														
	Synaphea petiolaris							x						x	x		x	x
	Synaphea petiolaris subsp. *petiolaris*										x		x		x			

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Proteaceae	*Synaphea spinulosa*									x								
(continued)	*Synaphea stenoloba*	T	E		x													
	Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	CE	x	x													
	Synaphea sp. Pinjarra Plain (A.S. George 17182)	T	E	x	x													
	Synaphea sp. Serpentine (G.R. Brand 103)	T	CE	x	x													
	Synaphea sp.								x					x	x	x	x	x
	Xylomelum occidentale							x		x	x		x	x	x	x	x	x
	Proteaceae sp.														x			
Pteridaceae	*Adiantum aethiopicum*										x				x			
	Cheilanthes austrotenuifolia									x			x		x			
	Cheilanthes distans					x												
	Cheilanthes sieberi														x			
	Cheilanthes sieberi subsp. *sieberi*												x					
Ranunculaceae	*Clematis pubescens*						x	x	x	x	x	x	x	x	x	x	x	x
	Ranunculus colonorum						x	x	x	x	x			x	x			
Restionaceae	*Alexgeorgea nitens*							x		x	x							
	Chaetanthus leptocarpoides														x			
	Chaetanthus tenellus														x			
	Chordifex ?laxus														x			
	Desmocladus fasciculatus					x	x	x	x	x	x	x	x	x	x	x	x	x
	Desmocladus flexuosus						x	x	x	x	x	x	x	x	x	x	x	x
	Desmocladus sp.								x									
	Hypolaena exsulca					x	x	x		x	x		x	x	x	x	x	x
	Lepidobolus preissianus						x							x	x			
	Lepidobolus preissianus subsp. *preissianus*													x	x	x		
	Leptocarpus canus						x								x		x	
	Leptocarpus coangustatus						x	x			x			x	x			

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Restionaceae	*Leptocarpus decipiens*						x											
(continued)	*Leptocarpus scariosus*						x	x			x	x			x			
	Leptocarpus sp.						x											x
	Lepyrodia glauca						x											
	Lepyrodia heleocharoides	P3		x														
	Lepyrodia macra					x									x			
	Lepyrodia riparia														x			
	Loxocarya cinerea						x	x	x	x	x	x	x	x	x	x	x	x
	Loxocarya striata								x				x					
	Sporadanthus rivularis							x		x	x	x						
	Restionaceae sp.						x	x			x	x			x	x		
Rhamnaceae	*Cryptandra arbutiflora*					x												
	Cryptandra arbutiflora var. *arbutiflora*					x	x						x	x	x	x		
	Cryptandra arbutiflora var. *tubulosa*														x			
	Cryptandra mutila														x			
	Cryptandra myriantha														x			
	Cryptandra nutans					x												
	Cryptandra sp.						x								x			
	Stenanthemum emarginatum					x												
	Stenanthemum nanum														x			
	Trymalium ledifolium							x	x	x	x	x	x	x	x	x	x	x
	Trymalium ledifolium var. *ledifolium*						x											
	Trymalium ledifolium var. *rosmarinifolium*					x				x								
	Trymalium odoratissimum							x			x			x	x	x	x	x
	Trymalium odoratissimum subsp. *odoratissimum*					x	x	x	x	x	x	x	x	x				
Rosaceae	*Acaena echinata*													x	x			

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Rubiaceae	*Galium* sp.														x			
	Opercularia apiciflora						x	x		x	x			x	x	x		x
	Opercularia echinocephala					x	x	x	x	x	x	x	x	x	x	x	x	x
	Opercularia hispidula					x	x	x		x	x	x	x	x	x	x		x
	Opercularia vaginata					x	x			x			x		x			
	Opercularia sp.						x			x					x			
Rutaceae	*Asterolasia pallida*								x	x			x	x	x		x	
	Boronia crenulata							x	x	x	x	x	x	x	x	x	x	
	Boronia crenulata subsp. *crenulata* var. *crenulata*							x		x		x						
	Boronia crenulata subsp. *pubescens*													x	x			
	Boronia crenulata subsp. *viminea*						x	x		x	x	x	x	x		x		
	Boronia fastigiata					x	x	x	x	x	x	x	x	x	x	x	x	x
	Boronia molloyae					x		x	x	x	x	x	x	x	x		x	
	Boronia ovata													x				
	Boronia scabra subsp. *scabra*														x			
	Boronia spathulata							x			x							
	Boronia sp.						x	x			x				x		x	x
	Cyanothamnus ramosus					x												
	Cyanothamnus ramosus subsp. *anethifolius*														x			
	Cyanothamnus ramosus subsp. *ramosus*					x												
	Cyanothamnus tenuis	P4		x														
	Diplolaena microcephala												x					
	Philotheca spicata						x	x	x	x	x	x	x	x	x	x	x	x
	Rutaceae sp.								x									
Santalaceae	*Exocarpos sparteus*												x					
	Leptomeria cunninghamii					x	x	x	x	x	x	x	x	x	x	x	x	x
	Santalum acuminatum														x			

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Sapindaceae	*Dodonaea ceratocarpa*					x			x	x			x		x			
	Dodonaea pinifolia					x												
	Dodonaea viscosa subsp. *angustissima*												x					
Scrophulariaceae	* *Selago corymbosa*																x	
	* *Verbascum virgatum*												x					
Solanaceae	*Anthocercis gracilis*	T	V	x	x													
	* *Solanum nigrum*														x			
Stylidiaceae	*Levenhookia dubia*						x											
	Levenhookia preissii	P1								x								
	Levenhookia pusilla					x	x	x		x	x	x	x		x	x	x	x
	Levenhookia stipitata					x	x			x			x				x	x
	Stylidium affine														x			
	Stylidium amoenum					x	x	x	x	x	x	x	x	x	x	x	x	x
	Stylidium androsaceum					x		x			x				x			
	Stylidium breviscapum					x												
	Stylidium brunonianum					x	x	x		x	x		x	x				
	Stylidium bulbiferum					x		x		x	x	x	x	x		x	x	
	Stylidium calcaratum					x	x	x		x	x				x	x	x	
	Stylidium ciliatum					x	x		x				x				x	
	Stylidium crassifolium						x	x			x							
	Stylidium despectum					x												
	Stylidium dichotomum					x		x	x	x		x		x				
	Stylidium diuroides													x	x			
	Stylidium diuroides subsp. *diuroides*												x	x			x	
	Stylidium emarginatum						x								x			
	Stylidium eriopodum					x											x	
	Stylidium guttatum						x											

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Stylidiaceae	*Stylidium hispidum*					x									x	x		x
(continued)	*Stylidium ireneae*	P4					x	x			x							
	Stylidium junceum					x		x		x	x		x	x	x		x	
	Stylidium lateriticola												x		x	x		
	Stylidium lineatum							x			x				x			
	Stylidium longitubum	P4					x	x			x							
	Stylidium perpusillum					x												
	Stylidium petiolare						x											
	Stylidium piliferum							x	x	x	x	x	x	x	x	x	x	x
	Stylidium preissii													x				
	Stylidium pulchellum						x											
	Stylidium pycnostachyum						x			x								
	Stylidium recurvum					x												
	Stylidium repens					x		x	x	x	x		x	x	x			x
	Stylidium scariosum					x											x	x
	Stylidium schoenoides					x				x					x	x	x	
	Stylidium spathulatum						x											
	Stylidium tenue subsp. *majusculum*					x												
	Stylidium thesioides						x								x			
	Stylidium utricularioides						x											
	Stylidium xanthellum					x												
	Stylidium sp.						x	x	x	x	x	x		x	x		x	x
Thymelaeaceae	*Pimelea angustifolia*													x			x	
	Pimelea brevistyla subsp. *brevistyla*													x				
	Pimelea ciliata							x	x	x	x	x		x	x	x	x	x
	Pimelea ciliata subsp. *ciliata*						x	x			x		x					
	Pimelea imbricata														x			
	Pimelea imbricata var. *piligera*					x	x			x								
	Pimelea lanata							x		x	x							

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Thymelaeaceae (continued)	*Pimelea ?lehmanniana*													x				
	Pimelea lehmanniana subsp. *nervosa*												x		x			
	Pimelea rara	P4		x														
	Pimelea spectabilis							x		x	x							
	Pimelea suaveolens						x	x		x	x	x		x	x	x	x	x
	Pimelea suaveolens subsp. *suaveolens*							x		x	x		x	x				
	Pimelea sp.						x	x	x	x	x				x	x	x	
Typhaceae	*Typha* sp.												x					
Verbenaceae	*Verbenaceae* sp.						x											
Violaceae	*Pigea calycina*							x			x							
	Pigea debilissima					x	x	x		x	x	x			x			
	Pigea floribunda						x	x				x	x		x	x		x
Xanthorrhoeaceae	*Xanthorrhoea acanthostachya*																	x
	Xanthorrhoea gracilis					x	x	x	x	x	x	x	x	x	x	x	x	x
	Xanthorrhoea preissii					x	x	x	x	x	x	x	x		x	x	x	x
Zamiaceae	*Macrozamia riedlei*					x	x	x	x	x	x	x	x	x	x	x	x	x
Zygophyllaceae	* *Tribulus terrestris*					x												

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN KINGSBURY WEST AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Andersonia gracilis	Ericaceae	T	Endangered	Habit: Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Flower colour: White-pink-purple Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps. IBRA Distribution: GES, SWA Florabase records: 36	**Low** Species not known to occur in the Jarrah Forest
Anthocercis gracilis	Solanaceae	T	Vulnerable	Habit: Erect, spindly shrub, to 0.6 (-1) m high. Flower colour: yellow-green Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Sandy or loamy soils. Granite outcrops. IBRA Distribution: AVW, JAF Florabase records: 29	**Moderate** Within species range.
Banksia mimica	Proteaceae	T	Endangered	Habit: Prostrate, lignotuberous shrub, 0.15-0.4 m high. Flower colour: yellow-brown Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: White or grey sand over laterite, sandy loam. IBRA Distribution: JAF, SWA Florabase records: 37	**Low** Species within the area occur to the north on the SWA and south JAF
Caladenia huegelii	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.25-0.6 m high. Flower colour: green & cream & red Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Grey or brown sand, clay loam. IBRA Distribution: JAF, SCP Florabase records: 41	**Low** Location outside species known range. Species not known within Northern Jarrah Forest.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Diuris drummondii	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.5-1.05 m high. Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J A S O **N** **D** Soils: Low-lying depressions, swamps IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 51	**Moderate** Dependent on suitable low-lying depressions/habitat conditions.
Diuris micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.3-0.6 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Brown loamy clay. Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 7	**Moderate** Dependent on suitable depressions/habitat conditions.
Diuris purdiei	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.35 m high. Flower colour: yellow Flowering period (indicated in green): only after a summer or early autumn fire J F M A M J J A **S** **O** N D Soils: Grey-black sand, moist. Winter-wet swamps. IBRA Distribution: JAF, SWA Florabase records: 2	**Moderate** Dependent on suitable swamps/habitat conditions.
Drakaea elastica	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.12-0.3 m high. Flower colour: red & green & yellow Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: White or grey sand. Low-lying situations adjoining winter-wet swamps. IBRA Distribution: SWA Florabase records: 19	**Low** Species not known to occur in the Jarrah Forest

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN KINGSBURY WEST AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Drakaea micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.15-0.3 m high. Flower colour: red & yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White-grey sand. IBRA Distribution: JAF, SWA, WAR Florabase records: 49	**Low** Outside species range. Species not known within the Northern Jarrah Forest.
Eleocharis keigheryi	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils: Clay, sandy loam. Emergent in freshwater: creeks, claypans. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 56	**Moderate** Within species range, not recorded within proximity. Dependent on appropriate hydrology on site.
Eucalyptus x *balanites*	Myrtaceae	T	Endangered	Habit: Mallee to 5 m high, bark rough, flaky. Flower colour: white Flowering period (indicated in green): **J** **F** M A M J J A S **O** **N** **D** Soils: Sandy soils with lateritic gravel. IBRA Distribution: GES, SWA Florabase records: 11	**Low** Species not known to occur in the Jarrah Forest

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Lasiopetalum pterocarpum	Malvaceae	T	Endangered	Habit: Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines. IBRA Distribution: JAF Florabase records: 11	**Moderate** Within species range, known records within proximity. Restricted to creeklines.
Morelotia australiensis	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O **N D** Soils: Sand, sandy loam. Flats, well-drained areas. IBRA Distribution: JAF, SWA Florabase records: 46	**Moderate** Within species range, populations known to be within isolated remnant pockets of vegetation
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Proteaceae	T	Critically Endangered	Habit: Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S **O** N D Soils: Sandy with lateritic pebbles. Near winter-wet flats. IBRA Distribution: JAF, SWA Florabase records: 31	**Low** Restricted area of occupancy- endemic to the Pinjarra Plain.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Synaphea sp. Pinjarra Plain (A.S. George 17182)	Proteaceae	T	Endangered	Habit: Erect, clumped shrub (sub-shrub), to 0.8 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite. Flats, seasonally wet areas, railroad reserves often with wet depressions or drains. IBRA Distribution: SWA Florabase records: 63	**Low** Species not known to occur in the Jarrah Forest
Synaphea sp. Serpentine (G.R. Brand 103)	Proteaceae	T	Critically Endangered	Habit: Erect shrub 0.3-0.6 m high and to 0.5 m wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Sand, loamy sand, clay-loam, clay soil. Flats, gentle slope to wetland, seasonally wet areas. IBRA Distribution: SWA Florabase records: 36	**Low** Species not known to occur in the Jarrah Forest
Synaphea stenoloba	Proteaceae	T	Endangered	Habit: Caespitose shrub, 0.3-0.45 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Sandy or sandy clay soils. Winter-wet flats, granite. IBRA Distribution: SWA Florabase records: 52	**Low** Species not known to occur in the Jarrah Forest

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thelymitra stellata	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.25 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Sand, gravel, lateritic loam. IBRA Distribution: GES, JAF, SWA Florabase records: 20	**Moderate** Species occurs uncommon but widely spread between Three Springs and Pinjarra. Grows in *E. marginata* woodland.
Verticordia fimbrilepis subsp. *fimbrilepis*	Myrtaceae	T	Endangered	Habit: Shrub, 0.3-0.7 m high. Flower colour: pink-white Flowering period (indicated in green): **J** F M A M J J A S **O N D** Soils: Gravelly or clayey soils. Flats, road verges. IBRA Distribution: AVW, JAF Florabase records: 39	**Low** Species habitat within eastern extent of JAF and AVW (EPBC Conservation Advice, 2021)
Drosera paleacea	Droseraceae	P1	-	Habit: Fibrous-rooted, rosetted perennial, herb, to 0.03 m high, to 0.015 m wide. Flower colour: white-cream Flowering period (indicated in green): **J** F M A M J J A **S O N D** Soils: White sand, sandy clay. IBRA Distribution: AVW, SWA, WAR Florabase records: 17	**Low** Species not known to occur in the Jarrah Forest
Hemigenia rigida	Lamiaceae	P1	-	Habit: Upright or spreading shrub, 0.1-0.6 (-1) m high. Flower colour: blue-purple/violet Flowering period (indicated in green): **J** F M A M J J **A S O N D** Soils: Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops IBRA Distribution: AVW Florabase records: 4	**Low** Species not known to occur in the Jarrah Forest

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hibbertia acrotoma	Dilleniaceae	P1	-	Habit: Openly branched, spreading to prostrate shrub to 0.5m. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S** O N D Soils: Loam soils over laterite or granite IBRA Distribution: JAF, SWA Florabase records: 7	**Moderate** Project area within species known range (Edge of Darling Scarp between Serpentine & Oakley Dam, Thiele K.R., 2019)
Hibberta hortiorum	Dilleniaceae	P1	-	Habit: Mat-forming shrubs to 0.1m high or less. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Laterite IBRA Distribution: JAF Florabase records: 12	**Low** Species known range not within project area (Limited to area around North Bannister, east of Albany Highway, Thiele K.R., 2019)
Levenhookia preissii	Stylidiaceae	P1	-	Habit: Annual (ephemeral), herb, 0.03-0.17 m high. Flower colour: pink-red Flowering period (indicated in green): **J** F M A M J J A **S O N D** Soils: Grey or black, peaty sand. Swamps. IBRA Distribution: SWA Florabase records: 14	**Low** Species not known to occur in the Jarrah Forest
Paracaleana granitica	Orchidaceae	P1	-	Habit: Perennial, herb, to 0.07 m high. Flower colour: green-purple Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: Growing on moss mats, granite. Outcrops. IBRA Distribution: JAF Florabase records: 7	**Moderate** Within species range

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Synaphea odocoileops	Proteaceae	P1	-	Habit: Tufted, compact shrub, 0.2-0.5 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Brown-orange loam & sandy clay, granite. Swamps, winter-wet areas. IBRA Distribution: SWA Florabase records: 22	**Low** Species not known to occur in the Jarrah Forest
Calectasia grandiflora	Dasypogaceae	P2	-	Habit: Rhizomatous, perennial, herb (or undershrub), to 0.65 m high, without stilt roots. Flower colour: blue/purple Flowering period (indicated in green): J F M A M **J J A S O N** D Soils: White, grey or yellow sand, sandy clay, gravel, laterite, granite. Swampy areas, rock outcrops, flats, slopes, ridges. IBRA Distribution: JAF, SWA Florabase records: 12	**Low** Species not known to the Northern Jarrah Forest
Grevillea ornithopoda	Proteaceae	P2	-	Habit: Spreading, virgate shrub, 1-3 (-5) m high, up to 3 m wide. Flower colour: cream-white Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Loam, loam over clay, sand, clay. Edge of river bank and creek, dunes IBRA Distribution: JAF, SWA Florabase records: 20	**Moderate** Within species range. Historical record within 10km area.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Johnsonia pubescens subsp. *cygnorum*	Hemerocallidaceae	P2	-	Habit: Tufted, perennial, herb, 0.15-0.25 m high. Flower colour: white-green Flowering period (indicated in green): J F M A M J J A **S** O N D Soils: Grey-white-yellow sand. Flats, seasonally-wet sites. IBRA Distribution: SWA Florabase records: 12	**Low** Species not known to occur in the Jarrah Forest
Tetratheca phoenix	Elaeocarpaceae	P2	-	Habit: Few-branched shrub (subshrub), to 0.25 m high. Flower colour: dark pink-magenta Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Brown gravelly loam over granite. Mid to Upper slopes, near granite outcrops. IBRA Distribution: JAF Florabase records: 10	**High** Within species range. Recorded within Alcoa O'Neill lease.
Acacia drummondii subsp. *affinis*	Fabaceae	P3	-	Habit: Erect shrub, 0.3-1 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J **J** **A** S O N D Soils: Lateritic gravelly soils. IBRA Distribution: AVW, JAF, SWA Florabase records: 37	**High** Within species range. Recorded within Myara Forest block.
Acacia horridula	Fabaceae	P3	-	Habit: Harsh, slender, single-stemmed shrub, 0.3-0.6 (-1) m high. Flower colour: yellow Flowering period (indicated in green): J F M A **M** **J** **J** **A** S O N D Soils: Gravelly soils over granite, sand. Rocky hillslopes. IBRA Distribution: JAF, SWA Florabase records: 33	**High** Within species range. Recorded within Myara North (MCPL 19/20)

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia oncinophylla subsp. *oncinophylla*	Fabaceae	P3	-	Habit: Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Granitic soils IBRA Distribution: AVW, JAF, SWA Florabase records: 42	**Moderate** Within species range.
Adenanthos cygnorum subsp. chamaephyton	Proteaceae	P3	-	Habit: Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Flower colour: white-cream-pink-green/green Flowering period (indicated in green): **J** F M A M J **J A S O N D** Soils: Grey sand, lateritic gravel. IBRA Distribution: AVW, JAF, SWA Florabase records: 21	**Moderate** Within species range. Recorded at O'Neill (MCPL 2009)
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	Ericaceae	P3	-	Habit: Shrub, to 1.1 m high and 1.1 m wide. Flower colour: white-cream/mauve-pink Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Loam, clay, sand, gravel. Granite, slopes and drainage lines. IBRA Distribution: JAF Florabase records: 22	**Moderate** Within species range.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Conospermum scaposum	Proteaceae	P3	-	Habit: Erect shrub, 0.2-0.45(-0.75) m high. Flower colour: blue Flowering period (indicated in green): **J F** M A M J J A S **O N D** Soils: White-grey sand, sandy clay. Low swampy areas, road verges. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 46	**Moderate** Species recorded at Myara North (MCPL 2019/20)
Cyathochaeta teretifolia	Cyperaceae	P3	-	Habit: Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2.0 m high, to 1.0 m wide. Flower colour: brown Flowering period (indicated in green): **J** F M A M J J A **S O N** D Soils: Grey sand, sandy clay. Swamps, creek edges. IBRA Distribution: JAF, SWA, WAR Florabase records: 39	**Moderate** Dependent on habitat hydrology requirements on-site. Species recorded within proximity.
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	Apiaceae	P3	-	Habit: Erect perennial, herb, 0.15-0.5 m high. Flower colour: white/blue Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Clay, sandy clay. Claypans, seasonally wet flats. IBRA Distribution: SWA Florabase records: 0	**Low** Species not known to occur in the Jarrah Forest (restricted to wetter areas of the SWA)
Halgania corymbosa	Boraginaceae	P3	-	Habit: Erect shrub, 0.35-1 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Gravelly soils, soils over granite. IBRA Distribution: JAF, SWA Florabase records: 18	**Low** Species records to the west of the Darlington scarp.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Isopogon autumnalis	Proteaceae	P3	-	Habit: Shrub 0.3-1 m high, commonly 0.5-1 m wide. Flower colour: pale yellow Flowering period (indicated in green): J **F** **M** **A** **M** J J A S O N D Soils: Sandy soils. IBRA Distribution: GES, JAF, SWA Florabase records: 59	**Low** Records to the west of the Darlington scarp.
Lasiopetalum glutinosum subsp. *glutinosum*	Malvaceae	P3	-	Habit: Shrub to 0.8 m high. Flower colour: pink-purple Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Lateritic gravel and clay, clay loam, sandy clay over granite. Slopes, granite outcrops. IBRA Distribution: AVW, JAF, SWA Florabase records: 48	**High** Within species range. Records within proximity.
Lepyrodia heleocharoides	Restionaceae	P3	-	Habit: Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N **D** Soils: Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps. IBRA Distribution: JAF, SWA Florabase records: 20	**High** Record of population of >50 plants within 2kms

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Meionectes tenuifolia	Haloragaceae	P3	-	Habit: Annual semi-aquatic herb, to 0.35 m high. Flower colour: orange-red-brown, green Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Grey sand or grey-brown clay, shallow soils. Seasonally inundated flat, edge of swamp. IBRA Distribution: JAF, SWA Florabase records: 24	**High** Dependent on suitable habitat. Species record within close proximity.
Stackhousia sp. Red-blotched corolla (A. Markey 911)	Celastraceae	P3	-	Habit: Erect herb or shrub, approximately 0.2 m high. Flower colour: cream-yellow Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Brown loamy sand, clayey sand over laterite, white sandy clay over granite, grey clay. Slopes. IBRA Distribution: AVW, GES, JAF Florabase records: 9	**Moderate** Within species range
Thysanotus anceps	Asparagaceae	P3	-	Habit: Rhizomatous, leafless perennial, herb, to 0.4 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: White or grey sand, lateritic gravel, laterite. IBRA Distribution: GES, JAF, SWA Florabase records: 17	**Moderate** Recorded within proximity within JAF.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia oncinophylla subsp. patulifolia	Fabaceae	P4	-	Habit: Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Granitic soils, occasionally on laterite. IBRA Distribution: JAF, SWA Florabase records: 31	**Low** Records nearby on SWA, only occasionally on laterite
Aponogeton hexatepalus	Aponogetonceae	P4	-	Habit: Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Flower colour: green-white Flowering period (indicated in green): J F M A M J **J A S O** N D Soils: Mud. Freshwater: ponds, rivers, claypans. IBRA Distribution: JAF, SWA Florabase records: 30	**Low** Not known to the Northern Jarrah Forests
Calothamnus graniticus subsp. *leptophyllus*	Myrtaceae	P4	-	Habit: Erect, multi-stemmed shrub, 1-2 m high. Flower colour: red Flowering period (indicated in green): J F M A M **J J A** S O N D Soils: Clay over granite, lateritic soils. Hillsides. IBRA Distribution: JAF, SWA Florabase records: 32	**Low** Nearby records within SWA
Cyanothamnus tenuis	Rutaceae	P4	-	Habit: Procumbent or erect & slender shrub, 0.1-0.5 m high. Flower colour: blue/pink-white Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Laterite, stony soils, granite. IBRA Distribution: JAF, SWA Florabase records: 44	**High** Within species range. Recorded within proximity.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Drosera occidentalis	Droseraceae	P4	-	Habit: Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Flower colour: pink/white Flowering period (indicated in green): **J F** M A M J J A S **O N D** Soils: White/black sand over yellow clay, yellow sand, moist brown/grey clay/sand, peaty sand, sandy clay. Damp flats, flood plain. IBRA Distribution: JAF, SWA Florabase records: 18	**Low** Nearby records within SWA. Dependent on suitable habitat on-site.
Grevillea pimeleoides	Proteaceae	P4	-	Habit: Non-lignotuberous shrub, 0.4-2.4 m high. Flower colour: yellow-orange Flowering period (indicated in green): J F M A **M J J A S O N** D Soils: Gravelly soils over granite. Rocky hillsides. IBRA Distribution: JAF Florabase records: 36	**High** Species recorded within close proximity.
Parsonsia diaphanophleba	Apocynaceae	P4	-	Habit: Woody climber, to 10 m high. Flower colour: white/cream & pink Flowering period (indicated in green): **J F** M **A M J** J A **S** O N D Soils: Alluvial soils. Along rivers. IBRA Distribution: JAF, SWA Florabase records: 28	**Low** Species occurs on alluvial soils along rivers.

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Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Pimelea rara	Thymelaeaceae	P4	-	Habit: Shrub, 0.2-0.35 m high. Flower colour: white Flowering period (indicated in green): **J** F M A M J **J** A S O N **D** Soils: Lateritic soils. IBRA Distribution: JAF Florabase records: 52	**High** Multiple species recorded within survey area.
Senecio leucoglossus	Asteraceae	P4	-	Habit: Erect annual, herb, to 1.3 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** **D** Soils: Gravelly lateritic or granitic soils. Granite outcrops, slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 44	**High** Within species range and recorded within proximity.
Stylidium ireneae	Stylidiaceae	P4	-	Habit: Lax perennial, herb, (0.06-) 0.1-0.28 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S **O** **N** **D** Soils: Sandy loam. Valleys near creek lines. IBRA Distribution: JAF, SWA, WAR Florabase records: 25	**High** Within species range. Multiple records within proximity. Dependent on site topography & hydrology.
Verticordia lindleyi subsp. *lindleyi*	Myrtaceae	P4	-	Habit: Erect shrub, 0.2-0.75 m high. Flower colour: pink Flowering period (indicated in green): **J** F M A **M** J J A S O **N** **D** Soils: Sand, sandy clay. Winter-wet depressions. IBRA Distribution: GES, JAF, SWA Florabase records: 83	**Low** Nearby records within SWA. Grows on sand, sandy clay.

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES BY SITE-VEGETATION TYPES IN KINGSBURY WEST SURVEY AREA, 2023

Note: * denotes introduced species; PL - planted species

Species	A	AC	AW	CW	D	DA	DG	E	W	PW	SW	G	R	P	PS	S	SP	ST	TS	T
Acacia alata var. alata		x		x	x	x			x						x	x				
Acacia applanata												x			x					
Acacia barbinervis			x		x			x		x	x		x	x	x	x	x			
Acacia barbinervis subsp. barbinervis					x				x						x	x				
Acacia browniana															x					
Acacia celastrifolia				x	x									x	x	x				
Acacia divergens	x	x		x																
Acacia drummondii subsp. candolleana					x				x					x	x					
Acacia drummondii subsp. drummondii					x				x					x	x	x				
Acacia extensa				x	x				x	x					x	x	x			
Acacia lateriticola	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		
Acacia nervosa					x					x				x	x	x	x			
Acacia obovata					x		x	x	x	x	x		x	x	x	x	x			
Acacia pulchella				x					x							x	x			
Acacia urophylla										x					x	x	x		x	x
Acacia willdenowiana	x	x			x						x									
Adenanthos barbiger					x				x	x			x	x	x	x	x	x		x
Agrostocrinum scabrum															x	x				
Allocasuarina fraseriana					x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Allocasuarina humilis												x								
Amphipogon amphipogonoides					x				x	x			x		x	x				
Andersonia aristata												x								
Anigozanthos manglesii					x					x					x	x	x			
Astartea scoparia	x			x																
* *Asteraceae sp.*														x						
Babingtonia camphorosmae			x	x	x			x	x	x	x	x	x							
Banksia bipinnatifida					x			x		x	x	x	x							
Banksia dallanneyi var. dallanneyi			x	x	x			x	x	x	x	x	x	x	x	x	x	x		
Banksia grandis					x					x				x	x	x	x	x		x
Banksia littoralis	x	x	x	x																
Banksia sessilis				x	x				x	x	x		x	x	x	x	x			
Beaufortia macrostemon					x															
Billardiera fusiformis			x		x					x					x	x				
Boronia fastigiata		x	x	x	x			x		x	x		x	x	x	x	x	x		
Boronia sp.															x					
Borya sphaerocephala												x	x							
Bossiaea aquifolium									x											
Bossiaea ornata	x		x		x		x	x	x	x	x	x	x	x	x	x	x	x		x
Burchardia congesta														x	x					
Caladenia sp.														x						
Calothamnus rupestris					x					x										
Calothamnus sanguineus					x															
Calytrix flavescens					x															
Cassytha glabella				x																
Cassytha sp.				x					x	x										
Celastraceae sp.								x												
Chamaescilla corymbosa										x				x	x					
Chorizema cordatum				x											x	x				
Clematis pubescens																		x	x	x
Comesperma calymega										x					x	x				
Comesperma virgatum					x										x	x	x			
Conospermum capitatum			x								x			x	x					

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Note: * denotes introduced species; PL - planted species

Species	A	AC	AW	CW	D	DA	DG	E	W	PW	SW	G	R	P	PS	S	SP	ST	TS	T
Conostylis aculeata					x				x											
Conostylis pusilla												x								
Conostylis serrulata					x				x	x	x		x	x	x	x	x			
Conostylis setigera				x	x		x	x	x	x	x	x	x	x	x	x	x	x		
Conostylis setosa			x		x				x	x			x	x	x	x		x		
Corymbia calophylla	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cyathochaeta avenacea		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Cyperaceae sp.										x										
Dampiera alata					x				x					x	x	x				
Dampiera hederacea		x																		
Dampiera linearis					x			x		x				x	x	x	x			
Darwinia citriodora					x							x	x			x				
Daviesia decurrens														x	x	x				
Desmocladus fasciculatus	x				x			x	x	x	x	x	x	x	x	x				
Desmocladus flexuosus	x			x	x		x		x	x				x	x	x	x			
Dianella revoluta					x					x				x	x	x	x			
Drosera sp.			x	x	x			x	x	x	x	x	x	x	x	x				
Eriochilus dilatatus					x					x	x				x	x				
Eucalyptus marginata	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Eucalyptus megacarpa	x	x	x	x					x	x										
Eucalyptus patens	x	x		x					x	x										
PL *Eucalyptus sp. (planted)*					x					x					x		x			
Gahnia decomposita	x	x		x																
Glischrocaryon angustifolium													x							
Gompholobium confertum					x					x				x	x					
Gompholobium knightianum			x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Gompholobium marginatum					x			x	x	x	x		x	x	x	x		x		
Gompholobium polymorphum					x				x					x						
Gompholobium preissii					x				x	x			x	x	x	x				
Gompholobium sp.										x										
Grevillea pilulifera										x										
Grevillea pulchella					x											x				
Grevillea pulchella												x	x							
Grevillea wilsonii								x		x				x	x					
Haemodorum sp.					x									x				x		
Hakea amplexicaulis				x	x		x	x	x	x	x	x	x	x	x	x				
Hakea lissocarpha					x				x	x			x		x	x		x		
Hakea prostrata					x															
Hakea ruscifolia					x					x			x		x	x				
Hakea stenocarpa		x			x							x				x				
Hakea trifurcata					x															
Hakea undulata					x	x						x			x					
Hemigenia pritzelii					x			x	x	x	x			x	x					
Hibbertia acerosa			x	x	x			x	x	x			x	x	x	x	x			
Hibbertia amplexicaulis					x			x		x	x	x	x	x	x	x	x	x		x
Hibbertia commutata			x		x				x		x			x	x	x		x		
Hibbertia huegelii					x					x		x	x	x	x	x	x			
Hibbertia hypericoides			x	x	x		x	x	x	x	x	x	x	x	x	x	x	x		
Hibbertia ovata					x	x		x		x	x		x	x	x	x	x			
Hibbertia perfoliata					x										x	x				
Hibbertia silvestris					x										x	x				
Hibbertia sp.					x										x	x				

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES BY SITE-VEGETATION TYPES IN KINGSBURY WEST SURVEY AREA, 2023

Note: * denotes introduced species; PL - planted species

	Species	A	AC	AW	CW	D	DA	DG	E	W	PW	SW	G	R	P	PS	S	SP	ST	TS	T
	Hovea chorizemifolia					x					x		x	x	x	x	x	x	x	x	x
	Hovea trisperma																x				
	Hypocalymma angustifolium			x	x	x			x	x	x	x	x	x							
	Hypocalymma cordifolium			x	x																
	Hypocalymma robustum			x		x			x	x	x	x		x	x	x	x	x			
*	*Hypochaeris glabra*										x				x		x				
	Hypolaena exsulca		x	x	x	x	x		x		x	x				x	x				
	Isopogon dubius					x			x		x			x							
	Isopogon sphaerocephalus					x						x	x	x	x	x	x	x			
	Kennedia coccinea					x									x	x	x	x	x		x
	Kennedia prostrata					x											x				
	Kingia australis								x												
	Kunzea recurva								x												
	Labichea punctata															x	x				
	Lagenophora huegelii			x		x									x	x	x				
	Lasiopetalum floribundum				x	x				x	x				x	x	x	x	x	x	x
	Lasiopetalum glabratum																	x			
	Lechenaultia biloba					x			x	x	x	x		x	x	x	x	x			
	Lepidosperma gracile					x				x						x	x				
	Lepidosperma pubisquameum														x						
	Lepidosperma sp.		x			x	x		x	x	x	x	x	x	x	x	x				
	Lepidosperma squamatum			x		x		x	x	x	x	x	x	x	x	x	x	x			
	Lepidosperma tenue															x					
	Lepidosperma tetraquetrum	x	x		x																
	Leptocarpus sp.													x		x					
	Leptomeria cunninghamii					x										x	x				
	Leptospermum erubescens					x					x		x	x		x					
*	*Leptospermum laevigatum*					x															
	Leucopogon glabellus							x					x	x							
	Leucopogon verticillatus															x	x	x			x
	Levenhookia pusilla															x					
	Levenhookia stipitata															x					
	Lindsaea linearis				x	x	x			x	x	x				x					
	Lobelia gibbosa														x	x	x				
	Lomandra caespitosa	x	x	x	x	x			x		x	x	x		x	x	x	x	x		x
	Lomandra hermaphrodita			x	x	x			x	x	x	x	x	x	x	x	x	x			
	Lomandra nigricans	x				x										x	x				x
	Lomandra preissii			x	x	x	x		x		x			x	x	x	x	x			
	Lomandra purpurea										x				x	x		x	x		x
	Lomandra sericea					x										x	x	x			
	Lomandra sonderi			x	x	x			x		x	x		x	x	x	x	x			
	Lomandra sp.					x					x				x	x	x		x		
	Lomandra spartea			x		x			x	x	x	x		x	x	x	x	x			
	Loxocarya cinerea		x		x	x			x		x	x	x	x	x	x	x		x		x
	Lyginia barbata															x					
	Lysiandra calycina			x	x	x			x	x	x	x	x		x	x	x				
	Macrozamia riedlei	x	x	x	x	x			x	x	x	x	x		x	x	x	x	x		x
	Marianthus drummondianus				x	x					x	x			x	x					
	Marianthus sp.															x		x			
	Melaleuca parviceps					x					x	x	x	x							
	Melaleuca preissiana	x																			
	Melaleuca sp.	x									x										

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Note: * denotes introduced species; PL - planted species

	Species	A	AC	AW	CW	D	DA	DG	E	W	PW	SW	G	R	P	PS	S	SP	ST	TS	T
	Mesomelaena tetragona	x		x	x	x	x		x		x	x	x	x							
	Mirbelia dilatata	x	x		x	x				x	x					x		x			
	Monotaxis occidentalis					x					x					x	x				
	Morelotia octandra			x		x			x	x	x	x	x	x	x	x	x				
	Netrostylis sp. Jarrah Forest (R. Davis 7391)	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x		x
	Neurachne alopecuroidea				x	x			x		x	x			x	x	x				
	Olearia paucidentata																				
	Opercularia apiciflora					x															
	Opercularia echinocephala			x		x			x		x	x			x	x	x	x	x	x	x
	Opercularia hispidula																				x
	Orchidaceae sp.													x		x	x				
	Paraserianthes lophantha										x										
	Patersonia occidentalis					x		x		x	x	x	x			x	x	x			
	Patersonia pygmaea					x				x	x	x		x	x	x	x				
	Patersonia rudis					x			x		x		x	x	x	x	x				
	Patersonia sp.		x																		
*	*Pentameris airoides*					x									x	x					
	Pentapeltis peltigera		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		
	Pericalymma ellipticum					x															
	Persoonia angustiflora					x							x	x							
	Persoonia elliptica					x					x			x		x	x	x			
	Persoonia longifolia					x			x			x			x	x	x	x			x
	Petrophile striata														x	x					
	Philotheca spicata					x			x		x			x	x	x	x	x			
	Pigea floribunda													x							
	Pimelea ciliata										x					x					
	Pimelea suaveolens					x				x	x				x	x	x		x		
PL	*Pinus pinaster*					x					x					x		x			
	Platysace filiformis	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
	Platysace tenuissima				x	x				x	x	x			x	x	x	x			
	Poaceae sp.															x					
	Pteridium esculentum	x	x		x																x
	Pterochaeta paniculata			x		x			x		x	x	x	x	x	x	x				
	Pterostylis sp.														x	x					
	Pyrorchis nigricans					x										x					
	Rytidosperma caespitosum			x	x	x			x		x	x		x	x	x	x				
	Scaevola calliptera					x			x		x	x		x	x	x	x		x		x
	Senecio hispidulus																x				x
	Sowerbaea laxiflora															x					
	Sphaerolobium medium															x					
	Stirlingia latifolia		x			x				x	x	x			x	x					
	Stylidium amoenum					x			x	x	x				x	x	x				
	Stylidium hispidum															x					
	Stylidium piliferum			x		x		x		x	x	x	x	x	x	x	x	x			
	Stylidium repens					x			x	x	x	x	x	x	x						
	Stylidium scariosum			x		x					x					x	x				
	Stylidium sp.					x			x		x	x	x	x	x	x	x	x	x		
	Stylidium tărepens													x							
	Styphelia discolor			x		x			x		x	x		x	x	x	x	x	x		
	Styphelia nitens		x	x	x	x			x	x	x	x		x	x	x	x	x			
	Styphelia pallida					x			x	x	x			x	x	x	x	x			x
	Styphelia propinqua			x		x			x		x	x	x	x	x	x	x	x	x	x	

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Note: * denotes introduced species; PL - planted species

Species	A	AC	AW	CW	D	DA	DG	E	W	PW	SW	G	R	P	PS	S	SP	ST	TS	T
Styphelia sp.									x					x	x	x				
Styphelia tenuiflora					x					x			x	x	x	x	x			
Styphelia tortifolia					x					x			x		x	x				
Synaphea petiolaris															x					
Synaphea sp.									x											
Taxandria linearifolia	x	x		x																
Tetrarrhena laevis		x	x	x	x	x			x	x	x		x	x	x	x	x	x		x
Tetratheca hirsuta					x					x	x		x	x	x	x	x			
Thomasia paniculata	x			x																
Thysanotus dichotomus					x										x					
Thysanotus fastigiatus				x	x			x	x	x	x		x	x	x	x	x			
Thysanotus multiflorus					x					x				x	x	x	x			
Thysanotus sparteus					x					x			x		x	x				
Trachymene pilosa					x															
Trichocline spathulata														x	x	x	x			
Trymalium ledifolium			x	x	x		x		x	x	x		x	x	x	x	x		x	
Trymalium odoratissimum															x					
Verticordia densiflora										x										
Verticordia huegelii var. decumbens												x								
Verticordia plumosa var. plumosa															x					
Xanthorrhoea acanthostachya													x							
Xanthorrhoea gracilis		x		x	x		x		x	x	x	x	x	x	x	x	x			
Xanthorrhoea preissii		x	x	x	x			x	x	x	x	x	x	x	x	x	x			
Xanthosia atkinsoniana					x									x	x					
Xanthosia candida					x				x	x			x	x	x	x				x
Xanthosia huegelii					x			x		x	x				x	x				x
Xanthosia singuliflora					x					x	x			x	x	x				
Xylomelum occidentale					x	x				x										

ASSESSMENT OF FLORA AND VEGETATION VALUES

ALCOA OF AUSTRALIA WARRINGTON SURVEY AREA, WA

Prepared By

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6: Warrington – Pre- European Vegetation

7: Warrington – Vegetation Complexes

8: Warrington – Threatened and Priority Flora

9: Warrington - Old Growth Forests

10: Warrington – Dieback

11 Warrington – Survey Effort

12: Warrington – Site-Vegetation Types and Priority Flora Species

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APPENDICES

A1:	Threatened and priority flora definitions
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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BOM:	Bureau of Meteorology
DCCEEW:	Department of Climate Change, Energy, the Environment and Water
DBCA:	Department of Biodiversity, Conservation and Attractions
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
MCPL:	Mattiske Consulting Pty Ltd
IBRA:	Interim Biogeographical Regionalisation for Australia
PEC:	Priority ecological community
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned in 2023 by Alcoa of Australia Ltd (Alcoa) to conduct a desktop assessment to evaluate the potential flora and vegetation values of the Willowdale-Larego expansion survey area, namely Warrington, located approximately 116 km south east of Perth, WA. The Warrington survey area consists of 21 blocks totalling 1,134 hectares, located south- east of the existing Willowdale bauxite mining operation and within tenements ML 1S4, E 70/2338, E 70/5390 and E 70/5543. The survey areas have been assessed by Mattiske Consulting Pty Ltd at a regional mapping scale as part of the Regional Forest Agreement (RFA) project by Mattiske and Havel (1998).

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the Warrington survey area. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed.

The Warrington survey area occurs within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System by Heddle *et al.* (1980) and Mattiske and Havel (1998).

Potential Flora Values

A total of 578 vascular plant taxa, representative of 216 genera and 80 families, have the potential to occur within the Warrington survey area. The most commonly represented families in the Warrington area are Fabaceae (77 taxa), Proteaceae (45 taxa) and Myrtaceae (43 taxa). The most commonly represented genera in the Warrington area are *Acacia* (27 taxa), *Stylidium* (19 taxa) *Hibbertia* (15 taxa) and *Lomandra* (17 taxa).

A total of 49 introduced taxa has the potential to occur in the Warrington survey area. Only one of the potential weeds **Rubus ulmifolius* as listed under the **Rubus fruticosus* aggregate, is a Weed of National Significance (DAFF, 2023). **R. ulmifolius* is also a declared pest/organism under the *Biosecurity and Agriculture Management Act 2007* (WA) (DPIRD 2023).

Recorded Flora Values

A total of 238 vascular plant taxa, representative of 111 genera and 45 families, were recorded in the Warrington survey area. The most commonly represented families in the Warrington area are Fabaceae (32 taxa), Proteaceae (21 taxa) and Myrtaceae (16 taxa). The most commonly represented genera in the Warrington area are *Acacia* (27 taxa), *Stylidium* (19 taxa), *Hibbertia* (15 taxa) and *Lomandra* (17 taxa).

A total of 5 introduced taxa were recorded in the Warrington survey area. None of the weeds were Weeds of National Significance (DCCEEW, 2023) or declared pest/organism under the *Biosecurity and Agriculture Management Act 2007* (WA) (DPIRD 2023). One of these 5 species was the planted **Pinus* species.

Potential Vegetation Values

No Threatened Ecological Communities (TECs) occur in the Warrington survey areas. The desktop assessment did highlight one community which may occur, the *Banksia Woodland of the Swan Coastal Plain*; however this is restricted to the Swan Coastal Plain and as such does not extend into the Jarrah forest area on the Darling Ranges.

The Warrington survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023a) and as such was considered during the RFA process.

Recorded Vegetation Values

Heddle *et al*. (1980) defined and described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes as part of the System 6 studies. Mattiske and Havel (1998) updated this initial more restricted mapping coverage to the wider south-west forest region as (Regional Forest Agreement vegetation complexes). Havel, J.J. (2000) summarized in greater detail the relationships between the landforms, soils and climatic conditions. Mattiske and Havel (1998) defined and described five vegetation complexes in the survey areas. None of these are restricted to the Warrington survey area.

A total of 15 site-vegetation types and 1 cleared area were defined and mapped in the Warrington survey area (excluding the already cleared (CL) areas). The site-vegetation types were subdivided into three main groupings associated with site conditions which reflected landforms, soils and soil moisture levels. The site-vegetation types on the extreme sites such as on the valley systems areas and the creeklines differ markedly from the forest and woodland areas on the slopes and ridges. The Warrington area differed from some other areas near the Willowdale area as sections are dominated by creeklines and associated valley systems.

The majority of the vegetation was ranked as very good despite historical harvesting activities, recent intense fires, dieback and some established tracks and one restricted cleared area. The presence of the dieback disease is particularly evident in the condition of the vegetation on the lower slopes that support D, PW and SW site-vegetation types.

Potential Groundwater Dependent Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the site-vegetation types. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils on the lower slopes of the Yarragil (Yg1 and Yg2) valley systems. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Potential Old Growth Forest Areas

There are no patches of old growth forests occurring in the Warrington survey area as supplied by the Department of Biodiversity, Conservation and Attractions.

1. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned in 2023 by Alcoa of Australia Ltd (Alcoa) to conduct a desktop assessment to evaluate the potential flora and vegetation values of the Warrington survey area. The purpose of the assessment was to provide information pertaining to mining approvals. This desktop assessment was then followed by detailed mapping of the areas within the Warrington survey area.

1.1. Location and Scope of Project

The Warrington survey area occurs within the Northern Jarrah Forest subregion of the Southwest Botanical Province (Beard 1990), approximately 116 km south east of Perth, WA (Figure 1). The Warrington survey area is located approximately 7 km south-east of the existing Willowdale bauxite mine and intersects tenements ML 154, E 70/2338, E 70/5390 and E 70/5543 (Figure 2).

Parts of this region have previously been surveyed by E. M. Mattiske and Associates (1993 to 1994) and Mattiske Consulting Pty Ltd (1996 to 2022) at a regional mapping scale as part of the Regional Forest Agreement (RFA) project by Mattiske and Havel (1998). These studies built on the earlier work of Havel (1975a and 1975b) in the northern Jarrah Forest.

This report describes the potential and recorded flora and vegetation values of the Warrington survey area and places them within a local and regional context.

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The following key Western Australian (state) legislation relevant to this survey includes the:

- *Wildlife Conservation (Rare Flora) Notice 2022*
- *Biodiversity Conservation Act 2016* (BC Act) and *Regulations 2018*;
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) and *Regulations 2013*;
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

Furthermore, key Western Australian guidelines relevant to this survey are the:

- *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority [EPA] 2016a); and
- *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b); and.
- *Commonwealth of Australia (2013) - Survey Guidelines for Australia's Threatened Orchids. Guidelines for detecting Orchids listed as "Threatened" under the Environment Protection and Biodiversity Conservation Act 1999.*

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-A5.



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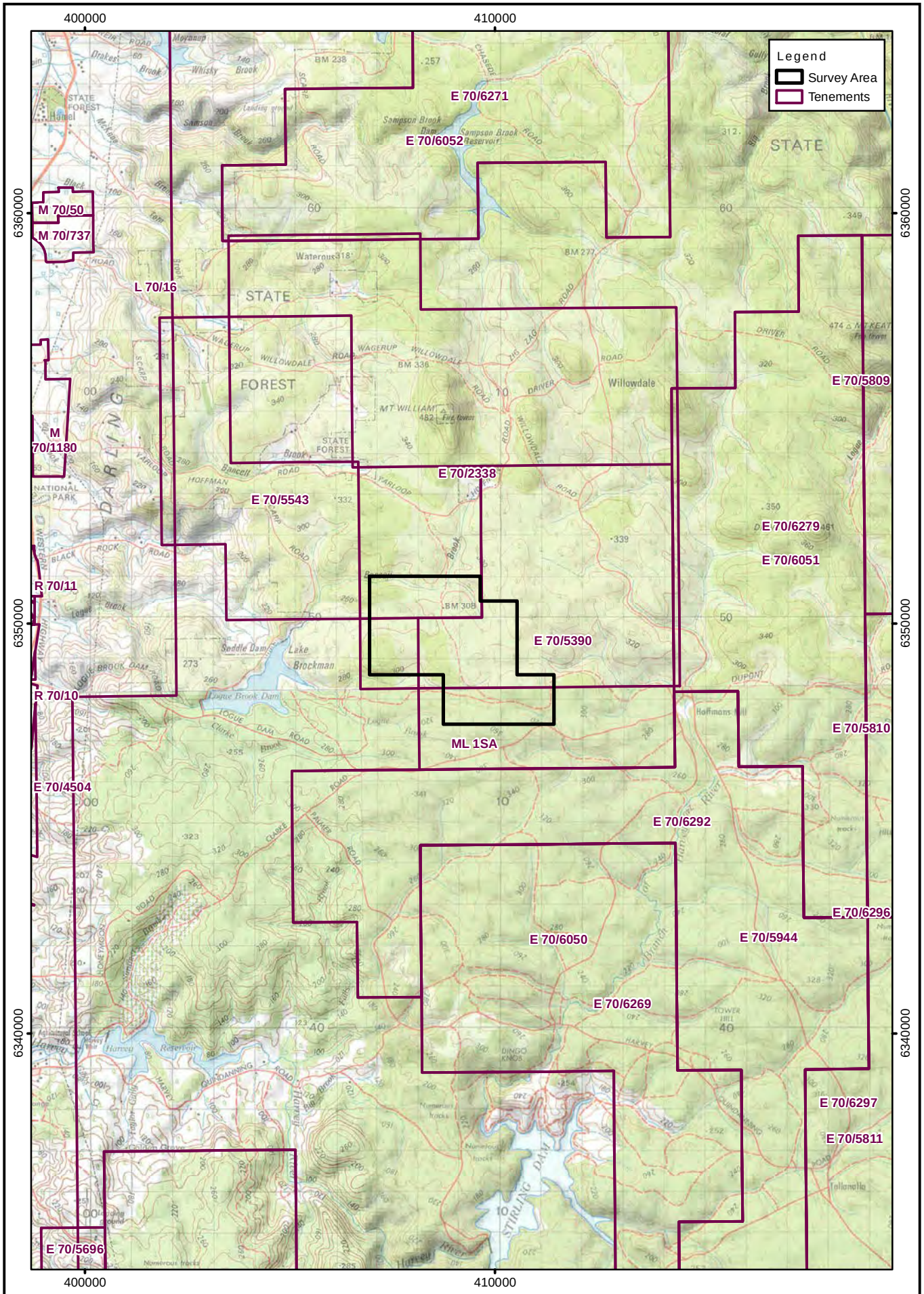
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Warrington Survey Area
Location

Figure: **1**



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0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F022_02

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Warrington Survey Area
Tenements

Figure: **2**

2. OBJECTIVES

The objective of this assessment was to undertake the desktop component of a detailed flora and vegetation survey of the Warrington survey area, including:

- Undertake a desktop assessment of the flora and vegetation of the Warrington survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Undertake a detailed assessment of the flora and vegetation of the Warrington survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Review previous literature and current databases associated with the Warrington survey area;
- Review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA 2022a) and plant collections held at the Western Australian Herbarium ([WAH] 1998 -), and plants listed by the Department of Climate Change, Energy and the Environment and Water [DCCEEW] (2023a) under the EPBC Act; and
- Prepare a report summarising the findings.

3. METHODS

3.1. Desktop Assessment

A desktop assessment was undertaken in April 2023 using FloraBase (WAH 1998-), NatureMap (DBCA 2007-) and the *EPBC Act* Protected Matters Search Tool (PMST) (DCCEEW 2023a) databases, to identify the possible occurrence of flora (including threatened and priority taxa) and threatened and priority ecological communities within the Warrington survey area. The NatureMap search (02-0423NM) was requested through the DBCA's interim biodiversity platform (email) with a 10 km search buffer applied to the following co-ordinate;

- -32°59'4.53"S, 116° 1'33.78"E

The PMST search was also completed on the above co-ordinate, with a 5 km buffer applied. The TPFL database of threatened and priority flora and ecological communities and the Western Australian Herbarium (WAH) database were arranged by CAD Resources, where a 25 km buffer was applied (Carine, WA). In addition, any flora recorded by Mattiske Consulting Pty Ltd (2015-2022) within or adjacent to the survey area were included. Summary of the vascular plant species recorded through these various databases are summarised in Appendices B and C.

Additionally, the land systems, Pre-European vegetation, vegetation complexes and Site Vegetation types as well as the presence of dieback and Old- growth were identified. Historical documentation and vegetation mapping of the Northern Jarrah Forest subregion that provide resource material for the floristics and vegetation of the Warrington area was reviewed, including Mattiske Consulting Pty Ltd (2015-2022) reports on their flora and vegetation surveys in the nearby Larego survey areas. Nomenclature of flora species was checked against and is consistent with Florabase (WAH 1998-).

3.2. Field studies

Field studies were undertaken at 772 sites on the 120m grid systems within the approximate 1134 ha of the Warrington survey area.

To maintain consistency with previous mapping of the area, enabling spatial and temporal comparisons, flora and vegetation were assessed using site-type classification based on Heddle *et al.* (1980). Sites were pre-designated using a 120 x 120 m grid system overlaid on the survey area. A total of 772 sites within the 1134 ha area were assessed with recordings on the trees (20m radius) and understorey (5m radius).

Additional targeted work was undertaken on the areas between the recording sites and also on specific areas such as the outcrop and sandier valley systems and creeklines.

This data was then used in combination with aerial imagery and field observations to map the vegetation of the survey area. Furthermore, searches for threatened, priority or Declared (plant) pests species were undertaken whilst walking between survey sites.

The following information was recorded at each vegetation assessment site:

GPS location	Easting, Northing and datum;
Soil types	gravels, sandy-gravels, sandy-loam-gravels, sandy-loams, loams, clay-loams, clays and peat;
Topography	ridge, upper slope, mid-slope, lower slope, valley floor and swamp;
Outcropping	type – granite, laterite, dolerite, and quantity – few, moderate, numerous;
Logging history	light, moderate or heavy, together with number of stumps within a 20 m radius;
Fire history	years since last fire; and
Dieback occurrence	*Phytophthora* spp. demarcation – field blazing, coloured flagging on trees, vegetation deaths, either old or recent.

At each site species were ranked according to the scale developed by Havel (1975a, 1975b). Tree and understorey species were assessed separately using the following method.

Tree species

Tree species (*Allocasuarina fraseriana, Banksia grandis, B. littoralis, B. seminuda, Corymbia calophylla, Eucalyptus marginata, E. megacarpa, E. patens, E. rudis, E. wandoo, Melaleuca preissiana, M. rhaphiophylla, Nuytsia floribunda, Persoonia elliptica, P. longifolia* and *Xylomelum occidentale*) were assessed within a 20 m radius from the observation point using the following scale:

0 absent;
1 one or two trees;
2 three to five trees;
3 more than five trees, but contributing less than one third of the total stand;
4 between one third and one half of the total stand; or
5 more than one half of the total stand.

Understorey species

Understorey species were assessed within a 5 m radius from the observation point using the following scale:

0 absent;
1 very rarely seen, only after a careful search;
2 present, observable, but in small numbers only;
3 common locally, but not uniform over the whole area;
4 common over the whole area; or
5 completely dominating the understorey.

The physiological stress was determined for each species within a 20 m radius from the observation point and ranked according to the following scale.

0 healthy, no evidence of stress;
1 odd plant showing signs of stress, not dead;
2 one or two dead plants, near death;
3 scattered stressed plants, (2-4) dead plants around survey site;

4 susceptible plants dying or dead (> 4 plants); or
5 "graveyard" death

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH). All plant specimens were identified through comparisons with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

4. DESKTOP FINDINGS

The climate, geology, soils and landforms all influence the vegetation of the area and are described in this section. Potential flora, including threatened, priority and introduced species are described, along with possible vegetation communities, and placed within a local and regional context.

4.1. Climate

The survey area lies at the southern end of the Northern Jarrah Forest subregion. Beard (1990) described the climate of this area as being warm Mediterranean, with rainfall of 600 – 1200 mm per annum and 5 - 6 dry months per year. Long-term and recent climatic data from BOM's Dwellingup weather station (Stn. No. 9538) is shown in Figure 3. Annual average rainfall at Dwellingup (1934 -2023) is 1224.5 mm (Bureau of Meteorology [BOM] 2023). Rainfall in 2022 was highest in August 2022 than the longer-term mean; although the summer months were again drier (Figure 3).

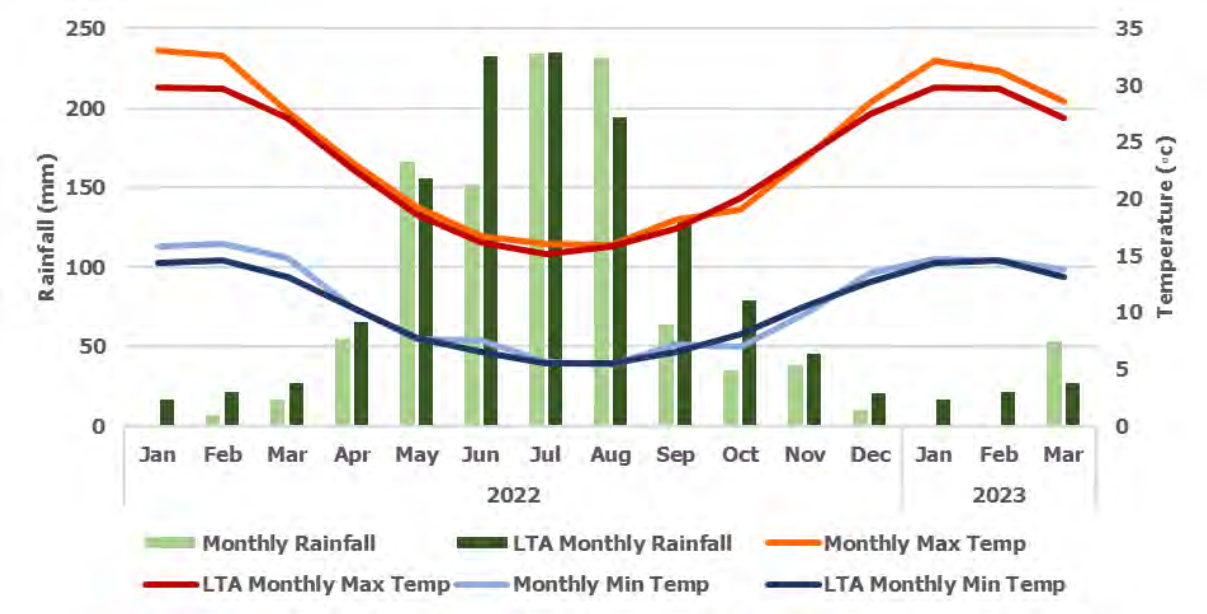
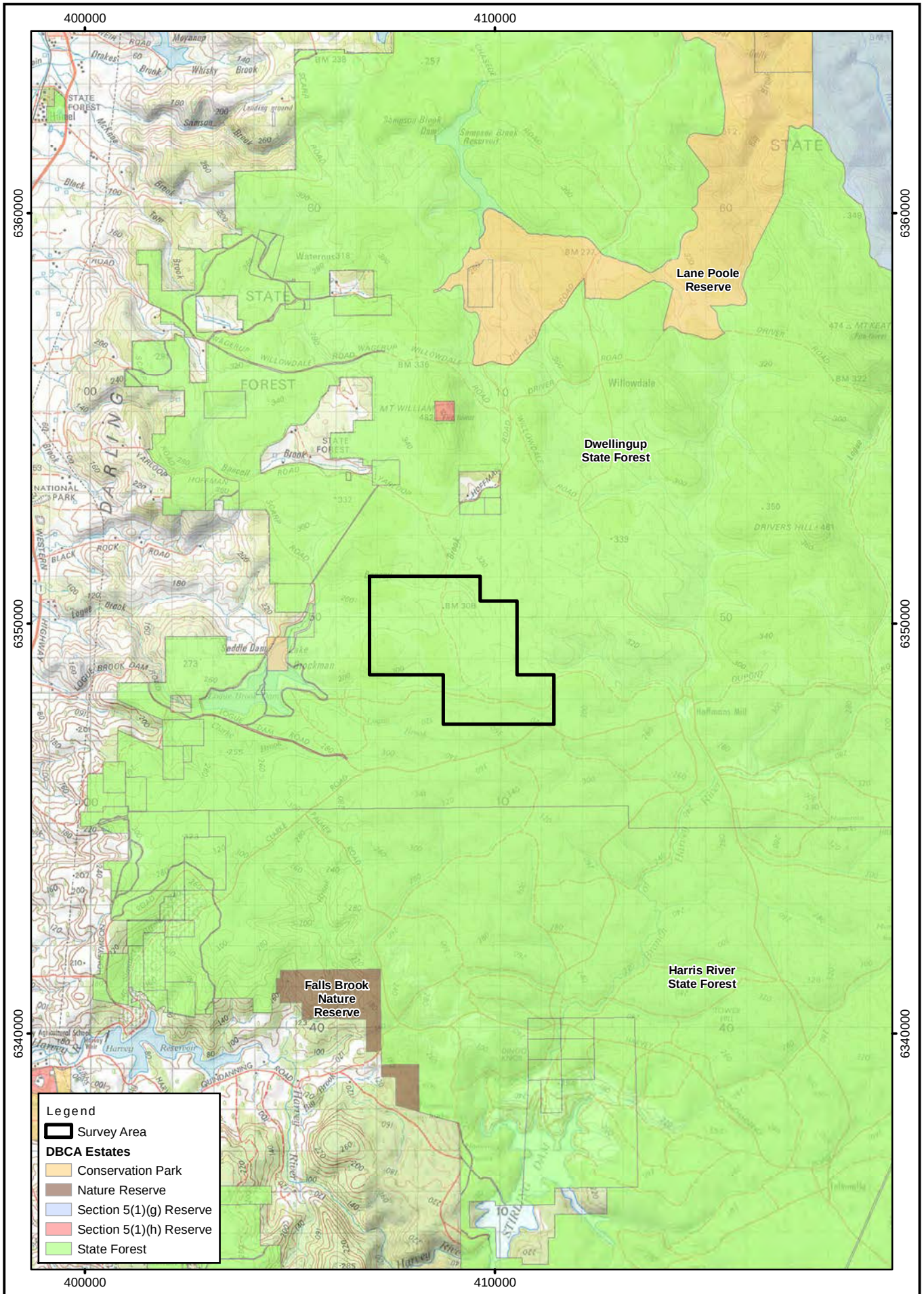


Figure 3: Climatic data for the Warrington survey area
Long-term rainfall and temperature data from the Dwellingup weather stations respectively (ID 009538 respectively, years 1934-2023) (BOM 2023).

4.2. DBCA Estates

The Warrington survey area is situated in the Dwellingup State Forest (Figure 4).



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Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F022_03

Date: April 2023 | Rev: A | A4

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Warrington Survey Area
DBCA Estates

Figure: **4**

4.3. Geology, Soils and Topography

The Warrington survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion encompasses the area to the east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of the Yilgarn Craton at an average elevation of 300 m (Beard 1990). The area is capped by extensive lateritic duricrust, dissected by drainage lines and broken by occasional granite hills. In the eastern section, the laterite becomes deeply dissected until it compresses isolated remnants. The duricrusted plateau of the Yilgarn Craton is characterised by lateritic gravels, consisting of 5m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon. These overlay mottled yellow-brown clay subsoils and hard setting loamy soils, which become evident in the east (Beard 1990).

Furthermore, Western Australia is divided into twelve Systems, separated by natural and demographic boundaries (Department of Conservation and Environment 1980). The survey area lies within the Darling System (as known as System 6), which is further divided into provinces, with the survey area lying in The Darling Plateau province (Department of Conservation and Environment 1980).

The underlying geological units of the Darling Plateau province have been defined by Churchward and McArthur (1980), with two main landform and soil units occurring within the survey areas, these are:

Dwellingup: Gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions.

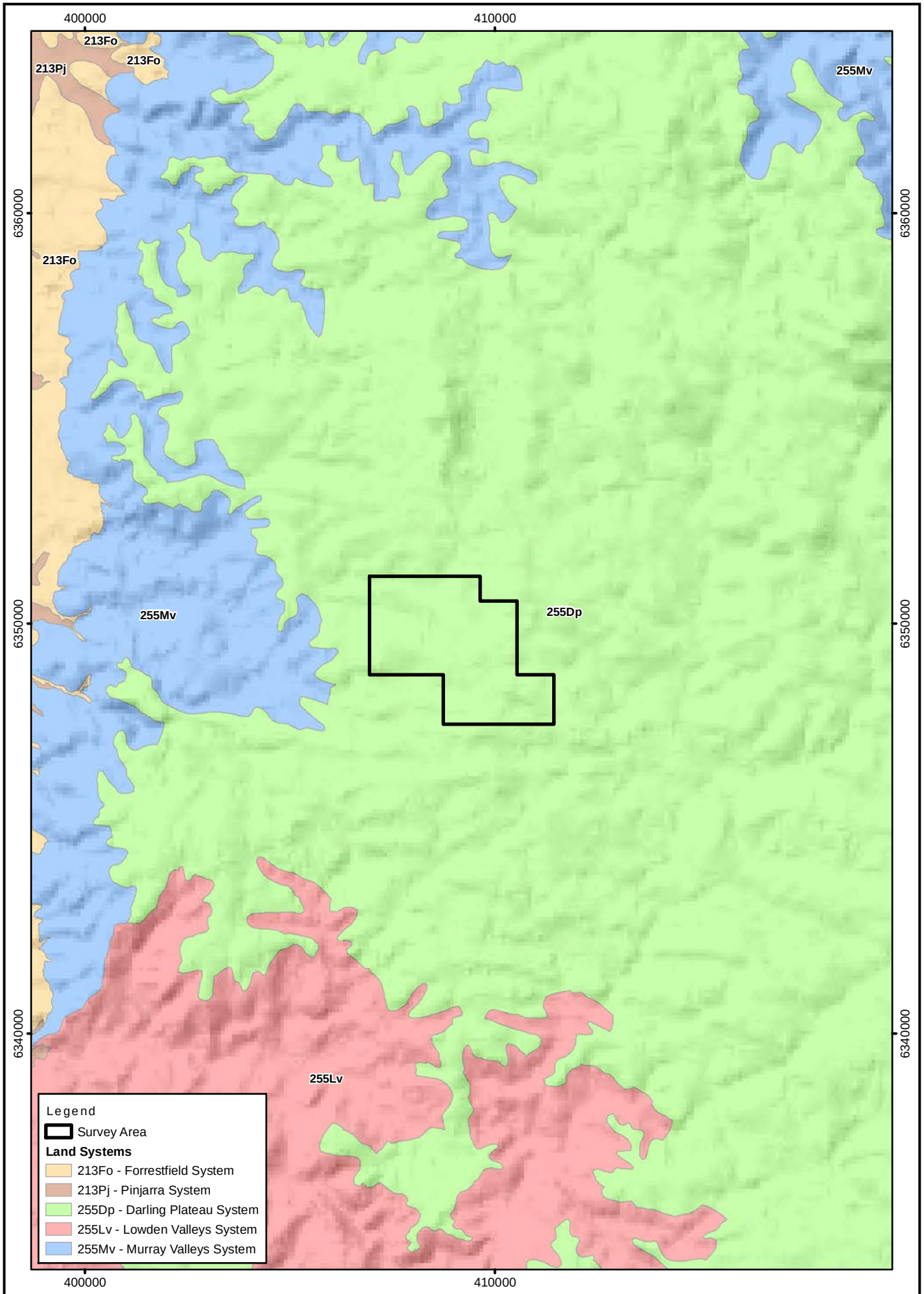
Yarragil: Valleys of the western part of the plateau; sandy gravels on the slopes; orange earth in swampy floors.

The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the Warrington survey areas (Figure 5, Table 1) includes the Darling Plateau System (255Dp) with two other land systems in nearby areas:

1. **Darling Plateau System (255Dp):** Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah-marri-wandoo forest and woodland.

Table 1: Extent of Land Systems intersecting the Warrington survey area

Land System	Mapping Unit	Total Extent (ha)	Area of Intersection with the Warrington survey area	Proportion of Current Extent (%)
Darling Plateau System	255Dp	820265.7327	1134.01	0.14



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0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F022_04

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Warrington Survey Area
Land Systems

Figure: **5**

4.4. Regional Vegetation

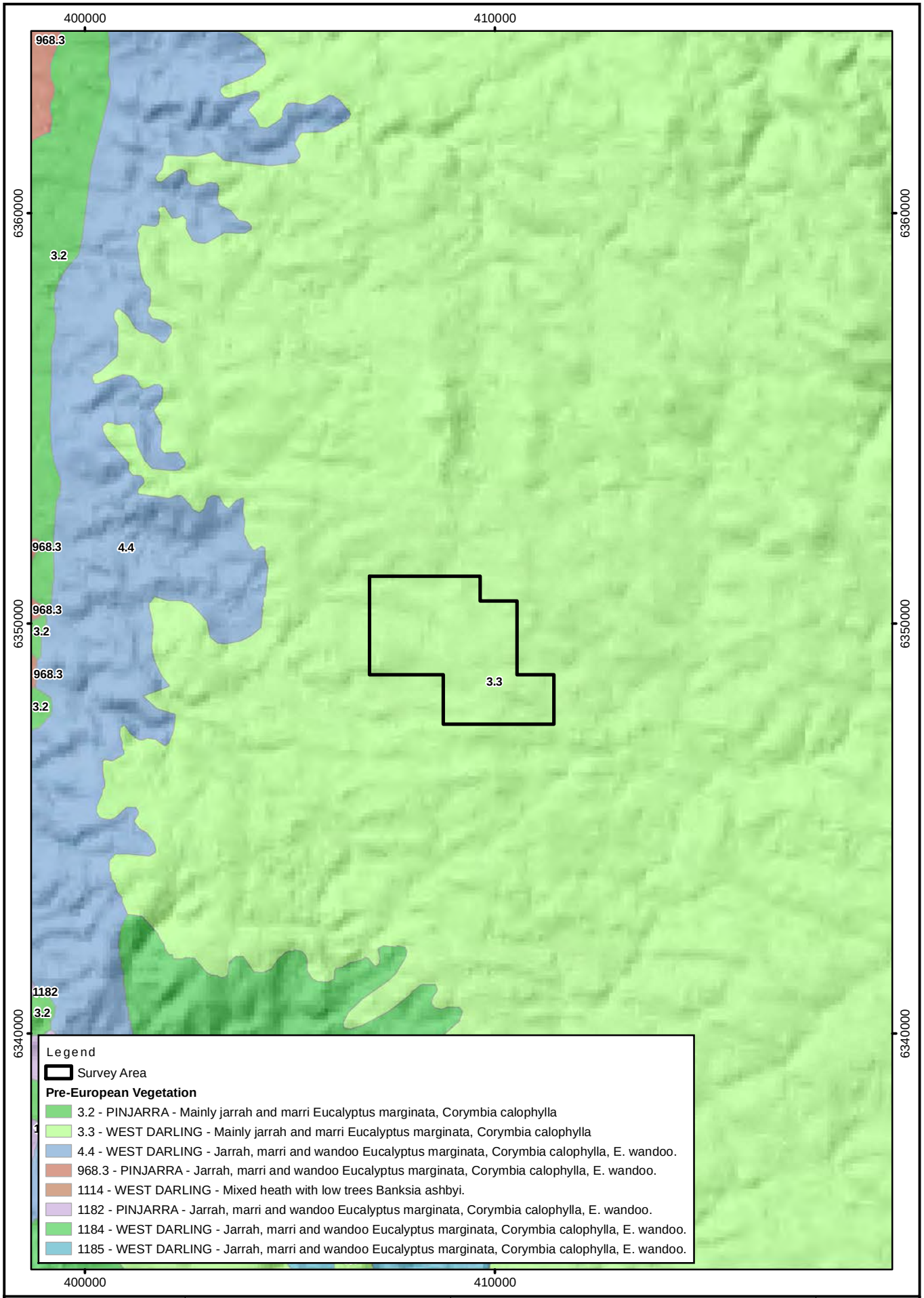
The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent. In lower rainfall areas towards the east trees decrease in size, forming woodlands or low forests. This dry sclerophyllous forest typically comprises a dominant *Eucalyptus marginata* and *Corymbia calophylla* overstorey, a mid-storey of *Allocasuarina fraseriana* (Sheoak), *Banksia grandis* (Bull Banksia), *Persoonia longifolia* (Snottygobble), *Persoonia elliptica* (Spreading Snottygobble), and a groundcover of woody shrubs with grass trees *Xanthorrhoea preissii*, *Kingia australis* and the cycad *Macrozamia riedlei* (Dell and Havel 1989).

The Pre-European vegetation systems present within the Warrington survey area (Figure 6, Table 2) include:

1. **West Darling System - Vegetation Association 3.3:** Mainly jarrah and marri *Eucalyptus marginata, Corymbia calophylla*

Table 2: Extent of pre-European vegetation associations intersecting the Warrington survey area

System	Vegetation Association	State-wide Pre-European Extent (ha)	Area of Intersection with the Warrington survey area (ha)	Proportion of Current Extent (%)
West Darling	3.3	485225.883	1134.01	0.23



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F022_05

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Warrington Survey Area

Pre-European Vegetation

Figure: **6**

Heddle *et al*. (1980) defined and described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes as part of the System 6 studies. Mattiske and Havel (1998) updated this initial more restricted mapping coverage to the wider south-west forest region as (Regional Forest Agreement vegetation complexes). Havel, J.J. (2000) summarized in greater detail the relationships between the landforms, soils and climatic conditions. Mattiske and Havel (1998) defined and described three vegetation complexes in the Warrington survey area (Figure 7, Table 3). These include:

Dwellingup 1 (D1): Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.

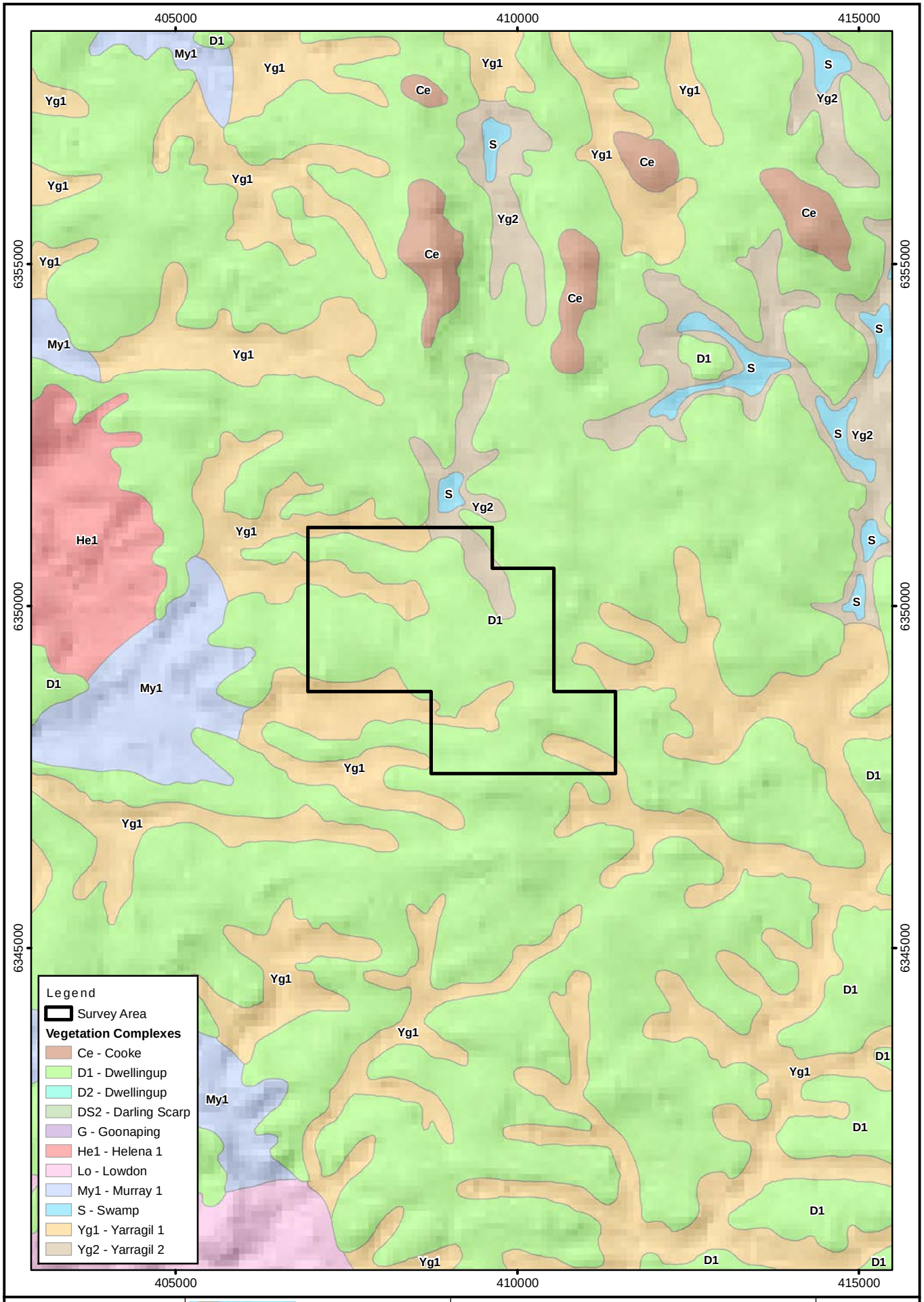
Yarragil 1 (Yg1): Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.

Yarragil 2 (Yg2): Open Forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* on slopes, woodland of *Eucalyptus patens* – *Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.

Table 3: Extent of Vegetation Complexes intersecting the Warrington survey area

Vegetation Complex	Vegetation Class	Total Extent (ha)	Area of Intersection with the Warrington survey area (ha)	Proportion of Regional Extent (%)
Dwellingup 1	D1	297624.85	869.360	0.29
Yarragil 1	Yg1	113828.12	208.404	0.18
Yarragl 2	Yg2	71234.37	56.247	0.08

More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area falling within the Northern Jarrah Forest subregion (JF1) of the Jarrah Forest (JAF) Region (DCCEEW 2023b). The vegetation of the Northern Jarrah Forest subregion consists of Jarrah – Marri forest, with Bullich and Blackbutt in the valleys to the west, grading to Wandoo and Marri woodlands to the east. Heath vegetation is the common understorey of forests and woodlands and occurs on granite rocks. The majority of the diversity between communities in this subregion occurs on lower slopes and near granite soils (Williams and Mitchell 2001).



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Scale: 1:75,000
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Warrington Survey Area
Vegetation Complexes

Figure: **7**

4.5. Potential Flora

A total of 548 vascular plant taxa, representative of 216 genera and 80 families, have the potential to occur within the wider Warrington survey area (inclusive of Larego surveys 2015-2022). The most commonly represented families are Fabaceae (71 taxa), Myrtaceae (43 taxa), and Proteaceae (43 taxa). The most commonly represented genera in the Warrington area are *Acacia* (25 taxa), *Stylidium* (16 taxa) *Hibbertia* (15 taxa) and *Lomandra* (15 taxa).

4.6. Potential Threatened and Priority Flora

Four threatened flora species, pursuant to section 179 of the *EPBC Act* and as listed by DCCEEW (2023a) or pursuant to Part 2, Division 1 and Subdivision 2 of the *BC Act* and as listed by DBCA (2022a) have the potential to occur in the Warrington survey area (Appendix C). Three of these species are listed Vulnerable with one listed Critically Endangered. Of these four species, only Morelotia australiensis has the potential to occur in the survey area. The other species are either restricted to the Darling Scarp (west of the survey area) or

A total of fourteen priority flora species, including two Priority 1, three Priority 2, six Priority 3 and three Priority 4 have the potential to occur within the Warrington survey based on desktop assessment (Appendices B and C, Figure 8). All potential threatened and priority flora are listed in Appendix C, along with their State and Federal Conservation Codes (see Appendix A for definitions), a description and an assessment of the likelihood of their occurrence in the Warrington survey area.

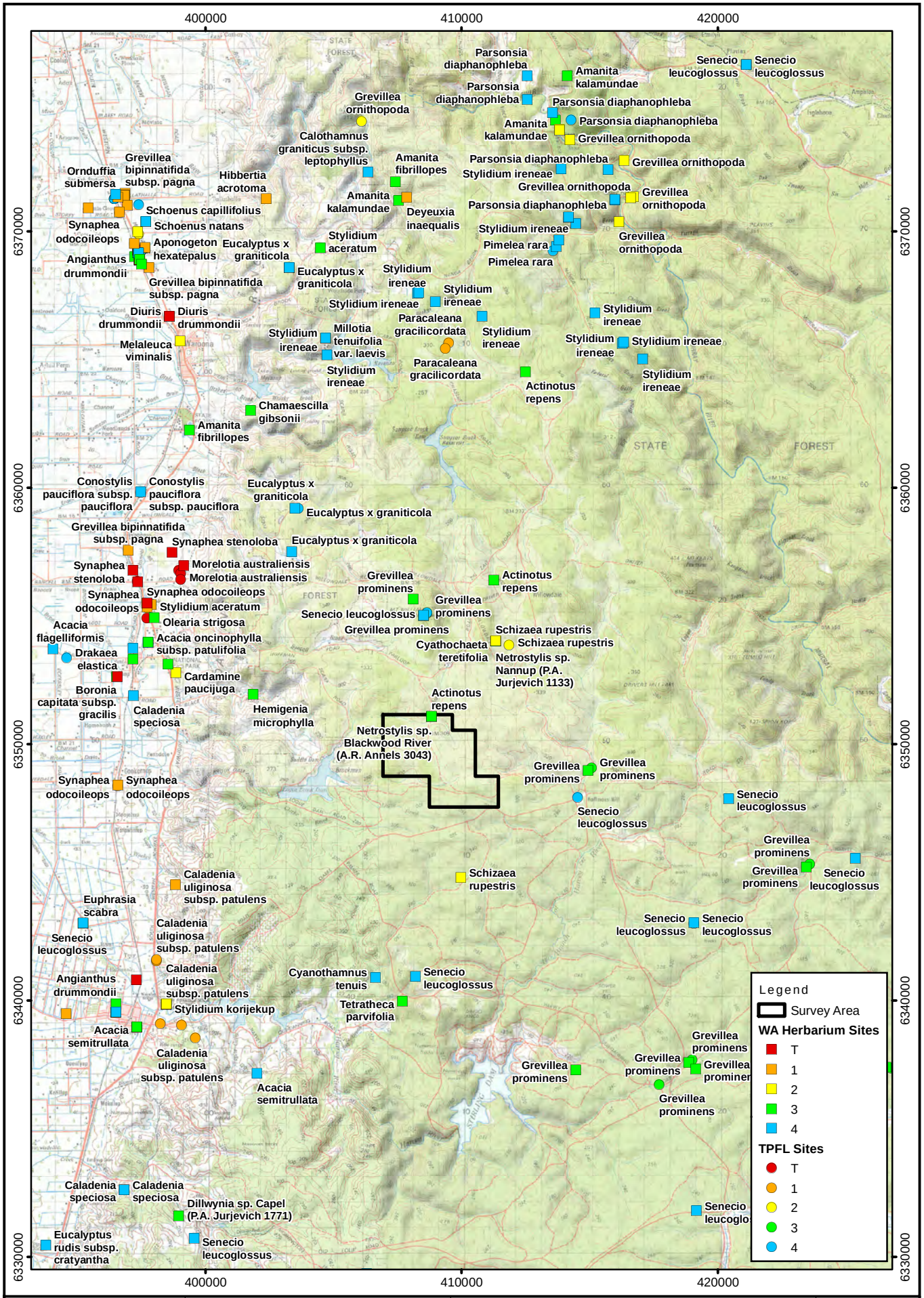
An assessment of the likelihood of recording any of the listed threatened and priority taxa within the survey area, based on factors including known soil type, topography and distribution including state records, is set out in Appendix C.

The likelihood that these species would occur within the survey area was determined using the following criteria:

- Known records within a 10 km radius of the centre of the survey area (as described above) and including information obtained from the paid search results. More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).

The likelihood was ranked Low, Moderate or High. Records that have been documented either within or in close proximity of the survey area were ranked as Moderate or High.

Of the 14 Priority flora species, one Priority 1, two Priority 2, three Priority 3 and one Priority 4 flora species had a moderate to high likelihood of occurrence, mainly due to previous records in the area and suitable habitat (Appendix C). Of the four threatened taxa, the Vulnerable, *Morelotia australiensis* had a Moderate ranking based on results from the paid database searches.



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Scale: 1:200,000
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Warrington Survey Area

Threatened and Priority Flora

Figure: **8**

4.7. Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

A total of 48 introduced taxa may potentially exist in the wider Warrington survey area, based on NatureMap (DBCA 2007-), the *EPBC Act* Protected Matters Search Tool (DCCEEW 2020b) search results (Appendix B) and records from Mattiske Consulting Pty Ltd.'s (2015-2022) surveys near Larego. Only one of the potential weeds **Rubus ulmifolius,* as listed under the **Rubus fruticosus* aggregate, is a Weed of National Significance (DAFF, 2023). It is also a declared pest/organism under the *Biosecurity and Agriculture Management Act 2007* (WA) (DPIRD 2023). In addition, **R. ulmifolius* is listed with a C3 Management Control and a Exempt Keeping category (refer to Appendix A3).

Table 4: Ecological Impact and Invasiveness rankings for Introduced (Weed) Species in the Introduced weed species potentially occurring within the Warrington survey area

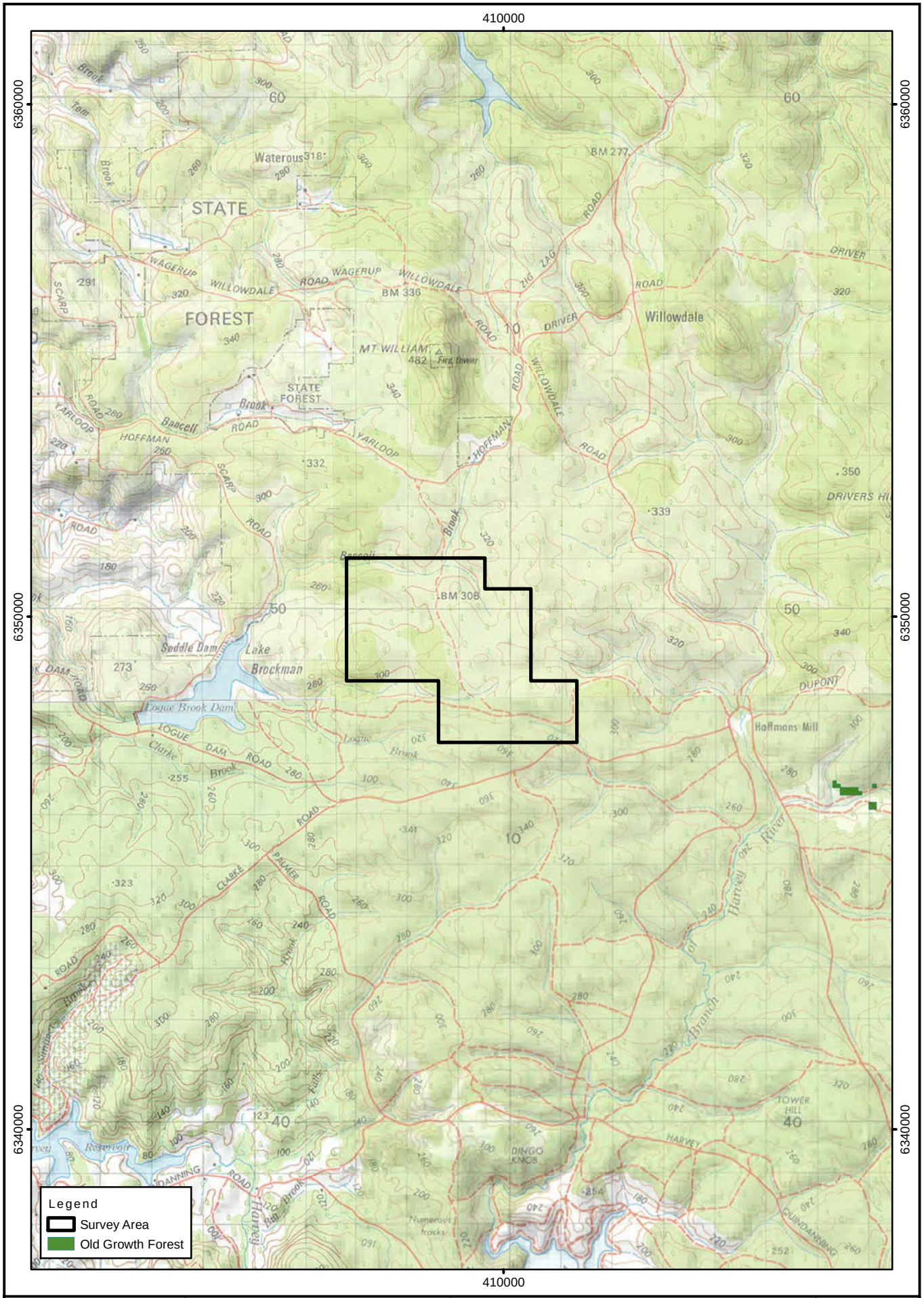
Note: [1]Department of Parks and Wildlife (DPAW 2014), [2]West Australian Organism List (DPIRD 2023), [2]Weeds of National Significance (DAFF 2023)

Species Name	DPAW[1]		WAOL[2]	Declared pest[3]
	Ecological Impact	Invasiveness Ranking		
^Acacia pulchella	-	-	Permitted - s11	-
^Acacia pulchella var. pulchella	-	-	Permitted - s11	-
**Acacia pycnantha*	Low	Slow	Permitted - s11	-
**Aira caryophyllea*	Unknown	Rapid	Permitted - s11	-
**Babiana angustifolia*	High	Moderate	Permitted - s11	-
**Briza maxima*	Unknown	Rapid	Permitted - s11	-
**Callistemon citrinus*	-	-	Permitted - s11	-
**Centaurium erythraea*	Unknown	Rapid	Permitted - s11	-
**Chasmanthe floribunda*	High	Slow	Permitted - s11	-
**Cotula coronopifolia*	Unknown	Rapid	Permitted - s11	-
**Cyperus congestus*	Unknown	Moderate	Permitted - s11	-
**Dischisma arenarium*	Unknown	Rapid	Permitted - s11	-
**Erigeron sumatrensis*	Unknown	Rapid	Permitted - s11	-
**Eucalyptus accedens*	-	-	Permitted - s11	-
**Eucalyptus microcorys*	Unknown	Unknown	Permitted - s11	-
**Eucalyptus saligna*	Unknown	Unknown	Permitted - s11	-
**Galium murale*	Low	Unknown	Permitted - s11	-
**Hypericum perforatum*	-	-	Permitted - s11	-
**Hypochaeris glabra*	Moderate	Rapid	Permitted - s11	-
**Lathyrus tingitanus*	Low	Slow	Permitted - s11	-
^Lechenaultia biloba	-	-	Permitted - s11	-

**Lilium candidum*	-	-	Permitted - s11	-
**Lonicera japonica*	Unknown	Slow	Permitted - s11	-
**Lotus subbiflorus*	Unknown	Rapid	Permitted - s11	-
**Lysimachia arvensis*	Unknown	Rapid	Permitted - s11	-
**Medicago polymorpha*	-	-	Permitted - s11	-
^Melia azedarach	-	-	Permitted - s11	-
**Orobanche minor*	Unknown	Rapid	Permitted - s11	-
**Oxalis purpurea*	High	Slow	Permitted - s11	-
**Oxalis* sp.	-	-	Permitted - s11	-
**Phytolacca octandra*	Unknown	Moderate	Permitted - s11	-
**Pinus pinaster*	Moderate	Rapid	Permitted - s11	-
**Pinus* sp.	-	-	Permitted - s11	-
**Polygala myrtifolia*	Moderate	Moderate	Permitted - s11	-
**Quercus palustris*	-	-	Permitted - s11	-
**Rubus ulmifolius*	High	Moderate	Declared Pest - s22(2)	Y
**Senecio vulgaris*	Low	Moderate	Permitted - s11	-
**Silene gallica*	Unknown	Rapid	Permitted - s11	-
**Silene gallica var. gallica*	-	-	Permitted - s11	-
**Sonchus oleraceus*	Moderate	Rapid	Permitted - s11	-
**Stachys arvensis*	Unknown	Rapid	Permitted - s11	-
**Syncarpia glomulifera*	-	-	Permitted - s11	-
**Trifolium ligusticum*	Unknown	Unknown	Permitted - s11	-
**Ursinia anthemoides*	Unknown	Rapid	Permitted - s11	-
**Vellereophyton dealbatum*	Moderate	Rapid	Permitted - s11	-
**Vinca major*	High	Slow	Permitted - s11	-
**Wahlenbergia capensis*	Unknown	Rapid	Permitted - s11	-
**Watsonia meriana var. meriana*	-	-	Permitted - s11	-

4.8. Old-Growth Forests

There are a few patches of old growth forests occurring outside and east of the Warrington survey area (Figure 9); however, based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Warrington survey area.



N 0 0.75 1.5 km Scale: 1:100,000 MGA94 (Zone 50)	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640	**Warrington Survey Area** **Old Growth Forest**	Figure: **9**
CAD Ref: a1992_F022_08	Author: E M Matttiske | MCPL Ref: ALC2305		
Date: April 2023 | Rev: A | A4	Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax (08) 9246 3202		

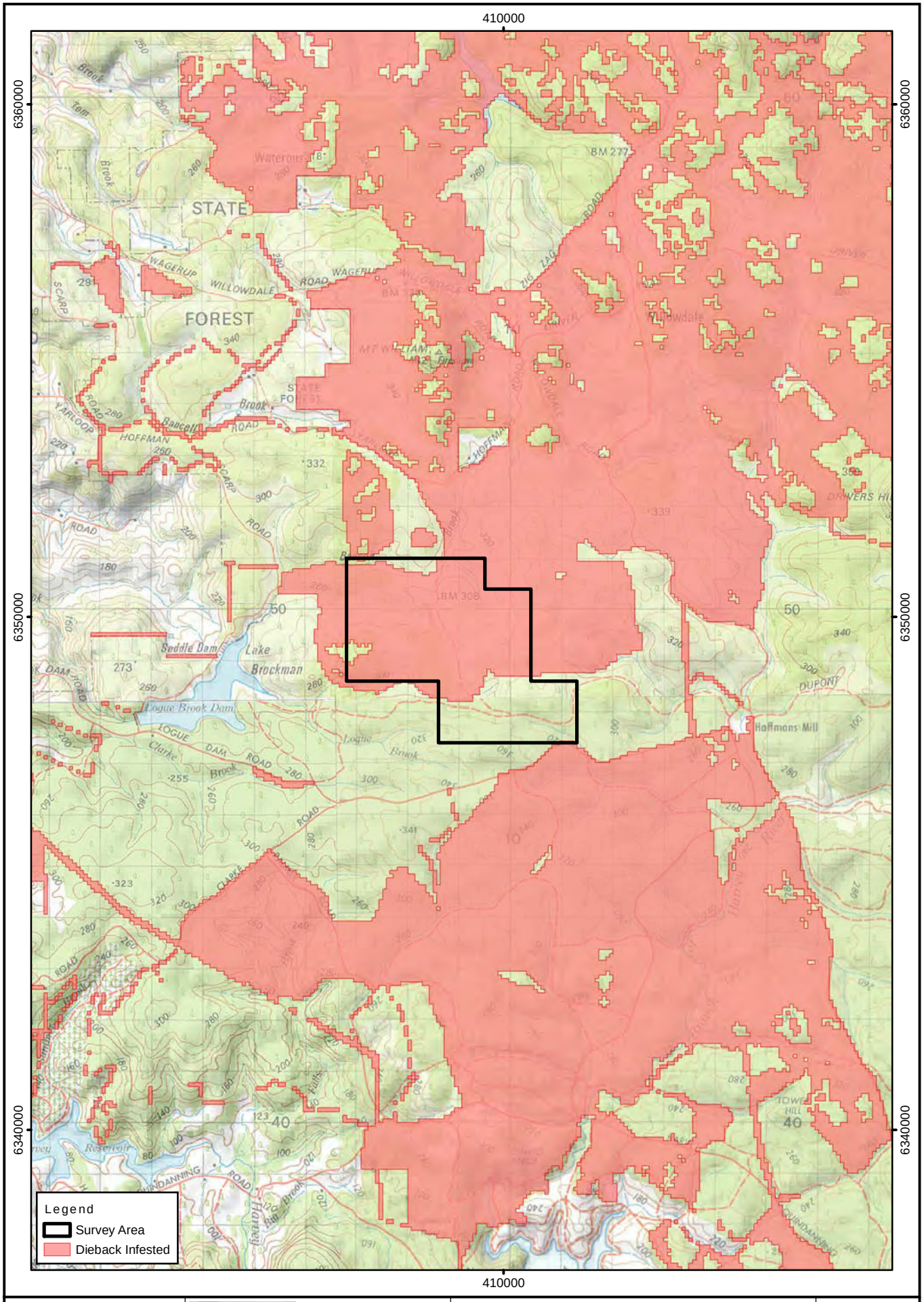
4.9. Groundwater Dependant Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes such as the Yarragil 1 and Yarragil 2 that occur within the Warrington survey area. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Acacia divergens, Boronia molloyae, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Eucalyptus rudis, Hypocalymma angustifolium, Hypocalymma cordifolium, Melaleuca preissiana, Melaleuca lateritia, Melaleuca viminea* and *Taxandria linearifolia.*

4.10. Dieback

The extent of dieback from datasets supplied by the Department Biodiversity, Conservation and Attractions highlights the extent within the Warrington survey area and adjacent forest areas, Figure 12.



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Warrington Survey Area
Dieback

Figure:
10

4.11. Previous Surveys

Over the past forty years, Mattiske Consulting has previously mapped the vegetation associated with Willowdale (including previous Larego areas; Mattiske Consulting Pty Ltd (2015, 2019, 2020, 2022). These areas are in close vicinity to the Warrington survey area.

4.12. Potential Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) occur in the Warrington survey areas. The desktop assessment did highlight one community which may occur, *the Banksia Woodlands of the Swan Coastal Plain*; however this is restricted to the Swan Coastal Plain and as such does not extend into the Jarrah forest area on the Darling Ranges.

4.13. Wetlands of International Importance (Ramsar)

No wetlands of international importance listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* and listed by the DCCEEW (2023a) occur within the Warrington survey area. The closest wetlands of international importance is the Peel- Yalgorup system.

5. FIELD STUDIES FINDINGS

The following text summarizes the key findings from recent studies in 2023 within the Warrington survey area; which includes recording sites for vegetation mapping and opportunistic and targeted assessments.

5.1. Survey Effort

The survey efforts has been undertaken over a decade from multiple studies within the Willowdale and Larego areas. The major effort in 2023 which when combined with the depth of previous studies in adjacent areas for both Alcoa and also other clients leads to the conclusion that the work exceeds the current EPA Guidance Statement (2016a and 2016b) expectations for flora and vegetation studies.

The survey effort to date has included (See Figure 11):

. More than 100 kilometres of foot transects which includes the mapping efforts and targeted searches;

. 772 recording sites in 2023 on a grid system which varied slightly from 120m x 120m with some sites closer than this average and some slightly wider. This pattern of recording is consistent with previous ecological studies in the northern Jarrah forest for both Alcoa and other clients in nearby areas;

. targeted searches of additional extreme sites that are variable within the broader Yarragil vegetation complexes as well as the variable communities on the valley slopes and on the Dwellingup vegetation complex on the ridges in the Warrington survey areas. The coverage of the flora on the swamp areas relied on the recording sites and targeted searching;

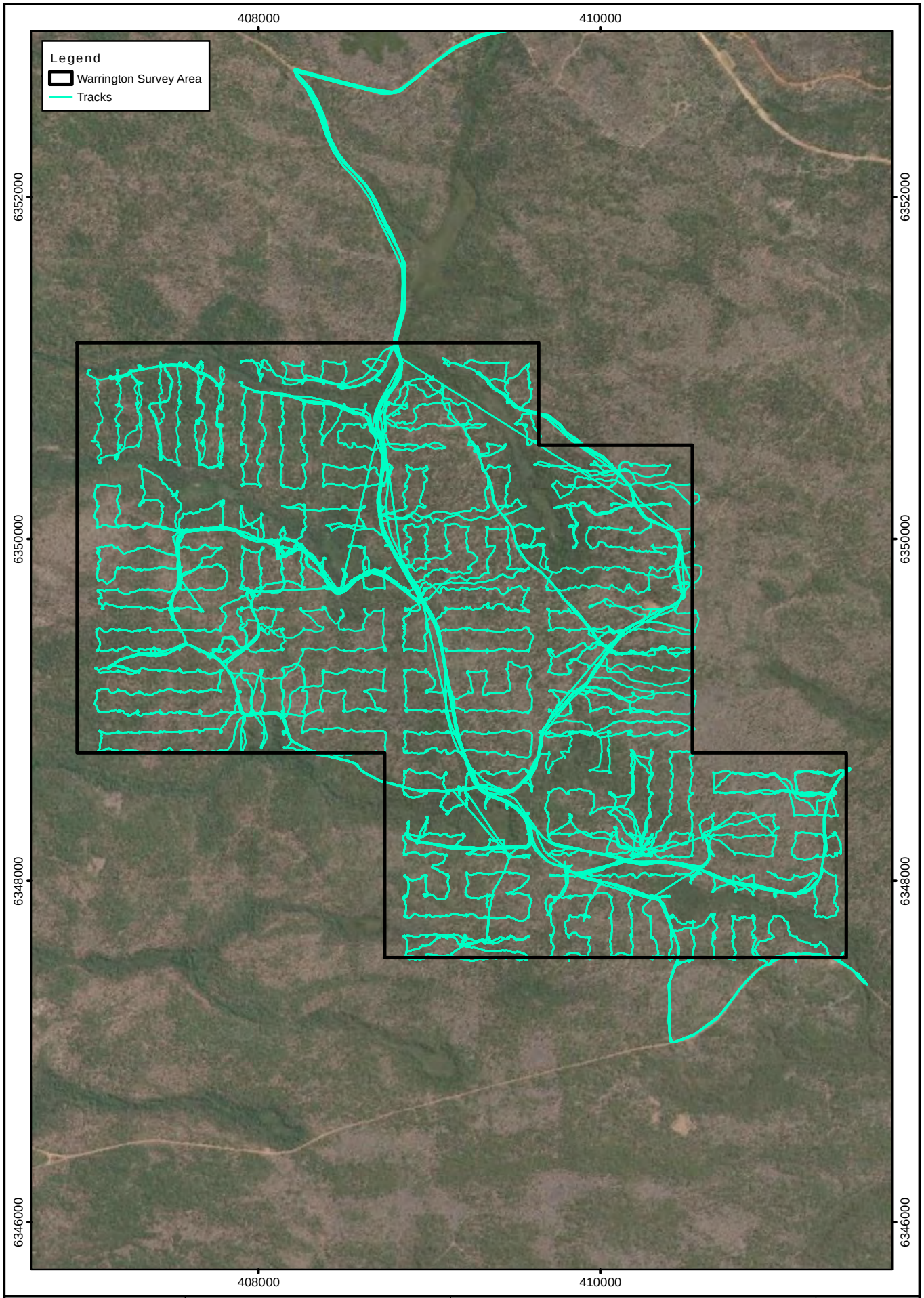
. detailed and consistent data collection on position in the landscape, soils, flora, vegetation and vegetation condition.

. consistent interpretation in line with previous site-vegetation studies where there is a greater reliance on key indicator species and a series of site parameters rather than the accepted clustering and groupings. Such an approach differs from the EPA guidance statement, but if the latter was followed the dominance of some tree and understorey species in the analyses would lead to a less comprehensive delineation of biodiversity values and also be inconsistent with the approach adopted on all other Alcoa leases where detailed flora and vegetation studies have been undertaken in the past by the Mattiske team and site personnel. In summary, the survey effort easily exceeds the expectations of the EPA Guidance Statement (2016a, 2016b).

A general assessment was made of the current survey against a range of factors that may have limited the outcomes and conclusions of this report (Table 4).

Table 4: Potential flora and vegetation survey limitations for the Warrington survey areas

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Reference resources such as mapping by Beard (1979), Mattiske and Havel (1998), previous vegetation mapping completed for Alcoa by E.M Mattiske and Associates and Mattiske Consulting Pty Ltd teams together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora, which were the focus of the present survey was sampled on a close grid pattern within the survey area. In addition to the regular sampling sites, searches were undertaken to assess the likelihood of threatened and priority flora species.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Not a constraint:** The survey areas near Willowdale and Larego areas have been sampled over multiple years, with the more recent work on the detailed records on the grid system and targeted searches between sites. The recent survey effort in the majority of the areas was undertaken in the winter months 2023 (June, July and August). The botanists undertaking the field surveys have had extensive experience working with the flora of the Jarrah forest. Any flora which could not be identified in the field was collected for subsequent identification. A few taxa were only recorded at genus level as flowering was not occurring.
Mapping reliability	**Not a constraint:** The vegetation was mainly assessed on a 120m x 120m grid pattern within the survey area. Over 100 kilometres were surveyed within the survey area. This together with 772 recording sites and the targeted and opportunistic survey sites (particularly near the granites and swamp areas) enabled intensive coverage of the values on the Warrington survey areas and therefore the associated mapping of key flora values and the site-vegetation types with a high level of confidence.
Timing, weather, season, cycle	**Minor constraint:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). The intensive work undertaken in sections of Larego has enabled coverage of different seasons. The detailed survey work commenced in June 2023 and was completed in August 2023. In view of extensive work in the areas adjacent to the survey areas this is considered to be only a minor constraint.
Disturbances (fire flood, accidental human intervention, *etc*.)	**Not a constraint:** With the exception of previous logging activities, an intense recent fire and occasional old forestry tracks, the vegetation of the survey area is largely undisturbed. A recent intense fire led to denser stands of *Bossiaea aquifolium* and as a result at time it was difficult to assess all stumps with a 20m radius. In view of the 40 years of experience by Dr Mattiske in northern Jarrah forest vegetation mapping the latter is not considered to lead to any constraints.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** Vehicle access through the Warrington survey areas was only restricted in small sections.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** All botanists had direct and recent experience working in the Jarrah Forest and working for Alcoa and a range of other clients, and thus were familiar with the local flora and vegetation values. Dr Mattiske has more than 40 years of ecological experience in flora and vegetation studies in the southwest forests at a detailed floristic level, as well as detailed and regional vegetation assessment level.



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Warrington Survey Area
Tracks

Figure:

11

5.2. Flora

The survey efforts were undertaken over several months and in view of the extensive work undertaken over multiple decades in the Willowdale and Larego areas was considered to exceed the EPA (2016a and 2016b) guidance statements expectations.

A total of 238 taxa from 45 families and 111 genera was recorded in the Warrington survey area and as such partly reflects the smaller survey area when compared with the total from previous surveys that have been undertaken over the last few decades.

The range of flora collected on the Warrington and nearby Larego survey areas is summarized in Table 5 and Appendix B. As the survey efforts were undertaken over multiple years and also seasons the coverage of the flora was considered to exceed the EPA (2016a and 2016b) guidance statements expectations. The recordings on the grids was undertaken over multiple months the coverage of the flora in more diverse and spatially more complex areas such as the broad valley systems, slopes and ridges was considered to be comprehensive.

Table 5: Summary of Flora Species on the Warrington and nearby Larego survey areas (see Appendix B)

Source	Families	Genera	Native Taxa	Introduced Taxa
Larego Survey areas 2022	43	111	238	4
Nature Map and Additional Potential and recorded Species (see Appendix B)	79	214	578	4545

The summary of results from the plots and the recording sites as summarized by the site-vegetation types reflects this shift from species in the lateritic slopes and ridges and the broader valleys (see Appendix E).

5.3. Introduced Flora Species

Of the 238 species, 5 were introduced or planted species (**Pinus* sp.), Appendices B and D. The introduced species all occur more widely in the Jarrah forest and are not listed as WONS weeds at the National scale or as Declared pests at the State level.

5.4. Threatened and Priority Flora

No Threatened flora species, pursuant to section 179 of the *EPBC Act* and as listed by DCCEEW (2022a) or pursuant to Part 2, Division 1 and Subdivision 2 of the *BC Act* and as listed by DBCA (2022a) were recorded during recent assessments of the Warrington survey areas.

Two Priority flora species as listed by DBCA (2022a) have been recorded in the Warrington and nearby Larego survey areas (Appendix B), Table 6 and Figure 12.

Table 6: Summary of Priority Flora recorded in Warrington survey areas

SPECIES	Federal Conservation Status	State Conservation Status	Site-vegetation Types	Population
Grevillea prominens	-	P3	S and ST	Ranged from 2 to 5 plants on 3 sites
Senecio leucoglossus	-	P4	T	2

Grevillea prominens (P3) is known from 10 records at the State Herbarium (DBCA 2007-) and has been recorded east and south-east of the Warrington survey area and was recorded on lateritic gravelly soils. This species has been recorded in the wider Jarrah forest (DBCA 2007-).

Senecio leucoglossus (P4) is known from 45 records at the State Herbarium (DBCA 2007-) and is generally on the granite and lateritic slopes and ridges. This species has been recorded regularly in the northern Jarrah forest by the Mattiske teams over some four decades.

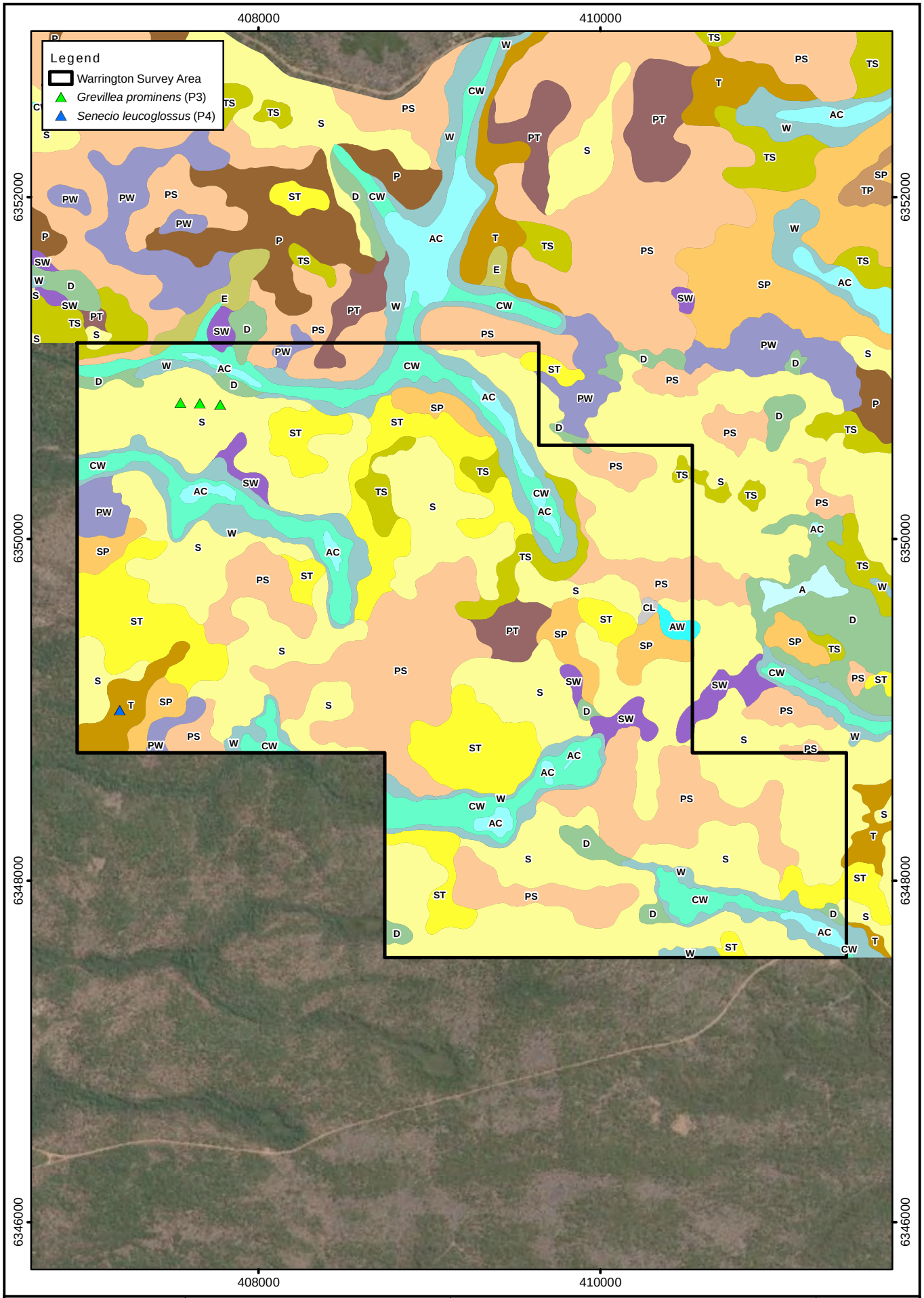
5.5. Site-vegetation Types

A total of 15 site-vegetation types were defined and mapped in the Warrington survey area, Table 7 and Figure 12. The site-vegetation types were subdivided into three main groupings associated with site conditions which reflected landforms, soils and soil moisture levels, Table 7. The site-vegetation types on the extreme sites such as broad valley systems differ markedly from the forest and woodland areas on the slopes and ridges. The delineation of the site-vegetation types was based on the earlier work of Havel (1975a and 1975b) and as such rely on key site and species indicators. Whilst Mattiske has refined these initial site-vegetation types there is still a reliance on the original work of Havel (1975a and 1975b). The initial code is the dominant site-vegetation type code and the second code (where added) reflects some local influence of secondary key stone species. These site-vegetation types were developed in consultation with Dr David Goodall (formerly CSIRO at the time). In the 1970's Dr Havel and Dr Goodall undertook extensive analyses to delineate and differentiate the key species and site parameters that assist in the division of the continuum of the dominant trees of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri). This approach has been used for some 45 years and as such to deviate from such an approach and rely on other approaches would negate the effort to date and the ability to align the findings with other areas in the northern Jarrah forest. So whilst such an approach might be perceived by assessors to deviate from the EPA guidance statements, to not adopt the site-vegetation approach would diminish the delineation of the biodiversity values in the Warrington survey area. In addition the ranking of species and condition of species in the field has increased the intensity and coverage of the sites within the Warrington survey areas.

The dominant site-vegetation types were PS, PT, SP, S, ST, T and TS (79.63%) on the slopes ad ridges and D, E, W, SW and PW on the moister slopes (11.34%). The more extreme sites associated with swamps and creeklines (types AC, AW and CW) covered less than 8.94% of the areas, Table 7.

The series of site-vegetation types associated with the broader valley systems which dominate the Yarragil 1 and Yarragil 2 vegetation complexes as defined by Mattiske and Havel (1998) provide a spatial diversity that supports a range of species. The site-vegetation types associated with these broader valleys (AC, AW, D, PW and SW) and lower slopes have the potential to be groundwater dependent ecosystems.

The site-vegetation types of PW and SW reflect the moister soils that may influence the spread and intensification of *Phytophthora cinnamomi.* As indicated in the Dieback data from DBCA (Figure 10) it is evident that dieback has influenced the condition of the vegetation in the Warrington survey areas.



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Warrington Survey Area
Site Vegetation Types and Priority Flora Species

Figure:

12

Table 7: Summary of Site-vegetation Types (SVT) on the Warrington survey areas

SVT Code	Description	Area_ Ha	% Total
Swamps (AC, AW) and Creeklines (CW)			
AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense *Melaleuca* species, *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	17.71	1.56
AW	Low open woodland of *Eucalyptus patens* and *Melaleuca preissiana* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	2.50	9.22
CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	81.19	7.16
Lower Slopes (D, E, W) and Moister Slopes (PW and SW)			
D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae* and *Acacia extensa* on clay loams to gravelly clay-loams.	15.84	1.40
E	Open woodland of *Eucalyptus marginata* and *Corymbia calophylla* over *Mesomelaena tetragona, Kingia australis, Leptospermum erubescens* and *Babingtonia camphorosmae* on sandy to sandy-loam soils on slopes.	0.73	0.06
W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Acacia extensa* and *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	84.38	7.44
PW	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels.	14.85	1.31
SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	12.78	1.13
Slopes and Upper Ridges (PS, PT, S, SP, ST, TS, T)			
PS	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	210.78	18.59
PT	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	12.86	1.13
S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy-gravels.	452.90	39.94
SP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	38.51	3.40
ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus, Leucopogon verticillatus, Pteridium esculentum, Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	145.93	12.87
TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	27.86	2.46
T	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly soils.	14.03	1.24

5.6. Vegetation Condition

The majority of the vegetation was ranked as good to excellent despite historical harvesting activities, intense fires, dieback and some established tracks in the area. The presence of the dieback disease is particularly evident in the condition of the vegetation on the lower slopes that support D, SW and PW site-vegetation types.

5.7. Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) occur in the Warrington survey areas (DBCA 2022c). The desktop assessment highlighted several potential TECs; however these are restricted to the Swan Coastal Plain and as such do not extend into the Jarrah forest area on the Darling Ranges.

One of the priority ecological communities (PECs), as listed at State level by DBCA (2020d) occurs north and east of the Warrington survey areas on the granite areas near Jarrahdale and Boddington.

The Warrington survey areas occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2022b) and as such was considered during the RFA process.

5.8. Old Growth Forests

Based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Warrington survey areas. This is supported by the data collected on degree of logging, number of stumps. The counting of the number of stumps was at times restricted by the density of the *Bossiaea aquifolium* (that had resulted mainly from recent intense fires); however in view of the number of logs and harvesting activities this was not considered to influenced the overall interpretation.

On the basis of the number of potential habitat trees and number of stumps, there are some areas of Warrington that have some potential to reflect lower logging rates (Figures 13, 14 and 15). In reviewing the data as collected within the Warrington survey areas it is apparent that the swamp areas (AC and CW) supported few larger trees and the site-vegetation types (i.e. PS, PT, S, St, T, TS and W) supported proportionally higher number of larger potential habitat trees (Diameter at Breast Height (DBH) > 50cm).

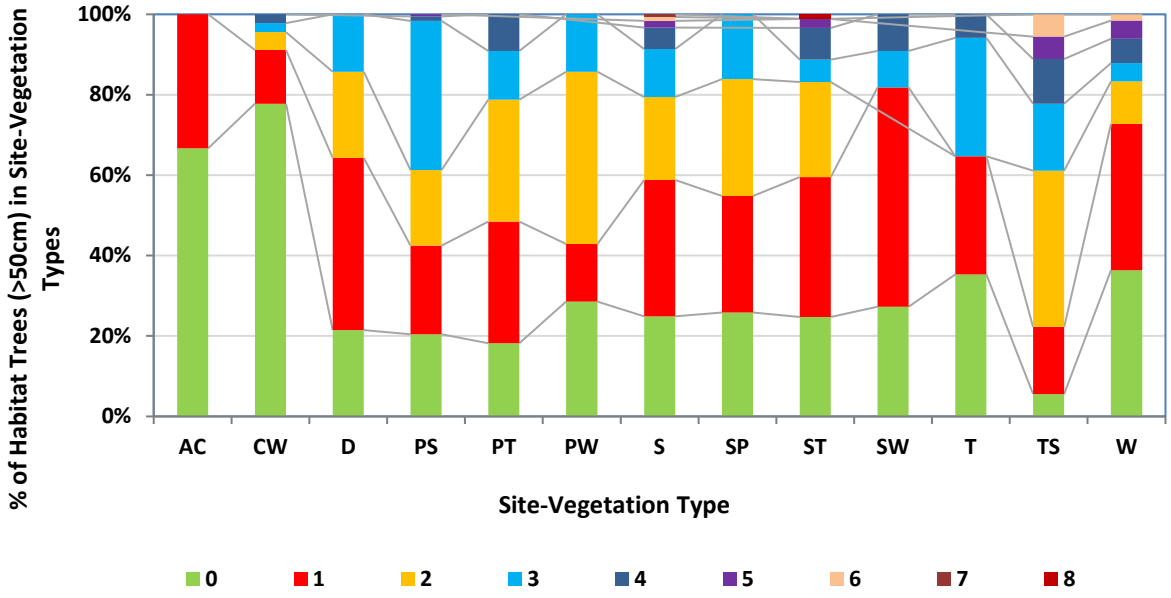


Figure 13: Summary of Number of Potential Habitat Trees (>50cm DBH) in the respective Site-vegetation Types on the Warrington survey areas (note AW and E site-vegetation types were restricted in area and formed extensions into current survey area from previous mapping)

The results in Figure 14 reflect the lower number of stumps from previous logging activities in the AC, CW, D and W site vegetation types associated with the creeklines, swamps and lower slopes.

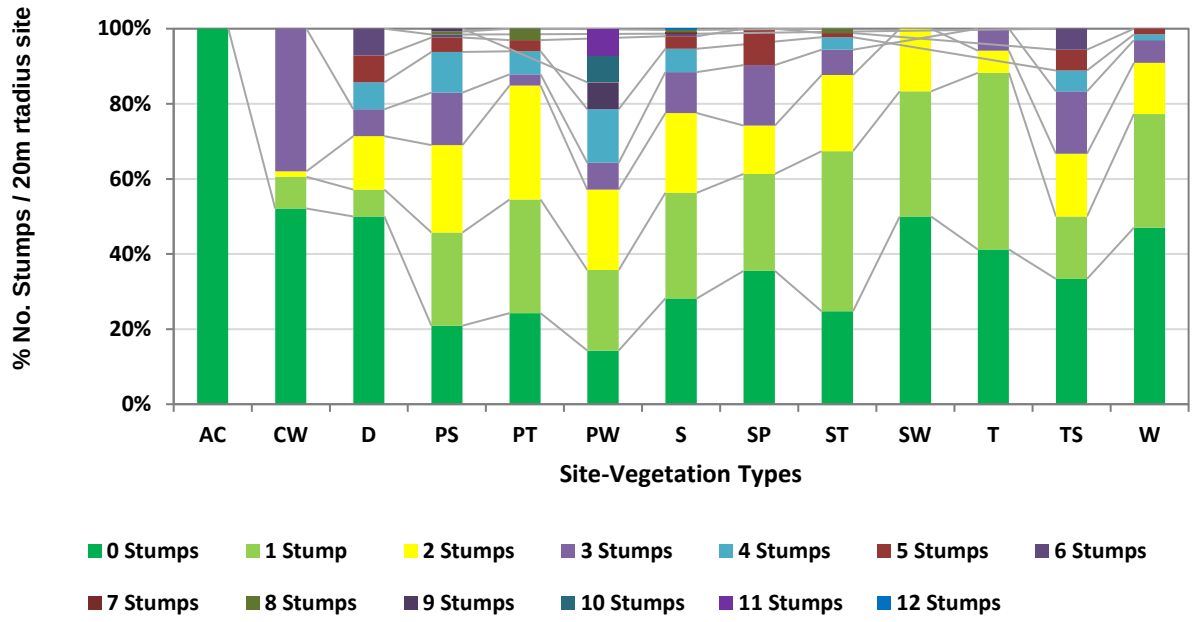
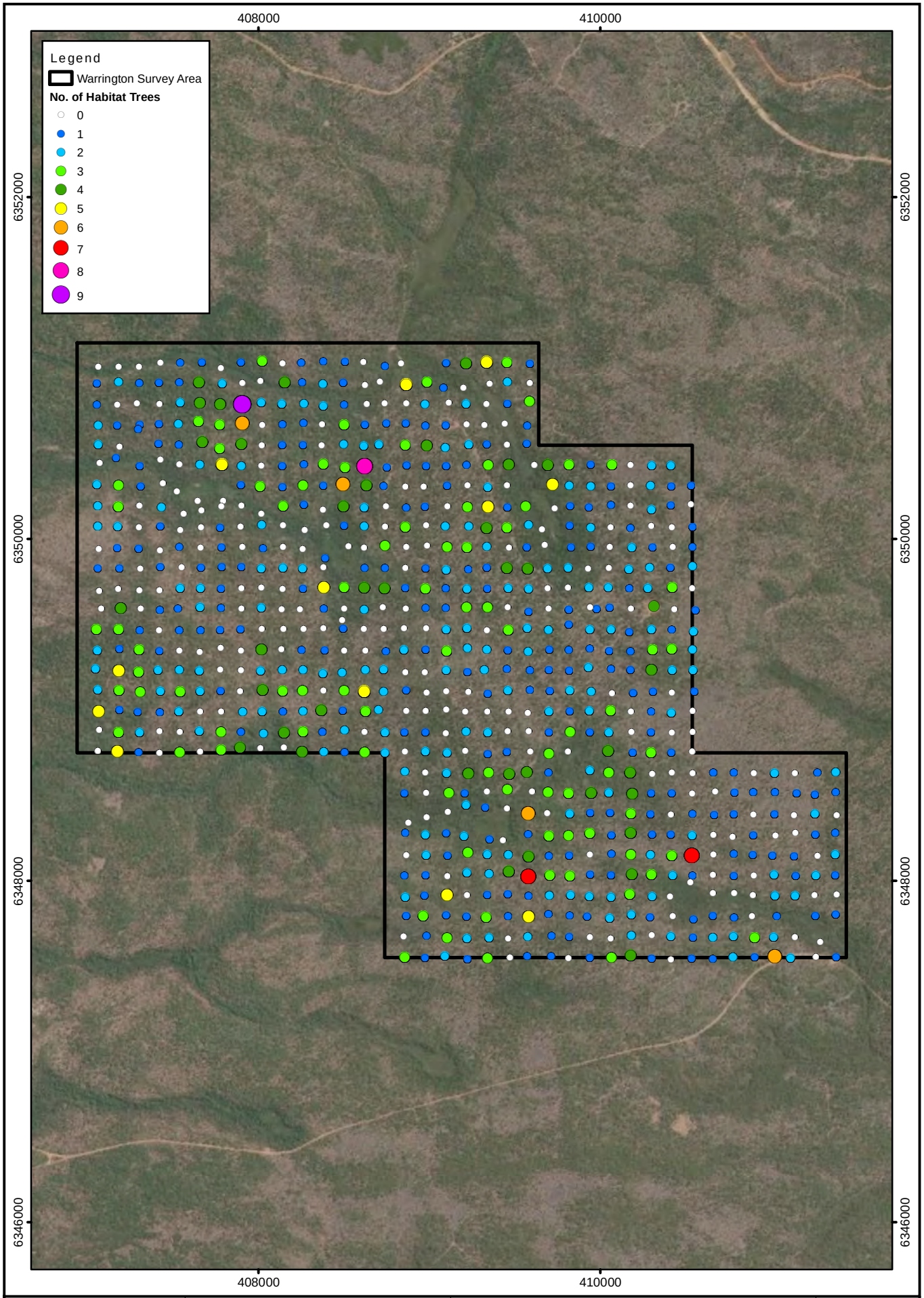


Figure 14: Summary of Number of Stumps per Site in the respective Site-vegetation Types on the Warrington survey areas (note AW and E site-vegetation types were restricted in area and formed extensions into current survey area from previous mapping)



N

0 190 380 m

Scale: 1:30,000
MGA94 (Zone 50)

CAD Ref: a1992_F022_14

Date: September 2023 | Rev: A | A4

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Warrington Survey Area
Potential Habitat Trees

Figure:
15

6. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

6.1. Flora

The survey efforts were undertaken over 3 months in the winter months of 2023. The seasonal work in the Warrington and nearby survey areas in recent years was considered to exceed the EPA (2016a and 2016b) guidance statements expectations.

A total of 238 vascular plant taxa, representative of 111 genera and 45 families, were recorded in the Warrington survey area. A total of 5 introduced taxa (weeds and planted species) were recorded in the Warrington survey area. None of the weeds were Weeds of National Significance (DCCEEW, 2023) or declared pest/organism under the *Biosecurity and Agriculture Management Act 2007* (WA) (DPIRD 2023).

No listed threatened flora species were recorded in the Warrington survey areas. The latter largely relates to the occurrence of most of the potential species on either granite outcrops or on the eastern Swan Coastal Plain.

Only two Priority species (*Grevillea prominens* (P3) and *Senecio leucoglossus* (P4)) were recorded in the Warrington survey areas.

6.2. Vegetation

The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent.

Heddle *et al*. (1980) defined and described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes as part of the System 6 studies. Mattiske and Havel (1998) updated this initial more restricted mapping coverage to the wider south-west forest region as (Regional Forest Agreement vegetation complexes). Havel, J.J. (2000) summarized in greater detail the relationships between the landforms, soils and climatic conditions. Mattiske and Havel (1998) defined and described three vegetation complexes in the Warrington survey areas. None of these are restricted to the Warrington survey areas.

A total of 15 site-vegetation types were defined and mapped in the Warrington survey areas (with an addition cleared area (CL). The site-vegetation types were subdivided into three main groupings associated with site conditions which reflected landforms, soils and soil moisture levels, Table 7. The site-vegetation types on the extreme sites such as broad valley systems and swamps differ markedly from the forest and woodland areas on the slopes and ridges. The delineation of the site-vegetation types was based on the earlier work of Havel (1975a and 1975b) and as such rely on key site and species indicators. Whilst Mattiske has refined these initial site-vegetation types there is still a reliance on the original work of Havel (1975a and 1975b). The initial code is the dominant site-vegetation type code and the second code (where added) reflects some local influence of secondary key stone species. These site-vegetation types were developed in consultation with Dr David Goodall (formerly CSIRO at the time). In the 1970's Dr Havel and Dr Goodall undertook extensive analyses to delineate and differentiate the key species and site parameters that assist in the division of the continuum of the dominant trees of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri). This approach has been used for some 45 years and as such to deviate from such an approach and rely on other approaches would negate the effort to date and the ability to align the findings with other areas in the northern Jarrah forest. So whilst such an approach might be perceived by assessors to deviate from the EPA guidance statements, to not adopt the site-vegetation approach would diminish the delineation of the biodiversity values in the Warrington survey areas. In addition the ranking of species

The dominant site-vegetation types were PS, PT, SP, S, ST, T and TS (79.63%) on the slopes ad ridges and D, E, W, SW and PW on the moister slopes (11.34%). The more extreme sites associated with swamps and creeklines (types AC, AW and CW) covered less than 8.94% of the areas.

The series of site-vegetation types associated with the broader valley systems which dominate the Yarragil 1 and Yarragil 2 vegetation complexes as defined by Mattiske and Havel (1998) provide a spatial diversity that supports a range of species. The site-vegetation types associated with these broader valleys (AC, AW, D, PW and SW) and lower slopes have the potential to be groundwater dependent ecosystems.

The site-vegetation types of PW and SW reflect the moister soils that may influence the spread and intensification of *Phytophthora cinnamomi.* As indicated in the Dieback data from DBCA it is evident that dieback has influenced the condition of the vegetation in the Warrington survey areas.

6.3. Potential Groundwater Dependent Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the vegetation complexes. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils on the swamps and lower slopes of the valley systems. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Thomasia paniculata, Astartea scoparia, Hypocalymma angustifolium, Hypocalymma cordifolium, Melaleuca preissiana, Melaleuca rhaphiophylla, Melaleuca lateritia, Melaleuca viminea,* and *Taxandria linearifolia.* These species occur mainly in the AC and CW and to a lesser degree in D, W, SW and PW site-vegetation types.

6.4. Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) occur in the Warrington survey areas (DBCA 2022c). The desktop assessment highlighted several potential TECs; however these are restricted to the Swan Coastal Plain and as such do not extend into the Jarrah forest area on the Darling Ranges.

One of the priority ecological communities (PECs), as listed at State level by DBCA (2022d) occurs north and east of the Warrington survey areas on the granite areas near Jarrahdale and Boddington.

The Warrington survey areas occur within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2022b) and as such was considered during the RFA process.

6.5. Old Growth Forests

Based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Warrington survey areas. This is supported by the data collected on degree of logging, number of stumps. The counting of the number of stumps was at times restricted by the density of the *Bossiaea aquifolium* (that had resulted mainly from recent intense fires); however in view of the number of logs and harvesting activities this was not considered to influenced the overall interpretation.

On the basis of the number of potential habitat trees there are some areas of Warrington that have some potential to reflect lower logging rates.

7. ACKNOWLEDGEMENTS

The authors would like to thank Alcoa of Australia Ltd for their assistance with this project.

8. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions (DBCA 2022a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act. Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from DBCA (2022a).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (DBCA 2022a). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from DBCA (2022a).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (28 June 2018)* (under Part 2, Division 2, Subdivision 1 of the BC Act; DBCA 2018). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the DBCA (and former equivalent departments) have been identifying and informally listing TECs since 1994. Some of these TECs are also endorsed by the Federal Minister as threatened, and some of these are listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from DBCA (2018).

CODE	CATEGORY	DEFINITION
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2022b) in the *Priority Ecological Communities for Western Australia – Version 34 (21 December 2022)*. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from DBCA (2022b).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2023).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- 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; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of vegetation condition categories

Note: Adapted from Keighery (1994).

CATEGORY	DEFINITION
1	Pristine or nearly so, no obvious sign of disturbance or damage caused by human activities since European settlement.
2	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.
3	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR AND RECORDED IN THE WARRINGTON SURVEY AREA

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Amaranthaceae		*Ptilotus manglesii*					x						
Anarthriaceae		*Lyginia* sp.					x						
Apiaceae		*Actinotus glomeratus*				x							
		Actinotus leucocephalus				x							
		Actinotus repens	P3			x					x		
		Pentapeltis peltigera				x	x	x	x	x			x
		Pentapeltis silvatica				x		x					
		Platysace compressa					x	x	x	x			x
		Platysace filiformis				x	x	x		x			x
		Platysace tenuissima											x
		Platysace sp.								x			x
		Xanthosia atkinsoniana				x	x		x	x			x
		Xanthosia candida				x	x	x	x	x			x
		Xanthosia huegelii				x	x	x		x			x
		Xanthosia singuliflora				x				x			x
		Xanthosia tasmanica				x							
		Xanthosia ciliata						x					
		Xanthosia sp.						x		x			x
		Apiaceae sp.											x
Apocynaceae	*	*Vinca major*				x							
Araliaceae		*Hydrocotyle callicarpa*				x							
		Trachymene pilosa				x		x		x			x
Asparagaceae		*Laxmannia squarrosa*				x	x		x				x
		Lomandra brittanii					x			x			
		Lomandra caespitosa				x	x		x	x			x
		Lomandra drummondii											x
		Lomandra hermaphrodita				x	x		x	x			x
		Lomandra integra				x							
		Lomandra micrantha					x			x			x
		Lomandra micrantha subsp. *micrantha*				x	x			x			
		Lomandra nigricans				x	x		x	x			x
		Lomandra pauciflora				x							
		Lomandra preissii				x			x	x			x
		Lomandra purpurea					x		x				x

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Asparagaceae		*Lomandra sericea*				x	x	x	x	x			x
(continued)		*Lomandra sonderi*					x	x	x	x			x
		Lomandra spartea					x	x	x	x			x
		Lomandra suaveolens						x					
		Lomandra sp.					x	x	x	x			x
		Thysanotus dichotomus				x	x	x		x			
		Thysanotus fastigiatus				x		x		x			
		Thysanotus manglesianus						x					
		Thysanotus multiflorus				x	x	x	x	x			x
		Thysanotus sparteus											x
		Thysanotus thyrsoideus					x	x		x			x
		Thysanotus sp.					x						x
Asteraceae		*Cotula australis*				x							
	*	*Cotula coronopifolia*				x							
	*	*Erigeron sumatrensis*						x					
	*	*Erigeron* sp.											x
		Hyalosperma cotula								x			
	*	*Hypochaeris glabra*				x	x	x	x	x			x
		Lagenophora huegelii				x	x	x	x	x			x
		Millotia tenuifolia				x			x				
		Olearia paucidentata				x		x					
		Olearia strigosa									x		
		Panaetia lessonii				x							
		Podolepis gracilis				x							
		Pseudognaphalium luteoalbum											x
		Pterochaeta paniculata				x	x	x	x	x			x
		Quinetia urvillei				x							
		Senecio diaschides				x		x		x			x
		Senecio hispidulus					x		x	x			x
		Senecio leucoglossus	P4			x		x	x	x	x	x	x
		Senecio multicaulis subsp. *multicaulis*				x							
		Senecio quadridentatus						x	x	x			x
	*	*Senecio vulgaris*								x			
		Senecio sp.				x	x	x	x	x			x
	*	*Sonchus oleraceus*								x			
		Trichocline spathulata				x	x	x	x	x			x
	*	*Ursinia anthemoides*					x						
	*	*Vellereophyton dealbatum*					x						

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Asteraceae		*Xerochrysum macranthum*				x							
(continued)		Asteraceae sp.					x	x		x			x
Boryaceae		*Borya sphaerocephala*				x		x		x			x
Brassicaceae		*Cardamine paucijuga*	P2								x		
Campanulaceae		*Isotoma hypocrateriformis*				x				x			
		Lobelia gibbosa						x					
		Lobelia sp.							x	x			
	*	*Wahlenbergia capensis*								x			
		Wahlenbergia preissii								x			
Caprifoliaceae	*	*Lonicera japonica*				x							
Caryophyllaceae	*	*Silene gallica*				x							
	*	*Silene gallica var. gallica*				x							
Casuarinaceae		*Allocasuarina fraseriana*				x	x	x	x	x			x
		Allocasuarina sp.						x					x
Celastraceae		*Stackhousia monogyna*					x	x		x			x
		Stackhousia pubescens				x							
		Stackhousia sp.				x		x	x				
		Tripterococcus brunonis								x			x
Centrolepidaceae		*Aphelia brizula*				x							
		Centrolepis fascicularis				x							
Colichicaceae		*Burchardia congesta*				x	x	x		x			x
Crassulaceae		*Crassula exserta*				x							
		Crassula sp.				x							
Cupressaceae		*Callitris ?acuminata*					x						
Cyperaceae		*Cyathochaeta avenacea*				x	x	x		x			x
		Cyathochaeta teretifolia	P3			x	x				x		
	*	*Cyperus congestus*				x							

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Cyperaceae		*Gahnia decomposita*				x	x	x	x	x			x
(continued)		*Gahnia trifida*				x	x						
		Lepidosperma apricola sens. lat.					x						
		Lepidosperma drummondii				x							
		Lepidosperma gracile					x			x			
		Lepidosperma leptostachyum				x	x						
		Lepidosperma longitudinale				x							
		Lepidosperma pubisquameum				x	x			x			x
		Lepidosperma squamatum				x	x	x	x	x			x
		Lepidosperma tenue					x	x	x				x
		Lepidosperma tetraquetrum				x	x	x	x	x			x
		Lepidosperma resinosum					x						
		Lepidosperma sp.			x		x	x	x	x			x
		Machaerina articulata				x							
		Machaerina vaginalis				x							
		Mesomelaena graciliceps				x							
		Morelotia australiensis	T	VU							x		
		Morelotia octandra				x	x	x	x				x
		Morelotia sp.				x							
		Netrostylis sp. Blackwood River (A.R. Annels 3043)	P3								x		
		Netrostylis sp. Jarrah Forest (R. Davis 7391)				x	x	x	x	x			x
		Netrostylis sp. Nannup (P.A. Jurjevich 1133)	P1			x					x		
		Cyperaceae sp.					x	x	x	x			x
Dasypogonaceae		*Kingia australis*					x	x					x
Dennstaedtiaceae	*	*Histiopteris incisa*											x
		Pteridium esculentum					x	x	x	x			x
		Pteridium esculentum subsp. *esculentum*				x							
Dicranceae		*Campylopus bicolor* var. *bicolor*				x							
Dilleniaceae		*Hibbertia acerosa*				x	x	x					x
		Hibbertia amplexicaulis				x	x	x	x	x			x
		Hibbertia commutata				x	x	x	x	x			x
		Hibbertia glomerata subsp. *glomerata*								x			
		Hibbertia hypericoides					x	x	x	x			x
		Hibbertia hypericoides subsp. *hypericoides*				x							
		Hibbertia lasiopus								x			

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Dilleniaceae		*Hibbertia ovata*					x	x	x				
(continued)		*Hibbertia perfoliata*					x	x	x				x
		Hibbertia pilosa				x							
		Hibbertia serrata				x	x						
		Hibbertia silvestris				x	x	x	x				
		Hibbertia stellaris				x							
		Hibbertia subvaginata							x	x			
		Hibbertia sp.					x	x		x			x
Droseraceae		*Drosera collina*				x							
		Drosera erythrorhiza					x	x					
		Drosera leucoblasta						x					
		Drosera pallida				x							
		Drosera pulchella				x							
		Drosera squamosa				x							
		Drosera stolonifera						x					
		Drosera sp.					x	x	x	x			x
Elaeocarpaceae		*Platytheca galioides*				x							
		Tetratheca hirsuta					x	x		x			x
		Tetratheca hirsuta subsp. *viminea*				x							
		Tetratheca parvifolia									x		
		Tetratheca virgata							x				
		Tetratheca ?pilifera	P3					x					
		Tetratheca sp.						x					x
Ericaceae		*Andersonia aristata*				x							
		Andersonia latiflora								x			x
		Andersonia lehmanniana				x							x
		Andersonia sp.					x	x					x
		Astroloma sp.					x	x					
		Leucopogon australis				x				x			x
		Leucopogon capitellatus				x	x	x	x	x			x
		Leucopogon glabellus								x			x
		Leucopogon gracillimus				x	x						
		Leucopogon hirsutus				x							
		Leucopogon verticillatus				x	x	x	x	x			x
		Leucopogon sp.					x	x		x			
		Sphenotoma capitata				x							

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Ericaceae		*Styphelia concinna*						x					
(continued)		*Styphelia discolor*				x		x	x	x			x
		Styphelia nitens				x	x	x	x	x			
		Styphelia pallida				x		x	x	x			x
		Styphelia propinqua				x	x	x	x	x			x
		Styphelia tenuiflora				x	x	x	x	x			x
		Styphelia sp.					x			x			x
Euphorbiaceae		*Amperea simulans*				x							x
		Monotaxis grandiflora						x					x
		Monotaxis occidentalis				x	x	x					
		Ricinocarpos glaucus				x							
		Stachystemon vermicularis								x			
		Euphorbiaceae sp.					x						
Fabaceae		*Acacia alata*						x		x			x
		Acacia alata var. *alata*				x	x		x				
		Acacia applanata											x
		Acacia browniana				x	x	x	x				x
		Acacia browniana var. *browniana*					x						
		Acacia browniana var.?*endlicheri*											x
		Acacia browniana var. *obscura*					x						
		Acacia celastrifolia					x	x					x
		Acacia decurrens				x							
		Acacia divergens				x	x	x	x	x			x
		Acacia drummondii subsp. *candolleana*				x	x	x	x	x			x
		Acacia drummondii subsp. *drummondii*					x	x	x	x			x
		Acacia extensa				x	x	x	x	x			x
		Acacia lateriticola				x	x	x	x	x			x
		Acacia myrtifolia						x					
		Acacia nervosa				x	x	x	x	x			
		Acacia oncinophylla subsp. *patulifolia*									x		
		Acacia preissiana						x					
		Acacia pulchella				x	x	x	x	x			x
		Acacia pulchella var. *pulchella*				x							
	*	*Acacia pycnantha*						x					
		Acacia saligna								x			
		Acacia urophylla				x		x	x	x			x
		Acacia varia var. *crassinervis*				x							

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Fabaceae		*Acacia varia* var. *varia*				x		x					
(continued)		*Acacia willdenowiana*					x	x		x			
		Acacia sp.					x						x
		Aotus procumbens				x							
		Bossiaea angustifolia				x							
		Bossiaea aquifolium					x		x	x			x
		Bossiaea aquifolium subsp. *aquifolium*				x		x					
		Bossiaea eriocarpa											x
		Bossiaea ornata				x	x	x	x	x			x
		Bossiaea spinescens				x							
		Callistachys lanceolata				x	x						
		Chorizema cordatum				x		x	x	x			
		Chorizema dicksonii						x					
		Chorizema rhombeum				x							
		Daviesia costata				x							x
		Daviesia cordata						x					x
		Daviesia decurrens					x	x					
		Daviesia preissii						x					
		Daviesia sp.						x					
		Eutaxia exilis				x							
		Gastrolobium glabratum				x							
		Gastrolobium sp.								x			
		Gompholobium capitatum											x
		Gompholobium knightianum					x	x		x			
		Gompholobium marginatum					x	x		x			x
		Gompholobium polymorphum						x					x
		Gompholobium preissii				x		x		x			x
		Gompholobium tomentosum					x						
		Gompholobium sp.						x		x			
		Hardenbergia comptoniana											x
		Hovea chorizemifolia				x	x	x	x	x			x
		Hovea trisperma				x	x	x					x
		Hovea sp.								x			
		Jacksonia alata				x							
		Jacksonia furcellata						x					
		Kennedia carinata				x							
		Kennedia coccinea				x	x	x	x	x			x
		Kennedia prostrata				x		x		x			
		Labichea punctata					x	x	x	x			x

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Fabaceae	*	*Lathyrus tingitanus*				x							
(continued)	*	*Lotus subbiflorus*				x							
	*	*Medicago polymorpha*				x							
		Mirbelia dilatata				x	x	x	x	x			x
		Paraserianthes lophantha						x	x	x			x
		Sphaerolobium linophyllum											x
		Sphaerolobium medium				x		x	x	x			x
		Sphaerolobium scabriusculum				x							
		Templetonia drummondii					x						
		Templetonia sp.							x				
	*	*Trifolium arvense*											x
	*	*Trifolium ligusticum*				x							
		Viminaria juncea				x							
		Fabaceae sp.								x			
Fagaceae	*	*Quercus palustris*				x							
Gentianaceae	*	*Centaurium erythraea*				x				x			
Goodeniaceae		*Dampiera alata*				x							x
		Dampiera hederacea				x		x					x
		Dampiera linearis					x			x			
		Dampiera sp.											x
		Goodenia fasciculata				x							
		Lechenaultia biloba				x	x	x	x	x			x
		Lechenaultia sp.											
		Scaevola calliptera				x	x	x		x			x
		Scaevola pilosa				x							
		Scaevola sp.						x					
		Goodeniaceae sp.								x			
Haemodoraceae		*Anigozanthos* sp.							x	x			
		Conostylis juncea				x							
		Conostylis pusilla						x		x			x
		Conostylis serrulata				x	x	x	x	x			x
		Conostylis setigera				x	x	x	x	x			x
		Conostylis setigera subsp. *setigera*				x							
		Conostylis setosa					x	x	x	x			x

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Haemodoraceae		*Conostylis* sp.						x	x				
(continued)		*Haemodorum laxum*								x			
		Haemodorum sp.					x	x		x			x
		Tribonanthes violacea				x							
		Haemodoraceae sp.						x					
Haloragaceae		*Glischrocaryon aureum*						x	x	x			
		Gonocarpus benthamii				x		x					
		Gonocarpus diffusus				x							
Hemerocallidaceae		*Agrostocrinum hirsutum*				x				x			x
		Agrostocrinum scabrum											x
		Agrostocrinum sp.				x							
		Caesia micrantha				x							
		Chamaescilla corymbosa					x	x	x	x			x
		Chamaescilla corymbosa var. *corymbosa*				x							
		Chamaescilla sp.					x						
		Dianella revoluta					x		x				x
		Dianella revoluta var. *divaricata*				x							
		Johnsonia lupulina				x	x			x			x
		Stypandra glauca				x	x						
		Tricoryne elatior				x							
		Tricoryne sp.											x
		Hemerocallidaceae sp.					x						
Hypericaceae	*	*Hypericum perforatum*				x							
Hypoxidaceae		*Pauridia gardneri*					x						
Iridaceae	*	*Babiana angustifolia*				x							
	*	*Chasmanthe floribunda*				x							
		Orthrosanthus laxus											x
		Patersonia babianoides								x			x
		Patersonia juncea						x					
		Patersonia occidentalis				x	x	x	x	x			x
		Patersonia occidentalis var. *occidentalis*				x							
		Patersonia pygmaea					x	x		x			x
		Patersonia rudis					x	x		x			x
		Patersonia sp.						x	x	x			x

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Iridaceae	*	*Watsonia meriana* var. *meriana*				x							
(continued)		Iridaceae sp.								x			
Juncaceae		*Juncus holoschoenus*				x							
		Juncus sp.					x						
Juncaginaceae		*Cycnogeton lineare*				x							
		Triglochin nana				x							
Lamiaceae	*	*Stachys arvensis*				x							
		Hemigenia humilis											x
		Hemigenia microphylla	P3			x					x		
		Hemigenia pritzelii				x	x	x	x	x			x
		Hemigenia sp.											x
		Lamiaceae sp.						x					
Lauraceae		*Cassytha filiformis*							x				
		Cassytha glabella								x			
		Cassytha glabella forma *casuarinae*				x							
		Cassytha pomiformis				x							
		Cassytha sp.					x	x	x	x			
Liliaceae	*	*Lilium candidum*				x							
Lindsaeaceae		*Lindsaea linearis*				x	x	x		x			x
Loganiaceae		*Orianthera serpyllifolia* subsp. *angustifolia*				x							
Loranthaceae		*Nuytsia floribunda*					x						
Malvaceae		*Lasiopetalum floribundum*				x	x	x	x	x			x
		Lasiopetalum glabratum					x	x	x	x			
		Lasiopetalum sp.						x					
		Thomasia ?*macrocalyx*						x					
		Thomasia paniculata				x	x	x	x	x			x
		Thomasia pauciflora				x							
		Thomasia sp. Big Brook (M. Koch 2373)				x							
		Thomasia sp.					x		x				

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Meliaceae	PL	*Melia azedarach*				x							
Myrtaceae		*Astartea scoparia*				x	x	x	x	x			x
		Babingtonia camphorosmae					x	x	x	x			
	*	*Callistemon citrinus*				x							
		Callistemon glaucus							x				
		Calothamnus sp.						x		x			
		Calytrix depressa				x							
		Calytrix leschenaultii					x	x	x				
		Calytrix sp.					x	x	x	x			x
		Corymbia calophylla				x	x	x	x	x			x
		Darwinia citriodora				x	x						
	PL	*Eucalyptus accedens*					x						
		Eucalyptus drummondii					x						
		Eucalyptus laeliae				x							
		Eucalyptus marginata				x	x	x	x	x			x
		Eucalyptus marginata subsp. *marginata*				x							
		Eucalyptus megacarpa				x	x	x	x	x			x
	PL	*Eucalyptus microcorys*				x	x						
		Eucalyptus patens				x		x	x	x			x
		Eucalyptus rudis						x	x	x			x
	PL	*Eucalyptus saligna*				x							
		Eucalyptus x *graniticola*	P4			x					x		
		Eucalytpus sp.						x					x
		Homalospermum firmum				x	x						
		Hypocalymma angustifolium				x	x	x	x	x			x
		Hypocalymma cordifolium				x	x	x	x	x			x
		Hypocalymma robustum				x	x	x	x	x			
		Hypocalymma sp.					x	x					
		Leptospermum erubescens						x		x			
		Melaleuca densa				x							
		Melaleuca huegelii subsp. *huegelii*				x							
		Melaleuca incana subsp. *incana*				x							x
		Melaleuca parviceps					x						x
		Melaleuca preissiana				x		x		x			
		Melaleuca trichophylla						x	x				
		Melaleuca viminea subsp. *viminea*				x							x
		Melaleuca sp.						x					
		Pericalymma ellipticum					x	x	x	x			x

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Myrtaceae	*	*Syncarpia glomulifera*				x							
(continued)		*Taxandria fragrans*				x							
		Taxandria linearifolia				x	x	x	x	x			x
		Verticordia huegelii var. *huegelii*				x							
		Verticordia plumosa var. *plumosa*				x	x						
		Myrtaceae sp.					x	x		x			x
Ophioglossaceae		*Ophioglossum lusitanicum*				x							
Orchidaceae		*Caladenia flava*					x						
		Caladenia flava subsp. *flava*				x							
		Caladenia latifolia								x			x
		Caladenia nana subsp. *nana*				x							
		Caladenia reptans								x			
		Caladenia reptans subsp. *reptans*											x
		Caladenia speciosa											
		Caladenia uliginosa subsp. *patulens*											
		Caladenia sp.					x			x			x
		Cryptostylis ovata				x	x		x	x			x
		Cyrtostylis huegelii											x
		Diuris micrantha	T	VU	x								
		Diuris sp.								x			x
		Drakaea elastica	T	CR								x	
		Elythranthera brunonis				x							
		Eriochilus dilatatus subsp. *dilatatus*				x							
		Leporella sp.					x						
		Leptocerus menziesii											x
		Microtis media						x					
		Microtis sp.					x						
		Prasophyllum brownii				x							
		Pterostylis crispula											x
		Pterostylis pyramidalis					x						
		Pterostylis recurva				x							x
		Pterostylis scabra				x							
		Pterostylis sp. Bloated snail orchid (W. Jackson BJ 486)				x							
		Pterostylis vittata				x				x			
		Pterostylis sp.				x	x	x	x	x			x
		Pyrorchis nigricans				x	x	x		x			x
		Thelymitra crinita				x							

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Orchidaceae		*Thelymitra* sp.				x							
(continued)		Orchidaceae sp.					x	x	x	x			x
Orobanchaceae	*	*Orobanche minor*						x					
Oxalidaceae	*	*Oxalis purpurea*				x							
	*	*Oxalis* sp.						x					
Phyllanthaceae		*Lysiandra calycina*				x	x	x	x	x			x
Phytolaccaceae	*	*Phytolacca octandra*						x					
Pinaceae	PL	*Pinus pinaster*					x		x				
	PL	*Pinus* sp.				x	x						x
Pittosporaceae		*Billardiera floribunda*				x				x			
		Billardiera fraseri								x			
		Billardiera fusiformis					x	x	x	x			x
		Billardiera variifolia				x		x					
		Billardiera sp.						x					
		Marianthus bicolor							x				
		Marianthus drummondianus				x		x	x				x
		Pittosporaceae sp.					x			x			x
Plantaginaceae		*Gratiola pubescens*				x							
Poaceae	*	*Aira caryophyllea*								x			
		Amphipogon amphipogonoides						x		x			x
		Amphipogon laguroides				x		x					
		Austrostipa sp.					x						
	*	*Briza maxima*								x			
		Dichelachne crinita				x							
		Eriachne sp.							x				
		Neurachne alopecuroidea					x	x	x	x			x
		Rytidosperma acerosum								x			
		Rytidosperma caespitosum					x	x	x	x			x
		Rytidosperma sp.					x			x			
		Tetrarrhena laevis				x	x	x	x	x			x
		Poaceae sp.					x	x	x	x			x

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Podocarpaceae		*Podocarpus drouynianus*					x						
Polygalaceae		*Comesperma calymega*						x		x			x
		Comesperma virgatum				x	x	x		x			x
		Comesperma sp.					x						x
	*	*Polygala myrtifolia*				x							
Primulaceae	*	*Lysimachia arvensis*						x					
Proteaceae		*Adenanthos barbiger*				x	x	x	x	x			x
		Adenanthos obovatus				x	x						
		Banksia dallanneyi subsp. *dallanneyi*						x					x
		Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*							x	x			
		Banksia dallanneyi subsp. *dallanneyi* var. *mellicula*				x							
		Banksia dallanneyi subsp. *sylvestris*				x			x	x			
		Banksia grandis				x	x	x	x	x			x
		Banksia littoralis					x	x	x	x			x
		Banksia seminuda				x			x				
		Banksia sessilis					x	x	x	x			x
		Banksia sphaerocarpa							x	x			
		Banksia squarrosa subsp. *squarrosa*						x					
		Banksia sp.							x	x			
		Conospermum capitatum											x
		Conospermum capitatum subsp. *glabratum*				x	x						
		Conospermum flexuosum				x							x
		Conospermum flexuosum subsp. *laevigatum*				x				x			
		Conospermum stoechadis								x			
		Conospermum sp.					x						x
		Grevillea bipinnatifida						x					x
		Grevillea bipinnatifida subsp. *bipinnatifida*				x							
		Grevillea diversifolia						x		x			
		Grevillea manglesii subsp. *manglesii*						x					
		Grevillea pilulifera				x							
		Grevillea prominens	P3			x				x	x		x
		Grevillea pulchella						x					x
		Grevillea pulchella subsp. *ascendens*											x
		Grevillea quercifolia				x	x						
		Grevillea synapheae				x							
		Grevillea wilsonii						x	x	x			x

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		Hakea amplexicaulis				x	x	x	x	x			X

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Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Proteaceae		*Hakea cyclocarpa*						x					x
(continued)		*Hakea incrassata*								x			
		Hakea lasianthoides				x			x				
		Hakea lissocarpha				x	x	x	x	x			x
		Hakea prostrata							x	x			x
		Hakea ruscifolia				x		x	x	x			x
		Hakea varia							x				
		Isopogon sphaerocephalus				x	x						
		Persoonia elliptica				x	x	x	x	x			x
		Persoonia longifolia				x	x	x	x	x			x
		Synaphea gracillima				x							
		Synaphea odocoileops	P1								x		
		Synaphea petiolaris				x	x						
		Xylomelum occidentale				x	x						x
Ranunculaceae		*Clematis pubescens*				x	x	x	x	x			x
Restionaceae		*Desmocladus fasciculatus*					x	x	x	x			x
		Desmocladus flexuosus					x	x	x	x			x
		Hypolaena exsulca				x	x	x	x	x			x
		Leptocarpus coangustatus				x							
		Leptocarpus laxus				x							
		Leptocarpus roycei				x							
		Leptocarpus tenax				x							
		Lepyrodia curvescens	P2					x					
		Lepyrodia glauca				x							
		Lepyrodia macra											x
		Lepyrodia muirii				x							
		Loxocarya cinerea				x				x			x
		Loxocarya striata					x						
		Sporadanthus rivularis				x	x						
		Restionaceae sp.					x			x			x
Rhamnaceae		*Trymalium ledifolium*				x	x	x	x	x			x
		Trymalium odoratissimum subsp. *odoratissimum*					x	x	x	x			
		Trymalium odoratissimum subsp. *trifidum*				x							
Rosaceae	*	*Rubus ulmifolius*						x					

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR AND RECORDED IN THE WARRINGTON SURVEY AREA

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SCC = State Conservation Code; FCC= Federal Conservation Code; CE = Critically Endangered; E = Endangered; V= Vulnerable. EPBC PMST (DCCEEW, 2013), NatureMap (DBCA, 2007-), Previous MCPL (MCPL, 2015), MCPL (MCPL, 2019), MCPL (MCPL, 2020), MCPL (2022), WAHerb amd TPFL (DBCA, 38-0423FL, 2023).

Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Rubiaceae	*	*Galium murale*				x							
		Opercularia apiciflora				x				x			x
		Opercularia echinocephala				x	x	x	x				x
		Opercularia hispidula				x				x			x
		Opercularia vaginata						x					
		Opercularia sp.						x		x			x
Rutaceae		*Asterolasia pallida*				x		x					
		Boronia crenulata				x	x			x			x
		Boronia crenulata subsp. *crenulata*							x				
		Boronia crenulata subsp. *crenulata* var. *crenulata*				x			x				
		Boronia crenulata subsp. *viminea*				x							
		Boronia fastigiata				x	x	x	x	x			x
		Boronia molloyae				x	x	x	x				x
		Boronia scabra subsp. *scabra*											x
		Boronia sp.					x						
		Cyanothamnus tenuis	P4			x					x		
		Philotheca spicata				x	x	x		x			x
Santalaceae		*Leptomeria cunninghamii*				x				x			x
Sapindaceae		*Dodonaea* sp.						x					x
Schizaeaceae		*Schizaea rupestris*	P2			x					x	x	
Scrophulariaceae	*	*Dischisma arenarium*				x							
Solanaceae		*Anthocercis gracilis*	T	VU	1								
Stylidiaceae		*Levenhookia pusilla*				x	x			x			x
		Levenhookia stipitata								x			x
		Stylidium aceratum											
		Stylidium amoenum				x	x	x	x	x			x
		Stylidium androsaceum				x							
		Stylidium brunonianum						x					
		Stylidium bulbiliferum								x			x
		Stylidium carnosum				x							
		Stylidium ciliatum				x		x	x				
		Stylidium crassifolium				x							

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR AND RECORDED IN THE WARRINGTON SURVEY AREA

Note: * denotes alien species; PL denotes planted species; PL* denotes both planted/alien; and Mixed (^) refers to part native and part naturalised. T, P1 to P4 reflect Threatened and Priority species (DBCA, 2019a).
SCC = State Conservation Code; FCC= Federal Conservation Code; CE = Critically Endangered; E = Endangered; V= Vulnerable. EPBC PMST (DCCEEW, 2013), NatureMap (DBCA, 2007-), Previous MCPL (MCPL, 2015), MCPL (MCPL, 2019), MCPL (MCPL, 2020), MCPL (2022), WAHerb amd TPFL (DBCA, 38-0423FL, 2023).

Family	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL	MCPL 2023
Stylidiaceae		*Stylidium despectum*				x							
(continued)		*Stylidium dichotomum*											x
		Stylidium diuroides subsp. *diuroides*				x							
		Stylidium hispidum				x				x			
		Stylidium piliferum					x	x	x	x			x
		Stylidium repens					x	x	x	x			x
		Stylidium rhynchocarpum				x							
		Stylidium schoenoides				x							
		Stylidium sp.					x	x	x	x			x
Thymelaeaceae		*Pimelea ciliata*											x
		Pimelea ciliata subsp. *ciliata*				x							
		Pimelea imbricata var. *piligera*				x							
		Pimelea lanata				x							
		Pimelea suaveolens					x	x	x				x
		Pimelea suaveolens subsp. *suaveolens*				x							
		Pimelea sylvestris				x							
		Pimelea sp.					x	x	x	x			x
Violaceae		*Pigea debilissima*				x							
		Pigea floribunda											x
Xanthorrhoeaceae		*Xanthorrhoea gracilis*				x	x	x	x	x			x
		Xanthorrhoea preissii				x	x	x	x	x			x
		Xanthorrhoea sp.						x		x			
Xyridaceae		*Xyris atrovirida*				x							
		Xyris lacera				x							
		Xyris sp.				x							
Zamiaceae		*Macrozamia riedlei*				x	x	x	x	x			x

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE WARRINGTON SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Anthocercis gracilis	Solanaceae	T	Vulnerable	Habit: Erect, spindly shrub, to 0.6 (-1) m high. Flower colour: yellow-green Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sandy or loamy soils. Granite outcrops. IBRA Distribution: AVW, JAF Florabase records: 29	Low Has not been recorded by DBCA or by MCPL previously within the survey area. Occurs mainly on the Darling Scarp and in the Wheatbelt.
Diuris micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.3-0.6 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Brown loamy clay. Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 9	Low Has not been recorded by DBCA or by MCPL previously within the survey area. Occurs mainly on the Darling Scarp and in the Wheatbelt.
Drakaea elastica	Orchidaceae	T	CR	Habit: Tuberous, perennial, herb, 0.12-0.3 m high. Flower colour: red, yellow & green Flowering period (indicated in green): J F M A M J J A S O N D Soils: White or grey sand. Low- lying situations adjoining winter-wet swamps. IBRA Distribution: SWA Florabase records: 18	Low One record listed in TPFL database as located within 10 km of survey area. Found adjacent to the SW Highway in dry sand. Occurs on the Swan Coastal Plain.
Morelotia australiensis	Cyperaceae	T	VU	Habit: Perennial (short-lived) tufted herb, 0.3–1.3 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Winter – wet swampy depressions, drainage lines or sandy rises. Grey sand over clay or yellow and sandy or clayey lateritic soils. IBRA Distribution: JAF, SWA Florabase records: 46	Moderate The WAHerb identified three records NE and within 10 km of survey area. Findings associated with lateritic gravel and clay loam.

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APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE WARRINGTON SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	Cyperaceae	P1	-	Habit: Perennial. Caespitose sedge 90 cm high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N D Soils: Creek, valley floors. IBRA Distribution: JAF Florabase records: 6	Moderate Locally abundant to the NW and within 5 km of survey area (WA Herb). Findings associated with clay loam and dark grey soils in lowland areas.
Synaphea odocoileops	Proteaceae	P1	-	Habit: Tufted, compact shrub, 0.2-0.5 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Brown-orange loam; sandy clay, granite. Swamps, winter-wet areas. IBRA Distribution: SWA Florabase records: 22	Low WAHerb listing 0.5 km N of Yarloop. Found in swamp associated with black/grey sandy clay.
Cardamine paucijuga	Brassicaceae	P2	-	Habit: Slender erect annual herb to 0.4m high. Flower colour: White Flowering period (indicated in green): J F M A M J J A S O N D Soils: In moist to dry habitats IBRA Distribution: SWA, WAR, JAF Florabase records: 10	Very Low Occurs on Swan Coastal Plain and in Southern Wheatbelt
Lepyrodia curvescens	Restionaceae	P2	-	Habit: Dioecious, shortly creeping, tufted rhizomatous, herb, 0.24-0.4 m high, rhizomes on surface or to 1 cm deep. Flower colour: Light brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand, laterite. Seasonally inundated swampland. IBRA Distribution: GES, JAF, SWA Florabase records: 21	Moderate Recorded previously by MCPL (2019) near creekline approximately 5 km NE of Warrington survey area.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE WARRINGTON SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Schizaea rupestris	Schizaeaceae	P2	-	Habit: Rhizomatous, perennial, herb or grass-like or (fern), 0.1-0.2m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand. Gullies, creek banks, shaded moist rock faces. IBRA Distribution: ESP, JAF, WAR Florabase records: 13	Moderate Two records identified by WA herb and one record contained in the TFPL database. All occurring within 5 km N and S of the survey area. Findings are associated with clay loam and dark gravelly soils.
Actinotus repens	Apiaceae	P3	-	Habit: Prostrate perennial to 5 cm high, c. 20cm wide. Flower colour: white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Coarse black peaty sand over clay. Creeklines, edges of water channels. IBRA Distribution: JAF, WAR Florabase records: 36	Moderate- High One record within 1 km of Warrington central survey point. Located on the banks of a creekline containing *E. patens*, *E. megacarpa*, *T. linearifolia*, and *M. dilatata.*
Cyathochaeta teretifolia	Cyperaceae	P3	-	Habit: Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2.0 m high, to 1.0 m wide. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Grey sand, sandy clay. Swamps, creek edges. IBRA Distribution: JAF, SWA, WAR Florabase records: 40	Low Recorded previously by MCPL (2015).
Grevillea prominens	Proteaceae	P3	-	Habit: Spreading shrub, 0.5-1.7m high, 0.3-1m wide. Flower colour: cream-white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Gravelly loam, along creeklines. IBRA Distribution: JAF Florabase records: 9	Moderate Recorded previously by MCPL (2022). Three records with WAHerb and within 10km of central Warrington survey point.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE WARRINGTON SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hemigenia microphylla	Lamiaceae	P3	-	Habit: Slender shrub, 0.4-1.8 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Sandy clay, peaty clay, granite. Winter-wet depressions. IBRA Distribution: JAF, SWA, WAR Florabase records: 25	Low DBCA and WAHerb records within 10 km of survey area.
Netrostylis sp. Blackwood River (A.R. Annels 3043)	Cyperaceae	P3	-	Habit: Erect or spreading sedge to 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Shallow grey sandy soil, clay loam. Along edges of creeklines and inundated swamp. IBRA Distribution: ESP, JAF, SWA, WAR Florabase records: 16	Moderate WAHerb lists one record within 1 km of central survey point and found within creekline.
Tetratheca pilifera	Elaeocarpaceae	P3	-	Habit: Spreading shrub, 0.1-0.3 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Gravelly soils. IBRA Distribution: JAF, SWA Florabase records: 35	Low. MCPL (2019) recorded at one location and within 5 km of survey area on the slopes and ridges associated with the S site- vegetation type.
Cyanothamnus tenuis	Rutaceae	P4	-	Habit: Procumbent or erect & slender shrub, 0.1-0.5 m high. Flower colour: white-pink Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Laterite, stony soils, granite. IBRA Distribution: JAF, SWA Florabase records: 44	Low WAHerb lists one record of species found on granite rock and south of survey area.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE WARRINGTON SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eucalyptus x graniticola	Myrtaceae	P4	-	Habit: Mallee to 4 m, smooth bark. Flower colour: Stamens cream Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Granite soils. IBRA Distribution: JAF Florabase records: 6	Low WAHerb lists two records, both north of survey area and associated with granite.
Senecio leucoglossus	Asteraceae	P4	-	Habit: Erect annual, herb, to 1.3 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** **D** Soils: Gravelly lateritic or granitic soils. Granite outcrops, slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 45	High Previously recorded by MCPL over multiple years.

APPENDIX D: SUMMARY OF RECORDED SPECIES BY SITE-VEGETATION TYPES, WARRINGTON SURVEY AREAS, 2023

* denotes introduced species and P1 to P4 denotes Priority species

Species	AC	CW	W	D	SW	PW	PS	PT	S	SP	ST	T	TS
**Erigeron* sp.		x	x										
**Histiopteris incisa*	x												
**Hypochaeris glabra*				x	x	x	x	x	x	x	x	x	x
**Pinus* sp.									x				
**Trifolium arvense*		x		x					x				
Acacia alata		x	x			x			x		x		
Acacia applanata		x	x			x			x		x		
Acacia browniana		x	x	x	x	x	x	x	x	x	x	x	x
Acacia celastrifolia								x			x		
Acacia divergens	x	x	x										
Acacia drummondii subsp. *candolleana*			x				x	x	x		x		
Acacia drummondii subsp. *drummondii*		x	x						x		x	x	x
Acacia extensa		x	x				x		x				
Acacia lateriticola		x	x		x			x	x	x	x	x	x
Acacia pulchella			x	x	x	x	x	x	x	x	x	x	x
Acacia sp.									x				
Acacia urophylla								x	x	x	x	x	x
Acacia browniana var. *?endlicheri*			x						x		x		
Adenanthos barbiger				x	x		x	x	x	x	x		x
Agrostocrinum hirsutum		x					x						x
Agrostocrinum scabrum		x			x		x		x	x	x		
Allocasuarina fraseriana			x	x	x	x	x	x	x	x	x		x
Allocasuarina sp.			x										
Amperea simulans							x		x	x			
Amphipogon amphipogonoides			x			x	x	x	x		x		x
Andersonia latiflora									x				
Andersonia lehmanniana									x	x			
Andersonia sp.							x		x				
Apiaceae sp.			x			x	x	x	x		x		x
Astartea scoparia	x	x	x										
Asteraceae sp.				x					x	x			
Banksia dallanneyi subsp. *dallanneyi*			x	x	x	x	x	x	x	x	x	x	x
Banksia grandis			x	x		x	x	x	x	x	x	x	x
Banksia littoralis	x	x	x										
Banksia sessilis					x	x	x		x	x	x		
Billardiera fusiformis		x	x		x						x		
Boronia crenulata			x		x		x		x			x	
Boronia fastigiata		x	x	x	x		x	x	x	x	x	x	x
Boronia molloyae		x											
Boronia scabra subsp. *scabra*									x				
Borya sphaerocephala						x							
Bossiaea aquifolium	x	x	x	x	x	x	x	x	x	x	x	x	x
Bossiaea eriocarpa											x		
Bossiaea ornata			x				x		x	x	x		
Burchardia congesta		x	x			x	x		x		x		
Caladenia latifolia							x						
Caladenia reptans subsp. *reptans*			x				x	x	x		x		x
Caladenia sp.			x	x		x	x	x	x	x	x	x	x
Calytrix sp.	x	x	x	x	x	x	x	x	x	x	x		
Chamaescilla corymbosa			x	x	x	x	x	x	x	x	x		
Clematis pubescens								x	x	x	x	x	x
Comesperma calymega							x		x		x		
Comesperma sp.				x								x	
Comesperma virgatum				x			x		x		x		
Conospermum capitatum					x	x	x		x		x		
Conospermum flexuosum							x		x	x			
Conospermum sp.									x				
Conostylis pusilla					x		x	x	x				
Conostylis serrulata			x	x	x	x	x	x	x	x	x		x
Conostylis setigera			x	x	x	x	x	x	x	x	x		x
Conostylis setosa			x			x	x	x	x		x		x
Corymbia calophylla	x	x	x	x	x	x	x	x	x	x	x	x	x

APPENDIX D: SUMMARY OF RECORDED SPECIES BY SITE-VEGETATION TYPES, WARRINGTON SURVEY AREAS, 2023

* denotes introduced species and P1 to P4 denotes Priority species

Species	AC	CW	W	D	SW	PW	PS	PT	S	SP	ST	T	TS
Cryptostylis ovata											x		
Cryptostylis sp.							x	x	x				
Cyathochaeta avenacea	x	x	x	x	x		x	x	x	x	x		x
Cyperaceae sp.		x	x		x	x	x	x	x	x	x		
Cyrtostylis huegelii									x				
Dampiera alata									x			x	
Dampiera hederacea	x	x											
Dampiera sp.										x			
Daviesia ?costata									x	x	x		
Daviesia cordata									x				
Desmocladus fasciculatus						x							
Desmocladus flexuosus			x		x		x	x	x		x		
Dianella revoluta							x		x		x		
Diuris sp.						x		x	x				x
Dodonaea sp.							x						
Drosera sp.			x	x	x	x	x	x	x	x	x	x	x
Drosera sp. 1							x		x				
Drosera sp. 2									x				
Eucalyptus marginata	x	x	x	x	x	x	x	x	x	x	x	x	x
Eucalyptus megacarpa	x	x	x										
Eucalyptus patens	x	x	x										
Eucalyptus rudis			x										
Eucalyptus sp.		x											
Fabaceae sp.									x				
Gahnia decomposita	x	x											
Gompholobium capitatum									x				
Gompholobium marginatum			x			x			x				
Gompholobium polymorphum									x				
Gompholobium preissii			x			x			x				
Grevillea bipinnatifida				x									
Grevillea prominens (P3)									x		x		
Grevillea pulchella									x	x			
Grevillea pulchella subsp*. ascendens*											x		
Grevillea wilsonii										x			
Haemodorum sp.			x	x			x	x	x	x	x		x
Hakea amplexicaulis		x	x	x	x	x	x	x	x	x	x	x	x
Hakea cyclocarpa							x						
Hakea lissocarpha				x			x		x				
Hakea prostrata			x	x			x		x				
Hakea ruscifolia									x				x
Hardenbergia comptoniana												x	x
Hemigenia ?humilis							x						
Hemigenia pritzelii		x	x	x	x	x	x	x	x	x	x	x	
Hemigenia sp.			x	x				x	x		x		
Hibbertia acerosa				x		x	x	x	x		x		x
Hibbertia amplexicaulis			x	x	x	x	x	x	x	x	x	x	x
Hibbertia commutata			x	x			x	x	x	x	x	x	x
Hibbertia hypericoides						x							
Hibbertia perfoliata							x		x				
Hibbertia sp.		x			x	x	x		x	x	x		
Hovea chorizemifolia			x				x	x	x		x	x	
Hovea trisperma		x							x				
Hybanthus floribundus									x				
Hypocalymma angustifolium		x	x	x	x	x	x		x				
Hypocalymma cordifolium	x	x	x										
Hypolaena exsulca			x	x	x	x	x		x	x	x		
Johnsonia lupulina							x		x		x		
Kennedia coccinea				x			x	x	x		x	x	
Kingia australis		x											
Labichea punctata			x	x			x	x	x				
Lagenophora heugelii			x	x	x	x	x	x	x	x	x	x	x
Lasiopetalum floribundum		x	x	x	x	x	x	x	x	x	x	x	x

APPENDIX D: SUMMARY OF RECORDED SPECIES BY SITE-VEGETATION TYPES, WARRINGTON SURVEY AREAS, 2023

* denotes introduced species and P1 to P4 denotes Priority species

Species	AC	CW	W	D	SW	PW	PS	PT	S	SP	ST	T	TS
Laxmannia sp.									x				
Laxmannia squarrosa									x				
Lechenaultia biloba			x	x	x	x	x	x	x	x	x	x	x
Lepidosperma ?pubisquameum							x		x				
Lepidosperma sp.		x	x	x		x	x	x	x	x	x	x	x
Lepidosperma sp. 1						x	x	x					
Lepidosperma sp. 2						x	x	x					
Lepidosperma squamatum		x				x	x	x	x	x			
Lepidosperma tenue			x						x		x		
Lepidosperma tetraquetrum	x	x							x				
Leptocerus menziesii							x				x		
Leptomeria cunninghamii				x			x		x				
Lepyrodia macra			x										
Leucopogon australis		x											
Leucopogon capitellatus			x	x				x	x	x	x		x
Leucopogon glabellus					x	x	x		x	x			
Leucopogon verticillatus			x		x		x	x	x	x	x	x	x
Levenhookia pusilla							x	x	x		x		
Levenhookia stipitata					x		x		x				
Lindsaea linearis		x	x										
Lomandra caespitosa		x	x	x	x	x	x	x	x	x	x	x	x
Lomandra drummondii							x	x	x	x	x		x
Lomandra hermaphrodita			x	x	x	x	x	x	x	x	x	x	x
Lomandra micrantha			x			x	x	x	x	x	x	x	
Lomandra nigricans				x	x	x	x	x	x	x	x	x	x
Lomandra preissii							x		x	x	x	x	
Lomandra purpurea							x		x				
Lomandra sericea			x	x	x	x	x	x	x	x	x	x	x
Lomandra sonderi			x	x	x	x	x	x	x	x	x		x
Lomandra sp.		x	x	x	x		x	x	x	x	x	x	x
Lomandra sp. 1									x				
Lomandra sp. 2									x				
Lomandra spartea			x			x	x	x	x	x	x		
Loxocarya cinerea			x			x	x		x				
Lysiandra calycina		x	x	x	x	x	x	x	x	x	x	x	x
Macrozamia riedlei	x	x	x	x	x	x	x	x	x	x	x	x	x
Malvaceae sp.		x											
Marianthus drummondianus		x							x			x	
Melaleuca incana subsp. *incana*		x											
Melaleuca parviceps					x	x							
Melaleuca viminea	x	x											
Mirbelia dilatata	x	x	x	x		x	x		x	x	x	x	x
Monotaxis occidentalis			x						x		x		
Morelotia octandra			x		x		x		x		x		
Myrtaceae sp.					x				x	x			
Netrostylis sp. Jarrah Forest (R. Davis 7391)		x	x	x	x	x	x	x	x	x	x	x	x
Neurachne alopecuroidea							x		x				
Opercularia apiciflora			x		x		x		x		x	x	x
Opercularia echinocephala			x	x	x	x	x	x	x	x	x	x	x
Opercularia hispidula									x				
Opercularia sp.										x	x		
Orchidaceae sp.		x	x	x	x	x	x	x	x	x	x	x	x
Orchidaceae sp. 1			x	x			x		x	x	x		
Orchidaceae sp. 2			x	x			x		x	x	x		x
Orchidaceae sp. 3							x						
Orthrosanthus laxus									x		x		
Paraserianthes lophantha							x		x			x	
Patersonia occidentalis						x	x		x				
Patersonia pygmaea				x		x	x	x	x	x			
Patersonia rudis					x				x				
Patersonia sp.							x		x				
Patersonia babianoides							x	x	x	x	x	x	x

APPENDIX D: SUMMARY OF RECORDED SPECIES BY SITE-VEGETATION TYPES, WARRINGTON SURVEY AREAS, 2023

* denotes introduced species and P1 to P4 denotes Priority species

Species	AC	CW	W	D	SW	PW	PS	PT	S	SP	ST	T	TS
Pentapeltis peligera		x	x	x	x		x	x	x		x		
Pericalymma ellipticum		x		x									
Persoonia elliptica						x			x		x	x	
Persoonia longifolia		x	x	x			x	x	x	x	x	x	x
Philotheca spicata			x			x	x	x	x	x	x		
Pimelea ciliata			x										
Pimelea sp.			x				x						
Pimelea suaveolens			x	x	x	x		x	x				
Pittosporaceae sp.		x	x						x				
Platysace compressa		x	x	x			x	x	x	x	x	x	x
Platysace filiformis	x		x		x	x	x	x	x	x	x	x	x
Platysace sp.			x					x	x	x	x	x	x
Platysace tenuissima						x							
Poaceae sp.		x	x	x		x	x		x	x	x	x	x
Pseudognaphalium luteoalbum							x				x		
Pteridium esculentum	x	x	x	x	x		x	x	x		x	x	x
Pterochaeta paniculata				x		x	x	x	x	x			
Pterostylis crispula								x	x		x		
Pterostylis sp.	x	x	x	x	x		x	x	x	x	x	x	x
Pterostylis sp. 1												x	
Pterostylis recurva									x				
Pyrorchis nigricans							x		x		x	x	
Restionaceae sp.		x				x		x	x				x
Rytidosperma caespitosum		x	x	x	x	x	x	x	x	x	x		x
Scaevola calliptera			x				x	x	x	x	x	x	
Senecio diaschides					x			x	x				x
Senecio hispidulus			x	x			x	x	x	x	x	x	
Senecio leucoglossus (P4)												x	
Senecio quadridentatis									x				
Senecio sp.							x	x	x		x		
Sphaerolobium linophyllum								x	x				
Sphaerolobium medium							x		x				
Stackhousia monogyna			x	x	x	x	x		x	x	x		
Stylidium amoenum			x	x	x	x	x	x	x	x	x	x	x
Stylidium bulbiferum									x				
Stylidium dichotomum					x	x	x	x	x		x		
Stylidium piliferum			x			x	x	x	x	x	x		
Stylidium repens							x		x				
Stylidium sp.			x		x		x		x	x	x	x	
Styphelia discolor			x	x			x	x	x		x		
Styphelia pallida				x	x		x	x	x			x	
Styphelia propinqua			x	x	x	x	x		x	x	x	x	
Styphelia sp.									x				
Styphelia tenuiflora								x	x		x		
Taxandria linearifolia	x	x	x										
Tetrarhena laevis		x	x			x	x	x	x	x	x	x	x
Tetratheca hirsuta			x				x		x		x	x	
Tetratheca sp.			x										
Thomasia paniculata	x	x	x										
Thsyanotus sp.							x		x		x		
Thysanotus multiflorus							x		x		x		
Thysanotus sparteus								x	x				
Thysanotus thyrsoideus			x			x	x	x	x	x	x	x	
Trachymene pilosa							x		x	x	x	x	
Trichocline spathulata			x	x	x	x	x	x	x	x	x	x	x
Tricoryne sp.							x						
Tripterococcus brunonis				x			x		x	x			
Trymalium ledifolium		x	x	x	x	x	x	x	x	x	x	x	x
Xanthorrhoea gracilis			x	x	x	x	x	x	x	x	x	x	x
Xanthorrhoea preissii			x	x			x		x		x	x	x
Xanthosia atkinsoniana				x	x	x	x		x	x			
Xanthosia candida			x				x	x	x		x	x	x

APPENDIX D: SUMMARY OF RECORDED SPECIES BY SITE-VEGETATION TYPES, WARRINGTON SURVEY AREAS, 2023

* denotes introduced species and P1 to P4 denotes Priority species

Species	AC	CW	W	D	SW	PW	PS	PT	S	SP	ST	T	TS
Xanthosia huegelii			x			x	x	x	x	x	x		
Xanthosia singuliflora						x	x		x	x	x		
Xanthosia sp.						x			x		x		
Xylomelum occidentale			x										

ASSESSMENT OF FLORA AND VEGETATION VALUES

ALCOA OF AUSTRALIA SPION SURVEY AREA, WA

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

Alcoa of Australia Limited

August 2023



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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BOM:	Bureau of Meteorology
DCCEEW:	Department of Climate Change, Energy, the Environment and Water
DBCA:	Department of Biodiversity, Conservation and Attractions
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
MCPL:	Mattiske Consulting Pty Ltd
IBRA:	Interim Biogeographical Regionalisation for Australia
PEC:	Priority ecological community
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned by Alcoa of Australia Ltd (Alcoa) to initially conduct a desktop and field assessment to evaluate the flora and vegetation values of the Spion survey area approximately 110 km south east of Perth, WA. The Spion survey area consists of nine blocks totalling 486 hectares, located east of the existing Willowdale bauxite mining operation and within tenements ML 1S4, E 70/6051, E 70/6279 and E 70/6456. The survey areas have been assessed by Mattiske Consulting Pty Ltd at a regional mapping scale as part of the Regional Forest Agreement (RFA) project by Mattiske and Havel (1998).

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the Spion survey area. The field studies were undertaken over several months in line with previous assessments in the northern Jarrah forest.

The Spion survey area occurs within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System by Heddle *et al.* (1980) and Mattiske and Havel (1998).

Potential Flora Values

A total of 462 vascular plant taxa, representative of 186 genera and 72 families, have the potential to occur within the Spion survey area. The most commonly represented families were Fabaceae (56 taxa), Proteaceae (39 taxa) and Myrtaceae (38 taxa). The most commonly represented genera in the Spion survey areas were *Acacia* (21 taxa), *Lomandra* (15 taxa) and *Hibbertia* (14 taxa).

A total of 33 introduced taxa (inclusive of five Mixed- part alien/ part naturalised) have the potential to occur in the Spion survey area. Only one of the potential weeds **Rubus ulmifolius* as listed under the **Rubus fruticosus* aggregate, is a Weed of National Significance (DCCEEW, 2023b). **R. ulmifolius* is also a declared pest/organism under the *Biosecurity and Agriculture Management Act 2007* (WA) (DPIRD 2023).

Recorded Flora Values

A total of 177 taxa from 40 families and 87 genera was recorded in the Spion survey areas and as such partly reflects the smaller survey area.

Of the 177 taxa, 1 was an introduced species. The introduced species all occur more widely in the Jarrah forest and are not listed as WONS weeds at the National scale or as Declared pests at the State level.

No Threatened flora species, pursuant to section 179 of the *EPBC Act* and as listed by DCCEEW (2023a) or pursuant to Part 2, Division 1 and Subdivision 2 of the *BC Act* and as listed by DBCA (2022a) were recorded during recent assessments of the Spion survey area.

One Priority three flora species (*Grevillea prominens*) as listed by DBCA (2022a) was recorded in the Spion survey area. This species occurred in the north-eastern section of the survey area.

Potential Vegetation Values

No Threatened Ecological Communities or Priority Ecological Communities (TECs and PECs) occur in the Spion survey area.

The Spion survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests and as such was considered during the RFA process.

Recorded Vegetation Values

Heddle *et al*. (1980) defined and described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes as part of the System 6 studies. Mattiske and Havel (1998) updated this initial more restricted mapping coverage to the wider south-west forest region as (Regional Forest Agreement vegetation complexes). Havel, J.J. (2000) summarized in greater detail the relationships between the landforms, soils and climatic conditions. Mattiske and Havel (1998) defined and described five vegetation complexes in the survey areas. None of these are restricted to the Spion survey area.

A total of 15 site-vegetation types and 1 cleared area were defined and mapped in the Spion survey area. The site-vegetation types were subdivided into four main groupings associated with site conditions which reflected landforms, soils and soil moisture levels. The site-vegetation types on the extreme sites such as on the valley systems, granite outcrop areas and the creeklines differ markedly from the forest and woodland areas on the slopes and ridges.

The majority of the vegetation was ranked as very good despite historical harvesting activities, recent intense fires (which resulted in dominance of *Bossiaea aquifolium* in understorey), dieback and some established tracks and one restricted cleared area. The presence of the dieback disease is particularly evident in the condition of the vegetation on the lower slopes that support D and SW site-vegetation types.

Groundwater Dependent Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the site-vegetation types. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils on the lower slopes of the Yarragil (Yg1 and Yg2) valley systems. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Old Growth Forest Areas

There are no patches of old growth forests occurring in the Spion survey areas as supplied by the Department of Biodiversity, Conservation and Attractions.

1. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned by Alcoa of Australia Ltd (Alcoa) to initially conduct a desktop assessment to evaluate the potential flora and vegetation values of the Spion survey area. The purpose of the assessment was to provide information pertaining to mining approvals. This desktop assessment was then followed by detailed mapping of the areas within the Spion survey areas.

1.1. Location and Scope of Project

The Spion survey area occurs within the Northern Jarrah Forest subregion of the Southwest Botanical Province (Beard 1990), approximately 110 km south east of Perth, WA (Figure 1). The Spion survey area is located in the Dwellingup State Forest and consists of nine blocks located approximately 20 km ESE of the Waroona townsite and 10 km E of the existing Willowdale bauxite mining operation. The survey area lies within tenements ML 1SA, E 70/6051, E 70 6279 and E 70/6456 (Figure 2).

Parts of this region have previously been surveyed by E. M. Mattiske and Associates (1993 to 1994) and Mattiske Consulting Pty Ltd (1996 to 2022) at a regional mapping scale as part of the Regional Forest Agreement (RFA) project by Mattiske and Havel (1998). These studies built on the earlier work of Havel (1975a and 1975b) in the northern Jarrah forest.

This report describes the potential and recorded flora and vegetation values of the Spion survey areas and places them within a local and regional context.

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The following key Western Australian (state) legislation relevant to this survey includes the:

- *Wildlife Conservation (Rare Flora) Notice 2022*
- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) and *Regulations 2013*;
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

Furthermore, key Western Australian guidelines relevant to this survey are the:

- *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority [EPA] 2016a); and
- *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b); and.
- *Commonwealth of Australia (2013) - Survey Guidelines for Australia's Threatened Orchids. Guidelines for detecting Orchids listed as "Threatened" under the Environment Protection and Biodiversity Conservation Act 1999.*

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-A5.



N

0 3 6 km

Scale: 1:400,000
MGA94 (Zone 50)

CAD Ref: a1992_F021_01

Date: April 2023 | Rev: A | A4

Mattiske Consulting Pty Ltd

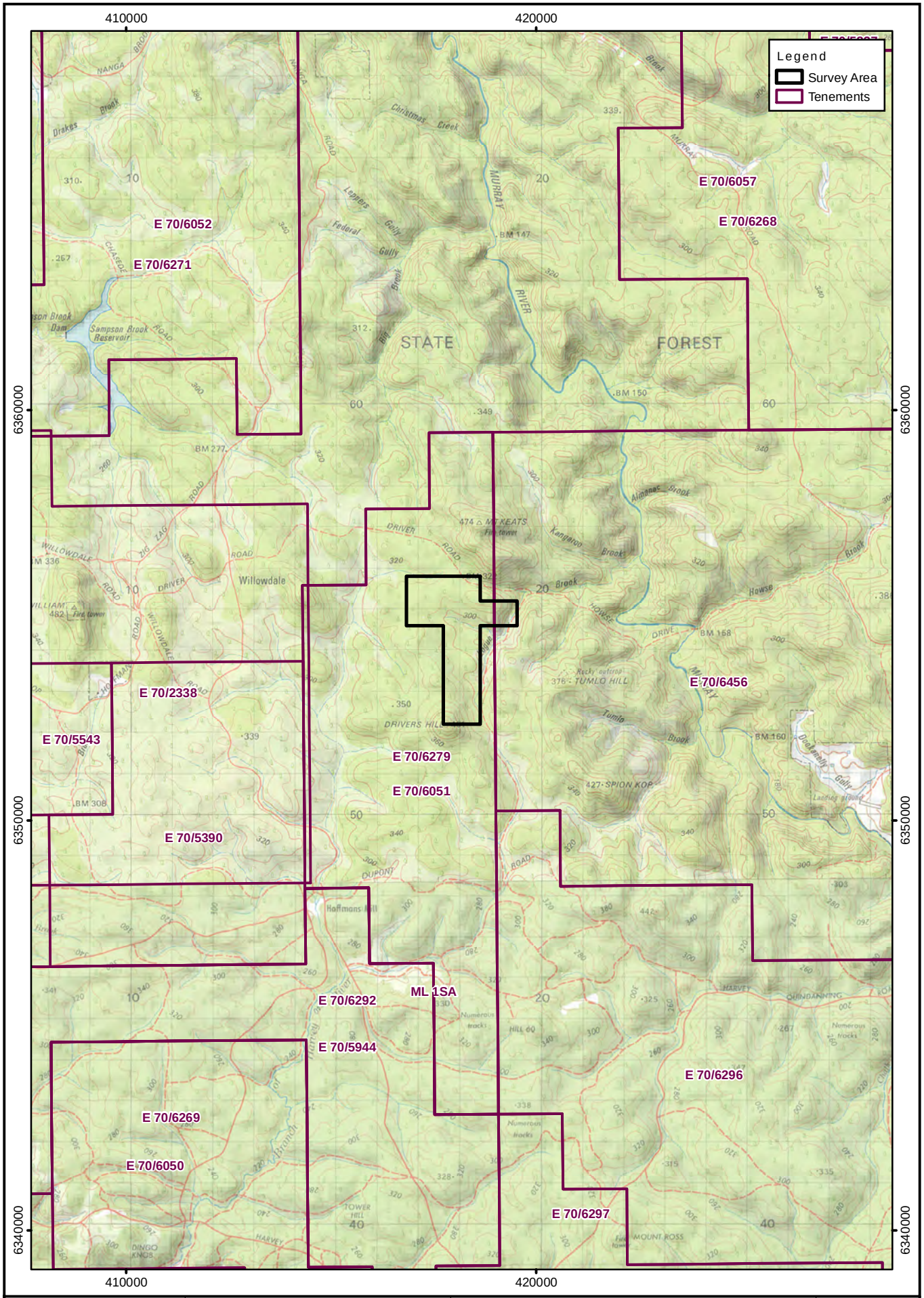
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Spion Survey Area
Location

Figure: **1**



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F021_02

Date: May 2023 | Rev: A | A4

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Spion Survey Area
Tenements

Figure:
2

2. OBJECTIVES

The objective of this assessment was to undertake the desktop component of a detailed flora and vegetation survey of the Spion survey area, including:

- Undertake a desktop assessment of the flora and vegetation of the Spion survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Undertake a detailed assessment of the flora and vegetation of the Spion survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Review previous literature and current databases associated with the Spion survey areas;
- Review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA 2022a) and plant collections held at the Western Australian Herbarium ([WAH] 1998 -), and plants listed by the Department of Climate Change, Energy and the Environment and Water [DCCEEW] (2023a) under the EPBC Act; and
- Prepare a report summarising the findings.

3. METHODS

3.1. Desktop Assessment

The NatureMap (01-0423 NM) and *EPBC Act* Protected Matters Search Tool (DCCEEW 2023a) databases were used to identify the possible occurrence of flora (including threatened and priority taxa) and threatened and priority ecological communities within the Spion survey areas. The vascular plant species recorded through this database search are summarized in Appendices B and C.

The TPFL database of threatened and priority flora and ecological communities and the Western Australian Herbarium (WAH) database were arranged by CAD Resources, where a 25 km buffer was applied (Carine, WA). In addition, any flora recorded by Mattiske Consulting Pty Ltd (2015-2022) within or adjacent to the survey area were included.

The following co-ordinate was used in the desktop assessment; -32°55'52.29"S, 116° 7'22.44"E (WGS1984), where search parameters were set to a 10 km radius for NatureMap and a 5 km buffer for the PMST.

Historical documentation and vegetation mapping of the Northern Jarrah Forest subregion that provide resource material for the floristics and vegetation of the Spion area was reviewed, including Mattiske Consulting Pty Ltd (2015-2022) reports on their flora and vegetation surveys in the nearby Larego survey areas. Nomenclature of flora species was checked against and is consistent with Florabase (WAH 1998-).

3.2. Field studies

Field studies were undertaken at 331 sites on the 120m grid systems within the approximate 486 ha of the Spion survey area in the summer and autumn months of 2023.

To maintain consistency with previous mapping of the area, enabling spatial and temporal comparisons, flora and vegetation were assessed using site-type classification based on Heddle *et al.* (1980). Sites were pre-designated using a 120 x 120 m grid system overlaid on the survey area. A total of 331 sites within the 486 ha area were assessed with recordings on the trees (20m radius) and understorey (5m radius). Additional targeted work was undertaken on the areas between the recording sites and also on specific areas such as the outcrop and sandier valley systems and creeklines.

This data was then used in combination with aerial imagery and field observations to map the vegetation of the survey area. Furthermore, searches for threatened, priority or Declared (plant) pests species were undertaken whilst walking between survey sites.

The following information was recorded at each vegetation assessment site:

GPS location	Easting, Northing and datum;
Soil types	gravels, sandy-gravels, sandy-loam-gravels, sandy-loams, loams, clay-loams, clays and peat;
Topography	ridge, upper slope, mid-slope, lower slope, valley floor and swamp;
Outcropping	type – granite, laterite, dolerite, and quantity – few, moderate, numerous;
Logging history	light, moderate or heavy, together with number of stumps within a 20 m radius;
Fire history	years since last fire; and
Dieback occurrence	*Phytophthora* spp. demarcation – field blazing, coloured flagging on trees, vegetation deaths, either old or recent.

At each site species were ranked according to the scale developed by Havel (1975a, 1975b). Tree and understorey species were assessed separately using the following method.

Tree species

Tree species (*Allocasuarina fraseriana, Banksia grandis, B. littoralis, B. seminuda, Corymbia calophylla, Eucalyptus marginata, E. megacarpa, E. patens, E. rudis, E. wandoo, Melaleuca preissiana, M. rhaphiophylla, Nuytsia floribunda, Persoonia elliptica, P. longifolia* and *Xylomelum occidentale*) were assessed within a 20 m radius from the observation point using the following scale:

0 absent;
1 one or two trees;
2 three to five trees;
3 more than five trees, but contributing less than one third of the total stand;
4 between one third and one half of the total stand; or
5 more than one half of the total stand.

Understorey species

Understorey species were assessed within a 5 m radius from the observation point using the following scale:

0 absent;
1 very rarely seen, only after a careful search;
2 present, observable, but in small numbers only;
3 common locally, but not uniform over the whole area;
4 common over the whole area; or
5 completely dominating the understorey.

The physiological stress was determined for each species within a 20 m radius from the observation point and ranked according to the following scale.

0 healthy, no evidence of stress;
1 odd plant showing signs of stress, not dead;
2 one or two dead plants, near death;
3 scattered stressed plants, (2-4) dead plants around survey site;
4 susceptible plants dying or dead (> 4 plants); or
5 “graveyard” death

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH). All plant specimens were identified through comparisons with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

4. DESKTOP FINDINGS

The climate, geology, soils and landforms all influence the vegetation of the area and are described in this section. Potential flora, including threatened, priority and introduced species are described, along with possible vegetation communities, and placed within a local and regional context.

4.1. Climate

The survey area lies at the southern end of the Northern Jarrah Forest subregion. Beard (1990) described the climate of this area as being warm Mediterranean, with rainfall of 600 – 1200 mm per annum and 5 - 6 dry months per year. The closest weather station is the Dwellingup weather station (Stn. No. 9538), located north of the Willowdale mine and Spion survey areas. Annual average rainfall at Dwellingup (1934 -2023) is 1224.5 mm (Bureau of Meteorology [BOM] 2023). Rainfall in 2022 was highest in August 2022 than the longer-term mean; although the summer months were again drier (Figure 3).

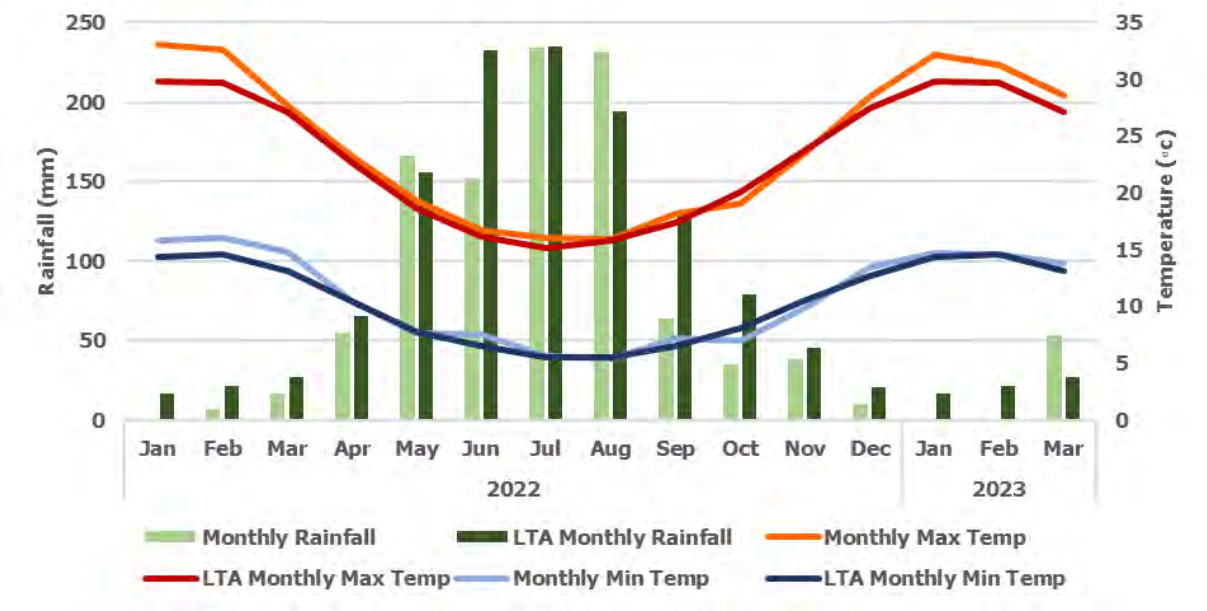
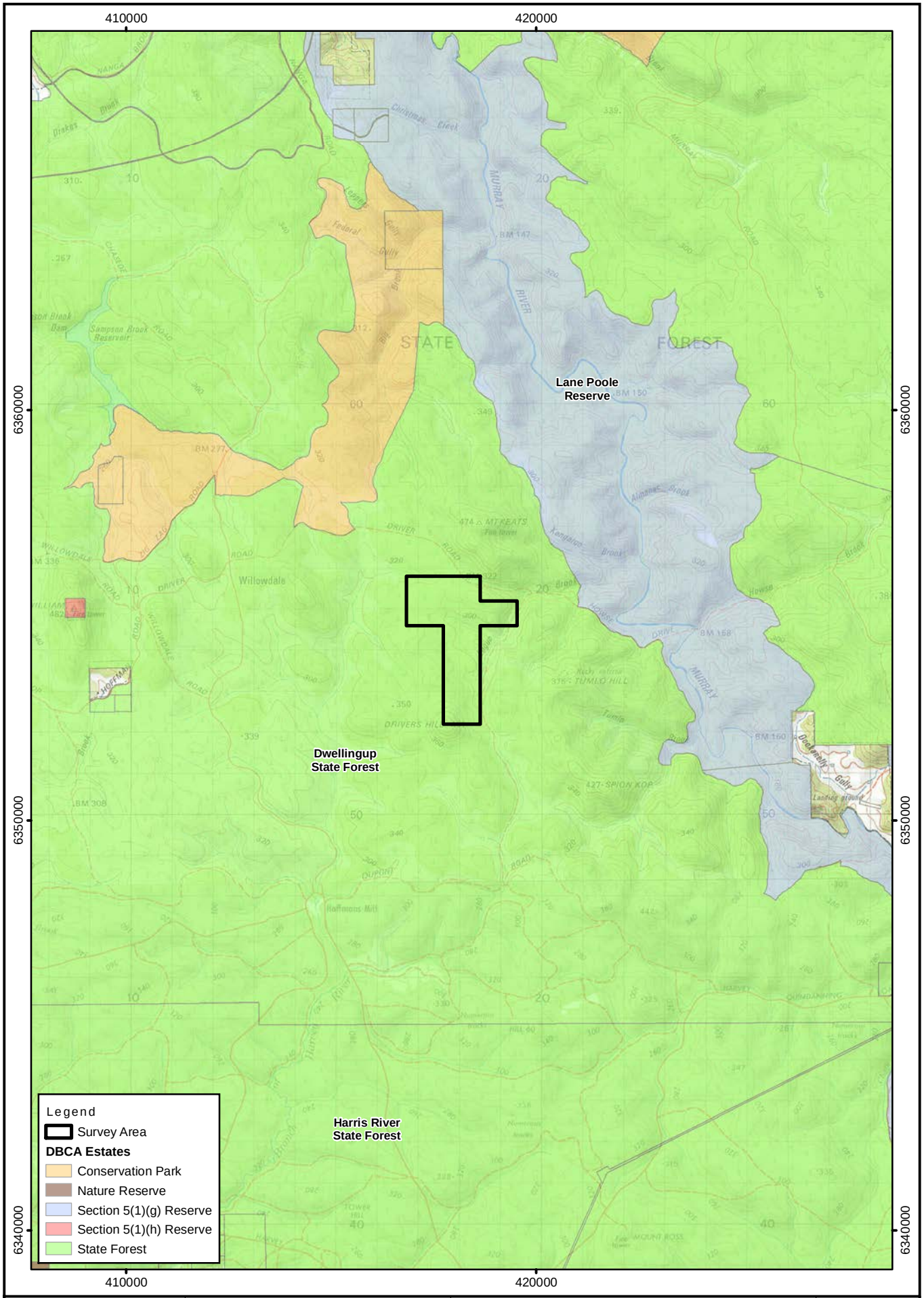


Figure 3: Climatic data for the Spion survey area

Long- term rainfall and temperature data from the Dwellingup weather stations respectively (ID 009538 respectively, years 1934-2023) (BOM 2023).

4.2. DBCA Estates

The Spion survey area is situated in the Dwellingup State Forest (Figure 4).



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

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Spion Survey Area
DBCA Estates

Figure: **4**

4.3. Geology, Soils and Topography

The Spion survey area are situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion encompasses the area to the east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of the Yilgarn Craton at an average elevation of 300 m (Beard 1990). The area is capped by extensive lateritic duricrust, dissected by drainage lines and broken by occasional granite hills. In the eastern section, the laterite becomes deeply dissected until it compresses isolated remnants. The duricrusted plateau of the Yilgarn Craton is characterised by lateritic gravels, consisting of 5m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon. These overlay mottled yellow-brown clay subsoils and hard setting loamy soils, which become evident in the east (Beard 1990).

Furthermore, Western Australia is divided into twelve Systems, separated by natural and demographic boundaries (Department of Conservation and Environment 1980). The survey area lies within the Darling System (as known as System 6), which is further divided into provinces, with the survey area lying in The Darling Plateau province (Department of Conservation and Environment 1980).

The underlying geological units of the Darling Plateau province have been defined by Churchward and McArthur (1980), with four main landform and soil units occurring within the survey areas, these are:

Dwellingup: Gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions.

Yarragil: Valleys of the western part of the plateau; sandy gravels on the slopes; orange earth in swampy floors.

Cooke: Hills rising above general plateau level; mainly mantled by laterite with some rock outcrop.

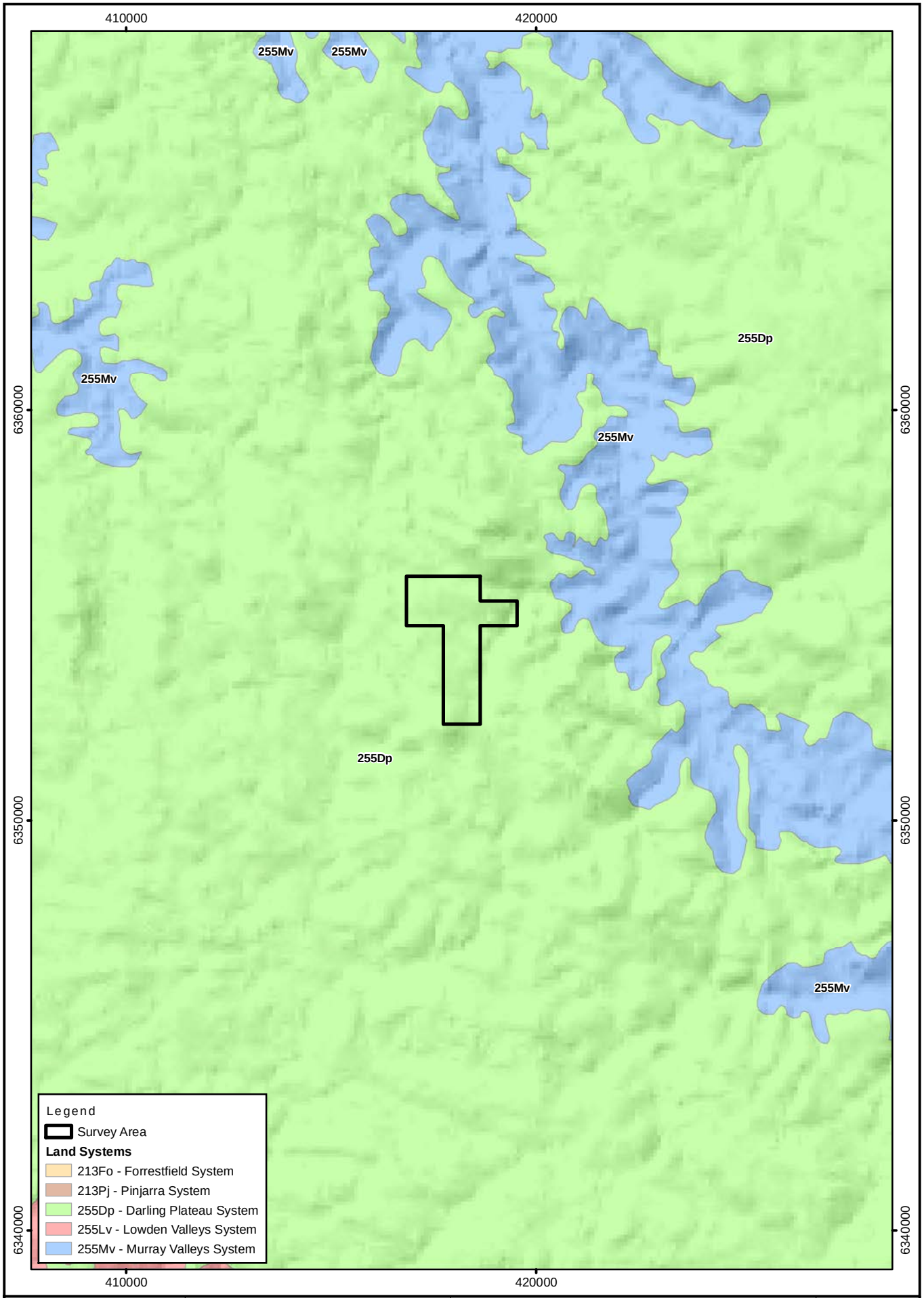
Murray: Deeply incised valleys with red and yellow earths on slopes; narrow alluvial terraces

The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the Spion survey area (Figure 5, Table 1) includes the Darling Plateau System (255Dp);

1. **Darling Plateau System (255Dp):** Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah-marri-wandoo forest and woodland.

Table 1: Extent of Land Systems intersecting the Spion survey area

Land System	Mapping Unit	Total Extent (ha)	Area of Intersection with the Spion survey area	Proportion of Current Extent (%)
Darling Plateau System	255Dp	820265.7327	486.00	0.059



N

0 1 2 km

Scale: 1:125,000
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Spion Survey Area
Land Systems

Figure: **5**

4.4. Regional Vegetation

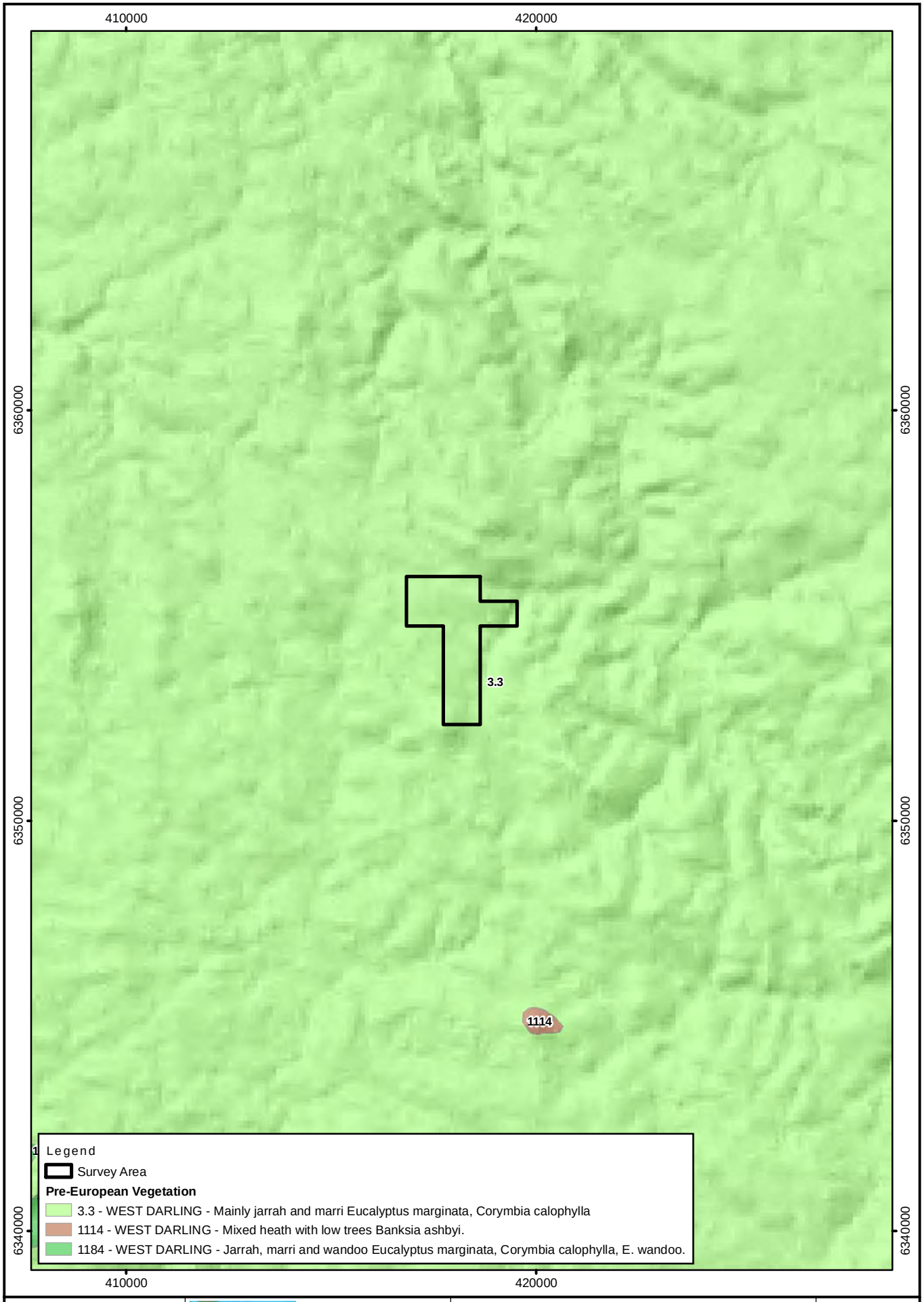
The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent. In lower rainfall areas towards the east trees decrease in size, forming woodlands or low forests. This dry sclerophyllous forest typically comprises a dominant *Eucalyptus marginata* and *Corymbia calophylla* overstorey, a mid-storey of *Allocasuarina fraseriana* (Sheoak), *Banksia grandis* (Bull Banksia), *Persoonia longifolia* (Snottygobble), *Persoonia elliptica* (Spreading Snottygobble), and a groundcover of woody shrubs with grass trees *Xanthorrhoea preissii*, *Kingia australis* and the cycad *Macrozamia riedlei* (Dell and Havel 1989).

The Pre-European vegetation systems present within the Spion survey area (Figure 6, Table 2) include:

1. **West Darling System - Vegetation Association 3.3:** Mainly jarrah and marri *Eucalyptus marginata, Corymbia calophylla*

Table 2: Extent of Pre-European vegetation associations intersecting the Spion survey area

System	Vegetation Association	State-wide Pre-European Extent (ha)	Area of Intersection with the Spion survey area (ha)	Proportion of Current Extent (%)
West Darling	3.3	485225.883	486.00	0.10



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

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Spion Survey Area

Pre-European Vegetation

Figure: **6**

Heddle *et al*. (1980) defined and described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes as part of the System 6 studies. Mattiske and Havel (1998) updated this initial more restricted mapping coverage to the wider south-west forest region as (Regional Forest Agreement vegetation complexes). Havel, J.J. (2000) summarized in greater detail the relationships between the landforms, soils and climatic conditions. Mattiske and Havel (1998) defined and described five vegetation complexes in the Spion survey area (Figure 7, Table 3). These include:

Cooke (Ce): Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp. *thalassica* - *Corymbia calophylla* (semiarid and arid zones) and on deeper soils adjacent to outcrops, closed heath of Myrtaceae - Proteaceae species and lithic complex on granite rocks and associated soils in all climate zones, with some *Eucalyptus laeliae* (semiarid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to periarid zones).

Dwellingup 1 (D1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.

Yarragil 1 (Yg1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.

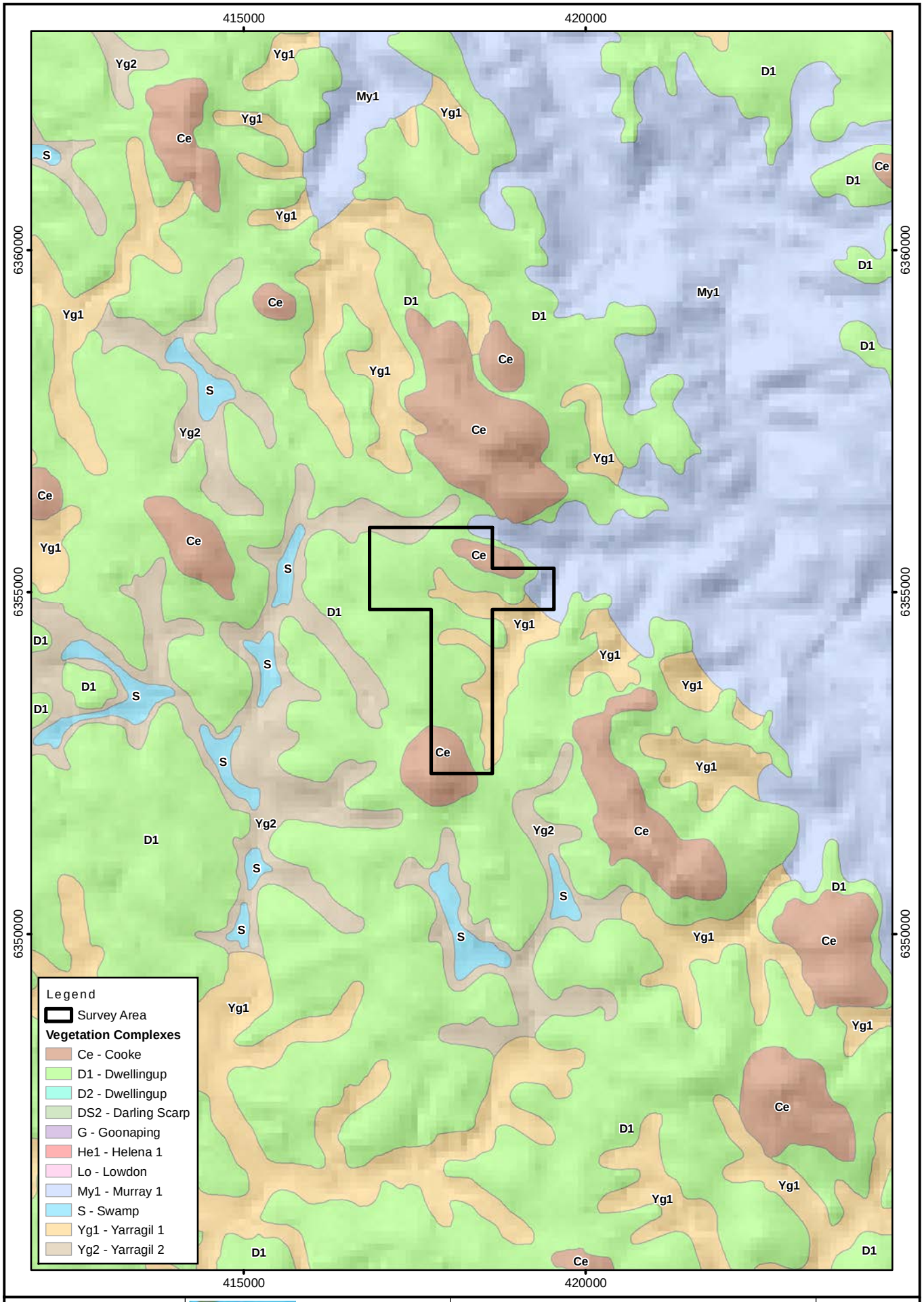
Yarragil 2 (Yg2): Open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* on slopes, woodland of *Eucalyptus patens* – *Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.

Murray 1 (My1): Open Forest of *Eucalyptus marginata* subsp. *marginata* – *Corymbia calophylla*-*Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis*- *Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones.

Table 3: Extent of Vegetation Complexes intersecting the Spion survey area

Vegetation Complex	Vegetation Class	Total Extent (ha)	Area of Intersection with the Spion survey area (ha)	Proportion of Regional Extent (%)
Cooke	Ce	51872.10	56.786	0.11
Dwellingup 1	D1	297624.85	299.865	0.10
Yarragil 1	Yg1	113828.12	89.273	0.08
Yarragil 2	Yg2	71234.37	15.052	0.02
Murray 1	My1	97562.81	25.026	0.03

More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area falling within the Northern Jarrah Forest subregion (JF1) of the Jarrah Forest (JAF) Region (DCCEEW 2023b). The vegetation of the Northern Jarrah Forest subregion consists of Jarrah – Marri forest, with Bullich and Blackbutt in the valleys to the west, grading to Wandoo and Marri woodlands to the east. Heath vegetation is the common understorey of forests and woodlands and occurs on granite rocks. The majority of the diversity between communities in this subregion occurs on lower slopes and near granite soils (Williams and Mitchell 2001).



N

0 0.5 1 km

Scale: 1:75,000
MGA94 (Zone 50)

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Spion Survey Area
Vegetation Complexes

Figure: **7**

4.5. Potential Flora

A total of 462 vascular plant taxa, representative of 186 genera and 72 families, have the potential to occur within the Spion survey area (Appendix B). The most commonly represented families were Fabaceae (56 taxa), Proteaceae (39 taxa) and Myrtaceae (38 taxa). The most commonly represented genera in the Spion survey areas were *Acacia* (21 taxa), *Lomandra* (15 taxa) and *Hibbertia* (14 taxa).

4.6. Potential Threatened and Priority Flora

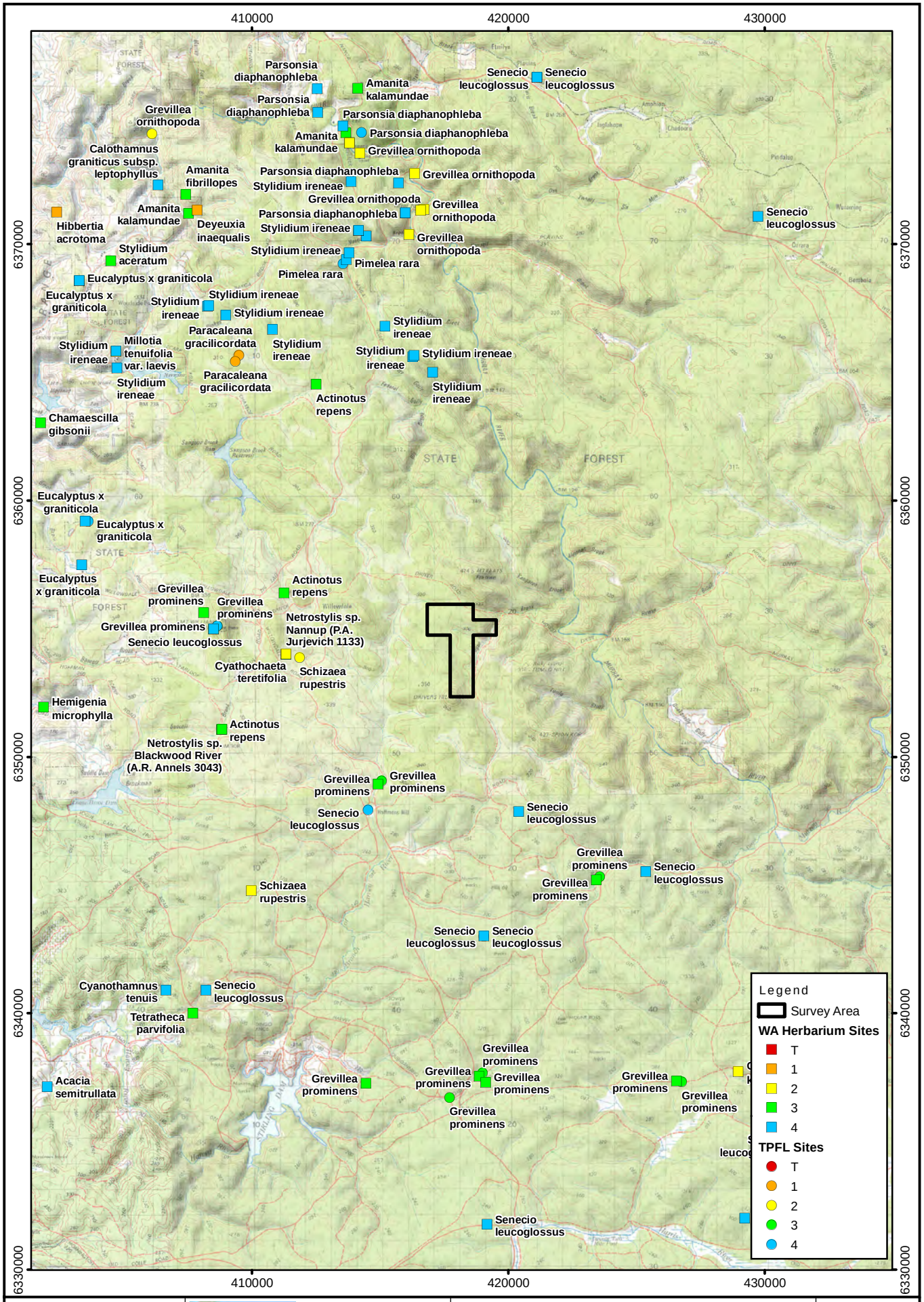
Two threatened flora species, pursuant to section 179 of the *EPBC Act* and as listed by DCCEEW (2023a) r pursuant to Part 2, Division 1 and Subdivision 2 of the *BC Act* and as listed by DBCA (2022a) have the potential to occur in the Spion survey area (Figure 8). Both of these threatened taxa have a low potential of occurring as neither have been recorded by DBCA or previously by MCPL within the vicinity of the survey area (Appendices B and C).

A total of ten priority flora species as listed by DBCA (2022a), including one Priority 1, two Priority 2, five Priority 3 and two Priority 4 have the potential to occur within the Spion survey area (Appendices B and C, Figure 8). All potential threatened and priority flora are listed in Appendix C, along with their State and Federal Conservation Codes (see Appendix A for definitions), a description and an assessment of the likelihood of their occurrence in the Larego survey areas.

The likelihood that these species would occur within the survey area was determined using the following criteria:

- Known records within a 10 km radius of the centre of the survey area (as described above) and including information obtained from the paid search results. More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).

The likelihood was ranked Low, Moderate or High, Appendix C. Records that have been documented either within or in close proximity of the Spion survey area were ranked as Moderate or High



N

0 1.5 3 km

Scale: 1:200,000
MGA94 (Zone 50)

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Spion Survey Area

Threatened and Priority Flora

Figure: **8**

4.7. Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

A total of 29 introduced taxa (inclusive of part native (Mixed)) may potentially exist in the Spion survey area, based on NatureMap (DBCA 2007-) and records from Mattiske Consulting Pty Ltd (2015-2022) Larego surveys. Only one of the potential weeds **Rubus ulmifolius,* as listed under the **Rubus fruticosus* aggregate, is a Weed of National Significance (DCCEEW, 2023b). It is also a declared pest/organism under the *Biosecurity and Agriculture Management Act 2007* (WA) (DPIRD 2023). In addition, **R. ulmifolius* is listed with a C3 Management Control and a Exempt Keeping category (refer to Appendix A3).

Table 4: Ecological Impact and Invasiveness rankings for Introduced (Weed) Species potentially occurring within the Spion survey area

Note: [1]Department of Parks and Wildlife (DPAW 2014), [2]West Australian Organism List (DPIRD 2023), [2]Weeds of National Significance (DCCEEW 2023b)

Species Name	DPAW[1]		WAOL[2]	Declared pest[3]
	Ecological Impact	Invasiveness Ranking		
**Acacia pycnantha*	Low	Slow	Permitted - s11	-
**Aira caryophyllea*	Unknown	Rapid	Permitted - s11	-
**Briza maxima*	Unknown	Rapid	Permitted - s11	-
**Callistemon citrinus*	-	-	Permitted - s11	-
**Centaurium erythraea*	Unknown	Rapid	Permitted - s11	-
**Cotula coronopifolia*	Unknown	Rapid	Permitted - s11	-
**Erigeron sumatrensis*	Unknown	Rapid	Permitted - s11	-
**Eucalyptus accedens*	-	-	Permitted - s11	-
**Eucalyptus microcorys*	Unknown	Unknown	Permitted - s11	-
**Eucalyptus saligna*	Unknown	Unknown	Permitted - s11	-
**Galium murale*	Low	Unknown	Permitted - s11	-
**Hypochaeris glabra*	Moderate	Rapid	Permitted - s11	-
**Lilium candidum*	-	-	Permitted - s11	-
**Lonicera japonica*	Unknown	Slow	Permitted - s11	-
^Melia azedarach	-	-	Permitted - s11	-
**Orobanche minor*	Unknown	Rapid	Permitted - s11	-
**Oxalis* sp.	-	-	Permitted - s11	-
**Phytolacca octandra*	Unknown	Moderate	Permitted - s11	-
**Pinus pinaster*	Moderate	Rapid	Permitted - s11	-
**Pinus* sp.2	-	-	Permitted - s11	-
**Quercus palustris*	-	-	Permitted - s11	-
**Rubus ulmifolius*	High	Moderate	Declared Pest - s22(2)	Y
**Senecio vulgaris*	Low	Moderate	Permitted - s11	-
**Sonchus oleraceus*	Moderate	Rapid	Permitted - s11	-
**Syncarpia glomulifera*	-	-	Permitted - s11	-
**Ursinia anthemoides*	Unknown	Rapid	Permitted - s11	-
**Vellereophyton dealbatum*	Moderate	Rapid	Permitted - s11	-
**Vinca major*	High	Slow	Permitted - s11	-
**Wahlenbergia capensis*	Unknown	Rapid	Permitted - s11	-

4.8. Old Growth Forests

There are a few patches of old growth forests occurring outside the Spion survey area (Figure 9); however based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Spion survey area.

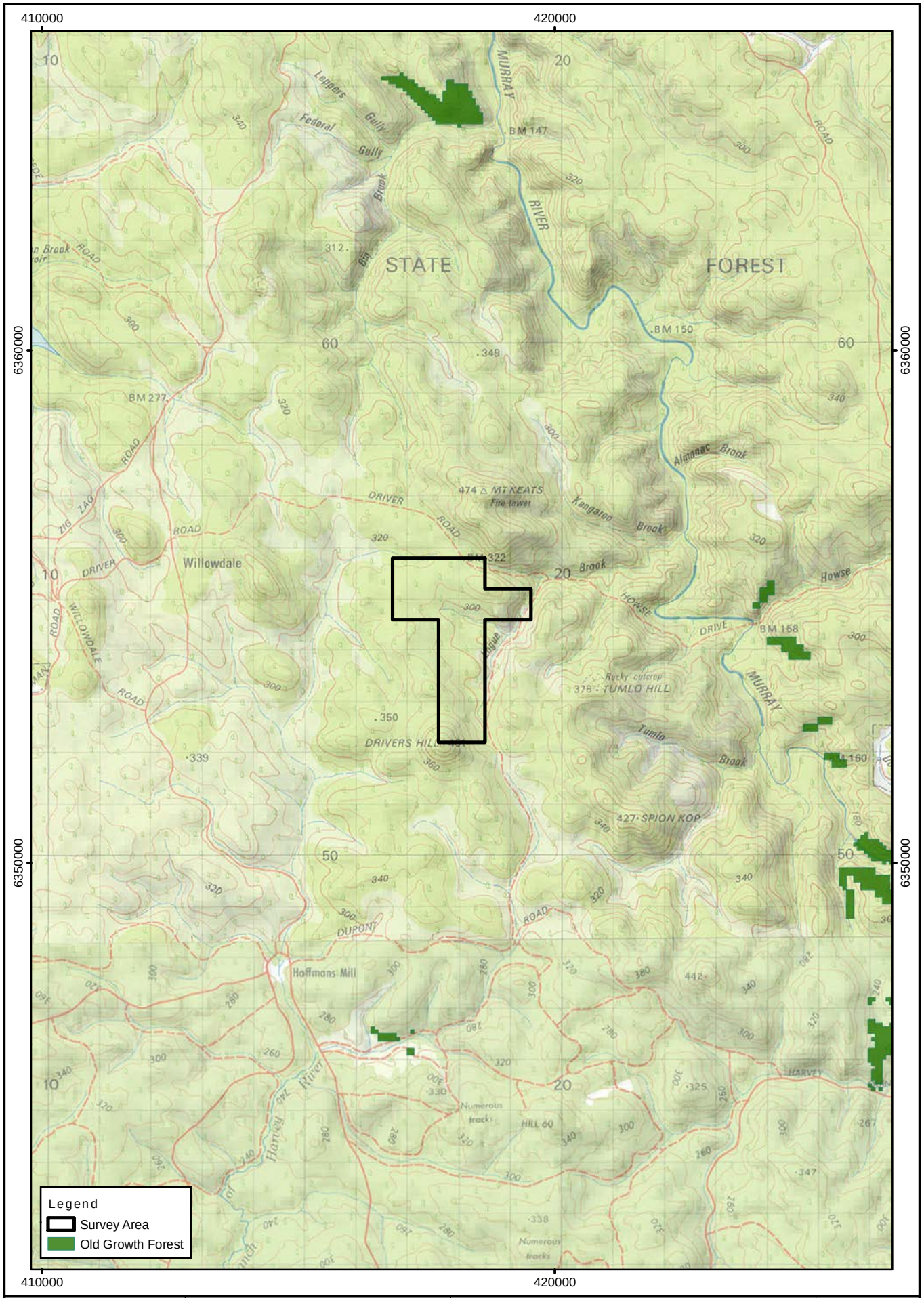
4.9. Groundwater Dependant Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes such as the Murray 1, Yarragil 1 and Yarragil 2 that occur within the Larego survey areas. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Acacia divergens, Thomasia paniculata, Astartea scoparia, Eucalyptus rudis, Hypocalymma angustifolium, Hypocalymma cordifolium,* and *Taxandria linearifolia.*

4.10. Dieback

The extent of dieback from datasets supplied by the Department Biodiversity, Conservation and Attractions highlights the extent within the Spion survey area and adjacent forest areas, Figure 10.



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 50)

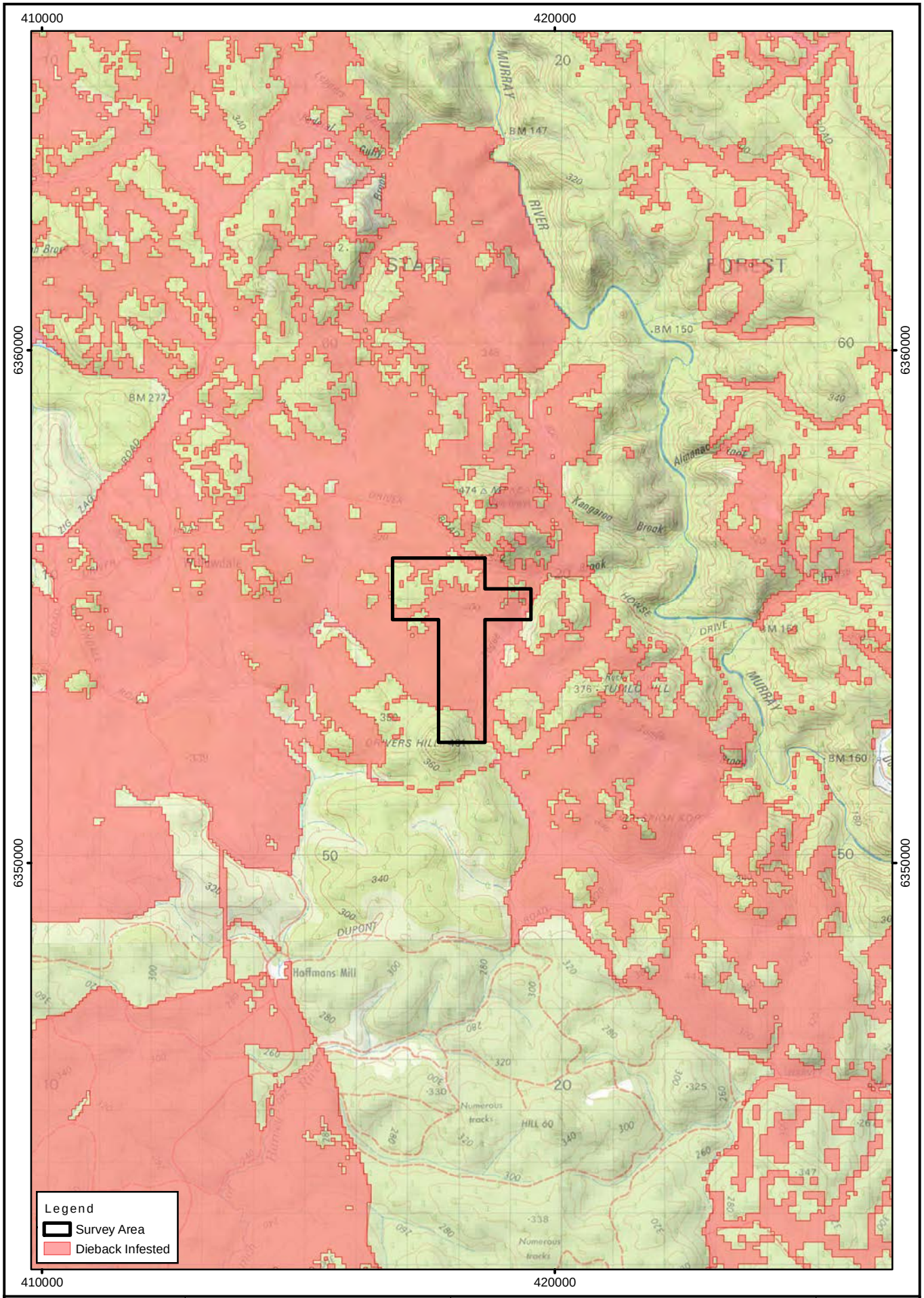
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Spion Survey Area
Old Growth Forest

Figure:
9



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 50)

CAD Ref: a1992_F021_10

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Spion Survey Area
Dieback

Figure:
10

4.11. Previous Surveys

Over the past forty years, Mattiske Consulting has previously mapped the vegetation associated with Willowdale (including previous Larego areas; Mattiske Consulting Pty Ltd (2015, 2019, 2020, 2022). These areas are in close vicinity to the Spion survey area.

4.12. Potential Threatened and Priority Ecological Communities

No Threatened Ecological Communities or Priority Ecological Communities (TECs and PECs) occur in the Spion survey areas (DBCA 2022b, 2023; DCCEEW, 2023a).

4.13. Wetlands of International Importance (Ramsar)

No wetlands of international importance listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* and listed by the DCCEEW (2023a) occur within the Spion survey areas. The closest wetlands of international importance is the Peel- Yalgorup System.

5. FIELD STUDIES FINDINGS

The following text summarizes the key findings from recent studies in 2023 within the Larego survey areas; which includes recording sites for vegetation mapping and opportunistic and targeted assessments.

5.1. Survey Effort

The survey efforts has been undertaken over a decade from multiple studies within the Willowdale and Larego areas. The major effort in 2023 which when combined with the depth of previous studies in adjacent areas for both Alcoa and also other clients leads to the conclusion that the work exceeds the current EPA Guidance Statement (2016a and 2016b) expectations for flora and vegetation studies.

The survey effort to date has included (See Figure 11):

. More than 40 kilometres of foot transects which includes the mapping efforts and targeted searches;

. 331 recording sites in 2023 on a grid system which varied sligh0tly from 120m x 120m with some sites closer than this average and some slightly wider. This pattern of recording is consistent with previous ecological studies in the northern Jarrah forest for both Alcoa and other clients in nearby areas;

. targeted searches of additional extreme sites that are variable within the broader Yarragil and Swamp vegetation complexes as well as the variable communities on the valley slopes and ridges in the Larego survey areas. The coverage of the flora on the granite and swamp areas relied on the recording sites and targeted searching;

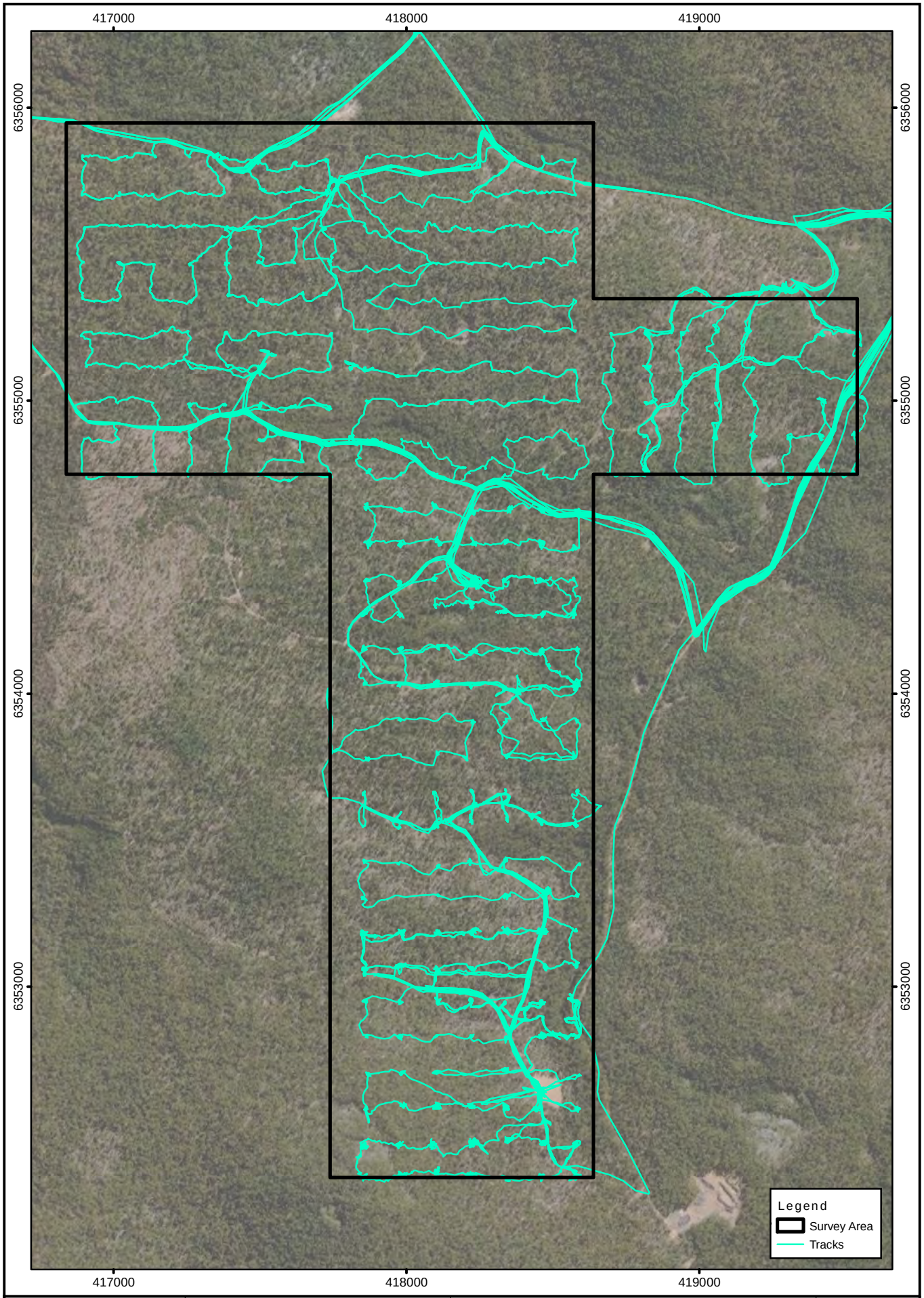
. detailed and consistent data collection on position in the landscape, soils, flora, vegetation and vegetation condition.

. consistent interpretation in line with previous site-vegetation studies where there is a greater reliance on key indicator species and a series of site parameters rather than the accepted clustering and groupings. Such an approach differs from the EPA guidance statement, but if the latter was followed the dominance of some tree and understorey species in the analyses would lead to a less comprehensive delineation of biodiversity values and also be inconsistent with the approach adopted on all other Alcoa leases where detailed flora and vegetation studies have been undertaken in the past by the Mattiske team and site personnel. In summary, the survey effort easily exceeds the expectations of the EPA Guidance Statement (2016a, 2016b).

A general assessment was made of the current survey against a range of factors that may have limited the outcomes and conclusions of this report (Table 4).

Table 4: Potential flora and vegetation survey limitations for the Larego survey areas

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Reference resources such as mapping by Beard (1979), Mattiske and Havel (1998), previous vegetation mapping completed for Alcoa by E.M Mattiske and Associates and Mattiske Consulting Pty Ltd teams together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora, which were the focus of the present survey was sampled on a close grid pattern within the survey area. In addition to the regular sampling sites, searches were undertaken to assess the likelihood of threatened and priority flora species.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Not a constraint:** The survey areas near Willowdale and Larego areas have been sampled over multiple years, with the more recent work on the detailed records on the grid system and targeted searches between sites. The recent survey effort in the majority of the areas was undertaken in early 6 months of 2023. The botanists undertaking the field surveys have had extensive experience working with the flora of the Jarrah forest. Any flora which could not be identified in the field was collected for subsequent identification. A few taxa were only recorded at genus level as flowering was not occurring.
Mapping reliability	**Not a constraint:** The vegetation was mainly assessed on a 120m x 120m grid pattern within the survey area. Over 40 kilometres were surveyed within the survey area. This together with 331 recording sites and the targeted and opportunistic survey sites (particularly near the granites and swamp areas) enabled intensive coverage of the values on the Spion survey area and therefore the associated mapping of key flora values and the site-vegetation types with a high level of confidence.
Timing, weather, season, cycle	**Minor constraint:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). The intensive work undertaken in sections of Larego has enabled coverage of different seasons. The detailed survey work commenced in early 2023 and continued to July 2023 on the Spion survey area. In view of extensive work in the areas adjacent to the survey areas this is considered to be only a minor constraint.
Disturbances (fire flood, accidental human intervention, *etc*.)	**Not a constraint:** With the exception of previous logging activities and occasional old forestry tracks, the vegetation of the survey area is largely undisturbed. In view of the >40 years of experience by Dr Mattiske in northern Jarrah forest vegetation mapping the latter is not considered to lead to any constraints.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** Vehicle access through the Spion survey area was only restricted in small sections and all areas were accessible on foot.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** All botanists had direct and recent experience working in the Jarrah Forest and working for Alcoa and a range of other clients, and thus were familiar with the local flora and vegetation values. Dr Mattiske has more than 40 years of ecological experience in flora and vegetation studies in the southwest forests at a detailed floristic level, as well as detailed and regional vegetation assessment level.



N

0 150 300 m

Scale: 1:17,500
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Spion Survey Area

Survey Effort

Figure:

11

5.2. Flora

The survey efforts were undertaken over several months and in view of the extensive work undertaken over multiple decades in the Willowdale and Larego areas was considered to exceed the EPA (2016a and 2016b) guidance statements expectations.

A total of 177 taxa from 40 families and 87 genera was recorded in the Spion survey areas and as such partly reflects the smaller survey area.

The range of flora collected on the Larego survey areas is summarized in Table 5 and Appendices B and D. As the survey efforts were undertaken over multiple years and also seasons the coverage of the flora was considered to exceed the EPA (2016a and 2016b) guidance statements expectations. The recordings on the grids was undertaken over multiple months the coverage of the flora in more diverse and spatially more complex areas such as the swamps, broad valley systems, slopes and ridges was considered to be comprehensive.

Table 5: Summary of Flora Species on the Larego survey areas (see Appendices B and D)

Source	Families	Genera	Native Taxa	Introduced Taxa
Larego Survey areas 2022	43	106	228	7
Spion Survey areas	40	87	177	1
Nature Map and Additional Potential and recorded Species (see Appendix B)	80	205	528	31

Of interest is the shift in landforms and soils across the survey areas and the latter is reflected in the change in the dominance of flora species that tolerate the lateritic uplands, gullies and outcrop areas. The summary of results from the plots and the recording sites as summarized by the site-vegetation types reflects this shift from species in the lateritic slopes and ridges and the broader valleys (see Appendix E).

5.3. Introduced Flora Species

Of the 177 species, 1 was an introduced species. The introduced species all occur more widely in the Jarrah forest and are not listed as WONS weeds at the National scale or as Declared pests at the State level.

5.4. Threatened and Priority Flora

No Threatened flora species, pursuant to section 179 of the *EPBC Act* and as listed by DCCEEW (2023a) or pursuant to Part 2, Division 1 and Subdivision 2 of the *BC Act* and as listed by DBCA (2022a) were recorded during recent assessments of the Spion survey area.

One Priority flora species as listed by DBCA (2022a) was recorded in the Spion survey areas (Appendix D), Table 6 and Figure 12.

Table 6: Summary of Priority Flora recorded in the Spion survey area

SPECIES	Federal Conservation Status	State Conservation Status	Site-vegetation Types	Population
Grevillea prominens (P3)	-	P3	G	3-5
Grevillea prominens (P3)	-	P3	T	3-5
Grevillea prominens (P3)	-	P3	AC	3-5
Grevillea prominens (P3)	-	P3	TS	3-5
Grevillea prominens (P3)	-	P3	ST	3-5
Grevillea prominens (P3)	-	P3	SW	3-5
Grevillea prominens (P3)	-	P3	TS	3-5
Grevillea prominens (P3)	-	P3	AC	3-5
Grevillea prominens (P3)	-	P3	S	1-3
Grevillea prominens (P3)	-	P3	S	3-5
Grevillea prominens (P3)	-	P3	W	5-10
Grevillea prominens (P3)	-	P3	T	3-5

Grevillea prominens (P3) is known from 9 records at the State Herbarium (DBCA 2007-) and has been recorded east of the western Larego survey area and south east of the eastern Larego survey area and was recorded in the Spion area on a range of soils ranging from lateritic gravelly soils to swamp loams to granite areas. This species has been recorded in the wider Jarrah forest (DBCA 2007-). *Grevillea prominens* was restricted to the north-eastern areas of the Spion area (Figure 12).

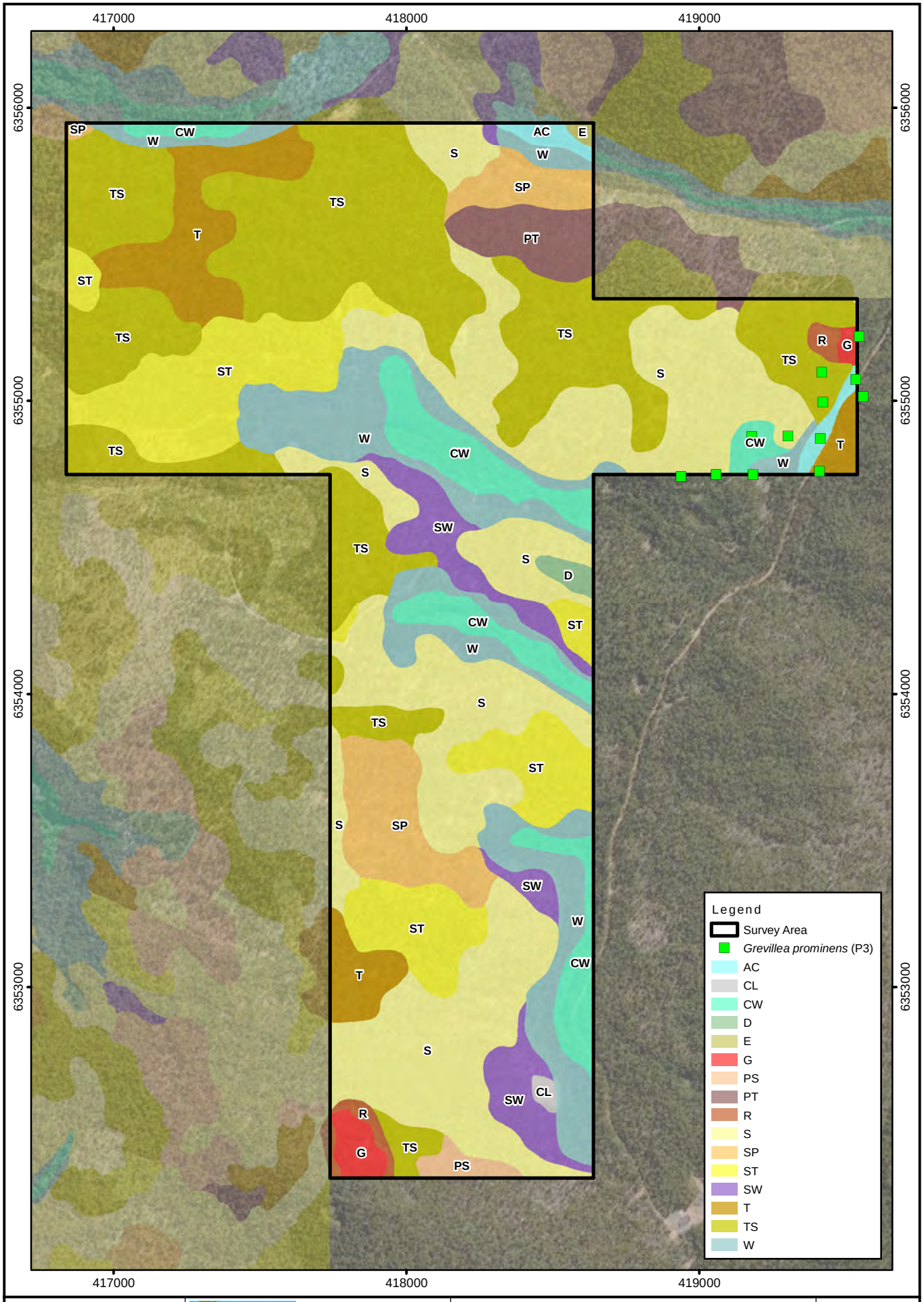
5.5. Site-vegetation Types

A total of 15 site-vegetation types and 1 cleared type were defined and mapped in the Spion survey area, Table 7 and Figure 12. The site-vegetation types were subdivided into four main groupings associated with site conditions which reflected landforms, soils and soil moisture levels, Table 7. The site-vegetation types on the extreme sites such as broad valley systems and swamps differ markedly from the forest and woodland areas on the slopes and ridges. The delineation of the site-vegetation types was based on the earlier work of Havel (1975a and 1975b) and as such rely on key site and species indicators. Whilst Mattiske has refined these initial site-vegetation types there is still a reliance on the original work of Havel (1975a and 1975b). The initial code is the dominant site-vegetation type code and the second code (where added) reflects some local influence of secondary key stone species. These site-vegetation types were developed in consultation with Dr David Goodall (formerly CSIRO at the time). In the 1970's Dr Havel and Dr Goodall undertook extensive analyses to delineate and differentiate the key species and site parameters that assist in the division of the continuum of the dominant trees of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri). This approach has been used for some 45 years and as such to deviate from such an approach and rely on other approaches would negate the effort to date and the ability to align the findings with other areas in the northern Jarrah forest. So whilst such an approach might be perceived by assessors to deviate from the EPA guidance statements, to not adopt the site-vegetation approach would diminish the delineation of the biodiversity values in the Spion survey area. In addition the ranking of species and condition of species in the field has increased the intensity and coverage of the sites within the Larego survey areas.

The dominant site-vegetation types were S, ST and TS (63.76%) on the slopes and ridges and D, W and SW on the moister slopes (14.78%). The more extreme sites associated with swamps (types AC and CW) covered less than 6.82 of the areas and near the granite areas (G and R) covered 1.41%, Table 7, Figure 9. The site-vegetation types of D and SW reflect the moister soils that may influence the spread and intensification of *Phytophthora cinnamomi.*

Table 7: Summary of Site-vegetation Types (SVT) on the Spion survey area

SVT Code	Description	Area_ Ha	% Total
Swamps (AC) and Creeklines (CW)			
AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	3.65	0.75
CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	29.49	6.07
Lower Slopes (D, E, W) and Moister Slopes (SW)			
D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae* and *Acacia extensa* on clay loams to gravelly clay-loams.	1.68	0.35
E	Open woodland of *Eucalyptus marginata* and *Corymbia calophylla* over *Mesomelaena tetragona, Kingia australis, Leptospermum erubescens* and *Babingtonia camphorosmae* on sandy to sandy-loam soils on slopes.	0.55	0.11
W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Acacia extensa* and *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	50.97	10.49
SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	19.16	3.94
Slopes and Upper Ridges (PS, PT, S, SP, ST, TP, TS, T)			
PS	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	2.67	0.55
PT	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	9.99	2.06
S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy-gravels.	129.78	26.70
SP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	23.30	4.79
ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus, Leucopogon verticillatus, Pteridium esculentum, Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	54.89	11.29
TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	125.21	25.76
T	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly soils.	27.02	5.56
Granite and Outcrop Areas (G, R)			
G	Mosaic of Open Woodland of *Eucalyptus margnata – Corymbia calophylla* on the fringes of outcrops ranging to open heath communities of Proteaceae-Myrtaceae species and lithic complexes on the outcrop areas.	3.93	0.81
R	Open Woodland of *Eucalyptus marginata - Corymbia calophylla* on fringes of granite outcrops or shallow soils over mixed understorey species reflecting shallow soils over granite.	2.91	0.60
Cleared Areas (CL)			
CL	Already cleared areas	0.81	0.17



N

0 150 300 m

Scale: 1:17,500
MGA94 (Zone 50)

CAD Ref: a1992_F021_12

Date: August 2023 | Rev: A | A4

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Spion Survey Area
Vegetation and Priority Flora

Figure:

12

5.6. Vegetation Condition

The majority of the vegetation was ranked as very good despite historical harvesting activities, recent intense fires (which resulted in dominance of *Bossiaea aquifolium* in understorey), dieback and some established tracks and one restricted cleared area (Figure 13). The presence of the dieback disease is particularly evident in the condition of the vegetation on the lower slopes that support D and SW site-vegetation types.

5.7. Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) occur in the Spion survey area (DBCA 2023). The desktop assessment highlighted several potential TECs; however these are restricted to the Swan Coastal Plain and as such do not extend into the Jarrah forest area on the Darling Ranges.

No priority ecological communities (PECs), as listed at State level by DBCA (2022b) occurs within the Spion survey area.

The Spion survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023a) and as such was considered during the RFA process.



N

0 150 300 m

Scale: 1:17,500
MGA94 (Zone 50)

CAD Ref: a1992_F021_15

Date: August 2023 | Rev: A | A4

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Spion Survey Area
Vegetation Condition

Figure:

13

5.8. Old Growth Forests

There are a few patches of old growth forests occurring outside the Spion survey area (Figure 9); however based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Spion survey area.

On the basis of the number of potential habitat trees and the number of stumps there are some areas of Spion survey area that have some potential to reflect lower logging rates (Figures 14 to 17).

In reviewing the data as collected within the Larego survey areas it is apparent that the swamp areas (A and AC) supported few larger trees and the site-vegetation types (ST, T, TS and PS) supported proportionally higher number of larger potential habitat trees (Diameter at Breast Height (DBH) > 50cm).

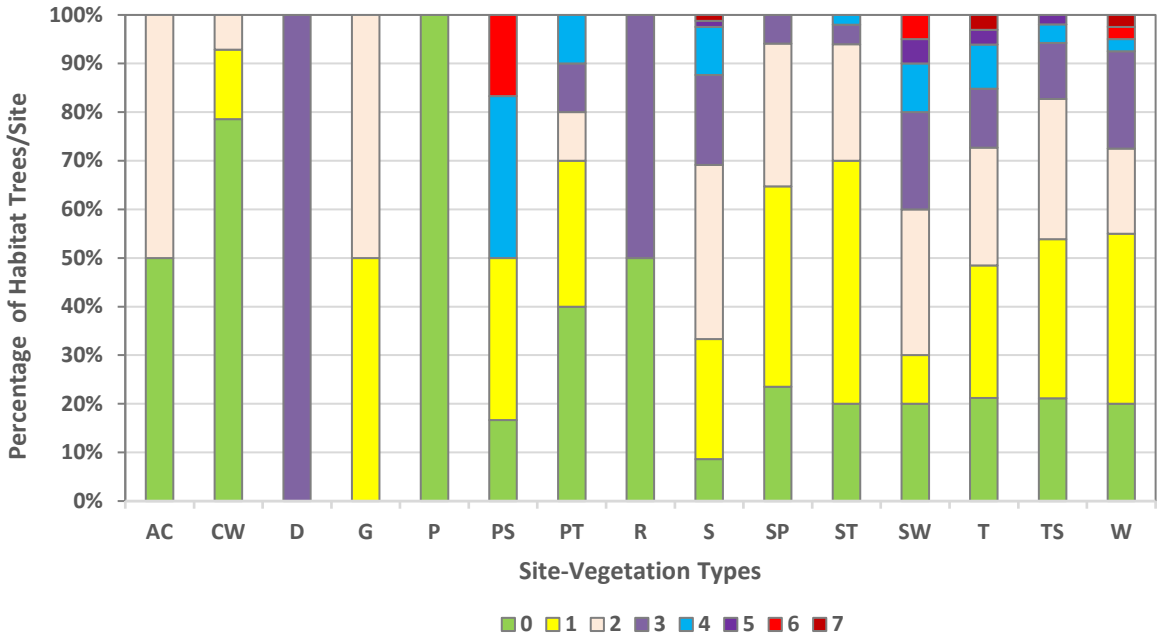
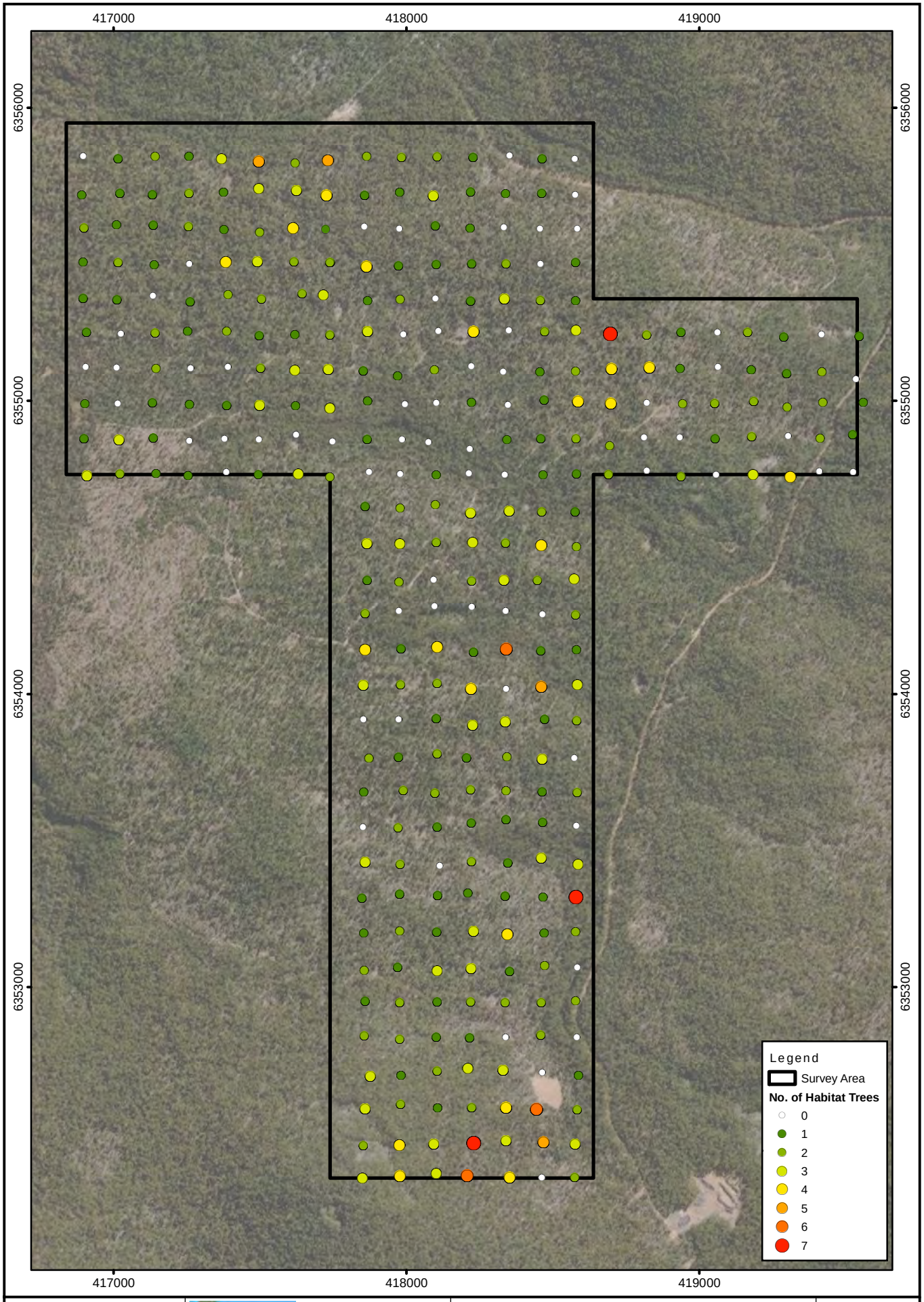


Figure 14: Summary of Number of Potential Habitat Trees (>50cm DBH) in the respective Site-vegetation Types on the Spion survey area



N

0 150 300 m

Scale: 1:17,500
MGA94 (Zone 50)

CAD Ref: a1992_F021_14

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Spion Survey Area
Potential Habitat Trees

Figure:
15

2-

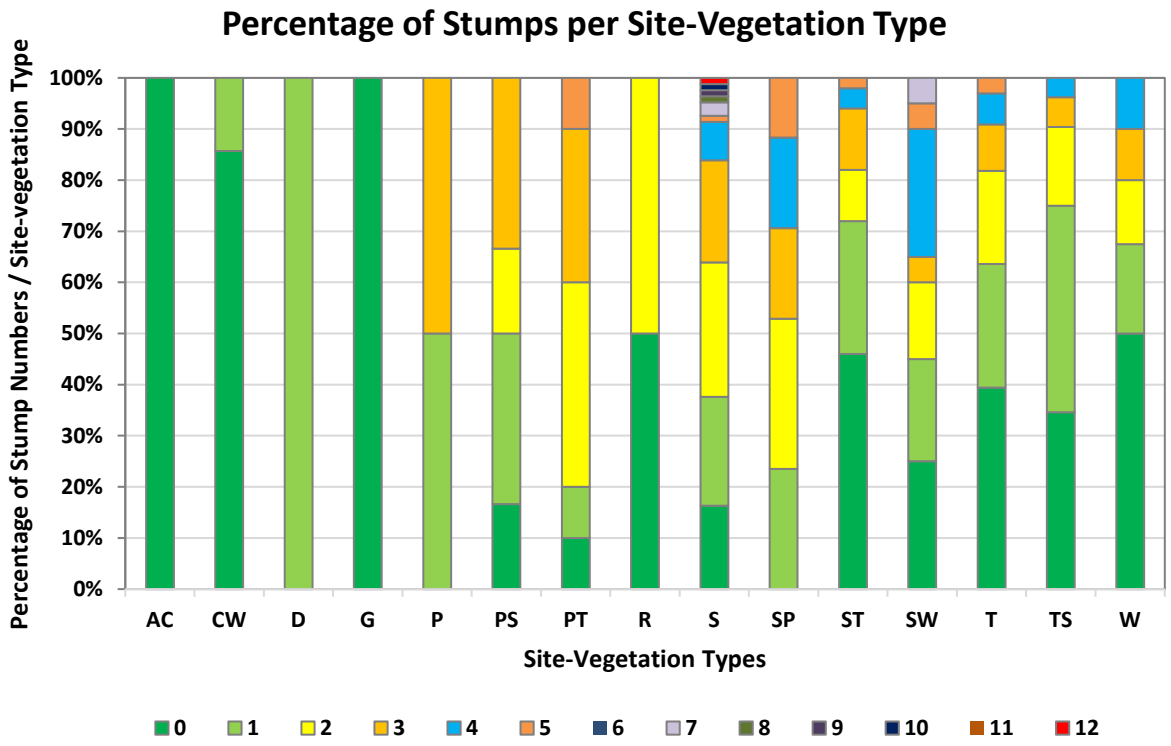
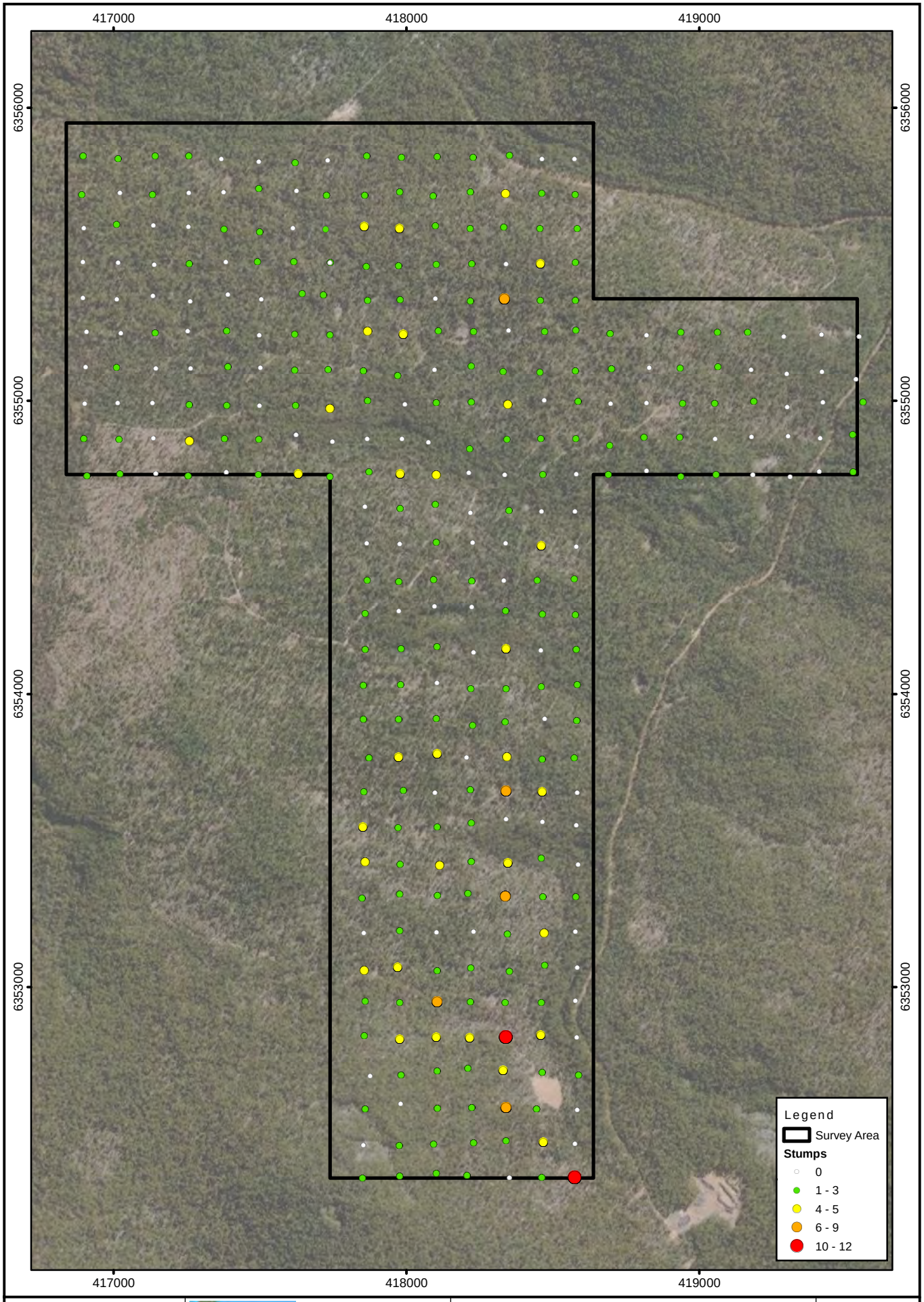


Figure 16: Summary of the Percentage Number of Stumps in the respective Site-vegetation Types on the Spion survey area



N

0 150 300 m

Scale: 1:17,500
MGA94 (Zone 50)

CAD Ref: a1992_F021_13

Date: August 2023 | Rev: A | A4

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Spion Survey Area
Number of Stumps

Figure:
17

6. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

6.1. Flora

The survey efforts were undertaken over several months in the first six months of 2023, largely in late summer and autumn. The seasonal work in the Spion survey area and the previous Larego survey areas and nearby survey areas in recent years was considered to exceed the EPA (2016a and 2016b) guidance statements expectations.

A total of 177 taxa was recorded in the Spion survey area. This is within the range that would be expected in the smaller area of Willowdale. Of the 177 species, 1 was an introduced species. The introduced species (**Hypochaeris glabra*) occurs more widely in the Jarrah forest and are not listed as WONS weeds at the National scale or as Declared pests at the State level.

No listed threatened flora species were recorded in the Spion survey areaa.

Only one Priority three species (*Grevillea prominens* P3) was recorded in the north-eastern section of the Spion survey area.

6.2. Vegetation

The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent.

Heddle *et al*. (1980) defined and described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes as part of the System 6 studies. Mattiske and Havel (1998) updated this initial more restricted mapping coverage to the wider south-west forest region as (Regional Forest Agreement vegetation complexes). Havel, J.J. (2000) summarized in greater detail the relationships between the landforms, soils and climatic conditions. Mattiske and Havel (1998) defined and described five vegetation complexes in the survey areas. None of these are restricted to the Spion survey area.

A total of 15 site-vegetation types and 1 cleared area were defined and mapped in the Spion survey area. The site-vegetation types were subdivided into four main groupings associated with site conditions which reflected landforms, soils and soil moisture levels, Table 7. The site-vegetation types on the extreme sites such as on the valley systems, granite outcrop areas and the creeklines differ markedly from the forest and woodland areas on the slopes and ridges. The delineation of the site-vegetation types was based on the earlier work of Havel (1975a and 1975b) and as such rely on key site and species indicators. Whilst Mattiske has refined these initial site-vegetation types there is still a reliance on the original work of Havel (1975a and 1975b). The initial code is the dominant site-vegetation type code and the second code (where added) reflects some local influence of secondary key stone species. These site-vegetation types were developed in consultation with Dr David Goodall (formerly CSIRO at the time). In the 1970's Dr Havel and Dr Goodall undertook extensive analyses to delineate and differentiate the key species and site parameters that assist in the division of the continuum of the dominant trees of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri). This approach has been used for some 45 years and as such to deviate from such an approach and rely on other approaches would negate the effort to date and the ability to align the findings with other areas in the northern Jarrah forest. So whilst such an approach might be perceived by assessors to deviate from the EPA guidance statements, to not adopt the site-vegetation approach would diminish the delineation of the biodiversity values in the Spion survey area in the regional context. In addition the ranking of species and condition of species in the field has increased the intensity and coverage of the sites within the Spion survey area.

The dominant site-vegetation types were S, ST and TS (63.76%) on the slopes and ridges and D, W and SW on the moister slopes (14.78%). The more extreme sites associated with swamps (types AC and CW) covered less than 6.82% of the areas and near the granite areas (G and R) covered 1.41%, Table 7. The site-vegetation types of D and SW reflect the moister soils that may influence the spread and intensification of *Phytophthora cinnamomi.* As indicated in the Dieback data from DBCA it is evident that dieback has influenced the condition of the vegetation in the Spion survey area.

The site-vegetation types associated with these broader valleys (AC, CW, D, W and SW) and lower slopes have the potential to be groundwater dependent ecosystems.

The site-vegetation types of SW reflect the moister soils that may influence the spread and intensification of *Phytophthora cinnamomi.* As indicated in the Dieback data from DBCA it is evident that dieback and recent intense fires have influenced the condition of the vegetation in the Spion survey area.

6.3. Potential Groundwater Dependent Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the vegetation complexes and the site-vegetation types. In view of the extensive flora and vegetation studies in the northern Jarrah Forest these vegetation complexes and site-types support species that prefer and occur on seasonally moister and wetter soils on the swamps and lower slopes of the valley systems. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Acacia divergens, Thomasia paniculata, Astartea scoparia, Eucalyptus rudis, Hypocalymma angustifolium, Hypocalymma cordifolium,* and *Taxandria linearifolia.*

6.4. Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) occur in the Spion survey area (DBCA 2023). The desktop assessment highlighted several potential TECs; however these are restricted to the Swan Coastal Plain and as such do not extend into the Jarrah forest area on the Darling Ranges.

One of the priority ecological communities (PECs), as listed at State level by DBCA (2022b) occurs north and east of the Larego survey areas on the granite areas near Jarrahdale and Boddington.

The Larego survey areas occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2022b) and as such was considered during the RFA process.

6.5. Old Growth Forests

There are a few patches of old growth forests occurring outside the Spion survey area; however based on data supplied by the Department of Biodiversity, Conservation and Attractions no areas have been highlighted within the Spion survey areas. As indicated by the summary of potential habitat trees and stump numbers at the 20m radius sites there are some areas with denser potential habitat trees and variable logging rates.

7. ACKNOWLEDGEMENTS

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8. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

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A. Rowe	Botanist	Field Studies, Data Collation, assisting in draft report	FB62000329-3
B. Farrar	Botanist	Field Studies, Data Collation	FB62000559
S. Gianniti	Botanist	Field Studies, Data Collation	FB62000563
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J. Wescombe	Botanist	Data collation, reporting	N/A
R. Jones	Botanist	Data collation and Assisting with Reporting	N/A

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions (DBCA 2022a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act. Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from DBCA (2022a).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (DBCA 2022a). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from DBCA (2022a).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (28 June 2018)* (under Part 2, Division 2, Subdivision 1 of the BC Act; DBCA 2018). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the DBCA (and former equivalent departments) have been identifying and informally listing TECs since 1994. Some of these TECs are also endorsed by the Federal Minister as threatened, and some of these are listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from DBCA (2018).

CODE	CATEGORY	DEFINITION
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2022b) in the *Priority Ecological Communities for Western Australia – Version 34 (21 December 2022)*. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from DBCA (2022b).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2023).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- 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; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of vegetation condition categories

Note: Adapted from Keighery (1994).

CATEGORY	DEFINITION
1	Pristine or nearly so, no obvious sign of disturbance or damage caused by human activities since European settlement.
2	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.
3	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE SPION SURVEY AREA

Note: * denotes alien species; PL denotes planted species; PL* denotes both planted/alien; and Mixed (^) refers to part native and part naturalised. T, P1 to P4 reflect Threatened and Priority species (DBCA, 2019a). SCC = State Conservation Code; FCC= Federal Conservation Code; CE = Critically Endangered; E = Endangere V= Vulnerable. EPBC PMST (DCCEEW, 2013), NatureMap (DBCA, 2007-), Previous MCPL reports (MCPL, 2015, 2019, 2020, 2022), WAHerb and TPFL (DBCA, 38-0423FL, 2023).

FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Amaranthaceae		*Ptilotus manglesii*					x					
Anarthriaceae		*Lyginia* sp.					x					
Apiaceae		*Actinotus glomeratus*				x						
		Actinotus leucocephalus				x						
		Actinotus repens	P3			x					x	
		Pentapeltis peltigera					x	x	x	x		
		Pentapeltis silvatica				x		x				
		Platysace compressa					x	x	x	x		
		Platysace filiformis				x	x	x		x		
		Platysace tenuissima					x	x		x		
		Platysace sp.								x		
		Xanthosia atkinsoniana				x	x		x	x		
		Xanthosia candida				x	x	x	x	x		
		Xanthosia huegelii				x	x	x		x		
		Xanthosia singuliflora				x				x		
		Xanthosia ciliata						x				
		Xanthosia sp.						x		x		
Apocynaceae	*	*Vinca major*				x						
Araliaceae		*Hydrocotyle callicarpa*				x						
		Trachymene pilosa						x		x		
Asparagaceae		*Laxmannia squarrosa*					x		x			
		Lomandra brittanii					x			x		
		Lomandra caespitosa				x	x		x	x		
		Lomandra hermaphrodita				x	x		x	x		
		Lomandra integra				x						
		Lomandra micrantha					x			x		
		Lomandra micrantha subsp. *micrantha*				x	x			x		
		Lomandra nigricans				x	x		x	x		
		Lomandra pauciflora				x						
		Lomandra preissii				x			x	x		
		Lomandra purpurea					x		x	x		
		Lomandra sericea				x	x	x	x	x		
		Lomandra sonderi					x	x	x	x		
		Lomandra spartea					x	x	x	x		
		Lomandra suaveolens						x				
		Lomandra sp.					x	x	x	x		
		Thysanotus dichotomus				x	x	x		x		
		Thysanotus fastigiatus				x		x		x		
		Thysanotus manglesianus						x				
		Thysanotus multiflorus				x	x	x	x	x		

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE SPION SURVEY AREA

Note: * denotes alien species; PL denotes planted species; PL* denotes both planted/alien; and Mixed (^) refers to part native and part naturalised. T, P1 to P4 reflect Threatened and Priority species (DBCA, 2019a). SCC = State Conservation Code; FCC= Federal Conservation Code; CE = Critically Endangered; E = Endangere V= Vulnerable. EPBC PMST (DCCEEW, 2013), NatureMap (DBCA, 2007-), Previous MCPL reports (MCPL, 2015, 2019, 2020, 2022), WAHerb and TPFL (DBCA, 38-0423FL, 2023).

FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Asparagaceae		*Thysanotus thyrsoideus*					x	x		x		
(Cont.)		*Thysanotus* sp.					x					
Asteraceae		*Cotula australis*				x						
	*	*Cotula coronopifolia*				x						
	*	*Erigeron sumatrensis*						x				
		Hyalosperma cotula								x		
	*	*Hypochaeris glabra*				x	x	x	x	x		
		Lagenophora huegelii				x	x	x	x	x		
		Millotia tenuifolia							x			
		Olearia paucidentata				x		x				
		Pterochaeta paniculata				x	x	x	x	x		
		Quinetia urvillei				x						
		Senecio diaschides				x		x		x		
		Senecio hispidulus					x		x	x		
		Senecio leucoglossus	P4			x		x	x	x	x	x
		Senecio multicaulis subsp. *multicaulis*				x						
		Senecio quadridentatus						x	x	x		
	*	*Senecio vulgaris*								x		
		Senecio sp.					x	x	x	x		
	*	*Sonchus oleraceus*								x		
		Trichocline spathulata				x	x	x	x	x		
	*	*Ursinia anthemoides*					x					
	*	*Vellereophyton dealbatum*					x					
		Asteraceae sp.					x	x		x		
Boryaceae		*Borya sphaerocephala*						x		x		
Campanulaceae		*Isotoma hypocrateriformis*								x		
		Lobelia heterophylla				x						
		Lobelia gibbosa						x				
		Lobelia sp.							x	x		
	*	*Wahlenbergia capensis*								x		
		Wahlenbergia preissii								x		
Caprifoliaceae	*	*Lonicera japonica*				x						
Casuarinaceae		*Allocasuarina fraseriana*				x	x	x	x	x		
		Allocasuarina sp.						x				
Celastraceae		*Stackhousia monogyna*					x	x		x		
		Stackhousia pubescens				x						
		Stackhousia sp.						x	x			
		Tripterococcus brunonis								x		

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE SPION SURVEY AREA

Note: * denotes alien species; PL denotes planted species; PL* denotes both planted/alien; and Mixed (^) refers to part native and part naturalised. T, P1 to P4 reflect Threatened and Priority species (DBCA, 2019a). SCC = State Conservation Code; FCC= Federal Conservation Code; CE = Critically Endangered; E = Endangere V= Vulnerable. EPBC PMST (DCCEEW, 2013), NatureMap (DBCA, 2007-), Previous MCPL reports (MCPL, 2015, 2019, 2020, 2022), WAHerb and TPFL (DBCA, 38-0423FL, 2023).

FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Centrolepidaceae		*Aphelia brizula*				x						
		Centrolepis fascicularis				x						
Colchicaceae		*Burchardia congesta*				x	x	x		x		
Crassulaceae		*Crassula exserta*				x						
	^	*Crassula* sp.				x						
Cupressaceae		*Callitris ?acuminata*					x					
Cyperaceae		*Cyathochaeta avenacea*				x	x	x		x		
		Cyathochaeta teretifolia	P3			x	x					
		Gahnia decomposita				x	x	x	x	x		
		Gahnia trifida				x	x					
		Lepidosperma leptostachyum				x						
		Lepidosperma pubisquameum				x	x			x		
		Lepidosperma squamatum				x	x	x	x	x		
		Lepidosperma tenue					x	x	x			
		Lepidosperma tetraquetrum				x	x	x	x	x		
		Lepidosperma resinosum					x					
		Lepidosperma sp.				x	x	x	x	x		
		Machaerina vaginalis				x						
		Mesomelaena graciliceps				x						
		Morelotia octandra				x	x	x	x			
		Netrostylis sp. Blackwood River (A.R. Annels 3043)	P3								x	
		Netrostylis sp. Jarrah Forest (R. Davis 7391)				x	x	x	x	x		
		Netrostylis sp. Nannup (P.A. Jurjevich 1133)	P1			x					x	
		Cyperaceae sp.					x	x	x	x		
Dasypogonaceae		*Kingia australis*					x	x				
Dennstaedtiaceae		*Pteridium esculentum*					x	x	x	x		
		Pteridium esculentum subsp. *esculentum*				x						
Dilleniaceae		*Hibbertia acerosa*					x	x				
		Hibbertia amplexicaulis				x	x	x	x	x		
		Hibbertia commutata				x	x	x	x	x		
		Hibbertia glomerata				x						
		Hibbertia glomerata subsp. *glomerata*								x		
		Hibbertia hypericoides					x	x	x	x		
		Hibbertia lasiopus								x		
		Hibbertia ovata					x	x	x			
		Hibbertia perfoliata					x	x	x			
		Hibbertia pilosa				x						
		Hibbertia serrata				x	x					
		Hibbertia silvestris				x	x	x	x			

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE SPION SURVEY AREA

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Dilleniaceae		*Hibbertia subvaginata*							x	x		
(Cont.)		*Hibbertia* sp.					x	x		x		
Droseraceae		*Drosera erythrorhiza*					x	x				
		Drosera leucoblasta						x				
		Drosera pallida				x						
		Drosera pulchella				x						
		Drosera squamosa				x						
		Drosera stolonifera						x				
		Drosera sp.					x	x	x	x		
Elaeocarpaceae		*Tetratheca hirsuta*					x	x		x		
		Tetratheca virgata							x			
		Tetratheca ?pilifera	P3					x				
		Tetratheca sp.						x				
Ericaceae		*Andersonia aristata*				x						
		Andersonia latiflora								x		
		Andersonia sp.					x	x				
		Astroloma sp.					x	x				
		Leucopogon australis				x				x		
		Leucopogon capitellatus				x	x	x	x	x		
		Leucopogon glabellus								x		
		Leucopogon gracillimus					x					
		Leucopogon hirsutus				x						
		Leucopogon verticillatus				x	x	x	x	x		
		Leucopogon sp.					x	x		x		
		Styphelia concinna						x				
		Styphelia discolor				x		x	x	x		
		Styphelia nitens					x	x	x	x		
		Styphelia pallida						x	x	x		
		Styphelia propinqua				x	x	x	x	x		
		Styphelia tenuiflora				x	x	x	x	x		
		Styphelia sp.					x			x		
Euphorbiaceae		*Amperea simulans*				x						
		Monotaxis grandiflora						x				
		Monotaxis occidentalis					x	x				
		Ricinocarpos glaucus				x						
		Stachystemon vermicularis				x				x		
		Euphorbiaceae sp.					x					
Fabaceae		*Acacia alata*						x		x		
		Acacia alata var. *alata*				x	x		x			
		Acacia browniana				x	x	x	x			
		Acacia browniana var. *browniana*					x					

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Fabaceae		*Acacia browniana* var. *obscura*					x					
(C0nt.)	^	*Acacia celastrifolia*					x	x				
		Acacia divergens				x	x	x	x	x		
		Acacia drummondii subsp. *candolleana*				x	x	x	x	x		
		Acacia drummondii subsp. *drummondii*					x	x	x	x		
		Acacia extensa				x	x	x	x	x		
		Acacia lateriticola					x	x	x	x		
		Acacia nervosa					x	x	x	x		
		Acacia preissiana						x				
		Acacia pulchella					x	x	x	x		
	*	*Acacia pycnantha*						x				
		Acacia saligna								x		
		Acacia urophylla						x	x	x		
		Acacia varia var. *varia*				x		x				
		Acacia willdenowiana					x	x		x		
		Acacia myrtifolia						x				
		Acacia sp.					x					
		Bossiaea aquifolium					x		x	x		
		Bossiaea aquifolium subsp. *aquifolium*				x		x				
		Bossiaea ornata					x	x	x	x		
		Callistachys lanceolata					x					
		Chorizema cordatum				x	x		x			
		Chorizema dicksonii						x				
		Daviesia cordata						x				
		Daviesia costata				x						
		Daviesia decurrens					x	x				
		Daviesia preissii						x				
		Daviesia sp.						x				
		Eutaxia exilis				x						
		Gastrolobium glabratum				x						
		Gastrolobium spinosum								x		
		Gastrolobium sp.					x					
		Gompholobium knightianum					x	x		x		
		Gompholobium marginatum					x	x		x		
		Gompholobium polymorphum						x				
		Gompholobium preissii						x		x		
		Gompholobium tomentosum					x					
		Gompholobium sp.						x		x		
		Hovea chorizemifolia				x	x	x	x	x		
		Hovea trisperma				x	x	x				
		Hovea sp.								x		
		Jacksonia furcellata						x				
		Kennedia coccinea				x	x	x	x	x		
		Kennedia prostrata						x		x		
		Labichea punctata					x	x	x	x		
		Mirbelia dilatata				x	x	x	x	x		

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Fabaceae	^	*Paraserianthes lophantha*				x		x	x	x		
(cont.)		*Sphaerolobium medium*						x	x	x		
		Sphaerolobium scabriusculum				x						
		Templetonia drummondii					x					
		Templetonia sp.							x			
		Fabaceae sp.								x		
Fagaceae	*	*Quercus palustris*				x						
Gentianaceae	*	*Centaurium erythraea*								x		
Goodeniaceae		*Dampiera hederacea*				x		x				
		Dampiera linearis					x			x		
	^	*Lechenaultia biloba*				x	x	x	x	x		
		Lechenaultia sp.					x					
		Scaevola calliptera				x	x	x		x		
		Scaevola sp.						x				
		Goodeniaceae sp.								x		
Haemodoraceae		*Anigozanthos* sp.							x	x		
		Conostylis serrulata				x	x	x	x	x		
		Conostylis setigera					x	x	x	x		
		Conostylis setigera subsp. *setigera*				x						
		Conostylis setosa					x	x	x	x		
		Conostylis pusilla						x		x		
		Conostylis sp.						x	x			
		Haemodorum laxum								x		
		Haemodorum sp.					x	x		x		
		Tribonanthes violacea				x						
		Haemodoraceae sp.						x				
Haloragaceae		*Glischrocaryon aureum*						x	x	x		
		Gonocarpus benthamii				x		x				
		Gonocarpus diffusus				x						
Hemerocallidaceae		*Agrostocrinum hirsutum*								x		
		Agrostocrinum sp.				x						
		Chamaescilla corymbosa					x	x	x	x		
		Chamaescilla corymbosa var. *corymbosa*				x						
		Chamaescilla sp.					x					
		Dianella revoluta					x		x			
		Dianella revoluta var. *divaricata*				x						
		Johnsonia lupulina				x	x			x		
		Stypandra glauca				x	x					
		Tricoryne elatior				x						
		Hemerocallidaceae sp.					x					

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Hypoxidaceae		*Pauridia gardneri*						x				
Iridaceae		*Patersonia babianoides*								x		
		Patersonia juncea						x				
		Patersonia occidentalis					x	x	x	x		
		Patersonia pygmaea					x	x		x		
		Patersonia rudis					x	x		x		
		Patersonia sp.						x	x	x		
		Iridaceae sp.								x		
Juncaginaceae		*Triglochin nana*				x						
Lamiaceae		*Hemiandra pungens*								x		
		Hemigenia pritzelii				x	x	x	x	x		
		Lamiaceae sp.						x				
Lauraceae		*Cassytha filiformis*							x			
		Cassytha glabella								x		
		Cassytha glabella forma casuarinae				x						
		Cassytha pomiformis				x						
		Cassytha sp.					x	x	x	x		
Liliaceae	*	*Lilium candidum*				x						
Lindsaeaceae		*Lindsaea linearis*				x	x	x		x		
Loganiaceae		*Orianthera serpyllifolia* subsp. *angustifolia*				x						
Loranthaceae		*Nuytsia floribunda*					x					
Malvaceae		*Lasiopetalum floribundum*				x	x	x	x	x		
		Lasiopetalum glabratum					x	x	x	x		
		Lasiopetalum sp.						x				
		Thomasia ?*macrocalyx*						x				
		Thomasia paniculata				x	x	x	x	x		
		Thomasia pauciflora				x						
		Thomasia sp. Big Brook (M. Koch 2373)				x						
		Thomasia sp.					x		x			
Meliaceae	^	*Melia azedarach*				x						
Myrtaceae		*Astartea scoparia*				x	x	x	x	x		
		Babingtonia camphorosmae					x	x	x	x		
	*	*Callistemon citrinus*				x						
		Callistemon glaucus							x			
		Calothamnus sp.						x		x		

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Myrtaceae		*Calytrix depressa*				x						
(Cont.)		*Calytrix leschenaultii*					x	x	x			
		Calytrix sp.					x	x	x	x		
		Corymbia calophylla				x	x	x	x	x		
		Darwinia citriodora					x					
	PL	*Eucalyptus accedens*					x					
		Eucalyptus drummondii										
		Eucalyptus marginata					x	x	x	x		
		Eucalyptus marginata subsp. *marginata*				x						
		Eucalyptus megacarpa				x	x	x	x	x		
	*	*Eucalyptus microcorys*				x	x					
		Eucalyptus patens				x		x	x	x		
		Eucalyptus rudis						x	x	x		
	*	*Eucalyptus saligna*				x						
		Eucalyptus sp.						x				
		Homalospermum firmum				x	x					
		Hypocalymma angustifolium				x	x	x	x	x		
		Hypocalymma cordifolium				x	x	x	x	x		
		Hypocalymma robustum					x	x	x	x		
		Hypocalymma sp.					x	x				
		Leptospermum erubescens						x		x		
		Melaleuca ?parviceps					x					
		Melaleuca preissiana						x		x		
		Melaleuca trichophylla						x	x			
		Melaleuca sp.						x				
		Pericalymma ellipticum					x	x	x	x		
	*	*Syncarpia glomulifera*				x						
		Taxandria fragrans				x						
		Taxandria linearifolia				x	x	x	x	x		
		Verticordia huegelii var. *huegelii*				x						
		Verticordia plumosa var. *plumosa*				x	x					
		Myrtaceae sp.					x	x		x		
Ophioglossaceae		*Ophioglossum lusitanicum*				x						
Orchidaceae		*Caladenia flava*					x					
		Caladenia latifolia								x		
		Caladenia macrostylis				x						
		Caladenia reptans								x		
		Caladenia sp.					x			x		
		Cryptostylis ovata				x	x		x	x		
		Diuris micrantha	T	VU	x							
		Diuris sp.								x		
		Drakaea livida				x						
		Eriochilus dilatatus				x						
		Leporella sp.					x					

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Orchidaceae		*Microtis media*						x				
(Cont.)		*Microtis* sp.					x					
		Paracaleana hortiorum				x						
		Pterostylis pyramidalis					x					
		Pterostylis recurva				x						
		Pterostylis scabra				x						
		Pterostylis vittata				x				x		
		Pterostylis sp.				x	x	x	x	x		
		Pyrorchis nigricans					x	x		x		
		Thelymitra crinita				x						
		Orchidaceae sp.					x	x	x	x		
Orobanchaceae	*	*Orobanche minor*						x				
Oxalidaceae	*	*Oxalis* sp.						x				
Phyllanthaceae		*Lysiandra calycina*				x	x	x	x	x		
Phytolaccaceae	*	*Phytolacca octandra*						x				
Pinaceae	*	*Pinus pinaster*					x		x			
	*	*Pinus* sp.				x	x					
Pittosporaceae		*Billardiera floribunda*				x				x		
		Billardiera fraseri										
		Billardiera fusiformis					x	x	x	x		
		Billardiera variifolia				x		x				
		Billardiera sp.						x				
		Marianthus bicolor							x			
		Marianthus drummondianus						x	x			
		Pittosporaceae sp.					x			x		
Plantaginaceae		*Gratiola pubescens*				x						
Poaceae	*	*Aira caryophyllea*								x		
	*	*Briza maxima*								x		
		Amphipogon amphipogonoides						x		x		
		Amphipogon laguroides				x		x				
		Austrostipa sp.					x					
		Eriachne sp.							x			
		Neurachne alopecuroidea					x	x	x	x		
		Rytidosperma acerosum								x		
		Rytidosperma caespitosum					x	x	x	x		
		Rytidosperma sp.					x			x		
		Tetrarrhena laevis				x	x	x	x	x		
		Poaceae sp.					x	x	x	x		

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Podocarpaceae		*Podocarpus drouynianus*					x					
Polygalaceae		*Comesperma calymega*						x		x		
		Comesperma virgatum					x	x		x		
		Comesperma sp.					x					
Proteaceae		*Adenanthos barbiger*							x			
		Adenanthos obovatus				x						
		Banksia dallanneyi subsp. *dallanneyi*						x				
		Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*							x	x		
		Banksia dallanneyi subsp. *dallanneyi* var. *mellicula*				x						
		Banksia dallanneyi subsp. *sylvestris*				x			x	x		
		Banksia grandis				x	x	x	x	x		
		Banksia littoralis					x	x	x	x		
		Banksia seminuda				x	x	x	x	x		
		Banksia sessilis					x	x	x	x		
		Banksia sphaerocarpa					x	x	x	x		
		Banksia squarrosa subsp. *squarrosa*						x				
		Banksia sp.							x	x		
		Conospermum capitatum subsp. *glabratum*				x	x					
		Conospermum flexuosum				x						
		Conospermum flexuosum subsp. *laevigatum*				x				x		
		Conospermum stoechadis								x		
		Conospermum sp.					x					
		Grevillea bipinnatifida						x				
		Grevillea diversifolia						x		x		
		Grevillea manglesii subsp. *manglesii*						x				
		Grevillea prominens	P3			x				x	x	x
		Grevillea pulchella						x				
		Grevillea quercifolia					x					
		Grevillea synapheae				x						
		Grevillea wilsonii						x	x	x		
		Hakea amplexicaulis				x	x	x	x	x		
		Hakea cyclocarpa						x				
		Hakea incrassata								x		
		Hakea lasianthoides				x			x			
		Hakea lissocarpha					x	x	x	x		
		Hakea prostrata							x	x		
		Hakea ruscifolia				x		x	x	x		
		Hakea varia							x			
		Isopogon sphaerocephalus					x					
		Persoonia elliptica				x	x	x	x	x		
		Persoonia longifolia				x	x	x	x	x		
		Synaphea petiolaris				x	x					
		Xylomelum occidentale					x					

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FAMILY	*	Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Ranunculaceae		*Clematis pubescens*				x	x	x	x	x		
		Ranunculus colonorum				x						
Restionaceae		*Desmocladus fasciculatus*					x	x	x	x		
		Desmocladus flexuosus					x	x	x	x		
		Hypolaena exsulca				x	x	x	x	x		
		Leptocarpus tenax				x						
		Lepyrodia curvescens	P2					x				
		Loxocarya cinerea				x				x		
		Loxocarya sriata					x					
		Sporadanthus rivularis				x	x					
		Restionaceae sp.					x			x		
Rhamnaceae		*Trymalium ledifolium*					x	x	x	x		
		Trymalium ledifolium var. *rosmarinifolium*				x						
		Trymalium odoratissimum subsp. *odoratissimum*				x	x	x	x	x		
Rosaceae	*	*Rubus ulmifolius*						x				
Rubiaceae	*	*Galium murale*				x						
		Opercularia apiciflora								x		
		Opercularia echinocephala				x	x	x	x			
		Opercularia hispidula				x				x		
		Opercularia vaginata						x				
		Opercularia sp.						x		x		
Rutaceae		*Asterolasia pallida*				x		x				
		Boronia crenulata				x		x				
		Boronia crenulata subsp. crenulata							x			
		Boronia crenulata subsp. viminea				x						
		Boronia fastigiata				x	x	x	x	x		
		Boronia molloyae				x	x	x	x			
		Boronia sp.					x					
		Philotheca spicata				x	x	x		x		
Santalaceae		*Leptomeria cunninghamii*								x		
Sapindaceae		*Dodonaea* sp.						x				
Schizaeaceae		*Schizaea rupestris*	P2			x					x	x
Solanaceae		*Anthocercis gracilis*	T	VU	x							
Stylidiaceae		*Levenhookia pusilla*				x	x			x		
		Levenhookia stipitata								x		
		Stylidium amoenum				x	x	x	x	x		

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE SPION SURVEY AREA

Note: * denotes alien species; PL denotes planted species; PL* denotes both planted/alien; and Mixed (^) refers to part native and part naturalised. T, P1 to P4 reflect Threatened and Priority species (DBCA, 2019a). SCC = State Conservation Code; FCC= Federal Conservation Code; CE = Critically Endangered; E = Endangere V= Vulnerable. EPBC PMST (DCCEEW, 2013), NatureMap (DBCA, 2007-), Previous MCPL reports (MCPL, 2015, 2019, 2020, 2022), WAHerb and TPFL (DBCA, 38-0423FL, 2023).

FAMILY	* Species	SCC	FCC	EPBC PMST	NatureMap	MCPL 2015	MCPL 2019	MCPL 2020	MCPL 2022	WAHerb	TPFL
Stylidiaceae	*Stylidium brunonianum*						x				
(cont.)	*Stylidium bulbiliferum*								x		
	Stylidium ciliatum						x	x			
	Stylidium crassifolium				x						
	Stylidium hispidum				x				x		
	Stylidium ireneae	P4			x					x	
	Stylidium lineatum				x						
	Stylidium piliferum					x	x	x	x		
	Stylidium repens					x	x	x	x		
	Stylidium rhynchocarpum				x						
	Stylidium sp.					x	x	x	x		
Thymelaeaceae	*Pimelea suaveolens*				x	x	x	x			
	Pimelea sylvestris				x						
	Pimelea sp.					x	x	x	x		
Violaceae	*Pigea debilissima*				x						
Xanthorrhoeaceae	*Xanthorrhoea gracilis*				x	x	x	x	x		
	Xanthorrhoea preissii				x	x	x	x	x		
	Xanthorrhoea sp.						x		x		
Xyridaceae	*Xyris atriviridis*				x						
	Xyris sp.				x						
Zamiaceae	*Macrozamia riedlei*				x	x	x	x	x		

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE SPION SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Anthocercis gracilis	Solanaceae	T	Vulnerable	Habit: Erect, spindly shrub, to 0.6 (-1) m high. Flower colour: yellow-green Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Sandy or loamy soils. Granite outcrops. IBRA Distribution: AVW, JAF Florabase records: 29	Low Has not been recorded by DBCA or by MCPL previously within the survey area.
Diuris micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.3-0.6 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Brown loamy clay. Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 9	Low Has not been recorded by DBCA or by MCPL previously within the survey area.
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	Cyperaceae	P1	-	Habit: Perennial. Caespitose sedge 90 cm high. Flower colour: Flowering period (indicated in green): J F M A M J J A S O N D Soils: Creek, valley floors. IBRA Distribution: JAF Florabase records: 6	Moderate Locally abundant to the NW and within 10 km of survey area (WA Herb). Findings associated with clay loam and dark grey soils in lowland areas.
Lepyrodia curvescens	Restionaceae	P2	-	Habit: Dioecious, shortly creeping, tufted rhizomatous, herb, 0.24-0.4 m high, rhizomes on surface or to 1 cm deep. Flower colour: Light brown Flowering period (indicated in green): J F M A M J J A **S** **O** **N** D Soils: Sand, laterite. Seasonally inundated swampland. IBRA Distribution: GES, JAF, SWA Florabase records: 21	Moderate Recorded previously by MCPL (2019) near creekline approximately 10 km W of Spion survey area.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE SPION SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Schizaea rupestris	Schizaeaceae	P2	-	Habit: Rhizomatous, perennial, herb or grass-like or (fern), 0.1-0.2m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand. Gullies, creek banks, shaded moist rock faces. IBRA Distribution: ESP, JAF, WAR Florabase records: 13	Low One record contained in both the WAHerb and TPFL databases with finding to the W and associated with clay- loams soils in riverbank.
Actinotus repens	Apiaceae	P3	-	Habit: Prostrate perennial to 5 cm high, c. 20cm wide. Flower colour: white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Coarse black peaty sand over clay. Creeklines, edges of other water channels. IBRA Distribution: JAF, WAR Florabase records: 36	Moderate Three records contained with the WAHerb, with one finding associated with riparian vegetation.
Cyathochaeta teretifolia	Cyperaceae	P3	-	Habit: Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2.0 m high, to 1.0 m wide. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Grey sand, sandy clay. Swamps, creek edges. IBRA Distribution: JAF, SWA, WAR Florabase records: 39	Moderate Recorded previously by MCPL (2015) and W of current survey area.
Grevillea prominens	Proteaceae	P3	-	Habit: Spreading shrub, 0.5-1.7m high, 0.3-1m wide. Flower colour: cream-white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Gravelly loam, along creeklines. IBRA Distribution: JAF Florabase records: 9	Moderate Three TPFL records in close proximity of the survey area and associated with clay soils.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE SPION SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2022a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Netrostylis sp. Blackwood River (A.R. Annels 3043)	Cyperaceae	P3	-	Habit: Erect or spreading sedge to 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Shallow grey sandy soil, clay loam. Along edges of creeklines and inundated swamp. IBRA Distribution: ESP, JAF, SWA, WAR Florabase records: 16	Moderate WAHerb lists one record within 10 km of central survey point and found within creekline.
Tetratheca pilifera	Elaeocarpaceae	P3	-	Habit: Spreading shrub, 0.1-0.3 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S O N D Soils: Gravelly soils. IBRA Distribution: JAF, SWA Florabase records: 35	Low. MCPL (2019) recorded at one location and within 10 km SW of survey area on the slopes and ridges associated with the S site-vegetation type.
Senecio leucoglossus	Asteraceae	P4	-	Habit: Erect annual, herb, to 1.3 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Gravelly lateritic or granitic soils. Granite outcrops, slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 45	High Previously recorded by MCPL over multiple years with numerous records contained in both the WAHerb and TPFL databases.
Stylidium ireneae	Stylidiaceae	P4	-	Habit: Lax perennial, herb, (0.06-) 0.1-0.28 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sandy loam. Valleys near creek lines. IBRA Distribution: JAF, SWA, WAR Florabase records: 29	Low Has not been recorded by DBCA or by MCPL previously within the survey area.

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE SPION SURVEY AREA

* - Denotes introduces species; P1 to P4 - Priority flora as defined by DBCA 2022a.

Family		Species
Apiaceae		*Pentapeltis peltigera*
		Platysace compressa
		Platysace filiformis
		Platysace tenuissima
		Platysace sp.
		Xanthosia candida
		Xanthosia huegelii
		Xanthosia singuliflora
		Apiaceae sp.
Asparagaceae		*Lomandra caespitosa*
		Lomandra drummondii
		Lomandra hermaphrodita
		Lomandra nigricans
		Lomandra preissii
		Lomandra purpurea
		Lomandra sericea
		Lomandra sonderi
		Lomandra spartea
		Lomandra sp.
		Thysanotus dichotomus
		Thysanotus fastigiatus
		Thysanotus multiflorus
		Thysanotus sparteus
		Thysantos thyrsoideus
		Thysanotus sp.
Asteraceae	*	*Hypochaeris glabra*
		Lagenophora huegelii
		Pterochaeta paniculata
		Senecio diaschides
		Senecio hispidulus
		Senecio quadridentatus
		Senecio sp.
		Trichocline spathulata
		Asteraceae sp.
Boryaceae		*Borya sphaerocephala*
Campanulaceae		*Wahlenbergia* sp.

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE SPION SURVEY AREA

* - Denotes introduces species; P1 to P4 - Priority flora as defined by DBCA 2022a.

Family	Species
Casuarinaceae	*Allocasuarina fraseriana*
	Allocasuarina huegeliana
Celestraceae	*Stackhousia ?monogyna*
Colchicaceae	*Burchardia congesta*
Cyperaceae	*Gahnia decomposita*
	Lepidosperma squamatum
	Lepidosperma tetraquetrum
	Lepidosperma sp.
	Mesomelaena tetragona
	Morelotia octandra
	Netrostylis sp. Jarrah Forest (R. Davis 7391)
Dennstaedtiaceae	*Pteridium esculentum*
Dilleniaceae	*Hibbertia amplexicaulis*
	Hibbertia commutata
	Hibbertia perfoliata
	Hibbertia silvestris
	Hibbertia sp.
Droseraceae	*Drosera* sp.
Elaeocarpaceae	*Tetratheca hirsuta*
Ericaceae	*Leucopogon australis*
	Leucopogon australis
	Leucopogon verticillatus
	Styphelia conostephioides
	Styphelia discolor
	Styphelia nitens
	Styphelia pallida
	Styphelia propinqua
	Styphelia tenuiflora
	Styphelia sp.
Euphorbiaceae	*Amperea simulans*
	Monotaxis occidentalis

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE SPION SURVEY AREA

* - Denotes introduces species; P1 to P4 - Priority flora as defined by DBCA 2022a.

Family	Species
Fabaceae	*Acacia alata* var. *alata*
	Acacia applanata
	Acacia divergens
	Acacia drummondii subsp. *candolleana*
	Acacia extensa
	Acacia lateriticola
	Acacia pulchella
	Acacia urophylia
	Bossiaea aquifolium
	Bossiaea ornata
	Chorizema cordatum
	Gastrolobium spinosum
	Gompholobium marginatum
	Gompholobium preissii
	Hardenbergia comptoniana
	Hovea chorizemifolia
	Hovea trisperma
	Hypocalymma angustifolium
	Kennedia coccinea
	Kennedia prostrata
	Labichea punctata
	Mirbelia dilatata
Goodeniaceae	*Lechenaultia biloba*
	Scaevola calliptera
	Scaevola sp.
Haemodoraceae	*Conostylis pusilla*
	Conostylis serrulata
	Conostylis setigera
Hemerocallidaceae	*Chamaescilla corymbosa*
	Dianella revoluta
Iridaceae	*Patersonia babianoides*
	Patersonia occidentalis
	Patersonia pygmaea
	Patersonia rudis
	Patersonia sp.

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE SPION SURVEY AREA

* - Denotes introduces species; P1 to P4 - Priority flora as defined by DBCA 2022a.

Family	Species
Lamiaceae	*Hemigenia incana*
	Hemigenia pritzelii
Lauraceae	*Cassytha* sp.
Malvaceae	*Lasiopetalum floribundum*
	Lasiopetalum glabratum
	Lasiopetalum sp.
	Thomasia paniculata
	Malvaceae sp.?
Myrtaceae	*Astartea scoparia*
	Calothamnus sp.
	Corymbia calophylla
	Eucalyptus marginata
	Eucalyptus megacarpa
	Eucalyptus patens
	Eucalyptus rudis
	Hypocalymma angustifolium
	Hypocalymma cordifolium
	Hypocalymma robustum
	Leptospermum erubescens
	Pericalymma ellipticum
	Taxandria linearifolia
Orchidaceae	*Caladenia* sp.
	Cryptostylis ovata
	Eriochilus sp.
	Pterostylis sp.
	Pterostylis sp. 1
	Pterostylis sp. 2
	Pyrorchis nigricans
	Orchidaceae sp.
	Orchidaceae sp. 1
	Orchidaceae sp. 2
Phyllanthaceae	*Lysiandra calycina*
Pittosporaceae	*Billardiera fusiformis*
	Marianthus sp.
	Pittosporaceae sp.

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE SPION SURVEY AREA

* - Denotes introduces species; P1 to P4 - Priority flora as defined by DBCA 2022a.

Family		Species
Poaceae		*Amphipogon amphipogonoides*
		Neurachne alopecuroidea
		Rytidosperma caespitosum
		Tetrarrhena laevis
		Poaceae sp.
Polygalaceae		*Comesperma virgatum*
		Comesperma sp.
Proteaceae		*Adenanthos barbiger*
		Banksia dallanneyi subsp. *dallanneyi*
		Banksia grandis
		Banksia littoralis
	P3	*Grevillea prominens*
		Grevillea wilsonii
		Hakea amplexicaulis
		Hakea lissocarpha
		Persoonia elliptica
		Persoonia longifolia
Ranunculaceae		*Clematis pubescens*
Restionaceae		*Desmocladus fasciculatus*
		Desmocladus flexuosus
Rhamnaceae		*Trymalium ledifolium*
		Trymalium odoratissimum
Rubiaceae		*Opercularia apiciflora*
		Opercularia echinocephala
Rutaceae		*Boronia crenulata*
		Boronia fastigiata
		Philotheca spicata
		Rutaceae sp.
Sapindaceae		*Dodonaea ?ceratocarpa*
Stylidiaceae		*Levenhookia pusilla*
		Levenhookia stipitata
		Stylidium amoenum

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE SPION SURVEY AREA

* - Denotes introduces species; P1 to P4 - Priority flora as defined by DBCA 2022a.

Family	Species
Stylidiaceae	*Stylidium piliferum*
	Stylidium sp.
Thymelaeaceae	*Pimelea ciliata*
	Pimelea suaveolens
	Pimelea suaveolens
Xanthorrhoeaceae	*Xanthorrhoea gracilis*
	Xanthorrhoea preissii
Zamiaceae	*Macrozamia riedlei*

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE RESPECTIVE SITE-VEGETATION TYPES IN THE SPION SURVEY AREA

* denotes introduced species, P1 to P4 denotes Prioirty species (DBCA A2007-);
Site-vegetation Type E is not included as this occurred on the fringes of previously mapped near the Spion survey area

Species	AC	CW	D	W	SW	P	PS	PT	SP	S	ST	TS	T	G	R
Bossiaea aquifolium	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Corymbia calophylla	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Eucalyptus marginata	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lasiopetalum floribundum	x	x		x	x	x	x	x	x	x	x	x	x		
Acacia alata var. alata	x	x		x	x				x	x	x				
Tetrarrhena laevis	x	x		x	x		x			x	x		x	x	
Acacia divergens	x	x		x											
Hypocalymma cordifolium	x	x		x							x	x			
Lepidosperma tetraquetrum	x	x		x											
Trymalium odoratissimum	x	x		x											
Clematis pubescens	x	x						x			x	x	x	x	
Eucalyptus rudis	x	x													
Lomandra caespitosa	x		x	x	x		x	x	x	x	x	x	x		x
Thysanotus fastigiatus	x			x	x	x	x	x	x	x	x	x	x	x	
Grevillea prominens (P3)	x			x	x					x	x	x	x	x	
Platysace compressa	x			x	x		x	x	x	x	x	x	x		
Xanthorrhoea preissii	x			x	x					x	x	x	x	x	x
Lasiopetalum sp.	x			x				x				x			
Styphelia discolor	x			x					x	x		x			x
Acacia applanata	x														
Banksia littoralis	x														
Monotaxis occidentalis	x														
Xanthosia singuliflora	x									x	x				x
Macrozamia riedlei		x	x	x	x			x	x	x	x	x	x	x	x
Acacia lateriticola		x		x	x				x						
Drosera sp.		x		x	x		x		x	x	x		x		
Opercularia echinocephala		x		x	x		x	x	x	x	x	x	x		
Persoonia longifolia		x		x	x		x	x	x	x	x	x	x		
Thysanotus dichotomus		x		x	x			x		x					
Xanthosia candida		x		x	x		x		x	x	x			x	
Cassytha sp.		x		x						x					
Eucalyptus megacarpa		x		x								x			
Eucalyptus patens		x		x											
Mirbelia dilatata		x		x							x				
Pteridium esculentum		x		x				x			x	x	x		
Astartea scoparia		x													
Billardiera fusiformis		x													
Gahnia decomposita		x													
Hovea trisperma		x													
Mesomelaena tetragona		x													
Scaevola sp.		x													

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE RESPECTIVE SITE-VEGETATION TYPES IN THE SPION SURVEY AREA

* denotes introduced species, P1 to P4 denotes Prioirty species (DBCA A2007-);
Site-vegetation Type E is not included as this occurred on the fringes of previously mapped near the Spion survey area

Species	AC	CW	D	W	SW	P	PS	PT	SP	S	ST	TS	T	G	R
Senecio sp.		x													
Taxandria linearifolia		x													
Thomasia paniculata		x													
Pericalymma ellipticum			x												
Trymalium ledifolium				x	x	x	x	x	x	x	x	x	x	x	x
Asteraceae sp.				x	x				x	x	x			x	
Banksia dallanneyi subsp. *dallanneyi*				x	x		x	x	x	x	x	x	x		x
Banksia grandis				x	x		x	x	x	x	x	x	x		
Boronia crenulata				x	x					x			x		
Boronia fastigiata				x	x			x	x	x	x	x	x		
Burchardia congesta				x	x					x	x	x	x		
Caladenia sp.				x	x		x			x	x	x	x		x
Chamaescilla corymbosa				x	x		x		x	x	x		x	x	x
Conostylis setigera				x	x		x		x	x	x	x	x		
Desmocladus flexuosus				x	x										
Gompholobium preissii				x	x										
Hakea amplexicaulis				x	x					x	x	x	x		
Hibbertia amplexicaulis				x	x		x	x	x	x	x	x	x		
Hibbertia commutata				x	x		x	x	x	x	x	x	x	x	x
Hovea chorizemifolia				x	x		x		x	x	x	x			
Hypocalymma angustifolium				x	x		x			x		x	x	x	x
Lagenophora huegelii				x	x		x	x	x	x	x	x	x	x	x
Lechenaultia biloba				x	x					x	x				
Leucopogon australis				x	x										
Lomandra hermaphrodita				x	x			x		x	x		x		
Lomandra preissii				x	x		x	x		x	x		x	x	
Lomandra sericea				x	x		x		x	x	x	x	x		
Lomandra sonderi				x	x		x	x	x	x	x	x	x		
Lomandra spartea				x	x				x	x	x				
Lysiandra calycina				x	x		x	x	x	x	x	x	x	x	x
Netrostylis sp. Jarrah Forest (R. Davis 7391)				x	x			x	x	x	x	x	x		
Orchidaceae sp.				x	x		x		x	x	x	x	x		
Patersonia babianoides				x	x					x					
Patersonia rudis				x	x		x		x	x	x				
Pentapeltis peltigera				x	x		x	x	x	x	x	x	x		
Platysace filiformis				x	x		x	x		x	x	x	x		
Poaceae sp.				x	x				x				x	x	
Pterostylis sp.				x	x		x	x	x	x	x	x	x		
Rytidosperma caespitosum				x	x			x	x	x	x		x		
Senecio hispidulus				x	x		x	x	x	x	x	x	x		
Stylidium amoenum				x	x			x	x	x	x	x	x		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE RESPECTIVE SITE-VEGETATION TYPES IN THE SPION SURVEY AREA

* denotes introduced species, P1 to P4 denotes Prioirty species (DBCA A2007-);
Site-vegetation Type E is not included as this occurred on the fringes of previously mapped near the Spion survey area

	Species	AC	CW	D	W	SW	P	PS	PT	SP	S	ST	TS	T	G	R
	Stylidium piliferum				x	x			x	x	x	x		x		
	Tetratheca hirsuta				x	x					x					
	Trichocline spathulata				x	x		x	x	x	x	x	x	x		
	Xanthorrhoea gracilis				x	x			x	x	x	x	x	x		
	Acacia extensa				x							x				
	Amperea simulans				x						x		x	x		
	Dodonaea ?ceratocarpa				x											
	Gompholobium marginatum				x											
	Hemigenia incana				x										x	x
	Hemigenia pritzelii				x						x			x		
	Hibbertia perfoliata				x					x	x					x
*	*Hypochaeris glabra*				x						x			x		
	Lepidosperma sp.				x							x				
	Lepidosperma squamatum				x											
	Leucopogon verticillatus				x					x	x	x	x	x		
	Lomandra nigricans				x						x	x				
	Lomandra purpurea				x					x	x	x				
	Morelotia octandra				x											
	Orchidaceae sp. 1				x					x						
	Orchidaceae sp. 2				x					x	x					
	Pittosporaceae sp.				x						x					
	Senecio diaschides				x						x	x	x	x		
	Stackhousia ?monogyna				x					x	x	x		x		
	Stylidium sp.				x						x			x		
	Styphelia conostephioides				x											
	Styphelia nitens				x							x				
	Styphelia pallida				x			x			x		x	x		
	Thysanotus multiflorus				x						x	x		x		
	Thysanotus sp.				x								x			
	Wahlenbergia sp.				x						x	x		x		
	Acacia drummondii subsp. *candolleana*					x						x				
	Acacia pulchella					x			x		x	x	x	x		
	Adenanthos barbiger					x					x		x			
	Amphipogon amphipogonoides					x						x				
	Chorizema cordatum					x										
	Conostylis serrulata					x				x	x	x		x		
	Cryptostylis ovata					x					x					
	Desmocladus fasciculatus					x										
	Hakea lissocarpha					x										x
	Patersonia occidentalis					x					x					
	Philotheca spicata					x					x					

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE RESPECTIVE SITE-VEGETATION TYPES IN THE SPION SURVEY AREA

* denotes introduced species, P1 to P4 denotes Prioirty species (DBCA A2007-);
Site-vegetation Type E is not included as this occurred on the fringes of previously mapped near the Spion survey area

Species	AC	CW	D	W	SW	P	PS	PT	SP	S	ST	TS	T	G	R
Pterochaeta paniculata					x		x		x	x					
Pterostylis sp. 1					x			x		x	x		x		
Pterostylis sp. 2					x					x	x		x		
Styphelia propinqua					x			x	x	x	x	x	x		
Styphelia tenuiflora					x		x			x					
Thysanotus sparteus					x					x					
Xanthosia huegelii					x								x		
Allocasuarina fraseriana						x	x	x	x	x	x	x			
Bossiaea ornata							x			x					
Persoonia elliptica							x				x	x			
Labichea punctata							x								
Hibbertia sp.								x				x			
Lasiopetalum glabratum								x							
Levenhookia stipitata								x							
Pimelea ciliata								x							
Lomandra sp.									x	x	x	x	x		
Platysace tenuissima									x		x	x			
Platysace sp.									x						
Acacia urophylla										x	x	x	x		x
Opercularia apiciflora										x	x	x	x		
Thysanotus thyrsoideus										x	x	x	x		
Comesperma virgatum										x	x				
Senecio quadridentatus										x	x				
Scaevola calliptera										x		x			
Conostylis pusilla										x					
Dianella revoluta										x					
Kennedia coccinea										x					
Kennedia prostrata										x					
Lomandra drummondii										x			x		
Neurachne alopecuroidea										x				x	
Patersonia pygmaea										x					
Pimelea suaveolens										x					
Styphelia sp.										x					
Levenhookia pusilla											x	x			
Rutaceae sp.											x				
Hardenbergia comptoniana												x			
Patersonia sp.												x			
Pyrorchis nigricans												x			
Apiaceae sp.													x		
Comesperma sp.													x		
Eriochilus sp.													x		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN THE RESPECTIVE SITE-VEGETATION TYPES IN THE SPION SURVEY AREA

* denotes introduced species, P1 to P4 denotes Prioirty species (DBCA A2007-);
Site-vegetation Type E is not included as this occurred on the fringes of previously mapped near the Spion survey area

Species	AC	CW	D	W	SW	P	PS	PT	SP	S	ST	TS	T	G	R
Hibbertia silvestris													x		
Hypocalymma robustum													x		
Marianthus sp.													x		
Allocasuarina huegeliana														x	
Borya sphaerocephala														x	
Calothamnus sp.														x	
Gastrolobium spinosum														x	
Grevillea wilsonii														x	
Leptospermopsis erubescens														x	
Malvaceae sp. ?															x

ASSESSMENT OF FLORA AND VEGETATION VALUES

ALCOA OF AUSTRALIA HAUL ROAD OPTIONS, ONEIL,

HUNTLY MINE, WA

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

Alcoa of Australia Limited

April 2024



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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BOM:	Bureau of Meteorology
DBCA:	Department of Biodiversity, Conservation and Attractions
DCCEEW:	Department of Climate Change, Energy, the Environment and Water
DPIRD:	Department of Primary Industries and Regional Development
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
MATTISKE:	Mattiske Consulting Pty Ltd
IBRA:	Interim Biogeographical Regionalisation for Australia
PEC:	Priority ecological community
RFA:	Regional Forest Agreement
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned in 2023 by GHD on behalf of Alcoa of Australia Ltd (Alcoa) to conduct an assessment of the flora and vegetation values within the ONeil Transport Corridor areas, approximately 60 km south east of Perth, WA. Initially this work entailed a review of past mapping in the area by Mattiske Consulting (2009, 2012) and an updated desktop assessment of the area. Field studies were then undertaken in the spring months of 2023 to search for additional threatened and priority flora and to reassess some of the previous site-vegetation type mapping as undertaken by Mattiske Consulting in a selection of sites. The ONeil Transport Corridor survey area is located in tenement ML 1SA and as such overlaps current Alcoa operational areas and previous mapping areas.

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the ONeil Transport Corridor area. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed again in 2023 in line with some changes in nomenclature from 2022 to 2023.

The ONeil Transport Corridor survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System.

Potential Flora

Based on the previous nearby surveys and the recent additional studies a total of 459 vascular plant taxa, representative of 168 genera and 59 families (Appendix B), have the potential to occur within the ONeil Transport Corridor survey area (Mattiske Consulting 1998-2023). The most commonly represented families were Fabaceae (67 taxa), Proteaceae (53 taxa), Myrtaceae (38 taxa) and Asparagaceae (253 taxa).

A total of twelve threatened flora species and 37 priority flora species has the potential to occur in the ONeil Transport Corridor survey area. Of the threatened flora species, all are considered to have a very low potential of occurring in the Oneil Transport survey area due to the lack of suitable habitat and also know distributions away from the survey area.

In 2023, the data indicated that of the Priority flora species, five priority flora species have a high potential to be in the survey area and four priority flora species have a moderate or moderate to high potential to be in the survey area.

On the basis of databases and previous surveys near or within the Oneil survey areas a total of 15 introduced taxa has the potential to occur in the ONeil Transport Corridor survey area (Appendix C). None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

Potential Vegetation Values

There are no TECs listed at Commonwealth or State level, or PECs listed at State level which would be likely to occur in the ONeil Transport Corridor survey area.

The ONeil Transport Corridor survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2024b) and as such was considered during the RFA process.

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the ONeil Transport Corridor survey area. In view of the proximity of the survey areas to the well-established North-East Road it is extremely unlikely that there will be additional old growth forests in the survey area. The ONeil Transport Corridor has areas of dieback in some of the valley systems.

Survey Effort

The survey effort in the ONeil Transport Corridor survey areas includes multiple survey efforts by Mattiske Consulting (2009, 2012) from the earlier flora and vegetation studies to the more recent targeted work and re-assessment of sites in a range of the site-vegetation types within the survey area.

Recorded Flora

In the more recent targeted flora and vegetation studies (including re-assessment of 45 sites a total of 122 vascular plant taxa, representative of 66 genera and 37 families (Appendix C), have been recorded in the ONeil Transport Corridor survey area. The most commonly represented families were Fabaceae (13 taxa), Myrtaceae (12 taxa), Asparagaceae (11 taxa), Proteaceae (9 taxa) and Asteraceae (7 taxa). .

A total of 2 priority flora species (*Hibbertia hortiorum* P1 and *Senecio leucoglossus* P4) were recorded in the ONeil Transport Corridor survey area. The *Hibbertia hortiorum* appears relatively regularly and in part reflects the recent split of *Hibbertia commutata* into multiple species by Kevin Thiele (2019). Recent work since this study by the Mattiske team has located this Hibbertia priority species outside the ONeil Transport Corridor survey area. The identification of this *Hibbertia* species as a Priority species has been confirmed at the State Herbarium.

Recorded Vegetation

A total of 17 site-vegetation types were defined and mapped in the ONeil Transport Corridor survey area and an addition two mapping units (CL cleared land and Rehabilitation areas). The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years. It is clearly apparent that there are some dominant site-vegetation types that dominate the ONeil Transport Corridor survey area (namely SP, S and TS which together cover 45.3% of the survey area). A total of some 26.55% of the area has been either cleared or rehabilitated within the ONeil Transport Corridor.

None of these site-vegetation types are restricted to the ONeil Transport Corridor survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2024e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2024b) within the ONeil Transport Corridor survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2024a) within the ONeil Transport Corridor survey area. At a State or National level none of the site-vegetation types have been listed as Threatened or Priority Ecological Communities.

1. INTRODUCTION

Mattiske Consulting Pty Ltd (Mattiske) was commissioned by GHD on behalf of Alcoa of Australia Ltd (Alcoa) to conduct a desktop assessment and field assessment to evaluate the flora and vegetation values within the ONeil Transport Corridor areas, approximately 80 km south east of Perth, WA. Alcoa wishes to expand their mining operations into the ONeil Transport Corridor region. The ONeil Transport Corridor survey area is located in tenement ML 1SA and consists of three priority areas as defined by Alcoa of Australia Ltd. These studies incorporated previous data from transects in the northern section undertaken by Mattiske for Alcoa over a series of monitoring times from 1994 to 2015 in the Cameron block and from recent permanent plots established in 2023 within the ONeil Transport Corridor areas.

1.1. Location and Scope of Project

The ONeil Transport Corridor survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province (Beard 1990), approximately 80 km south of Perth, WA (Figure 1). The ONeil Transport Corridor survey area consists of one polygon located in tenement ML 1SA (Figure 2).

This report describes the potential and recorded flora and vegetation values of the proposed ONeil Transport Corridor survey area and places them within a local and regional context.

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The following key Western Australian (state) legislation relevant to this survey includes the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) and *Regulations 2013*;
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

Furthermore, key Western Australian guidelines relevant to this survey are the:

- Environmental Factor Guideline: Flora and Vegetation (Environmental Protection Authority [EPA] 2016a);
- Technical Guidance – Flora and vegetation surveys for environmental impact assessment (EPA 2016b); and
- Survey Guidelines for Australia's Threatened Orchids. Guidelines for detecting Orchids listed as "Threatened" under the *Environment Protection and Biodiversity Conservation Act 1999*. (Commonwealth of Australia 2013)

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-A5.



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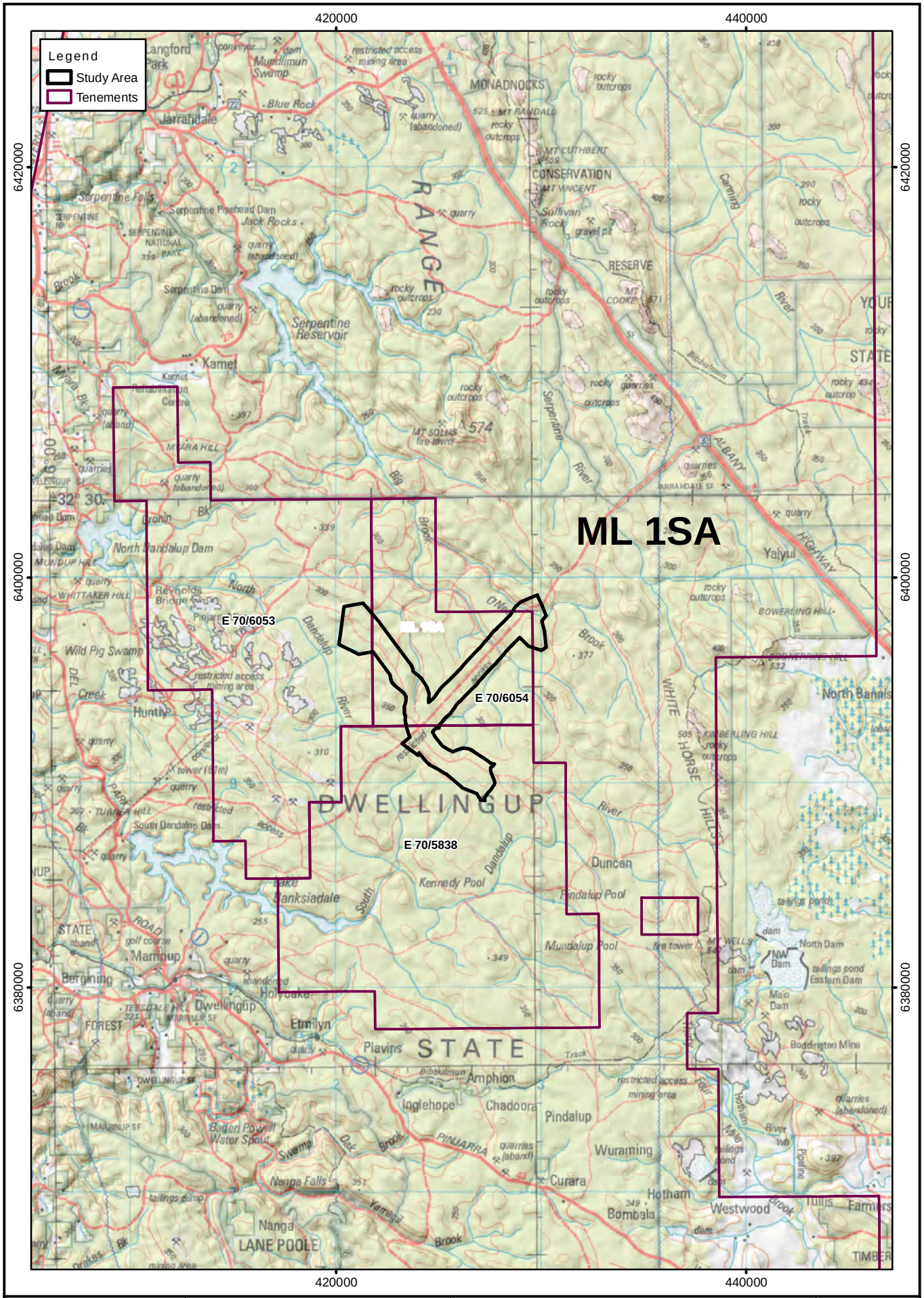
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Transport Corridor
Locality

Figure: **1**



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Transport Corridor
Tenements

Figure: **2**

2. OBJECTIVES

The objective of this assessment was to combine the earlier desktop assessment and the findings from the recent field studies of the ONeil Transport Corridor survey area, including:

- A desktop assessment of the flora and vegetation of the ONeil Transport Corridor survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Review previous literature and current databases associated with the ONeil Transport Corridor survey area;
- A summary of key findings from the detailed studies (plots, recording sites, transects and targeted surveys) conducted within the ONeil Transport Corridor area;
- Review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA 2023a, 2023c) and plant collections held at the Western Australian Herbarium ([WAH] 1998 -), and plants listed by the Department of Climate Change, Energy and the Environment [DCCEEW] (2024a) under the EPBC Act; and
- Prepare a report summarising the findings.

3. METHODS

3.1. Desktop Assessment

The NatureMap (DBCA 2007-) and EPBC Act Protected Matters Search Tool (DCCEEW 2023b) databases were used to identify the possible occurrence of flora (including threatened and priority taxa) and threatened and priority ecological communities within the ONeil Transport Corridor survey area.

In addition, historical documentation and vegetation mapping of the Northern Jarrah Forest subregion that provide resource material for the floristics and vegetation of the ONeil Transport Corridor survey area was reviewed, including Mattiske Consulting Pty Ltd (2009-2012) reports on their flora and vegetation surveys in the ONeil Transport Corridor region. Nomenclature of flora species was checked against and is consistent with Florabase (WAH 1998-).

3.2. Field Studies

To maintain consistency with previous mapping of the area, enabling spatial and temporal comparisons, flora and vegetation were assessed using site-type classification based on Heddle *et al.* (1980). Sites were pre-designated using a grid system overlaid on the survey area. Additional opportunistic sites were surveyed when changes in the vegetation, representing communities which would otherwise have been missed, were encountered whilst walking between designated survey sites. Site data was used to define vegetation types for each survey site. This data was then used in combination with aerial imagery and field observations to map the vegetation of the survey area. Furthermore, searches for threatened, priority or Declared (plant) pests species were undertaken whilst walking between survey sites.

The following information was recorded at each vegetation assessment site:

GPS location	Easting, Northing and datum;
Soil types	gravels, sandy-gravels, sandy-loam-gravels, sandy-loams, loams, clay-loams, clays and peat;
Topography	ridge, upper slope, mid-slope, lower slope, valley floor and swamp;
Outcropping	type – granite, laterite, dolerite, and quantity – few, moderate, numerous;
Logging history	light, moderate or heavy, together with number of stumps within a 20 m radius;
Fire history	years since last fire; and

Dieback occurrence *Phytophthora* spp. demarcation – field blazing, coloured flagging on trees, vegetation deaths, either old or recent.

At each site species were ranked according to the scale developed by Havel (1975a, 1975b). Tree and understorey species were assessed separately using the following method.

Tree species

Tree species (*Allocasuarina fraseriana, Banksia grandis, B. littoralis, B. seminuda, Corymbia calophylla, Eucalyptus marginata, E. megacarpa, E. patens, E. rudis, E. wandoo, Melaleuca preissiana, M. rhaphiophylla, Nuytsia floribunda, Persoonia elliptica, P. longifolia* and *Xylomelum occidentale*) were assessed within a 20 m radius from the observation point using the following scale:

0 absent;
1 one or two trees;
2 three to five trees;
3 more than five trees, but contributing less than one third of the total stand;
4 between one third and one half of the total stand; or
5 more than one half of the total stand.

Understorey species

Understorey species were assessed within a 5 m radius from the observation point using the following scale:

0 absent;
1 very rarely seen, only after a careful search;
2 present, observable, but in small numbers only;
3 common locally, but not uniform over the whole area;
4 common over the whole area; or
5 completely dominating the understorey.

The physiological stress was determined for each species within a 20 m radius from the observation point and ranked according to the following scale.

0 healthy, no evidence of stress;
1 odd plant showing signs of stress, not dead;
2 one or two dead plants, near death;
3 scattered stressed plants, (2-4) dead plants around survey site;
4 susceptible plants dying or dead (> 4 plants); or
5 “graveyard” death

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH). All plant specimens were identified through comparisons with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

3.3. Survey Limitations

A general assessment was made of the current survey area against a range of factors that may have limited the outcomes and conclusions of this report (Table 1).

Table 1: Potential flora and vegetation survey limitations for the ONeil Transport Corridor survey area

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Reference resources such as mapping by Beard 1979, Mattiske and Havel 1998, previous vegetation mapping completed for Alcoa by E.M Mattiske and Associates together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora, which were the focus of the present survey were thoroughly sampled on a grid pattern within the survey area.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Minor constraint:** The survey areas were sampled on a grid pattern. The botanists undertaking the field surveys have had extensive experience working with the flora of the Jarrah forest. Any flora which could not be identified in the field was collected for subsequent identification. Only minor constraint was the difficulty of assessing the total extent of the Priority 1 *Hibbertia hortiorum* records as this taxon was included in the earlier H*ibbertia commutata* records in previous assessments. Thiele (2019) split the Hibbertia commutate into multiple taxa and as a result the historical records for *Hibbertia commutata* may include more occurrences of the Priority species in the survey area. Therefore there is a need in this report to rely on the concentrated effort near the current tracks and also the wider 2023 records to summarize the occurrence of this species. In addition, the relationships of the Priority Hibbertia species with the site-vegetation types was also reviewed and summarized.
Mapping reliability	**Not a constraint:** The vegetation were assessed on a grid pattern within the survey area. This together with opportunistic survey sites will provide high quality data enabling the survey area to be mapped with a high level of confidence.
Timing, weather, season, cycle	**Not a constraint:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). The sampling was undertaken in the spring months of 2023 and when combined with the extensive work undertaken in the area and in adjacent areas reduces the risk of not covering the flora species. With regard to the conservation significant flora, the majority identified as potentially occurring within the survey area can be recorded out of season with the exception of some orchid species which do not flower as regularly and some *Drosera* species. Further detailed work will be undertaken in 2024.
Disturbances (fire flood, accidental human intervention, *etc.*)	**Potential Constraint:** Some areas had been recently burnt and hence it was necessary to extrapolate from nearby mapping. Generally, many species take 2 to 3 years to recover after burns in the northern Jarrah forest. **P**revious logging activities have been undertaken for many decades in this area. Some forestry areas had been burned recently; this affected the ability to accurately define vegetation communities. These land uses and activities may influence surveys in the area.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** Vehicle access was not restricted in the survey areas.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** All botanists had direct and recent experience working in the Jarrah Forest and working for Alcoa, and thus were familiar with the local flora and vegetation values. Dr Mattiske has more than 40 years of ecological experience in flora and vegetation studies in the southwest forests.

4. RESULTS

The climate, geology, soils and landforms all influence the vegetation of the area and are described in this section. Potential flora, including threatened, priority and introduced species are described, along with possible vegetation communities, and placed within a local and regional context.

4.1. Climate

The survey area lies in the Northern Jarrah Forest subregion. Beard (1990) described the climate of this area as being warm Mediterranean, with rainfall of 600 – 1200 mm per annum and 5 - 6 dry months per year. Annual average rainfall at Dwellingup is 1218.5 mm (Bureau of Meteorology [BOM] 2024). Rainfall in 2021 (1335.4mm) was higher than the long term (LT) of 1221.8mm, see Figure 3. The rainfall decreased in 2022 to 1009.2mm for the year and for the 11 months (January to November in 2023) to 951.6mm, Figure 3. The trend of lowering rainfall is not replicated in similar changes to the temperature.

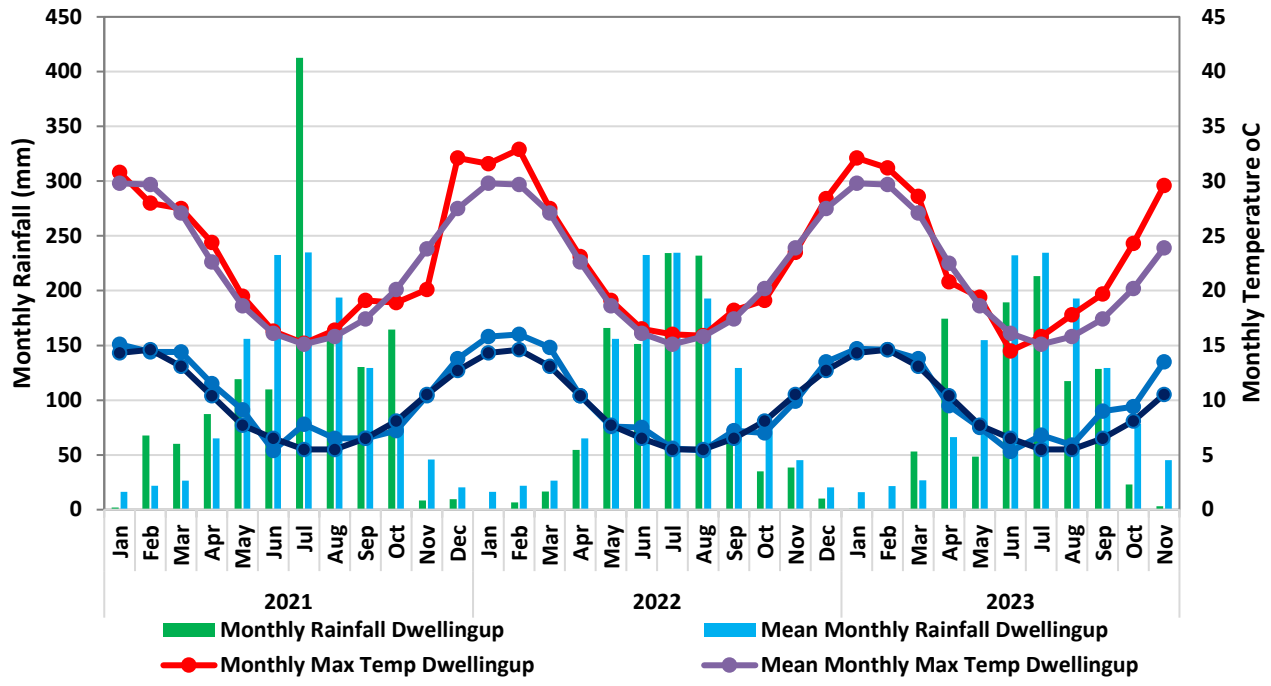
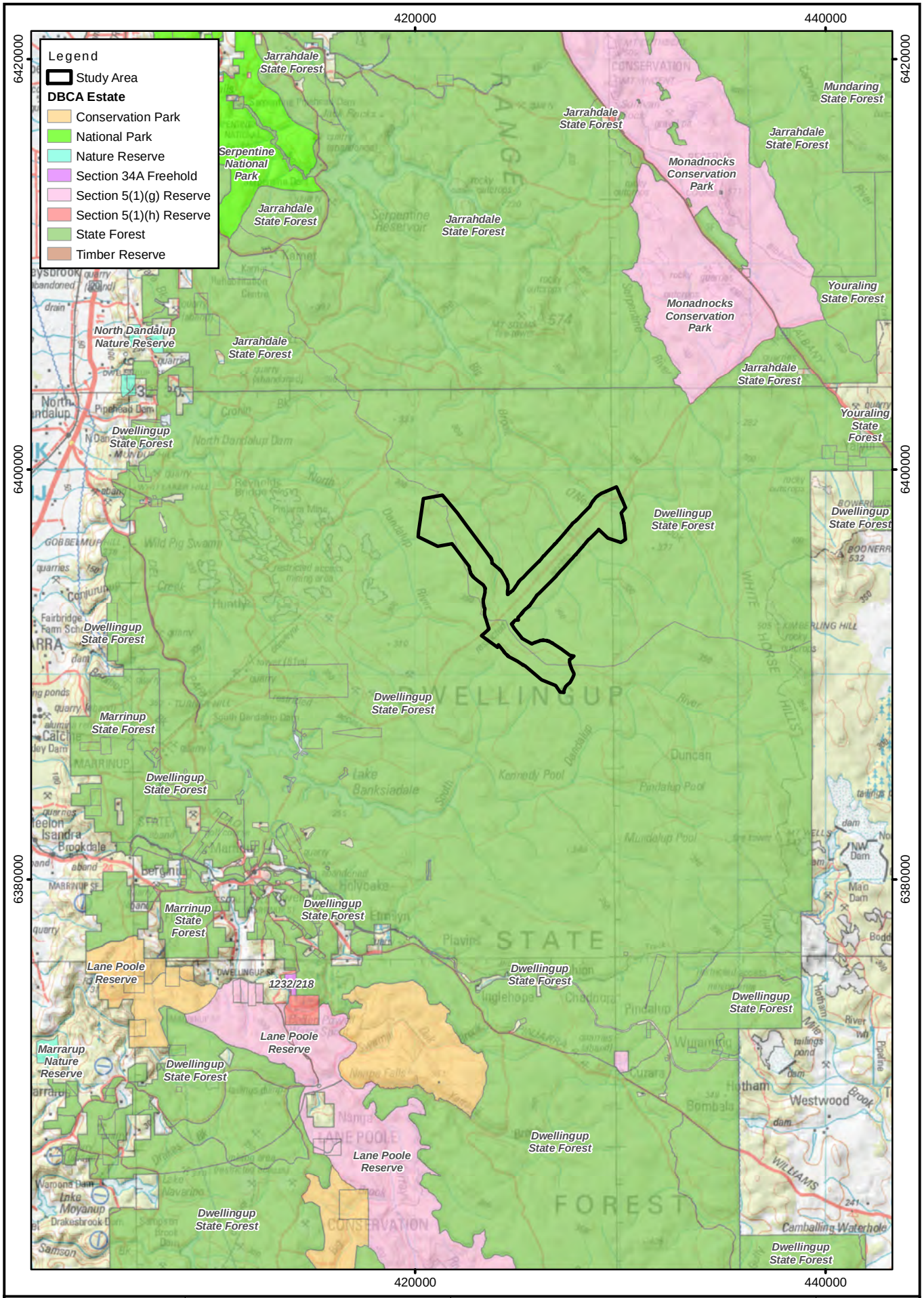


Figure 3: Climatic data for ONeil Transport Corridor survey area (BOM 2024)
Long term average rainfall and temperature from the Dwellingup weather station

4.2. DBCA Estates

The ONeil Transport Corridor survey area is situated in State Forest to the north-east of Dwellingup (Figure 4).



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Transport Corridor
DBCA Estates

Figure: **4**

4.3. Geology, Soils and Topography

The ONeil Transport Corridor survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion encompasses the area to the east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of the Yilgarn Craton at an average elevation of 300 m (Beard 1990). The area is capped by extensive lateritic duricrust, dissected by drainage lines and broken by occasional granite hills. In the eastern section, the laterite becomes deeply dissected until it compresses isolated remnants. The duricrusted plateau of the Yilgarn Craton is characterised by lateritic gravels, consisting of 5 m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon. This overlay mottled yellow-brown clay subsoils and hard setting loamy soils, which become evident in the east (Beard 1990).

Furthermore, Western Australia is divided into twelve Systems, separated by natural and demographic boundaries (Department of Conservation and Environment 1980). The survey area lies within the Darling System (as known as System 6), which is further divided into provinces, with the survey area lying in The Darling Plateau province (Department of Conservation and Environment 1980).

The underlying geological units of The Darling Plateau province have been defined by Churchward and McArthur (1980), with three main landform and soil units occurring within the survey areas, these are:

Dwellingup: Gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions.

Yarragil: Valleys of the western part of the plateau; sandy gravels on the slopes; orange earth in swampy floors.

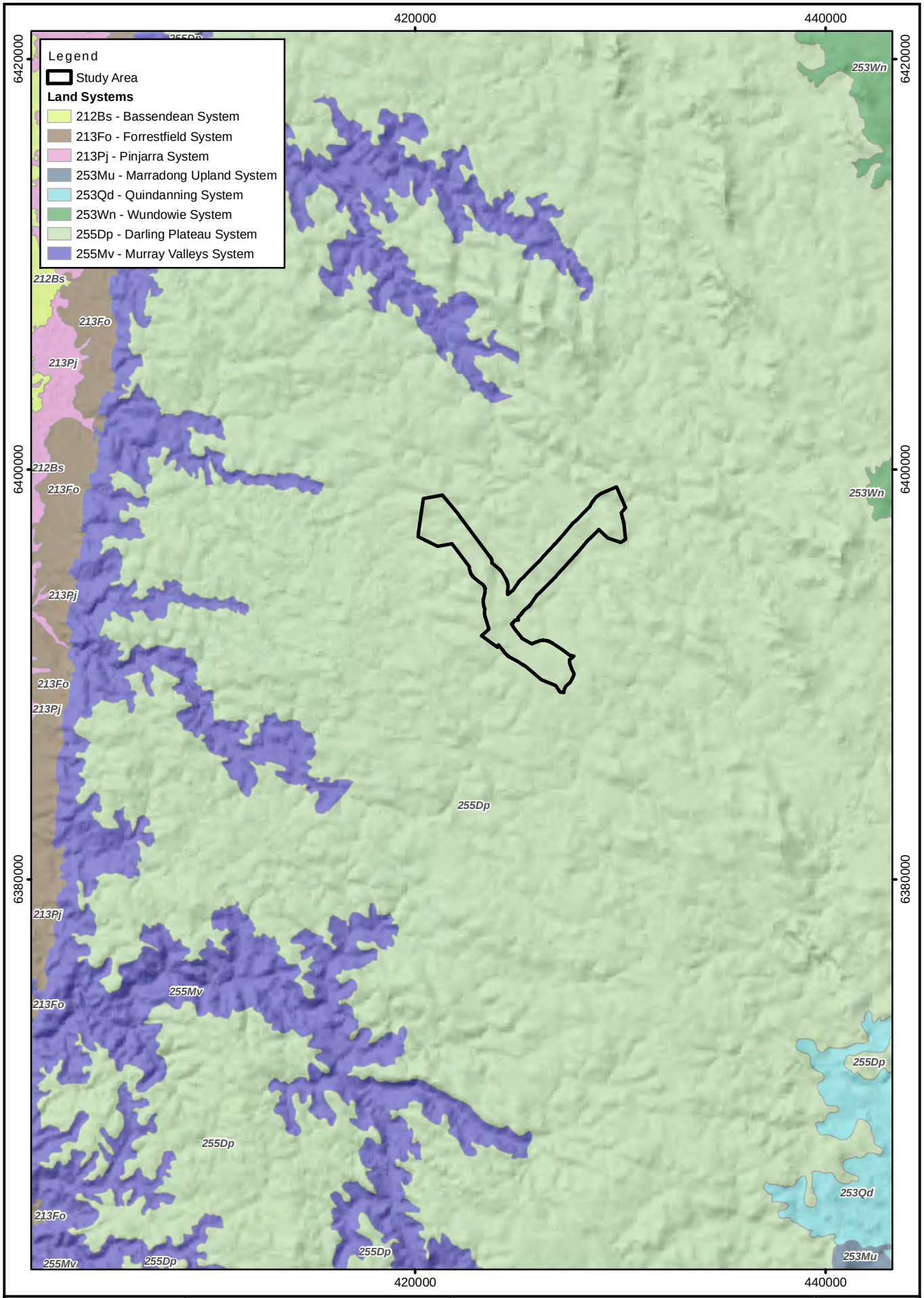
Cook: Hills rising above general plateau level ; mainly laterite but with some rock outcrop.

The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the ONeil Transport Corridor survey area (Figure 5, Table 2) includes:

1. **Darling Plateau System (255Dp):** Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah-marri-wandoo forest and woodland.

Table 2: Extent of Land Systems intersecting the ONeil Transport Corridor survey area

Land System	Mapping Unit	Total Extent (ha)	Area of Intersection with the ONeil Transport Corridor survey area	Proportion of Current Extent (%)
Darling Plateau System	255Dp	820265.73	2592.57	0.316



N

0 2 4 km

Scale: 1:250,000
MGA94 (Zone 50)

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Transport Corridor
Land Systems

Figure: **5**

4.4. Regional Vegetation

The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent. In lower rainfall areas towards the east trees decrease in size, forming woodlands or low forests. This dry sclerophyllous forest typically comprises a dominant *Eucalyptus marginata* and *Corymbia calophylla* overstorey, a mid-storey of *Allocasuarina fraseriana* (Sheoak), *Banksia grandis* (Bull Banksia), *Persoonia longifolia* (Snottygobble), *Persoonia elliptica* (Spreading Snottygobble), and a groundcover of woody shrubs with grass trees *Xanthorrhoea preissii*, *Kingia australis* and the cycad *Macrozamia riedlei* (Dell and Havel 1989).

The Pre-European vegetation system present within the ONeil Transport Corridor survey area (Figure 6, Table 3) includes:

1. **West Darling System**

   Vegetation Association 3.3: Mainly jarrah and marri *Eucalyptus marginata, Corymbia calophylla*.

Table 3: Extent of pre-European vegetation associations intersecting the ONeil Transport Corridor survey area

System	Vegetation Association	State-wide Pre-European Extent (ha)	Area of Intersection with the ONeil Transport Corridor survey area (ha)	Proportion of Current Extent (%)
West Darling	3.3	485226	2593	0.5

Heddle *et al.* (1980) and Mattiske and Havel (1998) described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes (Regional Forest Agreement vegetation complexes) and determined how they relate to the landforms, soils and climatic conditions. Four broad vegetation complexes occur in the ONeil Transport Corridor survey area (Figure 7, Table 4), these are:

Dwellingup 1 (D1): Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.

Dwellingup 2 (D2): Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones.

Cooke (Ce): Mosaic of Open Forest of E*ucalyptus marginata* subsp. *marginata – Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp*. thalassica – Corymbia calophylla* (semi-arid and arid zones) and on the deeper soils adjacent to outcrops closed heath of Myrtaceae-Proteaceae species and lithic complex on granite outcrops and associated soils in all climatic zones with some *Eucalyptus laeliae* (semi-arid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to perarid zones).

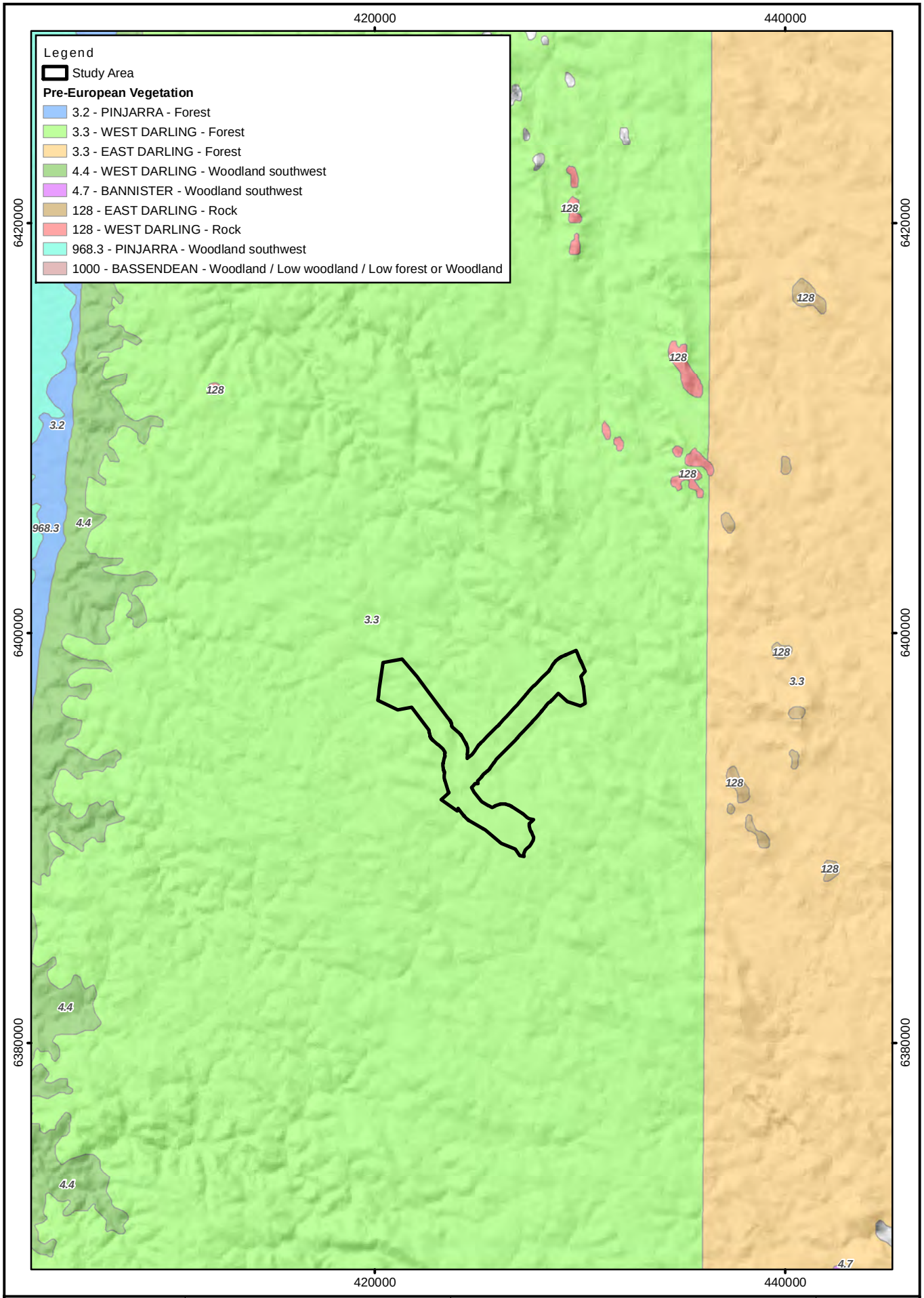
Yarragil 2 (Yg2): Open Forest of *Eucalyptus marginata* subsp. *thalassica* - *Corymbia calophylla* on slopes, woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.

Swamp (S): Mosaic of open woodland of *Melaleuca preissiana – Banksia littoralis,* closed scrub of Myrtaceae spp., closed heath of Myrtaceae spp., and sedgelands of *Baumea* and *Leptocarpus* spp. On seasonally wet and moist sand, peat and clay soils on valley floors in all climatic zones.

More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area falling within the Northern Jarrah Forest subregion (JF1) of the Jarrah Forest (JAF) Region (DCCEEW 2024c). The vegetation of the Northern Jarrah Forest subregion consists of Jarrah – Marri forest, with Bullich and Blackbutt in the valleys to the west, grading to Wandoo and Marri woodlands to the east. Heath vegetation is the common understorey of forests and woodlands and occurs on granite rocks. The majority of the diversity between communities in this subregion occurs on lower slopes and near granite soils (Williams and Mitchell 2001).

Table 4: Extent of Vegetation Complexes intersecting the ONeil Transport Corridors survey area

Area (Blocks)	Vegetation Complex	Vegetation Class	Total Extent (ha)	Area of Intersection with the ONeil Transport Corridor survey area (ha)	Proportion of Current Extent (%)
ONeil Transect Corridors	Coole	Ce	51872	7.6	0.02
	Dwellingup 1	D1	297625	1937.9	0.65
	Dwellingup 2	D2	120755	24.7	0.02
	Swamp	S	76246	40.6	0.05
	Yarragil 2	Yg2	71234	581.8	0.82



N

0 2 4 km

Scale: 1:250,000
MGA94 (Zone 50)

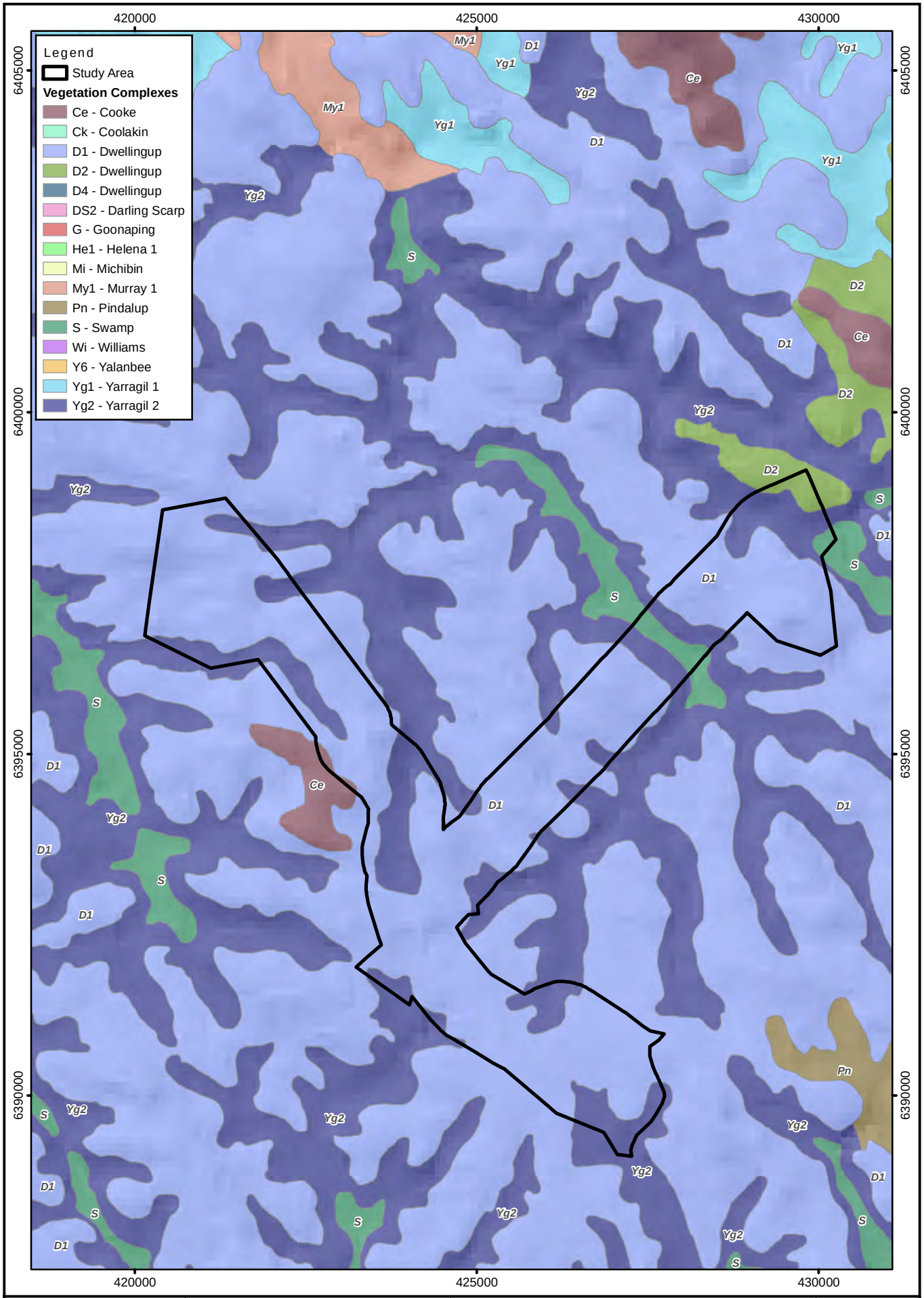
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Transport Corridor
Pre-European Vegetation

Figure: **6**



N

0 0.55 1.1 km

Scale: 1:75,000
MGA94 (Zone 50)

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Transport Corridor
Vegetation Complexes

Figure: **7**

4.5. Potential Flora

Based on the previous nearby surveys and the recent additional studies a total of 459 vascular plant taxa, representative of 168 genera and 59 families (Appendix B), have the potential to occur within the ONeil Transport Corridor survey area (Mattiske Consulting 1998-2023). The most commonly represented families were Fabaceae (67 taxa), Proteaceae (53 taxa), Myrtaceae (38 taxa) and Asparagaceae (253 taxa).

4.5.1. Potential Threatened and Priority Flora

A total of twelve threatened flora species and 37 priority flora species has the potential to occur in the ONeil Transport Corridor survey area. Of the threatened flora species, all are considered to have a very low potential of occurring in the Oneil Transport survey area due to the lack of suitable habitat and also know distributions away from the survey area.

In 2023, the data indicated that of the priority flora species, five species have a high potential to occur in the survey area and four priority flora species have a moderate or moderate to high potential to occur in the survey area.

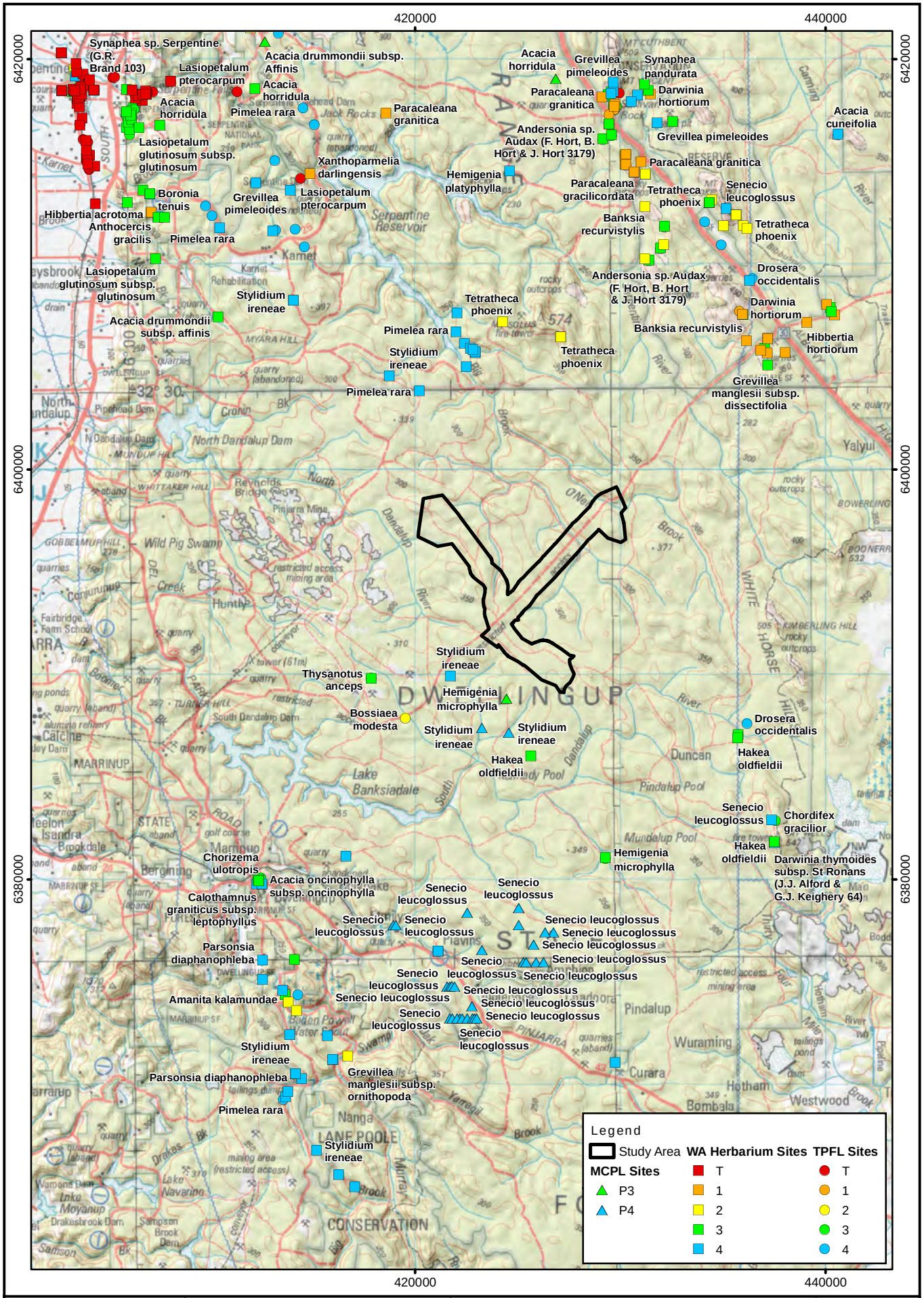
The likelihood that these species would occur within the survey areas was determined using the following criteria:

- Known records within a 20 km radius of the centre of the survey area (as described above). More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).
- The likelihood was ranked Low, Moderate or High.

All potential threatened and priority flora are listed in Appendix B, along with their State and Federal Conservation Codes (see Appendix A for definitions), a description and an assessment of the likelihood of their occurrence in the ONeil Transport Corridor survey area.

Based on this assessment, five priority flora species had a high likelihood of occurring in the ONeil Transport Corridor survey area, Appendix C and Figure 8. These included *Hibbertia hortiorum* (P1), *Tetratheca phoenix* (P2), *Pimelea rara* (P4), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4).

A further four priority flora had a moderate to high and moderate-high likelihood of occurrence in the Oneil Transport Corridor survey area (Appendix C). These included *Adenanthos cygnorum* subsp. *chamaephyton* (P3), *Andersonia* sp. Audax (F. Hort, B. Hort & J. Hort 3179) (P3), *Cyathochaeta teretifolia* (P3) and *Thysanotus anceps* (P3).



N

0 2 4 km

Scale: 1:250,000
MGA94 (Zone 50)

CAD Ref: a1992_F026_05

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Transport Corridor

Threatened and Priority Flora

Figure: 8

4.5.2. Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

On the basis of databases and previous surveys near or within the Oneil survey areas a total of 15 introduced taxa has the potential to occur in the ONeil Transport Corridor survey area (Appendix C). None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

An assessment of the likelihood that the significant weed species (Weeds of National Significance and/or declared pest organisms) would occur within the ONeil Transport Corridor survey area was determined using the following criteria:

- Known records within a 10-20 km radius of the centre of the survey area, based on studies that overlap the survey area or that have been recorded in nearby areas
- More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).

The majority of the weeds are relatively short-lived species that will not compete with native species unless the vegetation is cleared or disturbed.

4.6. Groundwater Dependant Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes (Yarragil 2 and Swamp), Figure 9. In view of the extensive flora and vegetation studies in the Northern Jarrah Forest subregion these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture in the absence of site-vegetation type data.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Acacia divergens, Boronia molloyae, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Eucalyptus patens, Hypocalymma angustifolium, Melaleuca preissiana, Melaleuca viminea* and *Taxandria linearifolia.*



N

0 0.55 1.1 km

Scale: 1:75,000
MGA94 (Zone 50)

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Transport Corridor

Potential GDE

Figure:

9

4.7. Old Growth Forests

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the ONeil Transport Corridor survey area (Figure 10).

Due to the proximity of the proposed transport corridoes to the main North-East Road is unlikely that there will be additional old growth forests in the survey area.

The data as presented on the history of harvesting in the area reflects the age of logging on the ONeil Transport Corridor survey area, see Figure 11. The data in Figure 11 reflects the more recent logging in the northern options which in part reflects the operational activities of Alcoa (pre mining). Some of the valley areas have not been logged for some time and as such reflect the linear patterns of these systems.

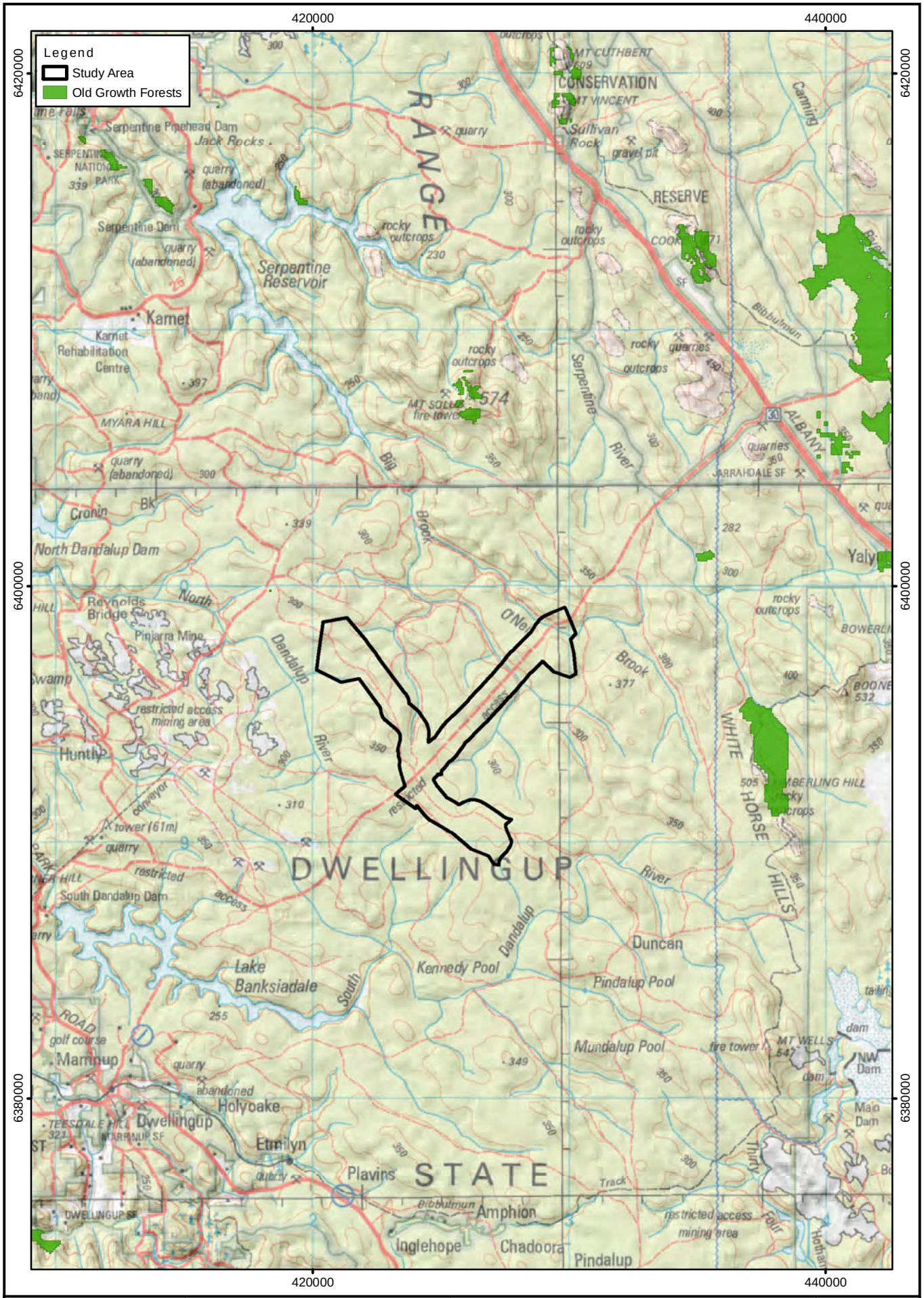
4.8. Previous Surveys

Mattiske Consulting has previously mapped the vegetation in the areas surrounding the ONeil Transport Corridor survey area. Recent flora and vegetation studies relevant to the ONeil Transport Corridor survey area include the previous flora and vegetation studies and transect monitoring has been done in the nearby Cameron block (including the sub-catchment Gordon) since 1993 (E.M. Mattiske and Associates 1993 to 1994; and Mattiske Consulting 1996 to 2006) and the ONeil Transport Corridor areas (Mattiske Consulting Pty Ltd 2009, 2012).

4.9. Potential Threatened and Priority Ecological Communities

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2043e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023c) with the potential to occur within the ONeil Transport Corridor survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2023b) with the potential to occur within the ONeil Transport Corridor survey area.



N

0 1.5 3 km

Scale: 1:200,000
MGA94 (Zone 50)

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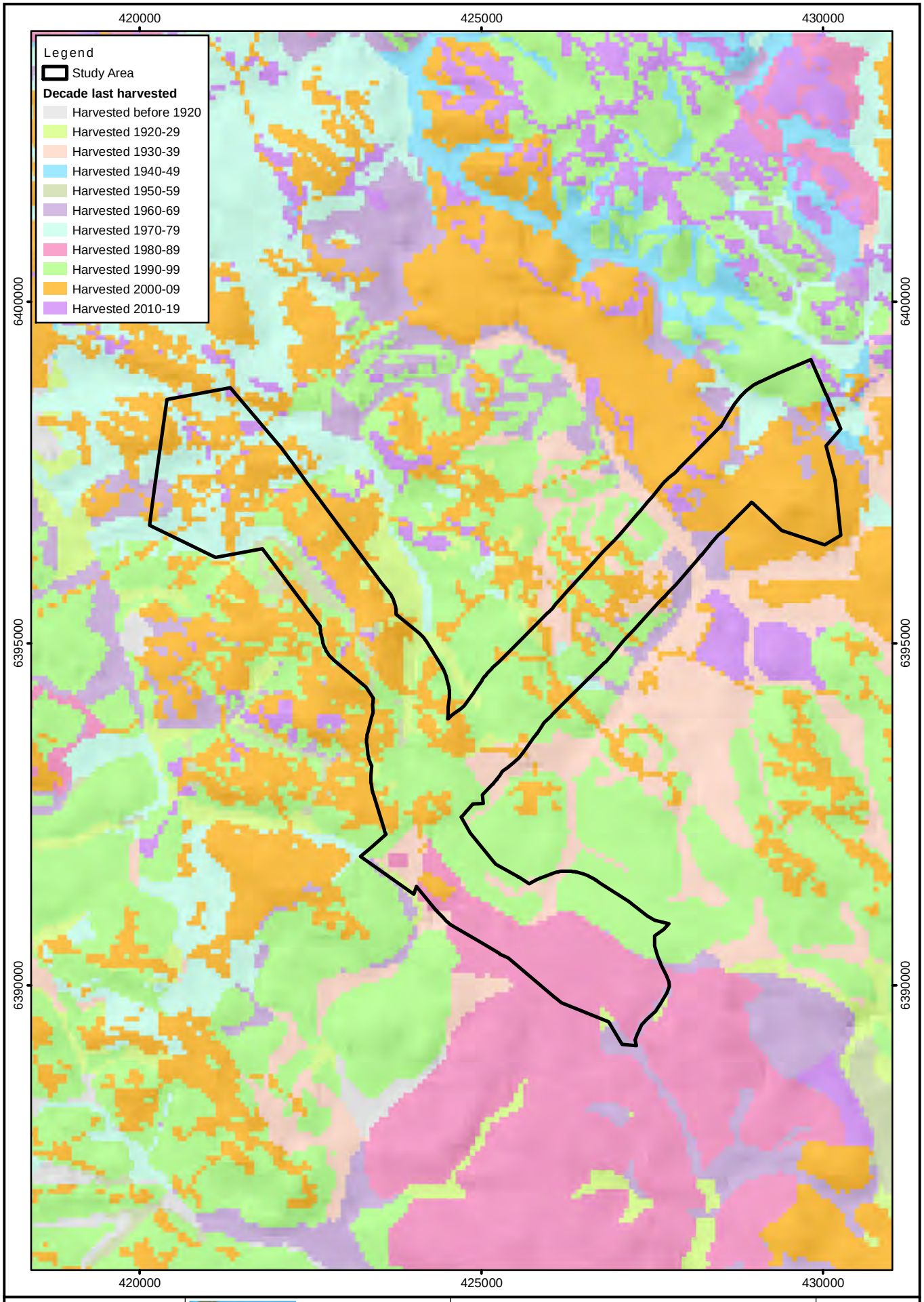
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Transport Corridor

Old Growth Forest

Figure:

10



N

0 0.55 1.1 km

Scale: 1:75,000
MGA94 (Zone 50)

CAD Ref: a1992_F026_10

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Transport Corridor
Harvested Year

Figure:

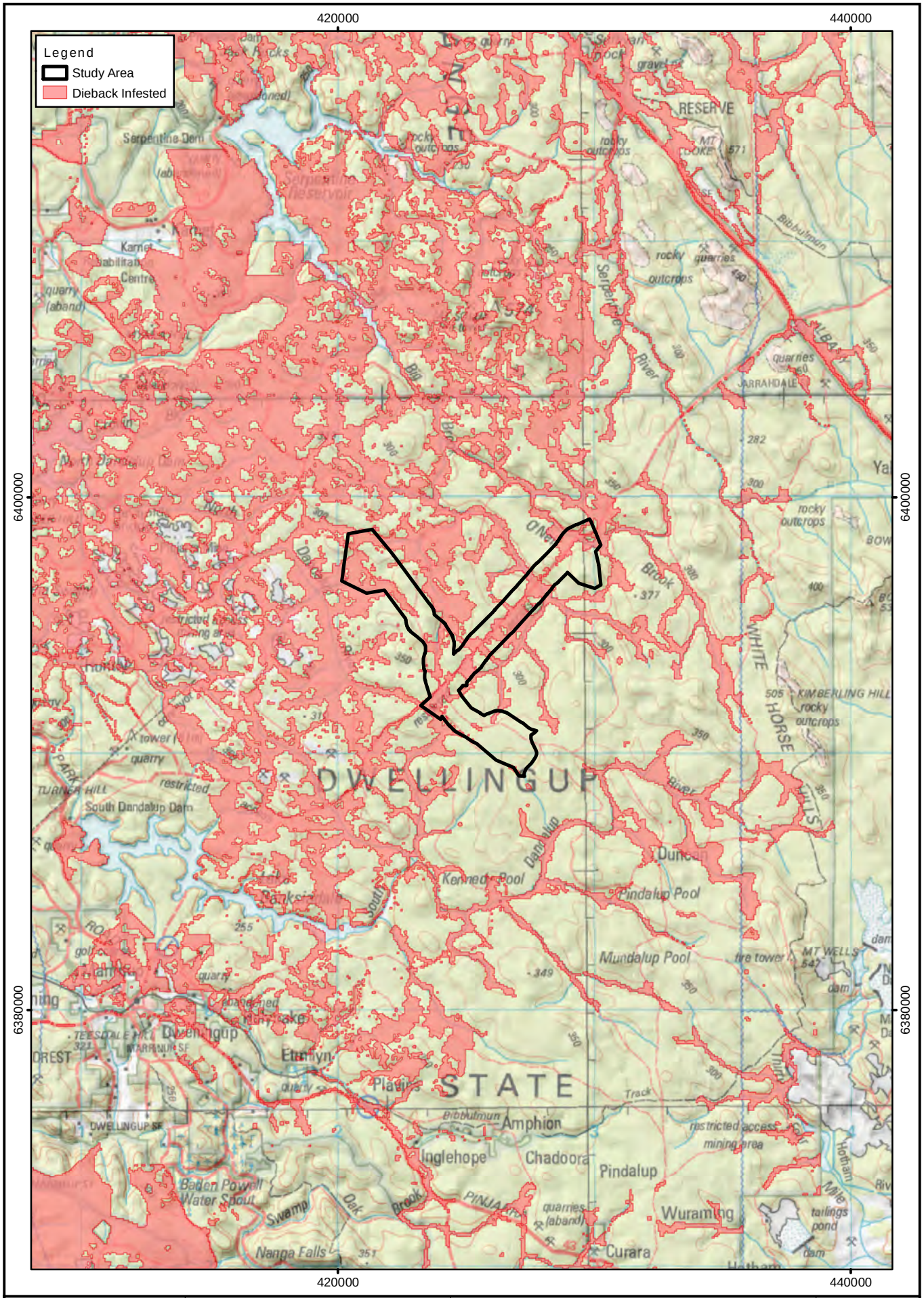
11

4.10. Wetlands of International Importance (Ramsar)

The Peel-Yalgorup System, a listed Ramsar Wetland of International Importance, is located adjacent to the City of Mandurah and consists of shallow estuaries, freshwater marshes and coastal saline lakes that include the Harvey Estuary, Peel Inlet, Lake McLarty, Lake Mealup and ten Yalgorup National Park wetlands (DCCEEW 2024f). The fringing vegetation is mainly samphire, rushes, sedges and paperbark communities. The Peel-Yalgorup System supports a wide variety of waterbirds, invertebrates and estuarine and marine fish and is considered the most important area for waterbirds in south-western Australia (DCCEEW 2024f). Whilst these potential values were recognized in the National database search (DCCEEW 2024f) these wetlands occur 50km west of the survey area and not in the ONeil Transport Corridor survey area.

4.11 Review of Dieback Occurrence

The dieback data as shown on Figure 12 reflects the most up to date dieback interpretation data from both DBCA and Glevan Consulting for the ONeil Transport Corridor survey area. Sections of the ONeil Transport Corridor survey area have been infested with the dieback disease caused by *Phytophthora cinnamomi*. In other areas of the survey area the dieback infections are concentrated to the valleys systems. There may be some differences also in coverage and sampling in some of the areas of ONeil Transport Corridor survey area.



N

0 1.5 3 km

Scale: 1:200,000
MGA94 (Zone 50)

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Transport Corridor
Dieback

Figure:
12

5. RESULTS

5.1 Survey Effort

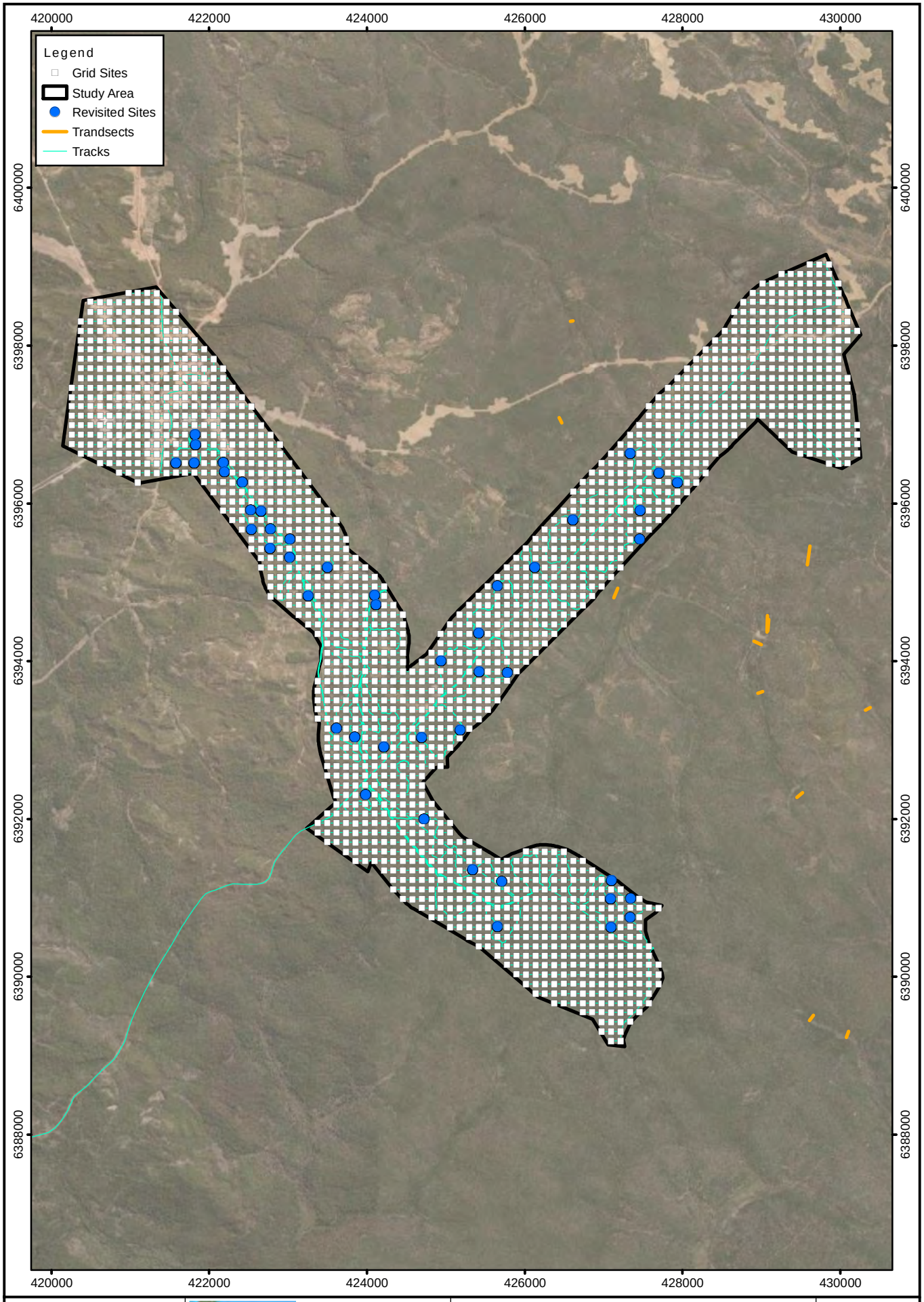
The survey effort is summarized in Table 5 and Figure 13 and in the following text.

. Previous detailed studies were undertaken by the Mattiske Consulting team on some 2047 sites for assessing native vegetation.
. Additional targeted flora and vegetation mapping was undertaken over two months from August 2023 to September 2023 by 4 experienced botanists from Mattiske Consulting.
. Targeted re-assessment of 45 sites was undertaken in the spring months of 2023.

Table 5 provides a summary of the number of recording sites in each site-vegetation type. The more restricted site-vegetation types are obviously less well represented in the recording sites. None of the site-vegetation types are restricted to the survey area.

Table 5: Sampling Intensity in the respective areas of each Site-Vegetation Type

Site-vegetation Type	No Recording Sites (pre-2023)	No. Reassessed Sites (2023)	ONeil Transport Corridors (ha)	% Total Survey Area
A	2	-	1.834	0.07
AC	100	2	73.772	2.85
AW	6	-	3.5	0.14
C	36	2	16.359	0.63
CW	36	2	23.386	0.9
W	90	2	76.226	2.94
DA	-	-	1.285	0.05
D	180	2	131.509	5.07
G1	2	-	2.362	0.09
R	6	-	3.695	0.14
PS	108	-	76.051	2.93
PT	46	2	28.332	1.09
PW	54	3	40.318	1.56
SW	114	2	79.299	3.06
S	670	11	479.312	18.49
SP	512	2	372.414	14.36
ST	172	6	117.036	4.51
TS	436	5	322.895	12.45
T	80	4	54.646	2.11
CLEARED	236	-	171.025	6.6
REHABILITATION	724	-	517.315	19.95
TOTAL	3610	45	2592.572	



N

0 490 980 m

Scale: 1:65,000
MGA94 (Zone 50)

CAD Ref: a1992_F026_16

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Transport Corridor
Survey Effort

Figure:

13

5.2 Flora

In the more recent targeted flora and vegetation studies (including re-assessment of 45 sites a total of 122 vascular plant taxa, representative of 66 genera and 37 families (Appendix C), have been recorded in the ONeil Transport Corridor survey area. The most commonly represented families were Fabaceae (13 taxa), Myrtaceae (12 taxa), Asparagaceae (11 taxa), Proteaceae (9 taxa) and Asteraceae (7 taxa). .

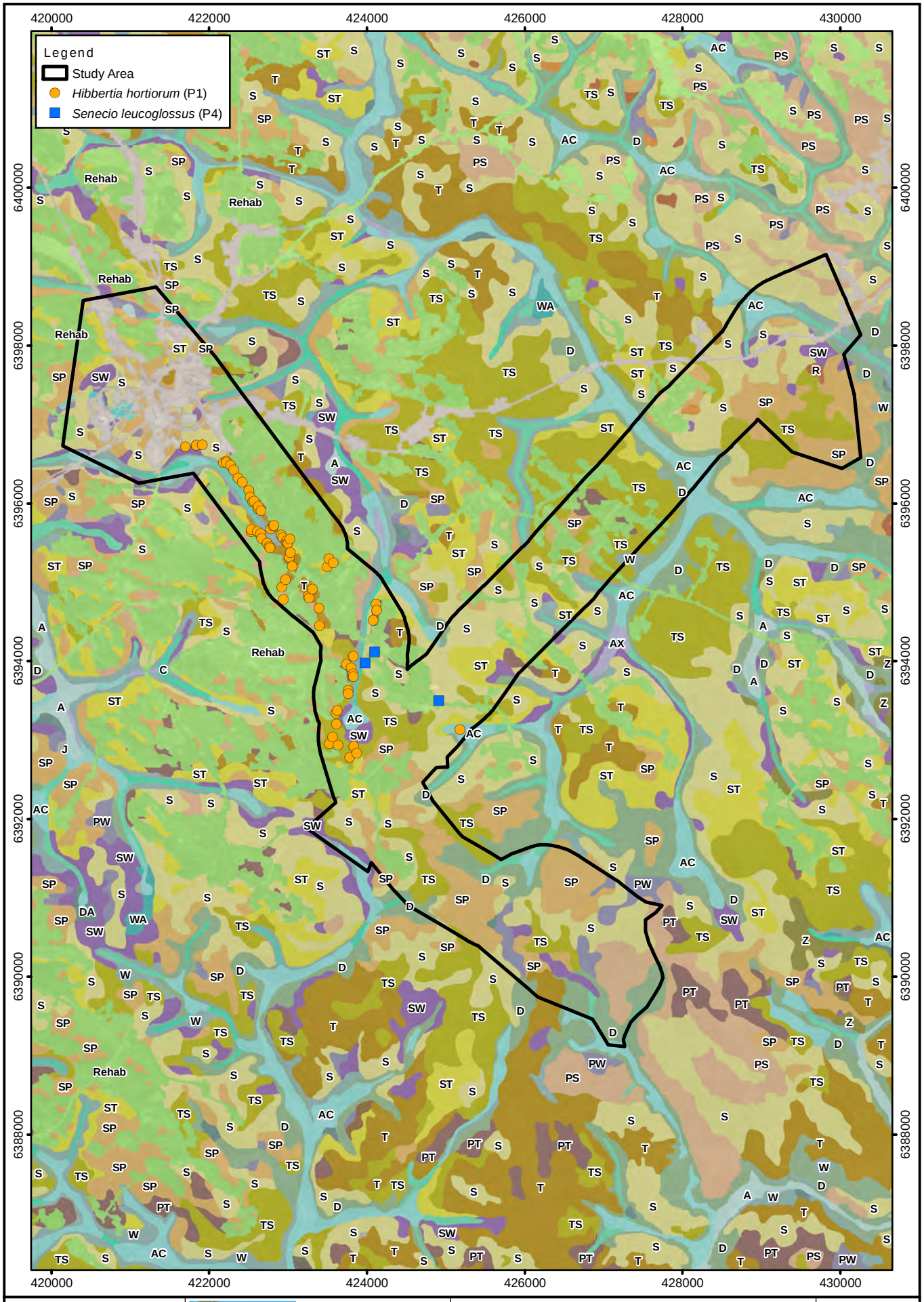
5.3 Threatened and Priority Flora

A total of 2 priority flora species (*Hibbertia hortiorum* P1 and *Senecio leucoglossus* P4) were recorded in the ONeil Transport Corridor survey area. The *Hibbertia hortiorum* appears relatively regularly and in part reflects the recent split of *Hibbertia commutata* into multiple species by Kevin Thiele (2019). Recent work since this study by the Mattiske team has located this *Hibbertia* priority species outside the ONeil Transport Corridor survey area towards the records known on the State Herbarium records (Florabase – WAH 1998 -). Currently this species is known from 12 records in the State Herbarium collection. The identification of this Hibbertia species as a Priority species has been confirmed at the State Herbarium. The location of the priority flora species and the range extension as recorded are summarized on Figure 14 and Appendix D.

Senecio leucoglossus (P4) has mainly been recorded extensively as scattered plants through the northern Jarrah forest. One specimen of this species wase confirmed at the State Herbarium (ACC10469/E). This species tends occur on lateritic soils and is known from 45 specimens at the State Herbarium. This species general mainly occurs in Jarrah-Marri-Bull Banksia (*Eucalyptus marginata – Corymbia calophylla – Banksia grandis*) forests. This species was recorded at three locations within the ONeil Transport Corridor survey area, but has been recorded regularly as scattered occurrences in other forest areas by the Mattiske team.

5.4 Introduced Species

One introduced taxa (**Hypochaeris glabra*) was recorded in the ONeil Transport Corridor survey area during the re-assessment. This introduced species is not a declared pest organisms pursuant to section 22 of the BAM Act. This species is not listed as a Weeds of National Significance (DCCEEW 2024d). This species is a short-lived annual.



N

0 500 1,000 m

Scale: 1:65,000
MGA94 (Zone 50)

CAD Ref: a1992_F026_14

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Transport Corridor

Current Vegetation Mapping

Figure: **14**

5.5 Vegetation

A total of 17 site-vegetation types were defined and mapped in the ONeil Transport Corridor survey area and an addition two mapping units (CL cleared land and Rehabilitation areas), Table 6 and Figure 14. The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years.

The results presented in Table 6 for each site-vegetation type also reflect the extent of the site-vegetation types and their percentage representation in the survey area. It is clearly apparent that there are some dominant site-vegetation types that dominate the ONeil Transport Corridor survey area (namely SP, S and TS which together cover 45.3% of the survey area). A total of some 26.55% of the area has been either cleared or rehabilitated within the ONeil Transport Corridor.

Table 6: Summary of site-vegetation types as defined for the ONeil Transport Corridor survey area based on Havel (1975a and 1975b) site-vegetation types as defined for the northern Jarrah forest

	SVT Code	Description	Total Area (ha)	% Survey Area
Swamps and Broad Valleys	A	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense stands of *Melaleuca viminea, Hakea varia, Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	1.834	0.07
	AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	73.772	2.85
	AW	Low open woodland of *Eucalyptus patens* and *Melaleuca preissiana* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	3.5	0.14
	DA	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with patches of *Melaleuca preissiana, Banksia littoralis* over mixed low understorey species, including *Babingtonia camphorosmae* and *Astartea scoparia* on clay loams to gravelly clay-loams.	143.41	2.50
	D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae, Daviesia decurrens, Davieisa preissii* and *Acacia extensa* on clay loams to gravelly clay-loams.	556.98	9.72
Valley Floors and Lower Slopes	C	Woodland to Open Forest of *Eucalyptus patens – Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	16.359	0.63
	CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	23.386	0.9
	W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	76.226	2.94
Slopes with seasonal soil moisture	SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	79.299	3.06
	PW	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels.	40.318	1.56

Table 6: Summary of site-vegetation types as defined for the ONeil Transport Corridor survey area based on Havel (1975a and 1975b) site-vegetation types as defined for the northern Jarrah forest (continued)

	SVT Code	Description	Total Area (ha)	% Survey Area
Slopes and Ridges - Sandy Loam Gravels	PT	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	28.332	1.09
	PS	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	76.051	2.93
	SP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	372.414	14.36
	S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy-gravels.	479.312	18.49
	ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus, Leucopogon verticillatus, Pteridium esculentum, Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	117.036	4.51
	TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	322.895	12.45
	T	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly soils.	54.646	2.11
Other Areas	CL	Cleared Areas	171.025	6.6
	Rehab	Rehabilitation Areas	517.315	19.95
	Total		**2592.572**	

None of these site-vegetation types are restricted to the ONeil Transport Corridor survey area; however as all of the northern jarrah forest has not been mapped at this finer scale, it is not feasible to provide a percentage representation of each site-vegetation type.

The condition of the vegetation is excellent, except for the degraded areas in the rehabilitation areas that are still regenerating and completely degraded in Cleared areas.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2024e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023c) within the ONeil Transport Corridor survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2023b) within the ONeil Transport Corridor survey area. At a State or National level none of the site-vegetation types have been listed as Threatened or Priority Ecological Communities.

6. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the ONeil Transport Corridor area. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed again in 2023 in line with some changes in nomenclature from 2022 to 2023.

The ONeil Transport Corridor survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System (Heddle *et al.* 1980; Mattiske and Havel (1998).

Potential Flora

Based on the previous nearby surveys and the recent additional studies a total of 459 vascular plant taxa, representative of 168 genera and 59 families, have the potential to occur within the ONeil Transport Corridor survey area (Mattiske Consulting 1998-2023). The most commonly represented families were Fabaceae (67 taxa), Proteaceae (53 taxa), Myrtaceae (38 taxa) and Asparagaceae (253 taxa).

A total of twelve threatened flora species and 37 priority flora species has the potential to occur in the ONeil Transport Corridor survey area. Of the threatened flora species, all are considered to have a very low potential of occurring in the Oneil Transport survey area due to the lack of suitable habitat and also know distributions away from the survey area.

In 2023, the data indicated that of the Priority flora species, five priority flora species have a high potential to be in the survey area and four priority flora species have a moderate or moderate to high potential to be in the survey area.

On the basis of databases and previous surveys near or within the Oneil survey areas a total of 15 introduced taxa has the potential to occur in the ONeil Transport Corridor survey area (Appendix C). None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

Potential Vegetation Values

There are no TECs listed at Commonwealth or State level, or PECs listed at State level which would be likely to occur in the ONeil Transport Corridor survey area.

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the ONeil Transport Corridor survey area. In view of the proximity of the Dwellingup as a forestry township it is unlikely that there will be additional old growth forests in the survey area. The ONeil Transport Corridor has areas of dieback in some of the valley systems. The results for the dieback occurrence in these survey areas may also reflect the degree of sampling which is less intensive than in the western areas of the northern Jarrah forest.

Survey Effort

The survey effort in the ONeil Transport Corridor survey areas includes data from previous studies that overlap this area and also in nearby Jarrah forest areas. The recent survey effort concentrated on targeted

Threatened and Priority species and a re-assessment of selected sites in the dominant site-vegetation types. The degree of current mining activities restricted coverage of some site-vegetation types.

Recorded Flora

In the more recent targeted flora and vegetation studies (including re-assessment of 45 sites a total of 122 vascular plant taxa, representative of 66 genera and 37 families, have been recorded in the ONeil Transport Corridor survey area. The most commonly represented families were Fabaceae (13 taxa), Myrtaceae (12 taxa), Asparagaceae (11 taxa), Proteaceae (9 taxa) and Asteraceae (7 taxa). .

A total of 2 priority flora species (*Hibbertia hortiorum* P1 and *Senecio leucoglossus* P4) were recorded in the ONeil Transport Corridor survey area. The *Hibbertia hortiorum* appears relatively regularly and in part reflects the recent split of *Hibbertia commutata* into multiple species by Kevin Thiele (2019). Recent work since this study by the Mattiske team has located this *Hibbertia* priority species outside the ONeil Transport Corridor survey area towards the records known on the State Herbarium records (Florabase – WAH 1998). *Senecio leucoglossus* (P4) has mainly been recorded extensively as scattered plants through the northern Jarrah forest. This species was recorded at three locations within the ONeil Transport Corridor survey area, but has been recorded regularly as scattered occurrences in other forest areas by the Mattiske team.

The variety of weeds was low in the reassessed areas, although it would be expected that there would be more near cleared and disturbed areas. This low number reflects the slightly different approach on the Oneil Transport Corridor that has been studies multiple times during studies on the Huntly, Myara and Cameron areas by Mattiske Consulting over the last few decades.

Recorded Vegetation

A total of 17 site-vegetation types were defined and mapped in the ONeil Transport Corridor survey area and an addition two mapping units (CL cleared land and Rehabilitation areas). The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years.

None of these site-vegetation types are restricted to the ONeil Transport Corridor survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

The condition of the vegetation is excellent, except for the degraded areas in the rehabilitation areas that are still regenerating and completely degraded in Cleared areas.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2024e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023c) within the ONeil Transport Corridor survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2023b) within the ONeil Transport Corridor survey area. At a State or National level none of the site-vegetation types have been listed as Threatened or Priority Ecological Communities.

The ONeil Transport Corridor survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2024b) and as such was considered during the RFA process.

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the ONeil Transport Corridor survey area. In view of the proximity of the North-East Road it is unlikely that there will be additional old growth forests in the survey area.

6. ACKNOWLEDGEMENTS

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7. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were mainly involved in this project:

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Dr EM Mattiske	Managing Director & Principal Ecologist	Planning, managing, reporting	FB62000019-2
Dr S Ruoss	Senior Botanist	Field Studies and Plant IDs	FB62000031-4,5
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R Jones	Botanist	Data collation, reporting	N/A
J Wescombe	Botanist	Data collation, reporting	N/A

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions (DBCA 2024a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act. Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from DBCA (2024a).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (DBCA 2024a). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from DBCA (2024a).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (26 May 2023)* (under Part 2, Division 2, Subdivision 1 of the BC Act; DBCA 2023b). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the DBCA (and former equivalent departments) have been identifying and informally listing TECs since 1994. Some of these TECs are also endorsed by the Federal Minister as threatened, and some of these are listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from DBCA (2023b).

CODE	CATEGORY	DEFINITION
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2023a) in the *Priority Ecological Communities for Western Australia – Version 35 (19 June 2023)*. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from DBCA (2023a).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2024).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- 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; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of vegetation condition categories

Note: Adapted from Keighery (1994).

CATEGORY	DEFINITION
1	Pristine or nearly so, no obvious sign of disturbance or damage caused by human activities since European settlement.
2	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.
3	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Anthocercis gracilis	Solanaceae	T	Vulnerable	Habit: Erect, spindly shrub, to 0.6 (-1) m high. Flower colour: yellow-green Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Sandy or loamy soils. Granite outcrops. IBRA Distribution: AVW, JAF Florabase records: 30	**Very Low** On eastern and western fringes of northern Jarrah forest
Banksia mimica	Proteaceae	T	Endangered	Habit: Prostrate, lignotuberous shrub, 0.15-0.4 m high. Flower colour: yellow-brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White or grey sand over laterite, sandy loam. IBRA Distribution: JAF, SWA Florabase records: 40	**Very Low** Occurs to the north on the SWA and south JAF
Caladenia huegelii	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.25-0.6 m high. Flower colour: green & cream & red Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Grey or brown sand, clay loam. IBRA Distribution: JAF, SCP Florabase records: 43	**Very Low** Location outside species known range. Species not known within central part of northern Jarrah forest.
Diuris drummondii	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.5-1.05 m high. Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J A S O **N** **D** Soils: Low-lying depressions, swamps IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 55	**Very Low** Dependent on suitable low-lying depressions/habitat conditions.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Diuris micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.3-0.6 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Brown loamy clay. Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 9	**Very Low** Dependent on suitable depressions/habitat conditions.
Diuris purdiei	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.35 m high. Flower colour: yellow Flowering period (indicated in green): only after a summer or early autumn fire J F M A M J J A **S** **O** N D Soils: Grey-black sand, moist. Winter-wet swamps. IBRA Distribution: JAF, SWA Florabase records: 26	**Very Low** Dependent on suitable swamps/habitat conditions.
Drakaea micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.15-0.3 m high. Flower colour: red & yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White-grey sand. IBRA Distribution: JAF, SWA, WAR Florabase records: 50	**Very Low** Outside species range. Species not known within the Northern Jarrah Forest.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eleocharis keigheryi	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Clay, sandy loam. Emergent in freshwater: creeks, claypans. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 59	**Very Low** Not recorded within proximity. Dependent on appropriate hydrology on site.
Lasiopetalum pterocarpum	Malvaceae	T	Endangered	Habit: Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines. IBRA Distribution: JAF Florabase records: 11	**Very Low** Restricted to creeklines near Darling Scarp.
Morelotia australiensis	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O **N D** Soils: Sand, sandy loam. Flats, well-drained areas. IBRA Distribution: JAF, SWA Florabase records: 49	**Very Low** North of survey area near Darling Scarp

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thelymitra stellata	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.25 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Sand, gravel, lateritic loam. IBRA Distribution: GES, JAF, SWA Florabase records: 20	**Very Low** Spread between Three Springs and Pinjarra.
Verticordia fimbrilepis subsp. *fimbrilepis*	Myrtaceae	T	Endangered	Habit: Shrub, 0.3-0.7 m high. Flower colour: pink-white Flowering period (indicated in green): **J** F M A M J J A S **O N D** Soils: Gravelly or clayey soils. Flats, road verges. IBRA Distribution: AVW, JAF Florabase records: 39	**Very Low** Species habitat within north-eastern extent of JAF and AVW (EPBC Conservation Advice, 2021)
Darwinia hortiorum	Myrtaceae	P1	-	Habit: Low spreading shrub, 10-25cm Flower colour: green-cream Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Loam soils over laterite or granite slopes associated with outcrops IBRA Distribution: JAF Florabase records: 9	**Very Low** Species habitat within north-eastern extent of JAF
Hibbertia acrotoma	Dilleniaceae	P1	-	Habit: Openly branched, spreading to prostrate shrub to 0.5m. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S** O N D Soils: Loam soils over laterite or granite IBRA Distribution: JAF, SWA Florabase records: 7	**Very Low** Edge of Darling Scarp between Serpentine & Oakley Dam

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hibberta hortiorum	Dilleniaceae	P1	-	Habit: Mat-forming shrubs to 0.1m high or less. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Laterite IBRA Distribution: JAF Florabase records: 12	**High** Species known from mainly north-eastern areas of northern Jarrah forest
Paracaleana granitica	Orchidaceae	P1	-	Habit: Perennial, herb, to 0.07 m high. Flower colour: green-purple Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: Growing on moss mats, granite. Outcrops. IBRA Distribution: JAF Florabase records: 7	**Low** Mainly north of survey area and more common on north-eastern section of northern Jarrah forest
Banksia recurvistylis	Proteaceae	P2	-	Habit: Shrub, spreading, 2m to 3m wide and 1.5m high Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J A S O **N D** Soils: In cracks in granite outcrops, brown clays, sand and gravel with lateritic boulders IBRA Distribution: JAF Florabase records: 7	**Low** Mainly north of survey area and more common on north-eastern section of northern Jarrah forest
Bossiaea modesta	Fabaceae	P2	-	Habit: Slender, trailing and twining shrub. Flower colour: yellow/red Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: On soils derived from granite IBRA Distribution: JAF Florabase records: 22	**Low-Moderate** Mainly north of survey area, although been recorded west of survey area in the northern Jarrah forest

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Calectasia grandiflora	Dasypogaceae	P2	-	Habit: Rhizomatous, perennial, herb (or undershrub), to 0.65 m high, without stilt roots. Flower colour: blue/purple Flowering period (indicated in green): J F M A M **J J A S O N** D Soils: On soils derived from granite. Damp areas close to streams. IBRA Distribution: JAF, SWA, AVW Florabase records: 12	**Very Low** Species not known in the area near the survey area, mainly near the Darling Scarp and Perth
Grevillea ornithopoda	Proteaceae	P2	-	Habit: Spreading, virgate shrub, 1-3 (-5) m high, up to 3 m wide. Flower colour: cream-white Flowering period (indicated in green): J F M A **M J J A S O N** D Soils: Loam, loam over clay, sand, clay. Edge of river bank and creek, dunes IBRA Distribution: JAF, SWA Florabase records: 20	**Low Moderate** Within species range, recorded south, west and north of survey area.
Tetratheca phoenix	Elaeocarpaceae	P2	-	Habit: Few-branched shrub (subshrub), to 0.25 m high. Flower colour: dark pink-magenta Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Brown gravelly loam over granite. Mid to Upper slopes, near granite outcrops. IBRA Distribution: JAF Florabase records: 10	**High** Within species range. Recorded near survey area

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Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia drummondii subsp. *affinis*	Fabaceae	P3	-	Habit: Erect shrub, 0.3-1 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J **J** **A** S O N D Soils: Lateritic gravelly soils. IBRA Distribution: AVW, JAF, SWA Florabase records: 37	**Very Low** Mainly north-east of Perth in northern forests
Acacia horridula	Fabaceae	P3	-	Habit: Harsh, slender, single-stemmed shrub, 0.3-0.6 (-1) m high. Flower colour: yellow Flowering period (indicated in green): J F M A **M** **J** **J** **A** S O N D Soils: Gravelly soils over granite, sand. Rocky hillslopes. IBRA Distribution: JAF, SWA Florabase records: 33	**Low-Moderate** Mainly north of survey area and on Darling Scarp
Acacia oncinophylla subsp. *oncinophylla*	Fabaceae	P3	-	Habit: Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A** **S** **O** N D Soils: Granitic soils IBRA Distribution: AVW, JAF, SWA Florabase records: 42	**Low-Moderate** Within species range but associated with granitic soils.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Adenanthos cygnorum subsp. chamaephyton	Proteaceae	P3	-	Habit: Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Flower colour: white-cream-pink-green/green Flowering period (indicated in green): **J F** M A M J **J A S O N D** Soils: Grey sand, lateritic gravel. IBRA Distribution: AVW, JAF, SWA Florabase records: 22	**Moderate** Within species range. Recorded at O'Neil (MCPL 2009)
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	Ericaceae	P3	-	Habit: Shrub, to 1.1 m high and 1.1 m wide. Flower colour: white-cream/mauve-pink Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Loam, clay, sand, gravel. Granite, slopes and drainage lines. IBRA Distribution: JAF Florabase records: 23	**Moderate** Within species range, mainly to the north and north-east of survey area.
Conospermum scaposum	Proteaceae	P3	-	Habit: Erect shrub, 0.2-0.45(-0.75) m high. Flower colour: blue Flowering period (indicated in green): **J F** M A M J J A S **O N D** Soils: White-grey sand, sandy clay. Low swampy areas, road verges. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 47	**Low-Moderate** Species recorded at Myara North (MCPL 2019/20); however mainly north-east of Jarrah forest

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Cyathochaeta teretifolia	Cyperaceae	P3	-	Habit: Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2.0 m high, to 1.0 m wide. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Grey sand, sandy clay. Swamps, creek edges. IBRA Distribution: JAF, SWA, WAR Florabase records: 40	**Moderate** Dependent on habitat hydrology requirements on-site.
Grevillea dissectifolia	Proteaceae	P3	-	Habit: Erect shrub, 1-2.5m high. Flower colour: white-pink Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sands, loam and laterite and near lateritic boulders IBRA Distribution: JAF Florabase records: 24	**Low-Moderate** Species records mainly north and north-east of survey area.
Hakea oldfieldii	Proteaceae	P3	-	Habit: Open straggling shrub up to 2.5m. Flower colour: white-cream to yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Red clay or sand over laterite, seasonally wet flats IBRA Distribution: GES, SWA, AVW, JAF. MAL, ESP Florabase records: 66	**Low** Soil conditions less likely in survey area and occurs mainly south, southeast and east of survey area
Halgania corymbosa	Boraginaceae	P3	-	Habit: Erect shrub, 0.35-1 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J A S O N D Soils: Gravelly soils, soils over granite. IBRA Distribution: JAF, SWA Florabase records: 18	**Very Low** Species records to the west of the Darling Scarp and either north or east of survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hemigenia microphylla	Lamiaceae	P3	-	Habit: Slender shrub, 0.4-1.8 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Sandy-clay, peaty clay, granite and winter wet depressions. IBRA Distribution: JAF, SWA, WAR Florabase records: 26	**Low - Moderate** Mainly west and south, although localised occurrence south of survey area.
Isopogon autumnalis	Proteaceae	P3	-	Habit: Shrub 0.5-1 m high. Flower colour: cream, yellow Flowering period (indicated in green): **J F M A M J** J A S O N D Soils: Sandy soils. IBRA Distribution: GES, JAF, SWA Florabase records: 59	**Very Low** Records to the west of the Darling Scarp.
Lasiopetalum glutinosum subsp. *glutinosum*	Malvaceae	P3	-	Habit: Shrub to 0.8 m high. Flower colour: pink-purple Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Lateritic gravel and clay, clay loam, sandy clay over granite. Slopes, granite outcrops. IBRA Distribution: AVW, JAF, SWA Florabase records: 48	**Very Low** Records mainly north or west near Darling Scarp.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Lepyrodia heleocharoides	Restionaceae	P3	-	Habit: Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N **D** Soils: Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps. IBRA Distribution: JAF, SWA Florabase records: 20	**Very Low** Mainly west of in southern forested areas
Meionectes tenuifolia	Haloragaceae	P3	-	Habit: Annual semi-aquatic herb, to 0.35 m high. Flower colour: orange-red-brown, green Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Grey sand or grey-brown clay, shallow soils. Seasonally inundated flat, edge of swamp. IBRA Distribution: JAF, SWA Florabase records: 27	**Low** Dependent on suitable habitat.
Stackhousia sp. Red-blotched corolla (A. Markey 911)	Celastraceae	P3	-	Habit: Erect herb or shrub, approximately 0.2 m high. Flower colour: cream-yellow Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Brown loamy sand, clayey sand over laterite, white sandy clay over granite, grey clay. Slopes. IBRA Distribution: AVW, GES, JAF Florabase records: 9	**Very Low** Mainly west and north of survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thysanotus anceps	Asparagaceae	P3	-	Habit: Rhizomatous, leafless perennial, herb, to 0.4 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: White or grey sand, lateritic gravel, laterite. IBRA Distribution: GES, JAF, SWA Florabase records: 17	**Moderate – High** Recorded west of survey area.
Acacia oncinophylla subsp. patulifolia	Fabaceae	P4	-	Habit: Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Granitic soils, occasionally on laterite. IBRA Distribution: JAF, SWA Florabase records: 31	**Low-Moderate** Recorded mainly to north and north-west.
Aponogeton hexatepalus	Aponogetonceae	P4	-	Habit: Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Flower colour: green-white Flowering period (indicated in green): J F M A M J **J A S O** N D Soils: Mud. Freshwater: ponds, rivers, claypans. IBRA Distribution: JAF, SWA Florabase records: 30	**Very Low** Mainly on Swan Coastal Plain and southern forests.
Calothamnus graniticus subsp. *leptophyllus*	Myrtaceae	P4	-	Habit: Erect, multi-stemmed shrub, 1-2 m high. Flower colour: red Flowering period (indicated in green): J F M A M **J J A** S O N D Soils: Clay over granite, lateritic soils. Hillsides. IBRA Distribution: JAF, SWA Florabase records: 32	**Low** Nearby records within SWA and then occurs of survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Cyanothamnus tenuis	Rutaceae	P4	-	Habit: Procumbent or erect & slender shrub, 0.1-0.5 m high. Flower colour: blue/pink-white Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Laterite, stony soils, granite. IBRA Distribution: JAF, SWA Florabase records: 45	**Low** Mainly west on coastal plain and then on eastern fringes of Jarrah forest.
Drosera occidentalis	Droseraceae	P4	-	Habit: Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Flower colour: pink/white Flowering period (indicated in green): **J** F M A M J J A S **O N D** Soils: White/black sand over yellow clay, yellow sand, moist brown/grey clay/sand, peaty sand, sandy clay. Damp flats, flood plain. IBRA Distribution: JAF, SWA Florabase records: 23	**Low - Moderate** Nearby records within coastal plain and on eastern area of Jarrah orest.
Grevillea pimeleoides	Proteaceae	P4	-	Habit: Non-lignotuberous shrub, 0.4-2.4 m high. Flower colour: yellow-orange Flowering period (indicated in green): J F M A **M J J A S O N** D Soils: Gravelly soils over granite. Rocky hillsides. IBRA Distribution: JAF Florabase records: 36	**Low** Species recorded mainly to north of survey area and then localised site near Albany.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Parsonsia diaphanophleba	Apocynaceae	P4	-	Habit: Woody climber, to 10 m high. Flower colour: white/cream & pink Flowering period (indicated in green): **J F** M **A M J** J A **S** O N D Soils: Alluvial soils. Along rivers. IBRA Distribution: JAF, SWA Florabase records: 28	**Very Low** Species occurs on alluvial soils along rivers; mainly on coastal plain and south of survey area.
Pimelea rara	Thymelaeaceae	P4	-	Habit: Shrub, 0.2-0.35 m high. Flower colour: white Flowering period (indicated in green): **J** F M A M J J A S O N **D** Soils: Lateritic soils. IBRA Distribution: JAF Florabase records: 52	**High** Species recorded near survey area.
Senecio leucoglossus	Asteraceae	P4	-	Habit: Erect annual, herb, to 1.3 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Gravelly lateritic or granitic soils. Granite outcrops, slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 45	**High** Species recorded near and within survey area.
Stylidium ireneae	Stylidiaceae	P4	-	Habit: Lax perennial, herb, (0.06-) 0.1-0.28 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: Sandy loam. Valleys near creek lines. IBRA Distribution: JAF, SWA, WAR Florabase records: 30	**High** Species recorded near survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL TRANSPORT CORRIDORS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Verticordia lindleyi subsp. *lindleyi*	Myrtaceae	P4	-	Habit: Erect shrub, 0.2-0.75 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand, sandy clay. Winter-wet depressions. IBRA Distribution: GES, JAF, SWA Florabase records: 83	**Very Low** Nearby records within SWA. Grows on sand, sandy clay.

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family	Species	1998	2009	2023
Amaranthaceae	*Ptilotus drummondii*		x	
	Ptilotus drummondii var. drummondii		x	
	Ptilotus manglesii	x	x	x
Anarthriaceae	*Lyginia barbata*		x	
	Lyginia imberdis		x	
Apiaceae	*Pentapeltis peltigera*	x	x	x
	Platysace compressa	x		x
	Platysace filoformis		x	
	Platysace tenuissima	x	x	
	Platysace sp.			x
	Xanthosia atkinsoniana	x	x	x
	Xanthosia candida	x	x	x
	Xanthosia ciliata		x	
	Xanthosia huegelii	x	x	
	Xanthosia singuliflora		x	x
	Apiaceae sp.			x
Araliaceae	*Trachymene pilosa*		x	x
Asparagaceae	*Lomandra brttanii*	x	x	
	Lomandra caespitosa	x	x	x
	Lomandra drummondii		x	
	Lomandra integra	x	x	
	Lomandra hermaphrodita	x	x	x
	Lomandra micrantha	x	x	x
	Lomandra micrantha subsp. micrantha		x	
	Lomandra nigricans		x	x
	Lomandra odora		x	
	Lomandra preissii	x	x	
	Lomandra purpurea	x		
	Lomandra sericea	x	x	x
	Lomandra sonderi	x	x	x
	Lomandra spartea	x	x	x
	Lomandra sp.		x	x
	Sowerbaea laxiflora	x		
	Thysnaotus arenarius		x	
	Thysanotus dichotomus	x	x	
	Thysnaotus fastigiatus	x	x	
	Thysanotus manglesianus		x	
	Thysanotus multiflorus	x	x	x
	Thysanotus sparteus		x	
	Thysnaotus tenellus		x	
	Thysanotus thyrsoideus	x	x	x
	Thysanotus sp.		x	x

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Family		Species	1998	2009	2023
Asteraceae	*	*Conyza sumatrensis*	x		
		Craspedia variabilis	x	x	
		Helichrysum luteoalbum		x	
		Hyalosperma cotula		x	
	*	*Hypochaeris glabra*	x	x	x
		Lagenophora huegelii	x	x	x
		Millotia tenuifolia		x	
		Ozothamnus cordatus	x		
		Podolepis lessonii		x	
		Pterochaeta paniculata		x	
		Senecio diaschides	x	x	
		Senecio hispidulus	x	x	x
		Senecio hispidulus var. hispidulus		x	
	P4	*Senecio leucoglossus*	x	x	x
		Senecio quadridentatus		x	
	*	*Senecio vulgaris*		x	
		Senecio sp.		x	
	*	*Sonchus asper*		x	
		Siloxerus humifusus		x	
		Trichocline spathulata	x	x	x
	*	*Ursinia anthemoides*		x	
		Waitzia acuminata		x	
		Waitzia suaveolens var. suaveolens		x	
		Asteraceae sp.		x	
Campanulaceae		*Isotoma hypocrateriformis*		x	
		Lobelia gibbosa		x	
		Lobelia heterophylla		x	
		Lobelia rhombifolia		x	
	*	*Wahlenbergia capensis*		x	
Caryophyllaceae		*Caryophyllaceae sp.*		x	
Casuarinaceae		*Allocasuarina fraseriana*	x	x	x
		Allocasuarina humilis	x	x	
Colchicaceae		*Burchardia congesta*		x	x
Cyperaceae		*Baumea vaginalis*		x	
		Cyathochaeta avenacea	x	x	
		Gahnia decomposita		x	x
		Gahnia trifida	x	x	
		Lepidosperma brunonianum		x	
		Lepidosperma gladiatum		x	
		Lepidosperma leptostachyum		x	
		Lepidosperma longitudinale		x	
		Lepidosperma pubisquameum	x	x	
		Lepidosperma squamatum	x	x	

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

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Family	Species	1998	2009	2023
Cyperaceae	*Lepidosperma tenue*	x	x	
(continued)	*Lepidosperma tetraquetrum*		x	x
	Lepidosperma tuberculatum		x	
	Lepidosperma sp.		x	x
	Mesomelaena ?graciliceps		x	
	Mesomelaena tetragona	x	x	
	Morelotia octandra	x	x	
	Netrostylis sp. Jarrah Forest (R. Davis 7391)	x	x	x
	Schoenus brevisetis		x	
	Schoenus clandestinus		x	
	Schoenus sp.		x	
	Cyperaceae sp.			x
Dasypogonaceae	*Kingia australis*		x	
Dennstaedtiaceae	*Pteridium esculentum*	x	x	x
Dilleniaceae	*Hibbertia acerosa*	x	x	x
	Hibbertia amplexicaulis	x	x	x
	Hibbertia commutata	x	x	x
	Hibbertia commutata (hairy)		x	
	Hibbertia diamesogenos		x	
	Hibbertia gracilipes	x		
	P1 *Hibbertia hortiorum*			x
	Hibbertia huegelii		x	
	Hibbertia hypericoides		x	
	Hibbertia inconspicua	x		
	Hibbertia lasiopus	x	x	
	Hibbertia lasiopus/quadricolor	x		
	Hibbertia ovata		x	x
	Hibbertia pachyrrhiza		x	
	Hibbertia perfoliata	x	x	x
	Hibbertia pilosa		x	
	Hibbertia quadricolor		x	
	Hibbertia rhadinopoda	x		
	Hibbertia silvestris		x	
	Hibbertia stellaris	x	x	
	Hibbertia sp.			x
Droseraceae	*Drosera erythrorhiza*	x	x	
	Drosera platystigma		x	
	Drosera sp.		x	x
	Drosera sp. Climbing			x
Elaeocarpaceae	*Platytheca galioides*		x	
	Tetratheca hirsuta		x	x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

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Family	Species	1998	2009	2023
Ericaceae	*Andersonia caerulea*		x	
	Leucopogon australis	x	x	
	Leucopogon capitellatus	x	x	x
	Leucopogon glabellus		x	
	Leucopogon pulchellus		x	
	Leucopogon verticillatus	x	x	x
	Leucopogon sp.		x	
	Styphelia conostephioides		x	
	Styphelia discolor	x	x	x
	Styphelia erectifolia		x	
	Styphelia nitens	x	x	x
	Styphelia pallida	x	x	x
	Styphelia propinqua	x	x	x
	Styphelia tenuiflora	x	x	x
	Ericaceae sp.			x
Euphorbiaceae	*Monotaxis gracilis*	x		
	Monotaxis grandiflora		x	
	Monotaxis grandiflora var. grandiflora		x	
	Monotaxis occidentalis	x	x	x
	Stachystemon vermicularis		x	
Fabaceae	*Acacia alata*	x	x	x
	Acacia applanata	x		
	Acacia barbinervis		x	
	Acacia browniana	x		x
	Acacia celstrifolia		x	
	Acacia divergens	x	x	x
	Acacia drummondii subsp. candolleana	x	x	
	Acacia drummondii subsp. drummondii	x	x	x
	* *Acacia elata*		x	
	Acacia extensa	x	x	
	Acacia incurva	x	x	
	Acacia lateriticola		x	x
	Acacia nervosa	x	x	
	Acacia obovata		x	
	Acacia preissiana	x		
	Acacia pulchella	x	x	
	Acacia pulchella var. glaberrima		x	
	Acacia saligna	x		
	Acacia stenoptera		x	
	Acacia urophylla	x	x	
	Acacia varia		x	
	Acacia willdenowniana	x	x	
	Acacia sp.		x	
	Aotus cordifolia P3		x	
	Bossiaea aquifolium	x	x	x
	Bossiaea ornata	x	x	x

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Family		Species	1998	2009	2023
Fabaceae		*Callistachys lanceolata*		x	
(continued)		*Chorizema cordatum*		x	
		Chorizema dicksonii	x		
		Chorizema rhombeum	x	x	
		Daviesia decurrens	x	x	
		Daviesia horrida	x	x	
		Daviesia incrassata	x	x	
		Daviesia inflata		x	
		Daviesia longifolia		x	
		Daviesia physodes	x	x	
		Daviesia preissii	x	x	
		Daviesia rhombifolia	x	x	
		Eutaxia parvifolia		x	
		Eutaxia virgata		x	
		Gastrolobium calycinum		x	
		Gastrolobium ebracteolatum			x
		Gastrolobium spinosum	x	x	
		Gompholobium capitatum	x	x	
		Gompholobium confertum	x		
		Gompholbium cyaninum		x	
		Gompholobium knightianum	x	x	
		Gompholobium marginatum	x	x	x
		Gompholobium polymorphum	x	x	x
		Gompholobium preissii	x	x	x
		Gompholobium preissii		x	
		Gompholobium tomentosum		x	
		Gompholobium venustum		x	
		Gompholobium sp.		x	
		Hardenbergia comptoniana		x	
		Hovea chorizemifolia	x	x	
		Hovea trisperma		x	x
		Jacksonia furcellata		x	
		Jacksonia horrida		x	
		Kennedia coccinea	x	x	
		Kennedia prostrata	x	x	x
		Labichea punctata	x		
		Mirbelia dilatata	x	x	
		Mirbelia spinosa	x		
		Sphaerolobium medium	x	x	
		Sphaerolobium vimineum		x	
	*	*Trifolium sp.*		x	
Gentianaceae	*	*Centaurium erythraea*			
Goodeniaceae		*Dampiera alata*	x	x	
		Dampiera linearis	x	x	x
		Lechenaultia biloba	x	x	x

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Family		Species	1998	2009	2023
Goodeniaceae		*Scaevola calliptera*	x	x	x
(continued)		*Scaevola pilosa*	x	x	
Haemodoraceae		*Anigozanthos manglesii*		x	
		Conostylis aculeata	x		
		Conostylis serrulata	x	x	x
		Conostylis setigera	x	x	
		Conostylis setigera subsp. setigera	x	x	
		Conostylis setosa	x	x	x
		Conostylis sp.		x	
		Haemodorum discolor		x	
		Haemodorum ?simplex		x	
		Haemodorum sp.		x	x
		Haemodoraceae sp.		x	x
Haloragaceae		*Glischrocaryon aureum*	x	x	
		Gonocarpus cordiger	x	x	
		Gonocarpus sp.		x	
Hemerocallidaceae		*Agrostocrinum hirsutum*		x	
		Agrostocrinum scabrum	x		
		Chamaescilla corymbosa	x	x	x
		Dianella revoluta var. divaricata	x	x	
		Tricoryne elatior	x	x	
		Tricoryne humilis		x	
Hypericaceae	*	*Hypericum perforatum*		x	
Iridaceae		*Patersonia babianoides*	x	x	
		Patersonia juncea		x	
		Patersonia occidentalis	x	x	x
		Patersonia pygmaea	x	x	x
		Patersonia rudis	x	x	
		Patersonia rudis subsp. rudis		x	
Lamiaceae		*Hemiandra pungens*		x	
		Hemigenia incana		x	
		Hemigenia pritzelii	x	x	
Lauraceae		*Cassytha racemosa*	x	x	
		Cassytha sp.		x	x
Lentibulariaceae		*Utricularia multifida*		x	
Lindsaeaceae		*Lindsaea linearis*	x	x	
Loganiaceae		*Logania serpyllifolia*	x	x	
		Logania serpyllifolia subsp. angustifolia		x	

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family	Species	1998	2009	2023
Loranthaceae	*Nuytsia floribunda*		x	
Malvaceae	*Lasiopetalum floribundum*	x	x	x
	Lasiopelatum glabratum	x	x	
	Thomasia paniculata	x	x	x
Myrtaceae	*Astartea scoparia*	x	x	x
	Babingtonia camphorosmae	x	x	x
	Beaufortia macrostemon		x	
	Calothamnus planifolius		x	
	Calothamnus quadrifidus		x	
	Calytrix ?angulata		x	
	Corymbia calophylla	x	x	x
	Eucalyptus aspersa		x	
	Eucalyptus marginata	x	x	x
	Eucalyptus megacarpa	x	x	x
	Eucalyptus patens	x	x	x
	Eucalyptus rudis	x	x	
	Hypocalymma angustifolium	x	x	x
	Hypocalymma cordifolium	x	x	x
	Hypocalymma robustum		x	
	Kunzea ericifolia		x	
	Kunzea micrantha		x	
	Kunzea recurva	x	x	
	Leptospermopsis erubescens		x	
	Melaleuca incana	x		x
	Melaleuca incana subsp. incana	x	x	
	Melaleuca lateritia		x	
	Melaleuca parviceps		x	
	Melaleuca pauciflora	x	x	x
	Melaleuca preissiana	x	x	x
	Melaleuca rhaphiophylla		x	
	Melaleuca trichophylla		x	
	Melaleuca viminea	x	x	
	Melaleuca viminea subsp. viminea		x	
	Melaleuca sp.		x	
	Pericalymma ellipticum	x	x	
	Taxandria linearifolia	x	x	x
	Verticordia densiflora		x	
	Verticordia huegelii var. huegelii		x	
	Verticordia pennigera		x	
	Verticordia plumosa var. plumosa		x	
	Verticordia serrata		x	
	Myrtaceae sp.		x	
Olacaceae	*Olax benthamiana*	x		

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023
Orchidaceae		*Caladenia flava*		x	
		Caladenia flava subsp. flava		x	
		Caladenia sp.		x	x
		Cyrtostylis heugelii	x		
		Elythranthera brunonis		x	
		Elythranthera sp.		x	
		Eriochilus dilatatus	x		
		Microtis media	x		
		Pterostylis vittata	x		
		Pterostylis sp.		x	x
		Pyrorchis nigricans	x		
		Thelymitra crinita	x		
		Thelymitra sp.		x	
		Orchidaceae sp.		x	x
Orobanchaceae	*	*Parentucellia latifolia*		x	
Oxalidaceae		*Oxalis* sp.			x
Phyllanthaceae		*Lysiandra calycina*	x	x	x
		Poranthera huegelii		x	
Philydraceae		*Philydrella drummondii*		x	
Pittosporaceae		*Billardiera floribunda*	x	x	
		Billardiera fusiformis		x	
		Billardiera heterophylla	x		
		Billardiera variifolia	x	x	
		Billardiera sp.		x	
		Marianthus bicolor	x		
		Marianthus drummondianus	x	x	
Plantaginaceae	*	*Plantago lanceolata*	x		
Poaceae	*	*Aira caryophyllea*	x	x	
	*	*Aira cupaniana*		x	
		Amphipogon amphipogonoides	x	x	
		Amphipogon laguroides subsp. laguroides		x	
		Amphipogon turbinatus		x	
		Austrostipa campylachne		x	
		Austrostpa elegantissima	x		
		Neurachne alopecuroidea	x	x	
	*	*Pentaschistis airoides*		x	
		Rytidosperma acerosum		x	
		Rytidosperma caespitosum	x	x	x
		Rytidosperma setacea		x	
		Rytidosperma sp.		x	
		Tetrarrhena laevis	x	x	x
		Poaceae sp.		x	x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family	Species	1998	2009	2023
Polygalaceae	*Comesperma calymega*	x	x	
	Comesperma confertum	x		
	Comesperma polygaloides		x	
	Comesperma virgatum	x	x	
Proteaceae	*Adenanthos barbiger*		x	x
	Adenanthos cygnorum		x	
	Adenanthos cygnorum subsp. cygnorum		x	
	Adenanthos obovatus		x	
	Banksia armata var. armata		x	
	Banksia bipinnatifida subsp. bipinnatifida		x	
	Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*	x	x	x
	Banksia dallanneyi subsp. *sylvestris*		x	
	Banksia grandis	x	x	x
	Banksia littoralis	x	x	x
	Banksia seminuda	x	x	x
	Banksia sessilis	x	x	
	Banksia sphaerocarpa var. sphaerocarpa		x	
	Banksia squarrosa		x	
	Banksia squarrosa subsp. squarrosa		x	
	Conospermum amoenum		x	
	Conospermum capitatum	x	x	
	Conospermum capitatum subsp. glabratum		x	
	Grevillea bipinnatifida		x	
	Grevillea diversifolia		x	
	Grevillea diversifolia subsp. diversifolia		x	
	Grevillea manglesii subsp. manglesii		x	
	Grevillea pulchella		x	
	Grevillea pulchella subsp. ascendens		x	
	Grevillea quercifolia	x	x	
	Grevillea trifida		x	
	Grevillea wilsonii		x	
	Hakea amplexicaulis	x	x	x
	Hakea erinacea		x	
	Hakea incrassata	x	x	
	Hakea lissocarpha	x	x	x
	Hakea marginata		x	
	Hakea prostrata	x	x	
	Hakea ruscifolia	x	x	
	Hakea trifurcata		x	
	Hakea undulata		x	
	Hakea varia	x	x	
	Hakea sp.		x	
	Isopogon crithmifolius		x	
	Isopogon dubius		x	x
	Isopogon sphaerocephalus		x	
	Persoonia angustiflora	x	x	
	Persoonia elliptica	x	x	

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family	Species	1998	2009	2023
Proteaceae	*Persoonia longifolia*	x	x	x
(continued)	*Petrophile heterophylla*		x	
	Petrophile serruriae		x	
	Petrophile striata	x	x	
	Stirlingia latifolia		x	
	Stirlingia simplex		x	
	Synaphea damopsis	x	x	
	Synaphea gracillima	x	x	
	Synaphea petiolaris	x	x	
	Xylomelum occidentale	x	x	
Ranunculaceae	*Clematis pubescens*	x	x	x
	Ranunculus colonorum	x	x	
	Ranunculus sp.			x
	Ranunculaceae sp.			x
Restionaceae	*Alexgeorgea nitens*		x	
	Desmocladus fasciculatus	x	x	x
	Desmocladus flexuosus		x	x
	Hypolaena exsulca	x	x	
	Lepidobolus chaetocephalus		x	
	Lepidobolus preissianus		x	
	Lepidobolus preissianus subsp. preissianus		x	
	Leptocarpus canus	x	x	
	Leptocarpus coangustatus		x	
	Leptocarpus scariosus	x	x	
	Leptocarpus tenax		x	
	Lepyrodia riparia		x	
	Loxocarya cinerea	x	x	
Rhamnaceae	*Cryptandra arbutiflora*	x	x	
	Trymalium ledifolium	x	x	x
	Trymalium odoratissimum	x	x	x
	Trymalium odoratissimum subsp. odoratissimum		x	
Rubiaceae	*Opercularia apiciflora*	x	x	
	Opercularia echinocephala	x	x	x
	Opercularia hispidula	x	x	
Rutaceae	*Asterolasia pallida subsp. pallida*		x	
	Boronia crenulata	x	x	
	Boronia crenulata subsp. viminea		x	
	Boronia fastigiata	x	x	x
	Boronia molloyae		x	
	Philotheca spicata	x	x	x
Santalaceae	*Exocarpos sparteus*		x	
	Leptomeria cunninghamii	x	x	x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL TRANSPORT CORRIDORS, 1998 TO 2023

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family	Species	1998	2009	2023
Sapindaceae	*Dodonaea ceratocarpa*		x	
Stackhousiaceae	*Stackhousia monogyna*	x	x	
	Tripterococcus brunonis	x	x	
Stylidiaceae	*Levenhookia pusilla*		x	
	Levenhookia sp.		x	
	Stylidium amoenum	x	x	x
	Stylidium amoenum		x	
	Stylidium brunonianum		x	
	Stylidium calcaratum		x	
	Stylidium canaliculatum	x		
	Stylidium dichotomum		x	
	Stylidium diuroides subsp. diuroides		x	
	Stylidium junceum	x	x	
	Stylidium piliferum	x	x	x
	Stylidium pulchellum		x	
	Stylidium repens		x	
	Stylidium schoenoides		x	
	Stylidium thesioides		x	
	Stylidium sp.			
Thymelaeceae	*Pimelea ciliata*	x	x	
	Pimelea ciliata subsp. ciliata		x	
	Pimelea lehmanniana	x	x	
	Pimelea spectabilis		x	
	Pimelea suaveolens	x	x	x
	Pimelea sp.			x
Tremandraceae	*Tetratheca hirsuta*	x		
Violaceae	*Hybanthus floribundus*	x		
Xanthorrhoeaceae	*Xanthorrhoea gracilis*	x	x	x
	Xanthorrhoea preissii	x	x	x
Zamiaceae	*Macrozamia riedlei*	x	x	x

APPENDIX D: LOCATION OF PRIORITY SPECIES RECORDED ON ONEIL TRANSPORT CORRIDOR AREAS IN 2023

Note P1 - P4 Prioirty species defined in DBCA 2024a; SCC - State Conservation Code

Datum	Easting	Northing	Confirmed Species	SCC	Popn	Area (m2)
GDA94	421704	6396718	*Hibbertia hortiorum*	P1	1	1x1
GDA94	421839	6396738	*Hibbertia hortiorum*	P1	1	1x1
GDA94	421917	6396748	*Hibbertia hortiorum*	P1	2	2x2
GDA94	422217	6396539	*Hibbertia hortiorum*	P1	20	10x10
GDA94	422221	6396514	*Hibbertia hortiorum*	P1	2	2x2
GDA94	422273	6396481	*Hibbertia hortiorum*	P1	2	2x2
GDA94	422313	6396424	*Hibbertia hortiorum*	P1	15	5x5
GDA94	422366	6396322	*Hibbertia hortiorum*	P1	35	10x10
GDA94	422507	6396161	*Hibbertia hortiorum*	P1	2	5x5
GDA94	422522	6396083	*Hibbertia hortiorum*	P1	3	5x2
GDA94	422535	6395640	*Hibbertia hortiorum*	P1	16	10x10
GDA94	422556	6396023	*Hibbertia hortiorum*	P1	1	1x1
GDA94	422570	6396032	*Hibbertia hortiorum*	P1	80	10x10
GDA94	422614	6395648	*Hibbertia hortiorum*	P1	5	10x10
GDA94	422622	6395936	*Hibbertia hortiorum*	P1	3	2x2
GDA94	422628	6395959	*Hibbertia hortiorum*	P1	7	10x10
GDA94	422654	6395615	*Hibbertia hortiorum*	P1	5	10x10
GDA94	422670	6395558	*Hibbertia hortiorum*	P1	10	10x10
GDA94	422738	6395495	*Hibbertia hortiorum*	P1	7	10x10
GDA94	422763	6395456	*Hibbertia hortiorum*	P1	15	10x10
GDA94	422817	6395709	*Hibbertia hortiorum*	P1	1	1x1
GDA94	422824	6395725	*Hibbertia hortiorum*	P1	100+	2x100
GDA94	422917	6395605	*Hibbertia hortiorum*	P1	2	5x5
GDA94	422926	6394936	*Hibbertia hortiorum*	P1	5	3x3
GDA94	422935	6395562	*Hibbertia hortiorum*	P1	1	1x1
GDA94	422946	6394781	*Hibbertia hortiorum*	P1	20	5x5
GDA94	422975	6395033	*Hibbertia hortiorum*	P1	4	2x2
GDA94	422980	6395510	*Hibbertia hortiorum*	P1	4	2x2
GDA94	422987	6395533	*Hibbertia hortiorum*	P1	7	5x5
GDA94	423000	6395493	*Hibbertia hortiorum*	P1	25	10x10
GDA94	423002	6395492	*Hibbertia hortiorum*	P1	50+	10x10
GDA94	423032	6395374	*Hibbertia hortiorum*	P1	4	4x4
GDA94	423055	6395202	*Hibbertia hortiorum*	P1	6	5x2
GDA94	423268	6394799	*Hibbertia hortiorum*	P1	10	10x10
GDA94	423313	6394913	*Hibbertia hortiorum*	P1	5	10x10
GDA94	423399	6394674	*Hibbertia hortiorum*	P1	8	10x10
GDA94	423403	6394449	*Hibbertia hortiorum*	P1	5	10x10
GDA94	423525	6395299	*Hibbertia hortiorum*	P1	15	10x10
GDA94	423528	6392953	*Hibbertia hortiorum*	P1	30	50x50
GDA94	423569	6393037	*Hibbertia hortiorum*	P1	30	20x20
GDA94	423580	6395242	*Hibbertia hortiorum*	P1	50+	20x20

APPENDIX D: LOCATION OF PRIORITY SPECIES RECORDED ON ONEIL TRANSPORT CORRIDOR AREAS IN 2023

Note P1 - P4 Prioirty species defined in DBCA 2024a; SCC - State Conservation Code

Datum	Easting	Northing	Confirmed Species	SCC	Popn	Area (m2)
GDA94	423613	6393340	*Hibbertia hortiorum*	P1	100	10x10
GDA94	423614	6393200	*Hibbertia hortiorum*	P1	10	10x10
GDA94	423630	6393367	*Hibbertia hortiorum*	P1	4	5x5
GDA94	423641	6392935	*Hibbertia hortiorum*	P1	30	20x20
GDA94	423744	6393958	*Hibbertia hortiorum*	P1	200	50x20
GDA94	423764	6393628	*Hibbertia hortiorum*	P1	100	20x20
GDA94	423767	6393581	*Hibbertia hortiorum*	P1	4	5x5
GDA94	423786	6392780	*Hibbertia hortiorum*	P1	25	20x20
GDA94	423801	6393912	*Hibbertia hortiorum*	P1	200	50x20
GDA94	423824	6393838	*Hibbertia hortiorum*	P1	150	50x20
GDA94	423829	6394061	*Hibbertia hortiorum*	P1	200	50x20
GDA94	423833	6393802	*Hibbertia hortiorum*	P1	8	10x10
GDA94	423839	6392916	*Hibbertia hortiorum*	P1	25	20x20
GDA94	423875	6392830	*Hibbertia hortiorum*	P1	25	20x20
GDA94	424084	6394515	*Hibbertia hortiorum*	P1	7	5x5
GDA94	424127	6394640	*Hibbertia hortiorum*	P1	18	5x5
GDA94	422180	6396513	*Hibbertia hortiorum*	P1	2	2x2
GDA94	422422	6396270	*Hibbertia hortiorum*	P1	1	1x1
GDA94	422539	6395669	*Hibbertia hortiorum*	P1	2	2x2
GDA94	422662	6395905	*Hibbertia hortiorum*	P1	1	1x1
GDA94	422776	6395431	*Hibbertia hortiorum*	P1	2	2x2
GDA94	422780	6395672	*Hibbertia hortiorum*	P1	1	1x1
GDA94	423020	6395315	*Hibbertia hortiorum*	P1	1	1x1
GDA94	423026	6395549	*Hibbertia hortiorum*	P1	1	1s1
GDA94	423258	6394828	*Hibbertia hortiorum*	P1	2	2x2
GDA94	423500	6395187	*Hibbertia hortiorum*	P1	2	2x2
GDA94	424118	6394715	*Hibbertia hortiorum*	P1	2	2x2
GDA94	425185	6393127	*Hibbertia hortiorum*	P1	2	2x2
GDA94	423980	6393970	*Senecio leucoglossus*	P4	1	1x1
GDA94	424102	6394112	*Senecio leucoglossus*	P4	2	1x1
GDA94	424915	6393492	*Senecio leucoglossus*	P4	5	5x5

FLORA AND VEGETATION VALUES

ALCOA OF AUSTRALIA

HOLYOAKE EAST

HUNTLY MINE, WA

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

Alcoa of Australia Limited

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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BOM:	Bureau of Meteorology
DBCA:	Department of Biodiversity, Conservation and Attractions
DCCEEW:	Department of Climate Change, Energy, the Environment and Water
DPIRD:	Department of Primary Industries and Regional Development
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
MCPL:	Mattiske Consulting Pty Ltd
IBRA:	Interim Biogeographical Regionalisation for Australia
PEC:	Priority ecological community
RFA:	Regional Forest Agreement
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned in January 2022 by GHD on behalf of Alcoa of Australia Ltd to conduct a desktop assessment to evaluate the potential flora and vegetation values within the Holyoake East areas, approximately 80 km south east of Perth, WA. Alcoa wishes to expand their mining operations into the Holyoake East region. This was then followed by detailed field studies over the period from December 2022 to September 2023 for detailed flora and vegetation studies. The Holyoake East survey area is located in tenement ML 1SA and consists of three priority areas within the Cameron, Kennedy East and Pindalup North blocks.

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the Holyoake East area. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed again in 2023 in line with some changes in nomenclature from 2022 to 2023.

The Holyoake East survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla - Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System.

Potential Flora

A total of 860 vascular plant taxa, representative of 267 genera and 85 families (Appendix B), have the potential to occur within the Holyoake East survey area (Mattiske Consulting 2022). The most commonly represented families were Fabaceae (110 taxa), Orchidaceae (66 taxa), Myrtaceae (68 taxa) and Proteaceae (63 taxa). The most commonly represented genera were *Acacia* (40 taxa), *Stylidium* (29 taxa), *Hibbertia* (22 taxa) and *Drosera* (20 taxa).

A total of seven threatened flora species and 25 priority flora species have the potential to occur in the Holyoake East survey area. Of the threatened flora species, *Anthocercis gracilis* (T) is the only potential species and this species occurs on granite outcrops.

In 2022 and 2023, the data indicated that of the Priority flora species, four priority flora species have a high potential to be in the survey area and eleven priority flora species have a moderate potential to be in the survey area.

A total of 80 introduced taxa have the potential to occur in the Holyoake East survey area (Appendices B and D). Six of the introduced species are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2023). Four of the introduced taxa are listed Weeds of National Significance (DCCEEW 2023d). Some of these species may not occur in the less disturbed forest areas and as such reflect the wide radial approach to database searches.

Potential Vegetation Values

There are no TECs listed at Commonwealth or State level, or PECs listed at State level which would be likely to occur in the Holyoake East survey area. Although there are communities associated with granite outcrop areas that have been listed as PEC's at the State level to the north and east, on the basis of the database searches and previous observations, the occurrence of granite outcrops in the Holyoake East survey area is likely to be much lower and if present more localised in extent.
The Holyoake East survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023b) and as such was considered during the RFA process.

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the Holyoake East survey area. In view of the proximity of the Dwellingup as a forestry township it is unlikely that there will be additional old growth forests in the survey area. The Holyoake East has areas of dieback in some of the valley systems. The results for the dieback occurrence in these survey areas may also reflect the degree of sampling which is less intensive than in the western areas of the northern Jarrah forest.

Survey Effort

The survey effort in the Holyoake East survey areas includes data from the earlier transect studies within the northern valley systems to the more recent plots established on a range of the site-vegetation types within the survey area and the extensive recording on a grid pattern and targeted searches across the survey area. The other aspect of the survey efforts relates to the coverage over a range of seasons in 2022 and 2023.

These studies have been supplemented by extensive detailed plot and transect studies in the Northern Jarrah Forest over 40 years. It is important to recognise that the vegetation mapping efforts in seasons outside of the spring months can still be undertaken as the vegetation mapping relies on perennial species which persist through the seasons. Further the perennial species persist through different seasons and the key indicators can be recognized throughout the year. The site-vegetation types extend the vegetation mapping over large areas of the Northern Jarrah Forest and as such integrate the flora, vegetation and site values which provides additional and critical information to the understanding of patterns in the area. The site-vegetation type approach was developed by Dr J Havel (1975a, 1975b) in close consultation with Dr D Goodall from CSIRO in the mid 1970's. Whilst this approach may differ from some other studies in Western Australia the development by Havel and Goodall was undertaken to define a series of key indicators and site conditions that would enable a finer definition of the northern Jarrah Forest communities. Such an approach enabled the subdivision of the main forest types which relied heavily on the structural components and the dominant trees. The latter broader approach is evident in the regional mapping at a coarser level as undertaken for the Pre-European vegetation mapping as undertaken by Beard 1979. The adoption of the site-vegetation type approach also enabled consideration of representation in the wider Northern Jarrah Forest and as such is supplemented by the vegetation studies during the System 6 (Heddle *et al.* 1980) and the Regional Forest Agreement investigations (Mattiske and Havel 1998) supported by state and federal government agencies.

In summary, the work undertaken to date on the Holyoake East survey area supplements extensive studies previously within and adjacent to the current survey area and as such meets the EPA (2016a and 2016b) guidelines. With the proposed supplementary flora and vegetation studies in the spring months of 2024 the effort exceeds the effort undertaken on many projects as it enables a detailed and comprehensive assessment of the survey area in the local and regional context.

Recorded Flora

A total of 474 vascular plant taxa, representative of 192 genera and 66 families (Appendix B), have been recorded in the Holyoake East survey area. The most commonly represented families were Fabaceae (65 taxa), Proteaceae (38 taxa), Asteraceae (39 taxa) and Myrtaceae (30 taxa). The most commonly represented genera were *Lomandra* (19 taxa), *Acacia* (18 taxa) and *Hibbertia* (15 taxa).

A total of 2 priority flora species (*Lasiopetalum cardiophyllum* P4 and *Senecio leucoglossus* P4) were recorded either within or near the Holyoake East survey area and a range extension of *Leucopogon darlingensis* subsp. *darlingensis* was recorded in the Holyoake East survey area.

A total of 28 introduced taxa were recorded in the Holyoake East survey area. None of the introduced species are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2023). None of the introduced taxa are listed Weeds of National Significance (DCCEEW 2023d). The majority of the introduced species are relatively short lived annuals.

Recorded Vegetation

A total of 19 site-vegetation types were defined and mapped in the Holyoake East survey area and an addition two mapping units (CL cleared land and PL – plantations). The site-vegetation types were defined on the basis of key species and site parameters as defined in Habel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years.

It is clearly apparent that there are some dominant site-vegetation types that dominate the Holyoake East survey area (namely PS, S, TS and T which together cover 68.65% of the survey area)**.**

None of these site-vegetation types are restricted to the Holyoake East survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2023e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023b) within the Holyoake East survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2023a) within the Holyoake East survey area. At a State or National level none of the site-vegetation types have been listed as Threatened or Priority Ecological Communities.

1. INTRODUCTION

Mattiske Consulting Pty Ltd (Mattiske) was commissioned by GHD on behalf of Alcoa of Australia Ltd (Alcoa) to conduct a desktop assessment and field assessment to evaluate the flora and vegetation values within the Holyoake East areas, approximately 80 km south east of Perth, WA. Alcoa wishes to expand their mining operations into the Holyoake East region. The desktop completed in 2022 was followed by detailed field studies over the period from December 2022 to September 2023. The Holyoake East survey area is located in tenement ML 1SA and consists of three priority areas as defined by Alcoa of Australia Ltd. These studies incorporated previous data from transects in the northern section undertaken by Mattiske for Alcoa over a series of monitoring times from 1994 to 2015 in the Cameron block and from recent permanent plots established in 2022 within the Holyoake East areas.

1.1. Location and Scope of Project

The Holyoake East survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province (Beard 1990), approximately 80 km south of Perth, WA (Figure 1). The Holyoake East survey area consists of one polygon located in tenement ML 1SA (Figure 2).

This report describes the potential and recorded flora and vegetation values of the proposed Holyoake East survey area and places them within a local and regional context.

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

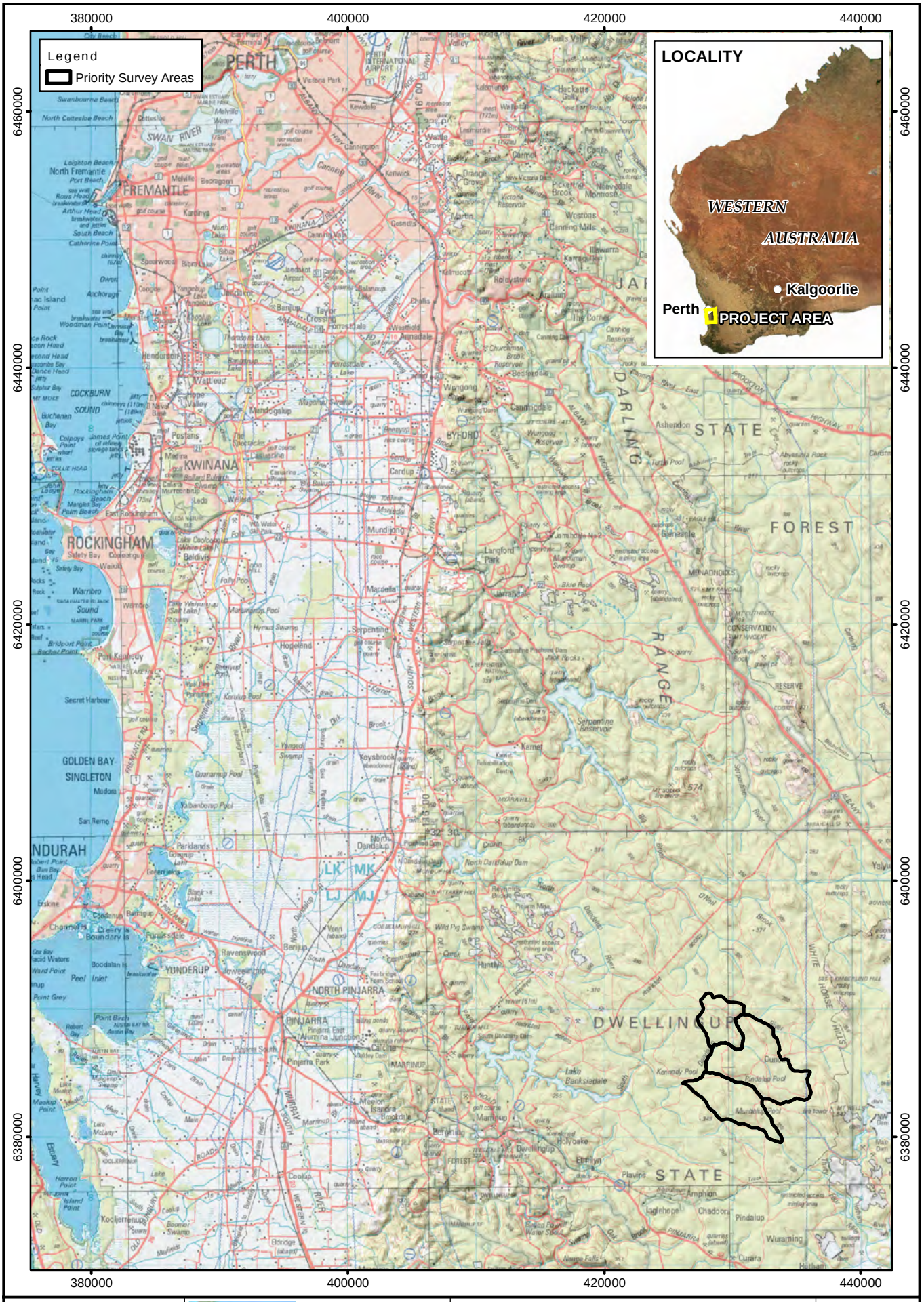
The following key Western Australian (state) legislation relevant to this survey includes the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) and *Regulations 2013*;
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

Furthermore, key Western Australian guidelines relevant to this survey are the:

- Environmental Factor Guideline: Flora and Vegetation (Environmental Protection Authority [EPA] 2016a);
- Technical Guidance – Flora and vegetation surveys for environmental impact assessment (EPA 2016b); and
- Commonwealth of Australia (2013) - Survey Guidelines for Australia's Threatened Orchids. Guidelines for detecting Orchids listed as "Threatened" under the *Environment Protection and Biodiversity Conservation Act 1999*.

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-A5.



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Scale: 1:400,000
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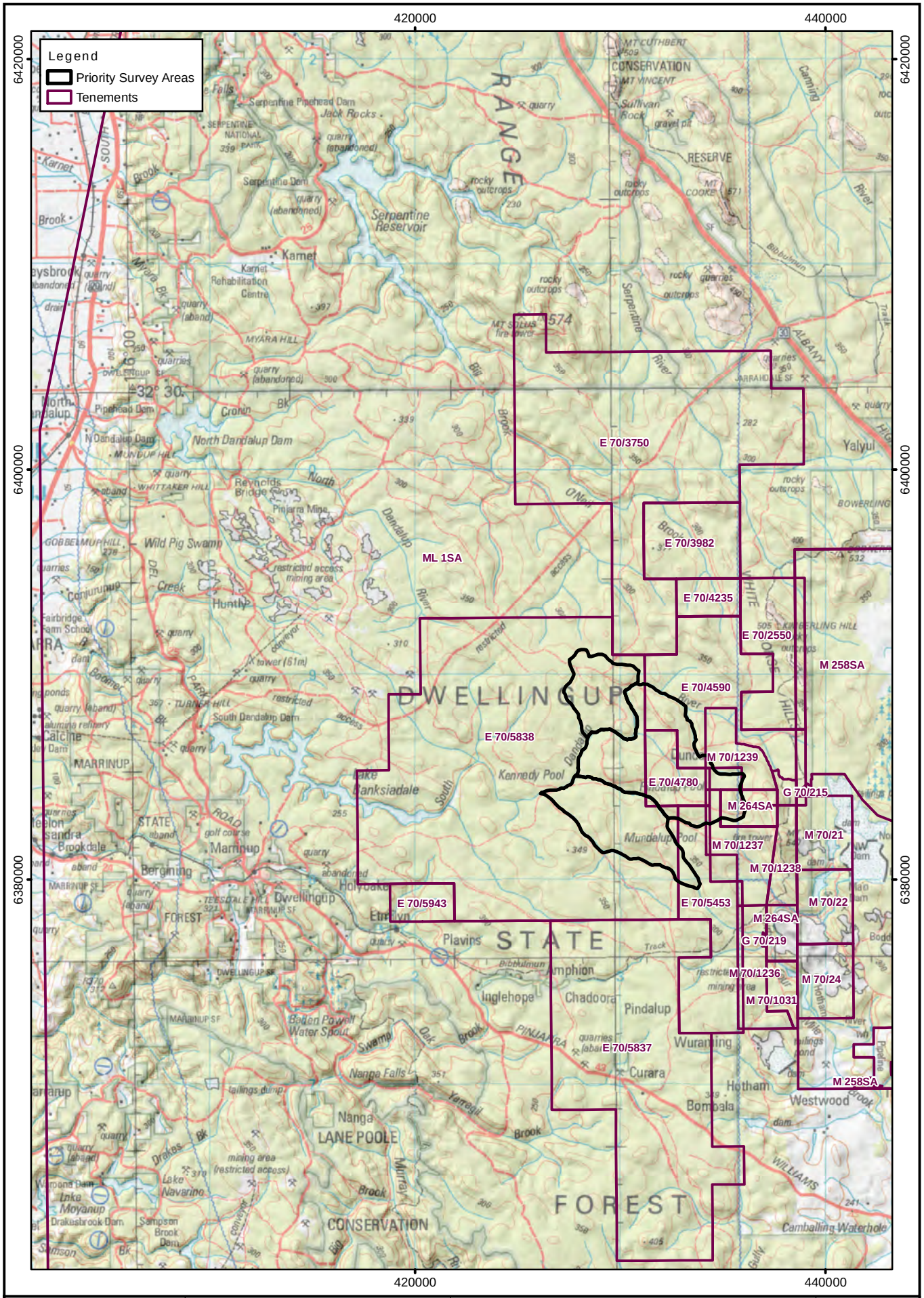
Date: December 2023 | Rev: A | A4

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Holyoake East - Priority Areas
Locality

Figure: **1**



N

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Scale: 1:250,000
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CAD Ref: a1992_F029_02

Date: December 2023 | Rev: A | A4

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Holyoake - Priority Areas
Tenements

Figure: **2**

2. OBJECTIVES

The objective of this assessment was to combined the earlier desktop assessment and the findings from the recent field studies of the Holyoake East survey area, including:

- A desktop assessment of the flora and vegetation of the Holyoake East survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Review previous literature and current databases associated with the Holyoake East survey area;
- A summary of key findings from the detailed studies (plots, recording sites, transects and targeted surveys) the Holyoake East area in the period from 2022 to 2023;
- Review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA 2023a, 2023c) and plant collections held at the Western Australian Herbarium ([WAH] 1998 -), and plants listed by the Department of Climate Change, Energy and the Environment [DCCEEW] (2023a) under the EPBC Act; and
- Prepare a report summarising the findings.

3. METHODS

3.1. Desktop Assessment

The NatureMap (DBCA 2007-) and *EPBC Act* Protected Matters Search Tool (DCCEEW 2023b) databases were used to identify the possible occurrence of flora (including threatened and priority taxa) and threatened and priority ecological communities within the Holyoake East survey area.

In addition, historical documentation and vegetation mapping of the Northern Jarrah forest subregion that provide resource material for the floristics and vegetation of the Holyoake East survey area was reviewed, including Mattiske Consulting Pty Ltd (1994-2022) reports on their flora and vegetation surveys in the Holyoake East region. Nomenclature of flora species was checked against and is consistent with Florabase (WAH 1998-).

3.2. Field Studies

To maintain consistency with previous mapping of the area, enabling spatial and temporal comparisons, flora and vegetation were assessed using site-type classification based on Heddle *et al.* (1980). Sites were pre-designated using a grid system overlaid on the survey area. Additional opportunistic sites were surveyed when changes in the vegetation, representing communities which would otherwise have been missed, were encountered whilst walking between designated survey sites. Site data was used to define vegetation types for each survey site. This data was then used in combination with aerial imagery and field observations to map the vegetation of the survey area. Furthermore, searches for threatened, priority or Declared (plant) pests species were undertaken whilst walking between survey sites.

The following information was recorded at each vegetation assessment site:

GPS location	Easting, Northing and datum;
Soil types	gravels, sandy-gravels, sandy-loam-gravels, sandy-loams, loams, clay-loams, clays and peat;
Topography	ridge, upper slope, mid-slope, lower slope, valley floor and swamp;
Outcropping	type – granite, laterite, dolerite, and quantity – few, moderate, numerous;
Logging history	light, moderate or heavy, together with number of stumps within a 20 m radius;
Fire history	years since last fire; and
Dieback occurrence	*Phytophthora* spp. demarcation – field blazing, coloured flagging on trees, vegetation deaths, either old or recent.

At each site species were ranked according to the scale developed by Havel (1975a, 1975b). Tree and understorey species were assessed separately using the following method.

Tree species

Tree species (*Allocasuarina fraseriana, Banksia grandis, B. littoralis, B. seminuda, Corymbia calophylla, Eucalyptus marginata, E. megacarpa, E. patens, E. rudis, E. wandoo, Melaleuca preissiana, M. rhaphiophylla, Nuytsia floribunda, Persoonia elliptica, P. longifolia* and *Xylomelum occidentale*) were assessed within a 20 m radius from the observation point using the following scale:

0 absent;
1 one or two trees;
2 three to five trees;
3 more than five trees, but contributing less than one third of the total stand;
4 between one third and one half of the total stand; or
5 more than one half of the total stand.

Understorey species

Understorey species were assessed within a 5 m radius from the observation point using the following scale:

0 absent;
1 very rarely seen, only after a careful search;
2 present, observable, but in small numbers only;
3 common locally, but not uniform over the whole area;
4 common over the whole area; or
5 completely dominating the understorey.

The physiological stress was determined for each species within a 20 m radius from the observation point and ranked according to the following scale.

0 healthy, no evidence of stress;
1 odd plant showing signs of stress, not dead;
2 one or two dead plants, near death;
3 scattered stressed plants, (2-4) dead plants around survey site;
4 susceptible plants dying or dead (> 4 plants); or
5 “graveyard” death

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH). All plant specimens were identified through comparisons with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

3.3. Survey Limitations

A general assessment was made of the current survey area against a range of factors that may have limited the outcomes and conclusions of this report (Table 1).

Table 1: Potential flora and vegetation survey limitations for the Holyoake East survey area

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Reference resources such as mapping by Beard 1979, Mattiske and Havel 1998, previous vegetation mapping completed for Alcoa by E.M Mattiske and Associates together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora, which were the focus of the present survey will be thoroughly sampled on a grid pattern within the survey area.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Not a constraint:** The survey areas will be sampled on a grid pattern. The botanists undertaking the field surveys have had extensive experience working with the flora of the Jarrah forest. Any flora which could not be identified in the field was collected for subsequent identification. Additional targeted work for the flora will be undertaken on specific key areas (granites, creek-lines).
Mapping reliability	**Not a constraint:** The vegetation will be assessed on a grid pattern within the survey area. This together with opportunistic survey sites will provide high quality data enabling the survey area to be mapped with a high level of confidence.
Timing, weather, season, cycle	**Not a constraint:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). As the seasons change the sampling over the 12-month period (2022 to 2023) when combined with the extensive work undertaken in the area and in adjacent areas reduces the risk of not covering the flora species. With regard to the conservation significant flora, the majority identified as potentially occurring within the survey area can be recorded out of season with the exception of some orchid species which do not flower as regularly and some *Drosera* species. Further detailed work will be undertaken in 2024.
Disturbances (fire flood, accidental human intervention, *etc.*)	**Potential Constraint:** Some areas had been recently burnt and hence it was necessary to extrapolate from nearby mapping. Generally, many species take 2 to 3 years to recover after burns in the northern Jarrah forest. **P**revious logging activities have been undertaken for many decades in this area. The forestry areas may have been burned recently; this will affect the ability to accurately define vegetation communities. These land uses and activities may influence surveys in the area.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** Vehicle access was not restricted in the survey areas.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** All botanists had direct and recent experience working in the Jarrah Forest and working for Alcoa, and thus were familiar with the local flora and vegetation values. Dr Mattiske has more than 40 years of ecological experience in flora and vegetation studies in the southwest forests.

4. FINDINGS FROM DESKTOP STUDIES

The climate, geology, soils and landforms all influence the vegetation of the area and are described in this section. Potential flora, including threatened, priority and introduced species are described, along with possible vegetation communities, and placed within a local and regional context.

4.1. Climate

The survey area lies at the southern end of the Northern Jarrah Forest subregion. Beard (1990) described the climate of this area as being warm Mediterranean, with rainfall of 600 – 1200 mm per annum and 5 - 6 dry months per year. The closest weather station is the Dwellingup weather station. Annual average rainfall at Dwellingup is 1218.5 mm (Bureau of Meteorology [BOM] 2023). Rainfall in 2021 (1335.4mm) was higher than the long term (LT) of 1221.8mm, see Figure 3. The rainfall decreased in 2022 to 1009.2mm for the year and for the 11 months (January to November in 2023) to 951.6mm, Figure 3. The trend of lowering rainfall is not replicated in similar changes to the temperature.

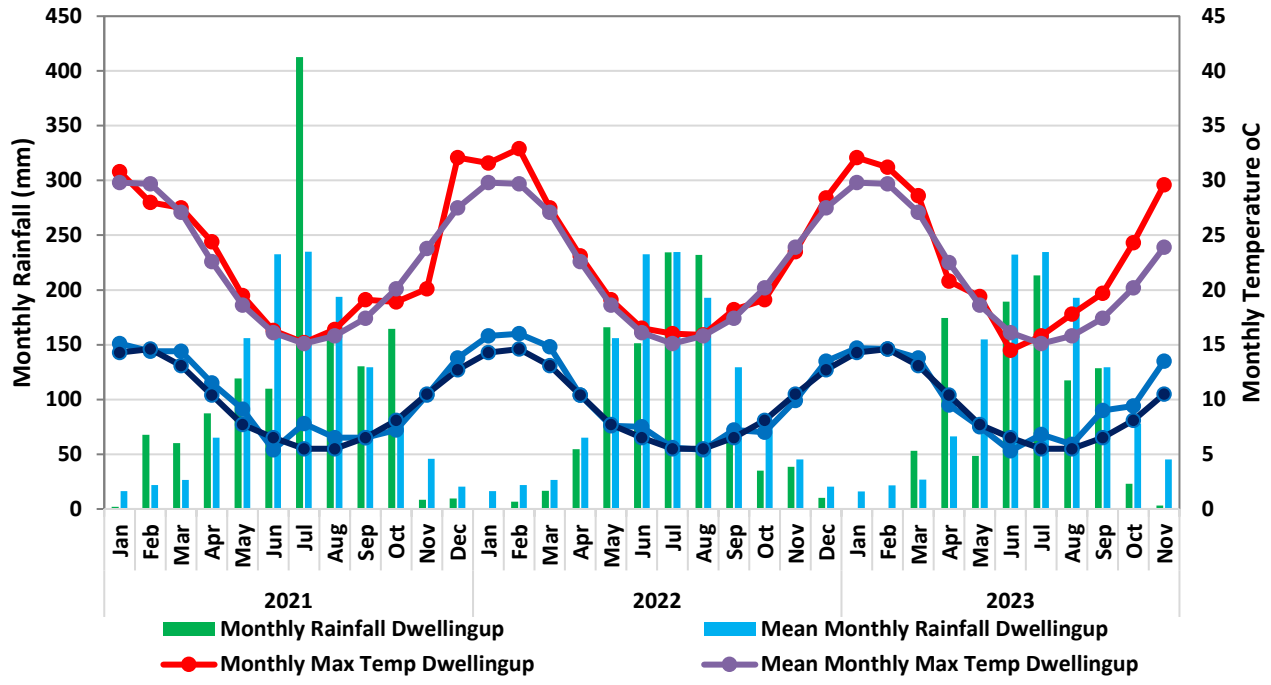
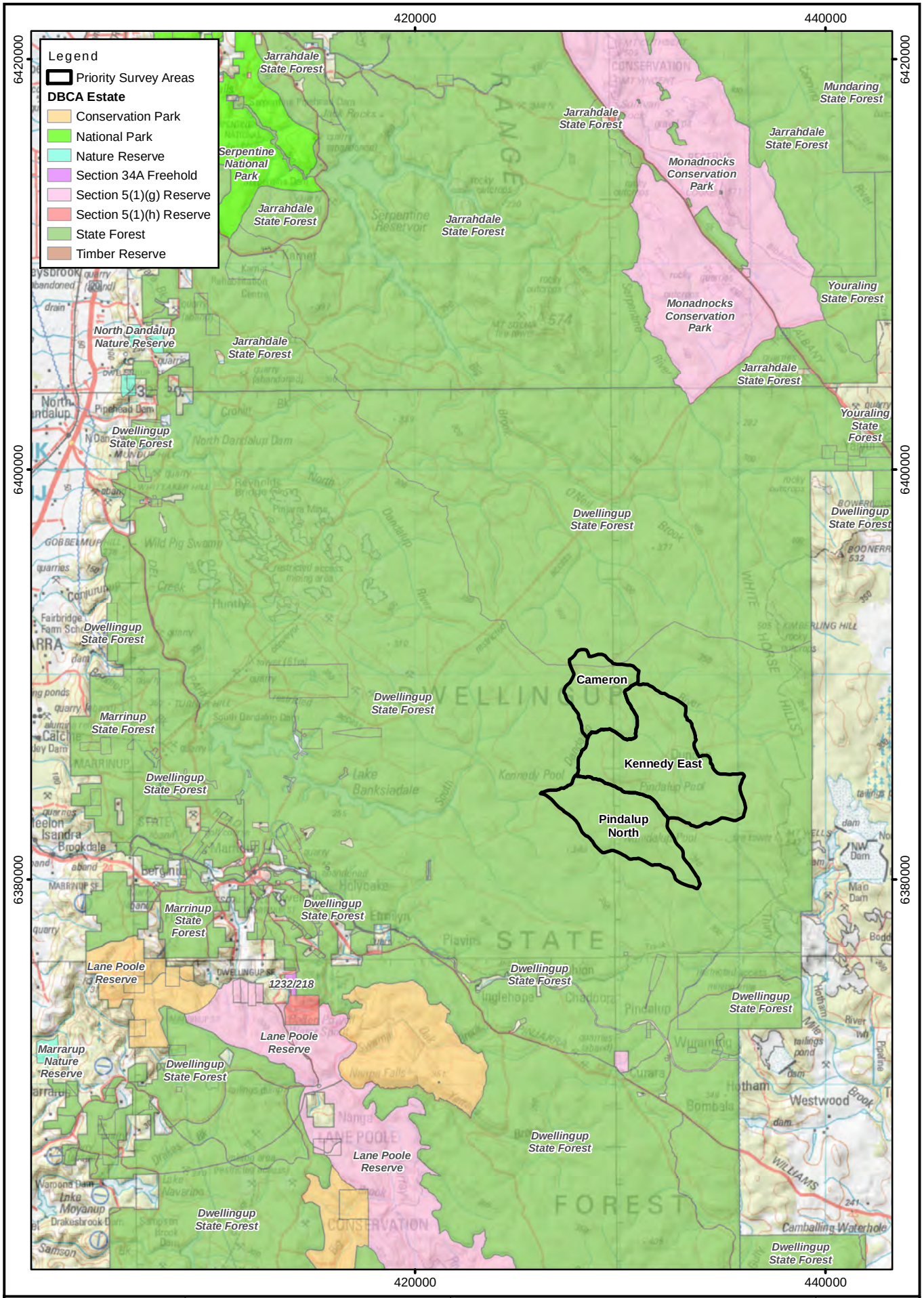


Figure 3: Climatic data for Holyoake East survey area (BOM 2023)
Long term average rainfall and temperature from the Dwellingup weather station

4.2. DBCA Estates

The Holyoake East survey area is situated in State Forest to the north-east of Dwellingup (Figure 4).



N

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Scale: 1:250,000
MGA94 (Zone 50)

CAD Ref: a1992_F029_03

Date: December 2023 | Rev: A | A4

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Holyoake East - Priority Areas
DBCA Estates

Figure: **4**

4.3. Geology, Soils and Topography

The Holyoake East survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion encompasses the area to the east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of the Yilgarn Craton at an average elevation of 300 m (Beard 1990). The area is capped by extensive lateritic duricrust, dissected by drainage lines and broken by occasional granite hills. In the eastern section, the laterite becomes deeply dissected until it compresses isolated remnants. The duricrusted plateau of the Yilgarn Craton is characterised by lateritic gravels, consisting of 5 m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon. These overlay mottled yellow-brown clay subsoils and hard setting loamy soils, which become evident in the east (Beard 1990).

Furthermore, Western Australia is divided into twelve Systems, separated by natural and demographic boundaries (Department of Conservation and Environment 1980). The survey area lies within the Darling System (as known as System 6), which is further divided into provinces, with the survey area lying in The Darling Plateau province (Department of Conservation and Environment 1980).

The underlying geological units of The Darling Plateau province have been defined by Churchward and McArthur (1980), with three main landform and soil units occurring within the survey areas, these are:

Dwellingup: Gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions.

Yarragil: Valleys of the western part of the plateau; sandy gravels on the slopes; orange earth in swampy floors.

Pindalup: Valleys pf the central part of the plateau, gravelly duplex soils on slopes, some rock outcrop, grey sands, duplex yellow soils and orange earths in broad floors.

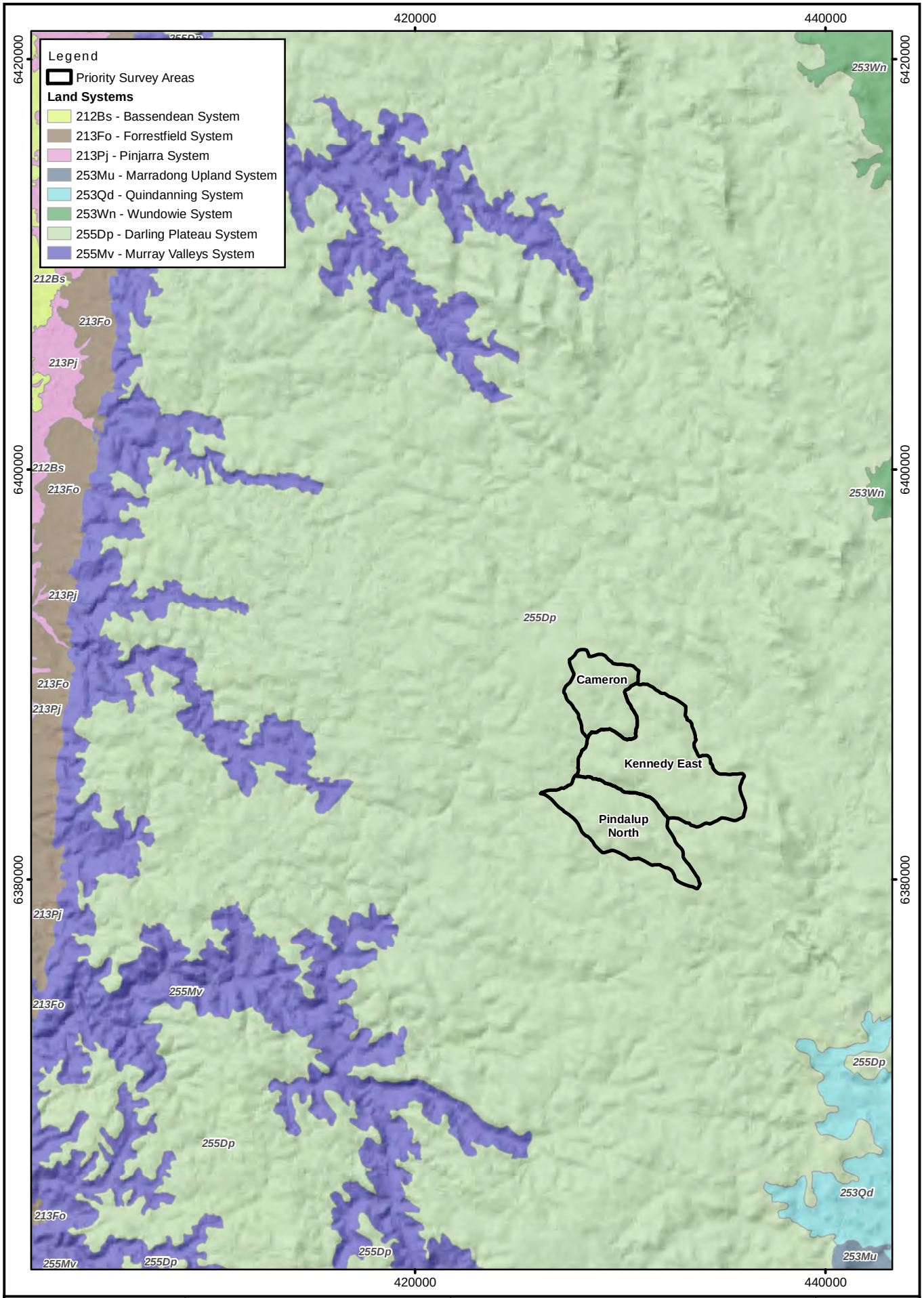
Cook: Hills rising above general plateau level ; mainly laterite but with some rock outcrop.

The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the Holyoake East survey area (Figure 5, Table 2) includes:

1. **Darling Plateau System (255Dp):** Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah-marri-wandoo forest and woodland.

Table 2: Extent of Land Systems intersecting the Holyoake East survey area

Land System	Mapping Unit	Total Extent (ha)	Area of Intersection with the Holyoake East survey area	Proportion of Current Extent (%)
Darling Plateau System	255Dp	820265.77	5731.14	0.699



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Scale: 1:250,000
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Holyoake East - Priority Areas
Land Systems

Figure: **5**

4.4. Regional Vegetation

The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent. In lower rainfall areas towards the east trees decrease in size, forming woodlands or low forests. This dry sclerophyllous forest typically comprises a dominant *Eucalyptus marginata* and *Corymbia calophylla* overstorey, a mid-storey of *Allocasuarina fraseriana* (Sheoak), *Banksia grandis* (Bull Banksia), *Persoonia longifolia* (Snottygobble), *Persoonia elliptica* (Spreading Snottygobble), and a groundcover of woody shrubs with grass trees *Xanthorrhoea preissii*, *Kingia australis* and the cycad *Macrozamia riedlei* (Dell and Havel 1989).

The Pre-European vegetation system present within the Holyoake East survey area (Figure 6, Table 3) include:

1. **West Darling System**

   Vegetation Association 3.3: Mainly jarrah and marri Eucalyptus marginata, Corymbia calophylla.

2. **East Darling System**

   Vegetation Association 3.3: Mainly jarrah and marri Eucalyptus marginata, Corymbia calophylla

Table 3: Extent of pre-European vegetation associations intersecting the Holyoake East survey area

System	Vegetation Association	State-wide Pre-European Extent (ha)	Area of Intersection with the Holyoake East survey area (ha)	Proportion of Current Extent (%)
West Darling	3.3	686824.44	5728.91	0.834
East Darling	3.3	303349.65	2.23	0.0007

Heddle *et al.* (1980) and Mattiske and Havel (1998) described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes (Regional Forest Agreement vegetation complexes) and determined how they relate to the landforms, soils and climatic conditions. Seven broad vegetation complexes occur in the Holyoake East survey area (Figure 7, Table 4), these are:

Dwellingup 1 (D1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.

Dwellingup 4 (D4): Open forest to woodland of *Eucalyptus marginata* subsp. *thalassica* - *Corymbia calophylla* on lateritic uplands in semiarid and arid zones.

Cooke (Ce): Mosaic of open forest of E*ucalyptus marginata* subsp. *marginata – Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp*. thalassica – Corymbia calophylla* (semi-arid and arid zones) and on the deeper soils adjacent to outcrops closed heath of Myrtaceae-Proteaceae species and lithic complex on granite outcrops and associated soils in all climatic zones with some *Eucalyptus laeliae* (semi-arid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to perarid zones).

Yarragil 1 (Yg1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.

Yarragil 2 (Yg2): Open forest of *Eucalyptus marginata* subsp. *thalassica* - *Corymbia calophylla* on slopes, woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.

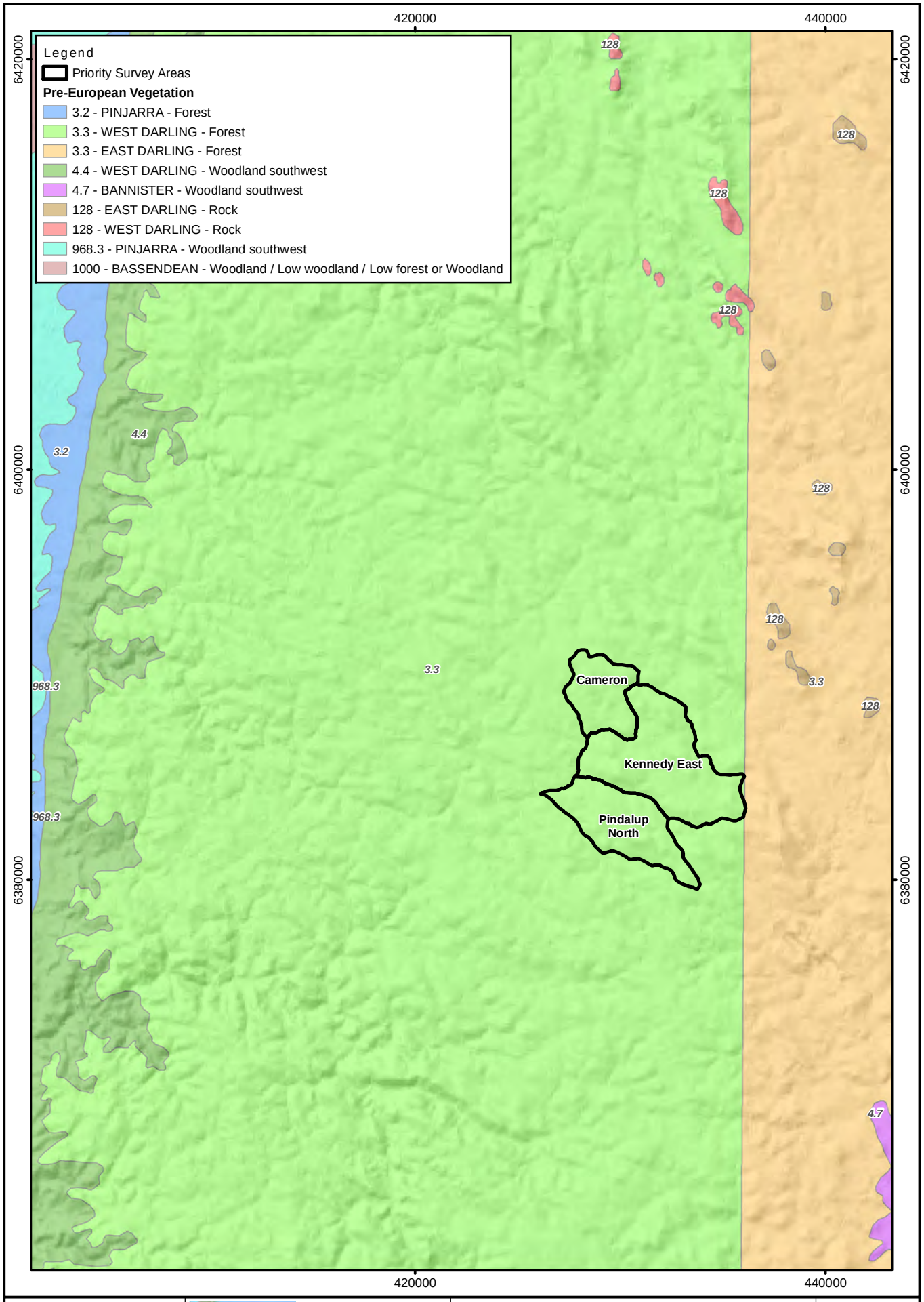
Pindalup (Pn): Open forest of *Eucalyptus marginata* subsp. *thalassica* - *Corymbia calophylla* on slopes and open woodland of *Eucalyptus wandoo with some Eucalyptus patens* on the lower slopes in semiarid and arid zones.

Swamp (S): Mosaic of open woodland of *Melaleuca preissiana – Banksia littoralis,* closed scrub of Myrtaceae spp., closed heath of Myrtaceae spp., and sedgelands of *Baumea* and *Leptocarpus* spp. On seasonally wet and moist sand, peat and clay soils on valley floors in all climatic zones.

More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area falling within the Northern Jarrah Forest subregion (JF1) of the Jarrah Forest (JAF) Region (DCCEEW 2023c). The vegetation of the Northern Jarrah Forest subregion consists of Jarrah – Marri forest, with Bullich and Blackbutt in the valleys to the west, grading to Wandoo and Marri woodlands to the east. Heath vegetation is the common understorey of forests and woodlands and occurs on granite rocks. The majority of the diversity between communities in this subregion occurs on lower slopes and near granite soils (Williams and Mitchell 2001).

Table 4: Extent of Vegetation Complexes intersecting the Holyoake East survey area

Area (Blocks)	Vegetation Complex	Vegetation Class	Total Extent (ha)	Area of Intersection with the Holyoake East survey area (ha)	Proportion of Current Extent (%)
Cameron	Dwellingup 1	D1	181038.81	688.305	0.38
	Yarragil 2	Yg2	46475.31	285.847	0.62
	Pindalup	Pn	128358.24	59.100	0.05
	Swamp	S	40612.97	63.038	0.16
Kennedy East	Dwellingup 1	D1	181038.81	1287.175	0.71
	Dwellingup 4	D4	115661.52	111.049	0.10
	Cooke	Ce	30304.20	78.241	0.26
	Yarragil 2	Yg2	46475.31	810.052	1.74
	Pindalup	Pn	128358.24	315.783	0.25
	Swamp	S	40612.97	303.691	0.75
Pindalup North	Dwellingup 1	D1	181038.81	1027.240	0.57
	Cooke	Ce	30304.20	53.358	0.18
	Yarragil 1	Yg1	64927.06	169.512	0.26
	Yarragil 2	Yg2	46475.31	446.483	0.96
	Pindalup	Pn	128358.24	9.147	0.01
	Swamp	S	40612.97	23.125	0.06



N

0 2 4 km

Scale: 1:250,000
MGA94 (Zone 50)

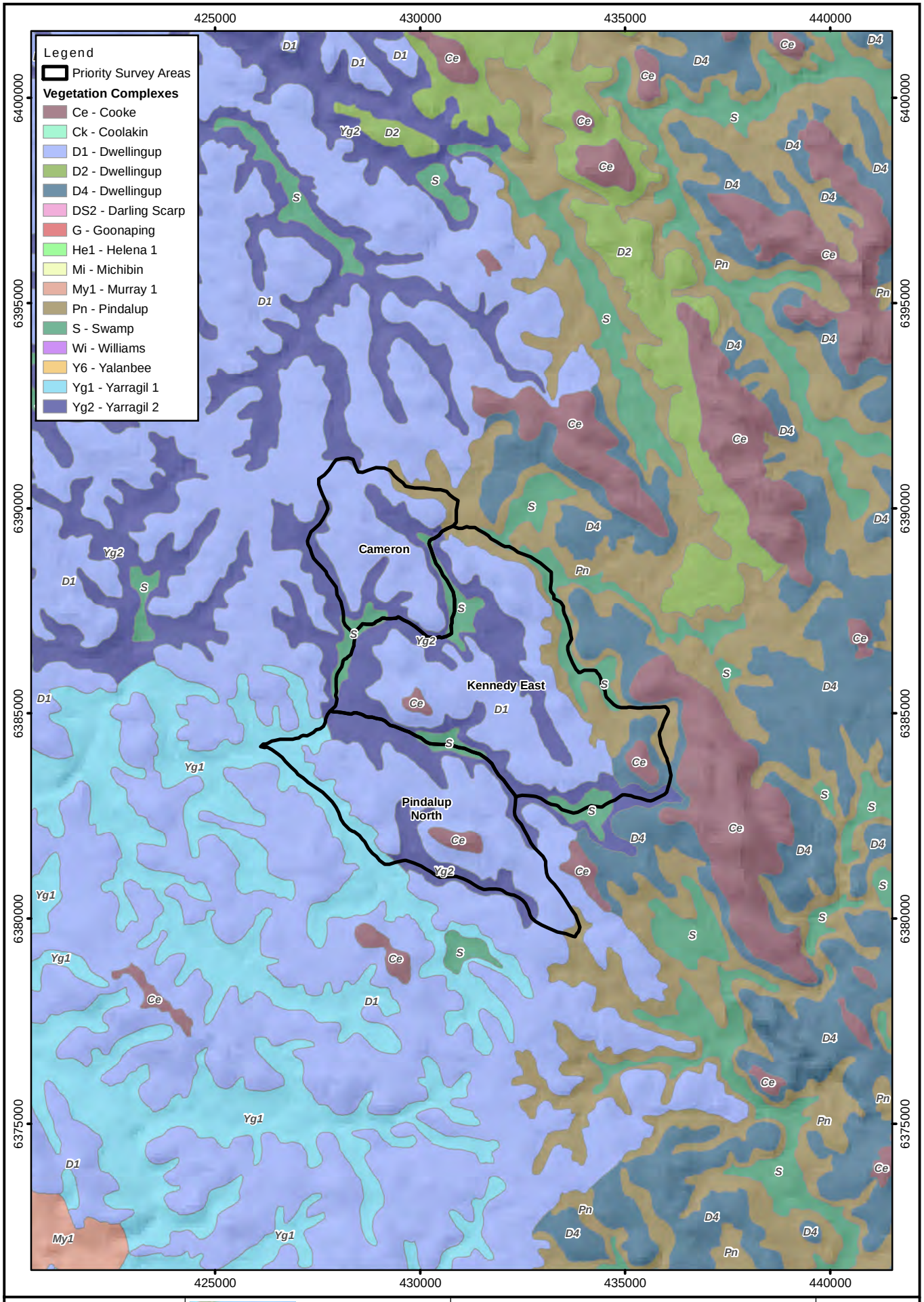
CAD Ref: a1992_F029_06

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Holyoake East - Priority Areas
Pre-European Vegetation

Figure: **6**



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F029_07

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Holyoake East - Priority Areas
Vegetation Complexes

Figure: **7**

4.5. Potential Flora

A total of 860 vascular plant taxa, representative of 267 genera and 85 families (Appendix B), have the potential to occur within the Holyoake East survey area (Mattiske Consulting 2022). The most commonly represented families were Fabaceae (110 taxa), Orchidaceae (66 taxa), Myrtaceae (68 taxa) and Proteaceae (63 taxa). The most commonly represented genera were *Acacia* (40 taxa), *Stylidium* (29 taxa), *Hibbertia* (22 taxa) and *Drosera* (20 taxa).

4.5.1. Potential Threatened and Priority Flora

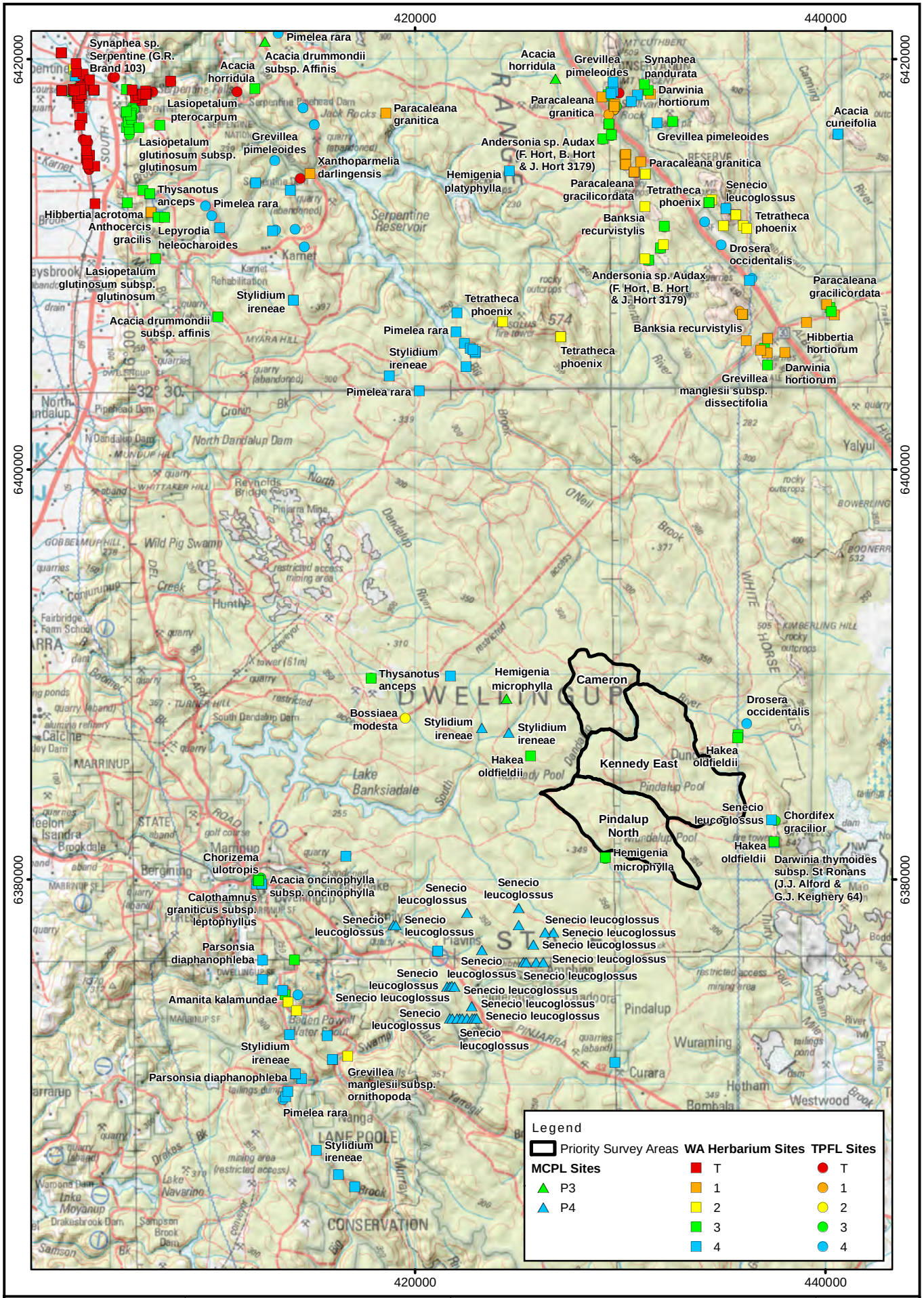
A total of seven threatened flora species and 25 priority flora species have the potential to occur in the Holyoake East survey area (Appendix C, Table 5, Figure 8). Of the threatened flora species, *Anthocercis gracilis* (T) is the only potential species that may occur on granite outcrops. In 2022 and 2023, the data indicated that of the Priority flora species, four priority flora species have a high potential to be in the survey area and eleven priority flora species have a moderate potential to be in the survey area.

The likelihood that these species would occur within the survey areas was determined using the following criteria:

- Known records within a 20 km radius of the centre of the survey area (as described above). More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).
- The likelihood was ranked Low, Moderate or High.

All potential threatened and priority flora are listed in Appendix C, along with their State and Federal Conservation Codes (see Appendix A for definitions), a description and an assessment of the likelihood of their occurrence in the Holyoake East survey area.

Based on this assessment, one threatened flora species, *Anthocercis gracilis* (T) has a moderate likelihood of occurring in the Holyoake East survey area. Six threatened flora species, *Diuris purdiei* (T), *Diuris micrantha* (T), *Thelymitra stellata* (T), *Verticordia fimbrilepis* subsp. *fimbrilepis* (T), *Lasiopetalum pterocarpum* (T) and *Thelymitra dedmaniarum* (T), have a low likelihood of occurring in the Holyoake East survey area. Seven priority flora species had a moderate likelihood of occurring in the Holyoake East survey area, Appendix C and Figure 8. Four priority flora have a high likelihood of occurrence (*Hakea oldfieldii* P3, *Hemigenia microphylla* P3, *Lasiopetalum cardiophyllum* P4 and *Senecio leucoglossus* P4), mainly due to previous records in the area or in adjacent areas and suitable habitat. An additional 11 priority flora species (one Priority 2, six Priority 3 and four Priority 4 species) have the potential to occur in the area.



N

0 2 4 km

Scale: 1:250,000
MGA94 (Zone 50)

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Holyoake East - Priority Areas
Potential Threatened and Priority Flora

Figure: **8**

4.5.2. Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

A total of 80 introduced taxa have the potential to occur in the Holyoake East survey area (Appendices B and D). Six of the introduced species are declared pest organisms pursuant to section 22 of the BAM Act. Four of the introduced taxa are listed Weeds of National Significance. Some of these species may not occur in the less disturbed forest areas and as such reflect the wide radial approach to database searches.

An assessment of the likelihood that the significant weed species (Weeds of National Significance and/or declared pest organisms) would occur within the Holyoake East survey area (Appendix D) was determined using the following criteria:

- Known records within a 40 km radius of the centre of the survey area (as described above). More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).

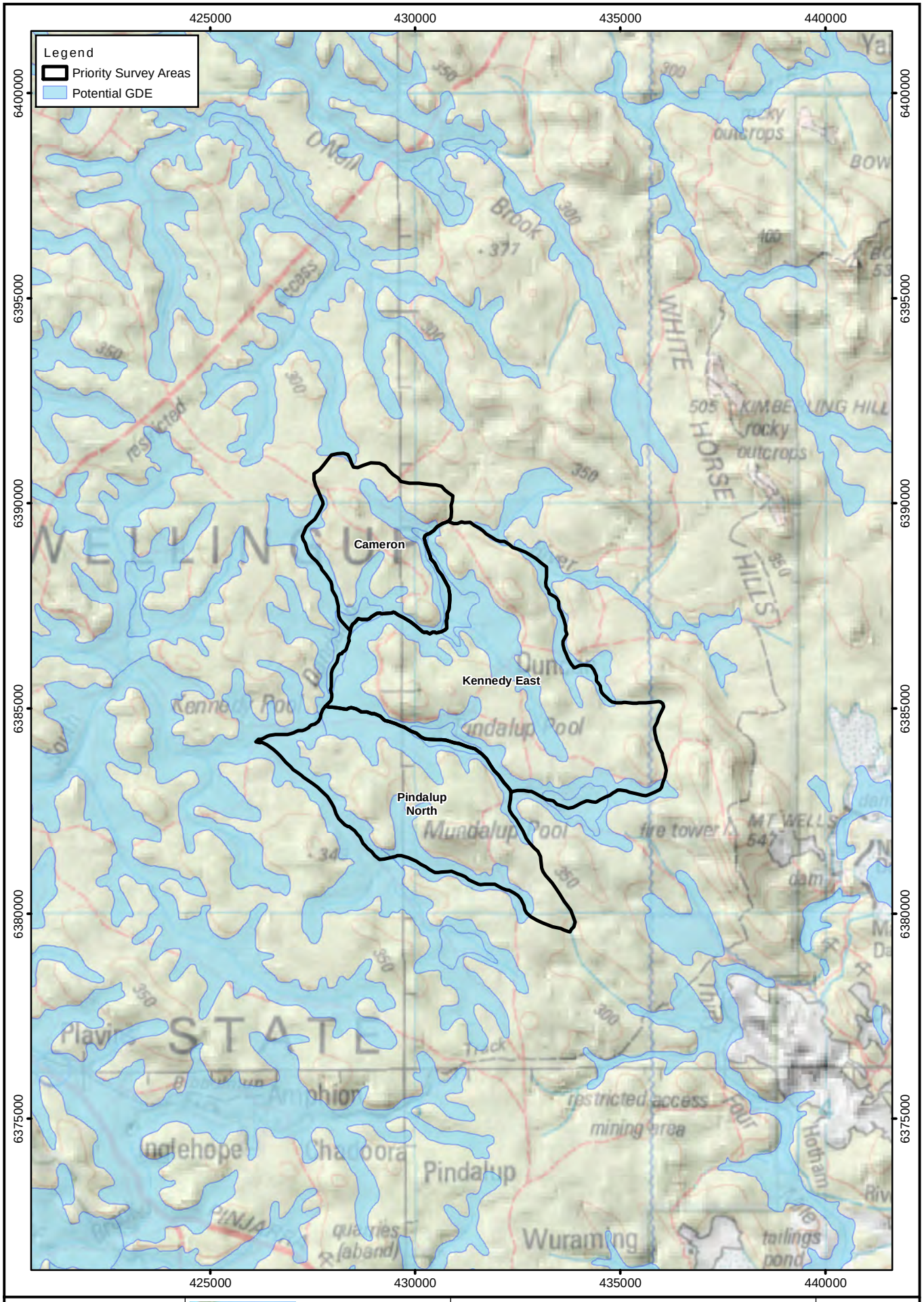
The likelihood was ranked Low, Moderate or High.

Based on this assessment, eight of the significant weed species had a high likelihood, and eighteen weed species had a moderate likelihood, of occurring in the Holyoake East survey area. The majority of the weeds with moderate or high likelihood are relatively short lived species that will not compete with native species unless the vegetation is cleared or disturbed.

4.6. Groundwater Dependant Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes (Yarragil 1, Yarragil 2, Pindalup and Swamp), Figure 9. In view of the extensive flora and vegetation studies in the Northern Jarrah forest subregion these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture in the absence of site-vegetation type data.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Acacia divergens, Boronia molloyae, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Eucalyptus rudis, Hypocalymma angustifolium, Melaleuca preissiana, Melaleuca viminea* and *Taxandria linearifolia.*



N

0 1 2 km

Scale: 1:125,000
MGA94 (Zone 50)

CAD Ref: a1992_F029_12

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Holyoake East - Priority Areas
Potential GDE

Figure:
9

4.7. Old Growth Forests

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the Holyoake East survey area (Figure 10).

Due to the proximity of the Dwellingup as a forestry township it is unlikely that there will be additional old growth forests in the survey area.

The data as presented on the history of harvesting in the area reflects the age of logging on the Holyoake East survey area, see Figure 11. These results as supplied by DBCA reflect the degree of logging in the Holyoake East survey area in the last few decades. Some of the valley areas have not been logged for some time and as such reflect the linear patterns of these systems.

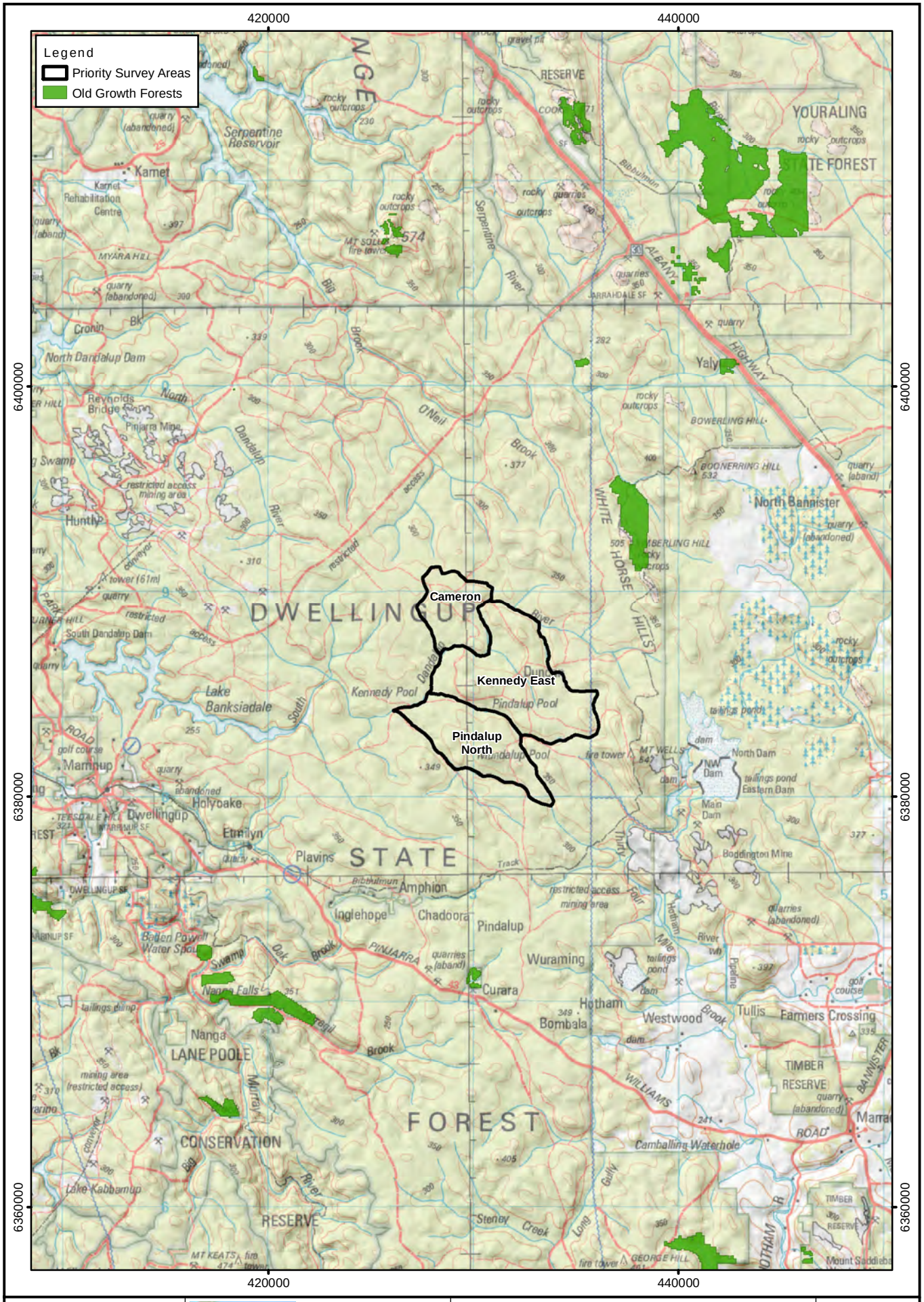
4.8. Previous Surveys

Mattiske Consulting has previously mapped the vegetation in the areas surrounding the Holyoake East survey area. Recent flora and vegetation studies relevant to the Holyoake East survey area include the previous flora and vegetation studies and transect monitoring has been done in the Cameron block (including the sub-catchment Gordon) since 1993 (E.M. Mattiske and Associates 1993 to 1994; and Mattiske Consulting 1996 to 2006) and the Holyoake East areas(Mattiske Consulting Pty Ltd 2021).

4.9. Potential Threatened and Priority Ecological Communities

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2023e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023b) with the potential to occur within the Holyoake East survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2023a) with the potential to occur within the Holyoake East survey area. Although there are communities associated with granite outcrop areas that have been listed as PEC's at the State level to the north and east, on the basis of the database searches and previous observations, the occurrence of granite outcrops in the Holyoake East survey area is likely to be much lower and if present more localised in extent.



N

0 2 4 km

Scale: 1:250,000
MGA94 (Zone 50)

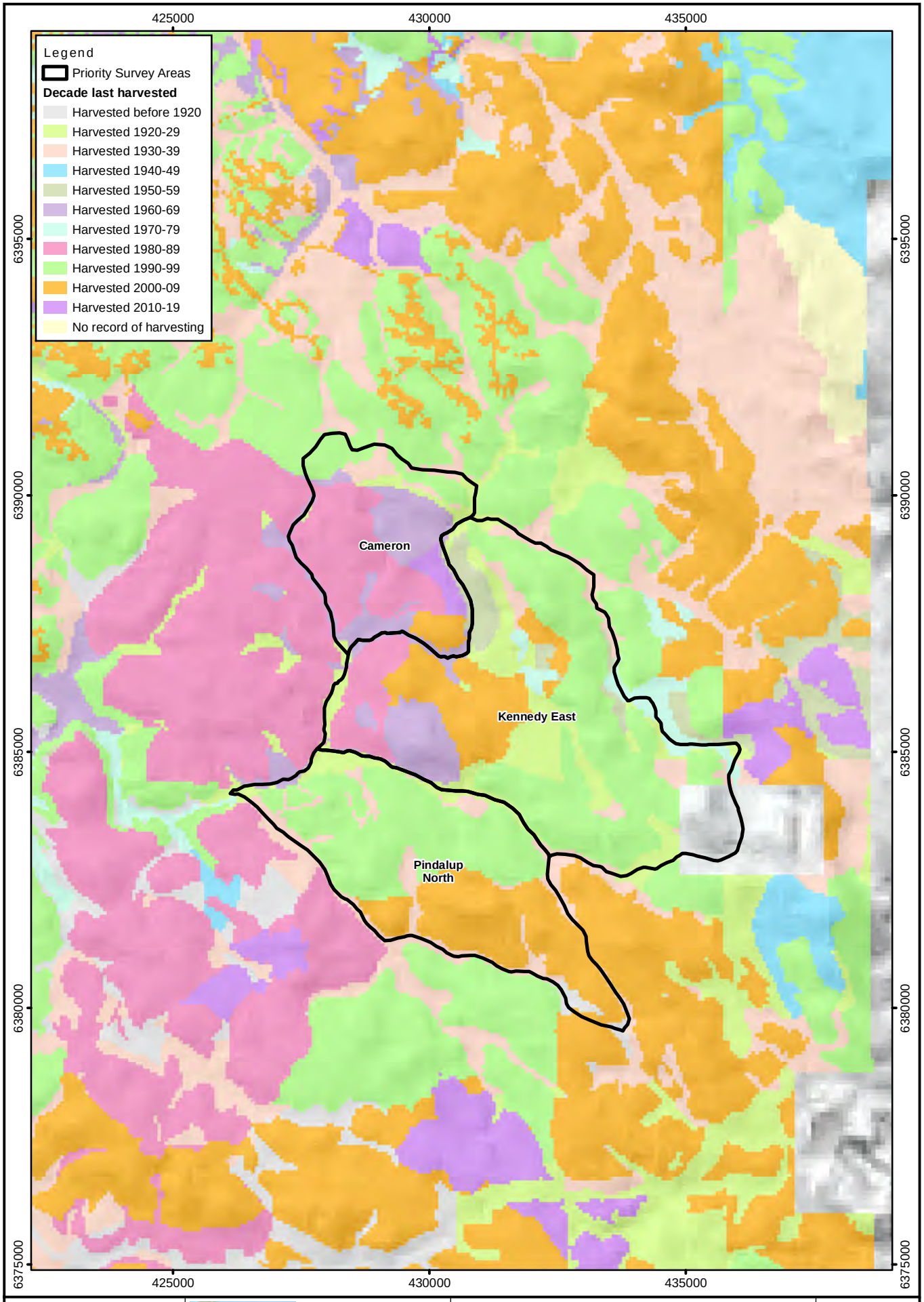
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Holyoake East - Priority Areas
Old Growth Forest

Figure: **10**



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 50)

CAD Ref: a1992_F029_10

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Holyoake East - Priority Areas
Harvested Year

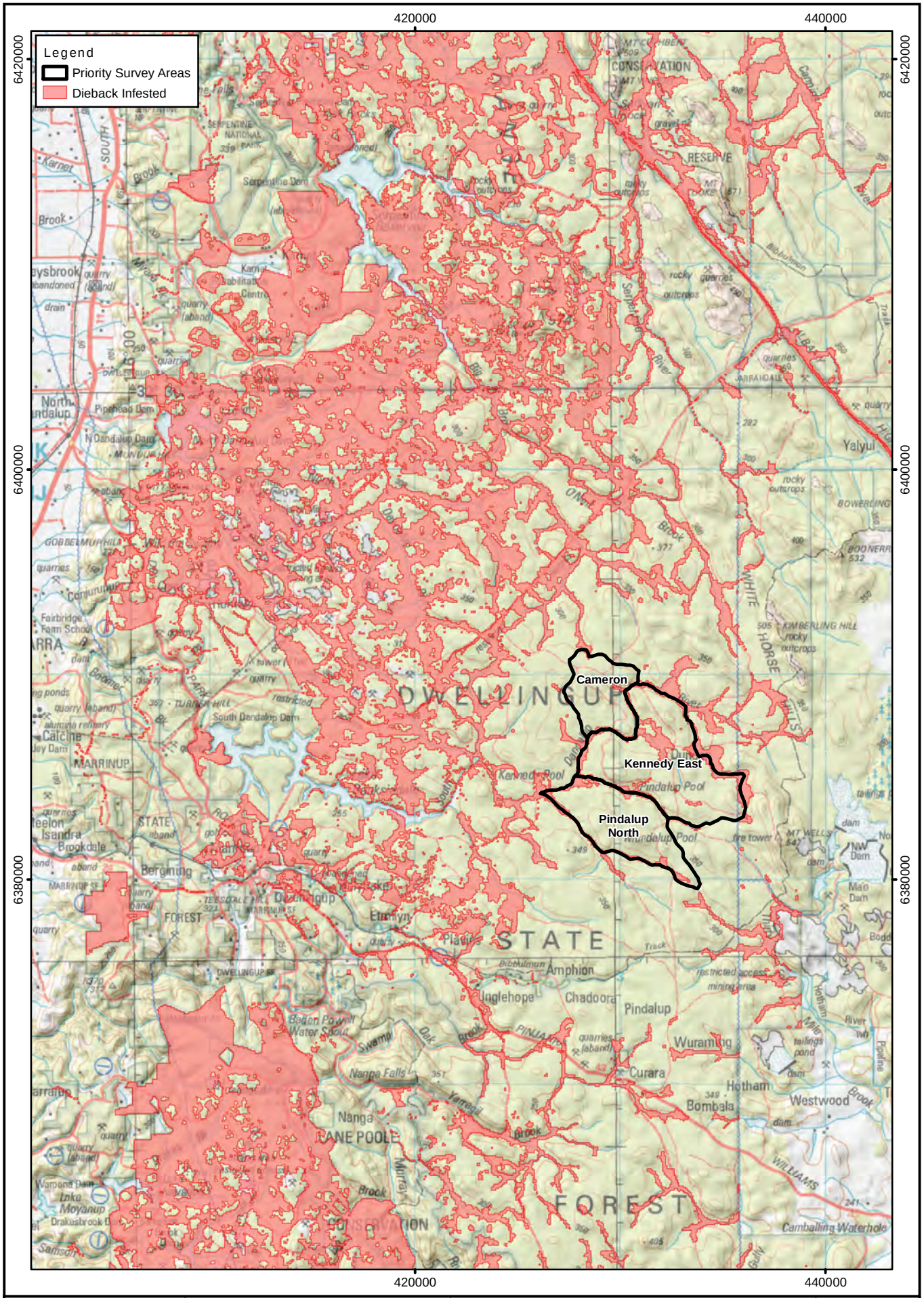
Figure:
11

4.10. Wetlands of International Importance (Ramsar)

The Peel-Yalgorup System, a listed Ramsar Wetland of International Importance, is located adjacent to the City of Mandurah and consists of shallow estuaries, freshwater marshes and coastal saline lakes that include the Harvey Estuary, Peel Inlet, Lake McLarty, Lake Mealup and ten Yalgorup National Park wetlands (DCCEEW 2023f). The fringing vegetation is mainly samphire, rushes, sedges and paperbark communities. The Peel-Yalgorup System supports a wide variety of waterbirds, invertebrates and estuarine and marine fish and is considered the most important area for waterbirds in south-western Australia (DCCEEW 2023f). Whilst these potential values were recognized in the National database search (DCCEEW 2023f) these wetlands occur west of the survey area and not in the Holyoake East survey area.

4.11. Review of Dieback Occurrence

The dieback data as shown on Figure 12 reflects the most up to date dieback interpretation data from both DBCA and Glevan Consulting for the Holyoake East survey area. Sections of the Holyoake East survey area have been infested with the Dieback disease caused by *Phytophthora cinnamomi*. In other areas of the survey area the dieback infections are concentrated to the valleys systems. There may be some differences also in coverage and sampling in some of the areas of Holyoake East survey area.



N

0 2 4 km

Scale: 1:250,000
MGA94 (Zone 50)

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Holyoake East - Priority Areas
Dieback

Figure:
12

5. RESULTS FROM FIELD STUDIES

5.1. Survey Effort

The survey effort is summarized in Table 5 and Figure 13 and in the following text.

- Targeted flora and vegetation mapping was undertaken over a seven month period from January 2023 to August 2023 on 37 days of mapping with a total of 203 person days.
- Targeted work and permanent plots were established in December 2022 was undertaken by 4 personnel over 3 days.
- Previous flora and vegetation studies and transect monitoring has been done in the Cameron block (including the sub-catchment Gordon) since 1993 (E.M. Mattiske and Associates 1993 to 1994; and Mattiske Consulting 1996 to 2006). Three of the Gordon transects have been included in the survey effort summaries.

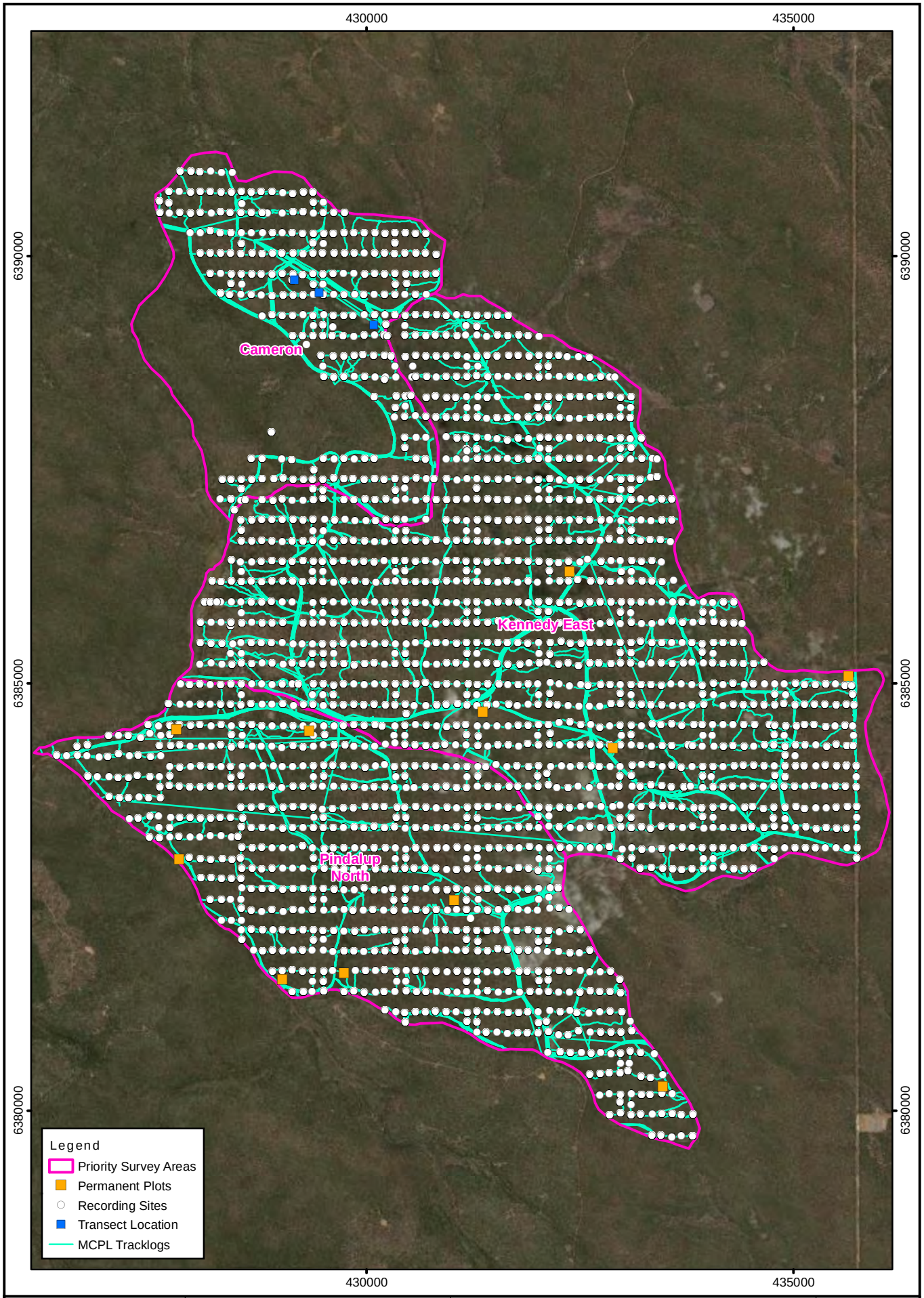
The main limitation was related to the area in the northwest that had been burnt just prior to survey work which resulted in an absence of understorey species. Consequently it was necessary to extrapolate from previous mapping to the west and north-west and from the current mapping. This area is apparent from Figure 13 where there is a gap in the recording site coverage of the area.

Table 5 provides a summary of the number of recording sites in each site-vegetation type. The more restricted site-vegetation types are obviously less well represented in the recording sites. None of the site-vegetation types are restricted to the survey area.

It is important to recognise that the vegetation mapping efforts in seasons outside of the spring months can still be undertaken as the vegetation mapping relies on perennial species which persist through the seasons. Further the perennial species persist through different seasons and the key indicators can be recognized throughout the year. The site-vegetation types extend the vegetation mapping over large areas of the Northern Jarrah Forest and as such integrate the flora, vegetation and site values which provides additional and critical information to the understanding of patterns in the area. The site-vegetation type approach was developed by Dr J Havel (1975a, 1975b) in close consultation with Dr D Goodall from CSIRO in the mid 1970's. Whilst this approach may differ from some other studies in Western Australia the development by Havel and Goodall was undertaken to define a series of key indicators and site conditions that would enable a finer definition of the northern Jarrah Forest communities. Such an approach enabled the subdivision of the main forest types which relied heavily on the structural components and the dominant trees. The latter broader approach is evident in the regional mapping at a coarser level as undertaken for the Pre-European vegetation mapping as undertaken by Beard 1979. The adoption of the site-vegetation type approach also enabled consideration of representation in the wider Northern Jarrah Forest and as such is supplemented by the vegetation studies during the System 6 (Heddle *et al*. 1980) and the Regional Forest Agreement investigations (Mattiske and Havel 1998) supported by state and federal government agencies.

Table 5: Sampling Intensity in the respective areas of each Site-Vegetation Type

Site-vegetation Type	No Recording Sites	Cameron (ha)	Kennedy East (ha)	Pindalup North (ha)	Total Area (ha)
A	100	32.84	186.78	75.91	295.53
AC	12	32.03	-	3.28	35.31
C	1	4.53	-	-	4.53
CW	1	4.84	-	-	4.84
W	36	16.62	50.65	11.98	79.25
AD	27	-	63.46	24.02	87.48
DA	44	3.69	124	15.72	143.41
D	189	128.15	302.11	126.72	556.98
DG	2	-	3.96	-	3.96
PS	250	206.47	279.9	256.99	743.36
PT	138	65.47	181.71	116.13	363.31
PW	9	3.59	21.81	-	25.40
SW	39	13.52	60.85	10.13	84.50
S	487	268.26	757.71	424.4	1450.37
SP	18	57.93	-	-	57.93
ST	3	11.93	-	-	11.93
TS	420	70.07	520.85	432.24	1023.16
T	258	142.81	343.39	231.34	717.54
Z	12	33.54	-	-	33.54
CL	-	0.55	-	-	0.55
PL	1	-	8.26	-	8.26
Total	2047	1096.84	2905.44	1728.86	5731.14



N

0 0.45 0.9 km

Scale: 1:60,000
MGA94 (Zone 50)

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Holyoake - Priority Areas
Survey Effort

Figure:

13

5.2. Flora

A total of 474 vascular plant taxa, representative of 192 genera and 66 families (Appendix B), have been recorded in the Holyoake East survey area. The most commonly represented families were Fabaceae (65 taxa), Proteaceae (38 taxa), Asteraceae (39 taxa) and Myrtaceae (30 taxa). The most commonly represented genera were *Lomandra* (19 taxa), *Acacia* (18 taxa) and *Hibbertia* (15 taxa).

5.3. Threatened and Priority Flora

A total of 2 priority flora species (*Lasiopetalum cardiophyllum* P4 and *Senecio leucoglossus* P4) were recorded either within or near the Holyoake East survey area and a range extension of *Leucopogon darlingensis* subsp. *darlingensis* was recorded in the Holyoake East survey area. The location of the priority flora species and the range extension as recorded are summarized on Figure 14.

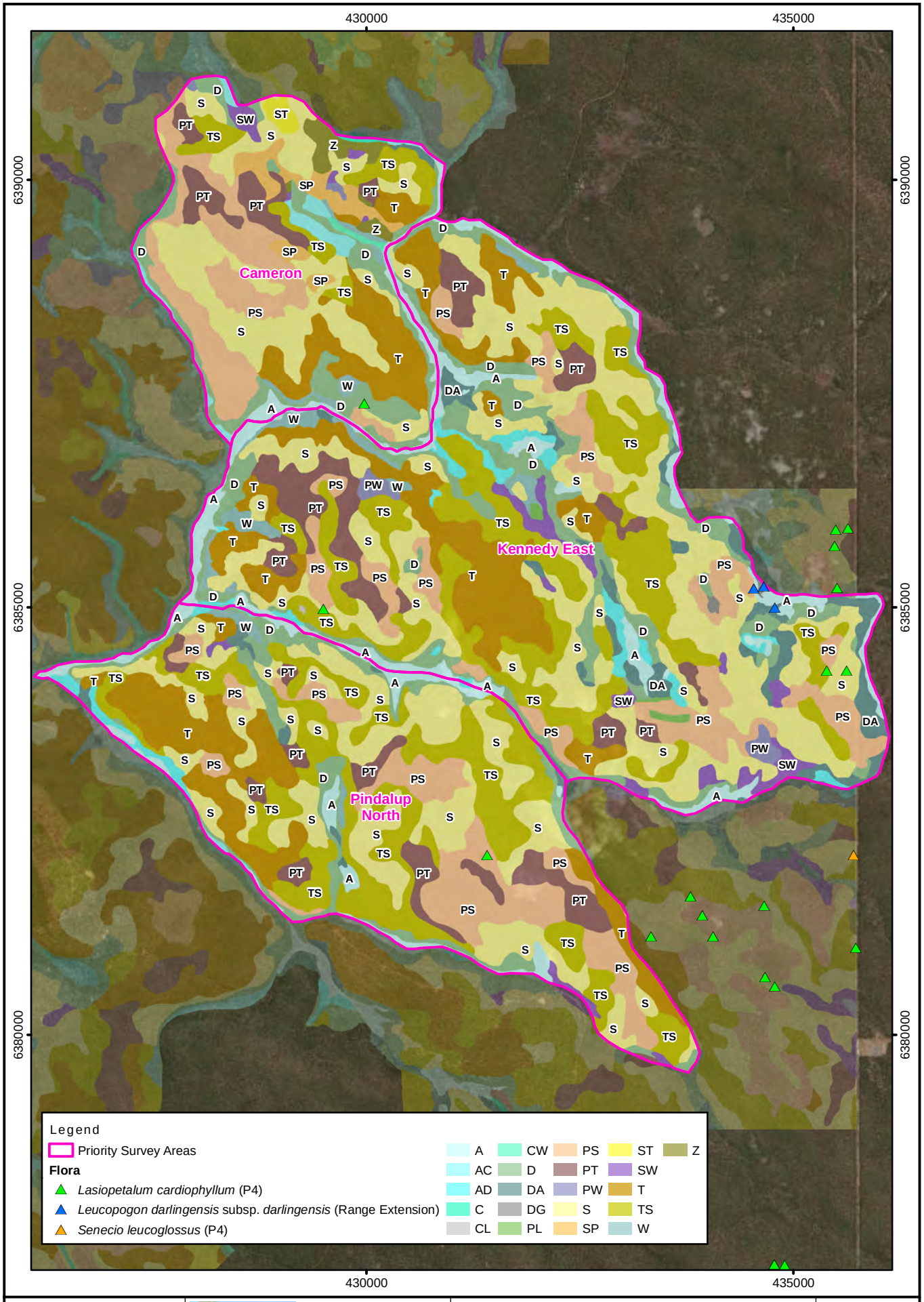
Lasiopetalum cardiophyllum (P4) has mainly been recorded on the eastern side of the northern Jarrah forest. Two specimens of this species were confirmed at the State Herbarium (ACC10469/E and ACC10556/E). This species tend to dominate the understorey when it occurs and in general mainly occurs in Jarrah-Marri-Sheoak (*Eucalyptus marginata – Corymbia calophylla – Allocasuarina fraseriana*) forests. This species was recorded at 22 locations within and near the Holyoake East survey area (Table 6). This species is known from 34 specimens at the State Herbarium (WAH 1998-). This species is distinguishable in non-flowering periods due to its characteristic leaf shape.

Senecio leucoglossus (P4) has mainly been recorded extensively as scattered plants through the northern Jarrah forest. One specimen of this species were confirmed at the State Herbarium (ACC10469/E). This species tends occur on lateritic soils and is known from 44 specimens at the State Herbarium. This species general mainly occurs in Jarrah-Marri-Bull Banksia (*Eucalyptus marginata – Corymbia calophylla – Banksia grandis*) forests. This species was recorded at one location near the Holyoake East survey area, but has been recorded in other forest areas by the Mattiske team.

Leucopogon darlingensis subsp*. darlingensis* occurs as a range extension at three sites in block M4723 (see Figure 14) and as such is a southerly to south-westerly extension of known occurrences which mainly occur north east of Albany Highway in the eastern Jarrah forests and then near Mundaring. This sub-species is known from 35 collections at the State Herbarium (WAH 1998-). Several plants occurs at each location.

5.4. Introduced Species

A total of 28 introduced taxa were recorded in the Holyoake East survey area. None of the introduced species are declared pest organisms pursuant to section 22 of the BAM Act. None of the introduced taxa are listed Weeds of National Significance (DCCEEW 2023d). The majority of the introduced species are relatively short lived annuals.



N

0 0.45 0.9 km

Scale: 1:60,000
MGA94 (Zone 50)

CAD Ref: a1992_F010_10_09

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Holyoake East - Priority Areas
Vegetation

Figure:
14

5.5. Vegetation

A total of 19 site-vegetation types were defined and mapped in the Holyoake East survey area and an addition two mapping units (CL cleared land and PL – plantations), Table 6 and Figure 14. The site-vegetation types were defined on the basis of key species and site parameters as defined in Habel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years.

The results presented in Table 6 for each site-vegetation type also reflect the extent of the site-vegetation types and their percentage representation in the survey area. It is clearly apparent that there are some dominant site-vegetation types that dominate the Holyoake East survey area (namely PS, S, TS and T which together cover 68.65% of the survey area).

Table 6: Summary of site-vegetation types as defined for the Holyoake East survey area based on Havel (1975a and 1975b) site-vegetation types as defined for the northern Jarrah forest

	SVT Code	Description	Total Area (ha)	% Survey Area
Swamps and Broad Valleys	A	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense stands of *Melaleuca viminea, Hakea varia, Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	295.53	5.16
	AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	35.31	0.62
	AD	Low open woodland of *Eucalyptus rudis* and *Eucalyptus marginata* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	87.48	1.53
	DA	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with patches of *Melaleuca preissiana, Banksia littoralis* over mixed low understorey species, including *Babingtonia camphorosmae* and *Astartea scoparia* on clay loams to gravelly clay-loams.	143.41	2.50
	D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae, Daviesia decurrens, Davieisa preissii* and *Acacia extensa* on clay loams to gravelly clay-loams.	556.98	9.72
	DG	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with mixed low understorey species, including *Grevillea bipinnatifida* and *Babingtonia camphorosmae,* on clay loams to gravelly clay-loams.	3.96	0.07
Valley Floors and Lower Slopes	C	Woodland to Open Forest of *Eucalyptus patens – Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	4.53	0.08
	CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	4.84	0.08
	W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	79.25	1.38
Slopes with seasonal soil moisture	SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	84.50	1.47
	PW	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels.	25.40	0.44

Table 6: Summary of site-vegetation types as defined for the Holyoake East survey area based on Havel (1975a and 1975b) site-vegetation types as defined for the northern Jarrah forest (continued)

	SVT Code	Description	Total Area (ha)	% Survey Area
Slopes and Ridges - Sandy Loam Gravels	PT	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	363.31	6.34
	PS	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	743.36	12.97
	SP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	57.93	1.01
	S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy-gravels.	1450.37	25.31
	ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus, Leucopogon verticillatus, Pteridium esculentum, Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	11.93	0.21
	TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	1023.16	17.85
	T	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly soils.	717.54	12.52
	Z	Open forest of *Eucalyptus marginata* and *Corymbia calophylla* over *Macrozamia riedlei, Xanthorrhoea preissii, Hakea lissocarpha* and *Phyllanthus calycinus* on sandy-loam to sandy-loam gravel soils on slopes.	33.54	0.59
Other Areas	CL	Cleared Areas	0.55	0.01
	PL	Plantation Areas (Pines)	8.26	0.14
	Total		5731.14	

None of these site-vegetation types are restricted to the Holyoake East survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2023e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023b) within the Holyoake East survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2023a) within the Holyoake East survey area. At a State or National level none of the site-vegetation types have been listed as Threatened or Priority Ecological Communities.

5.6. Vegetation Condition

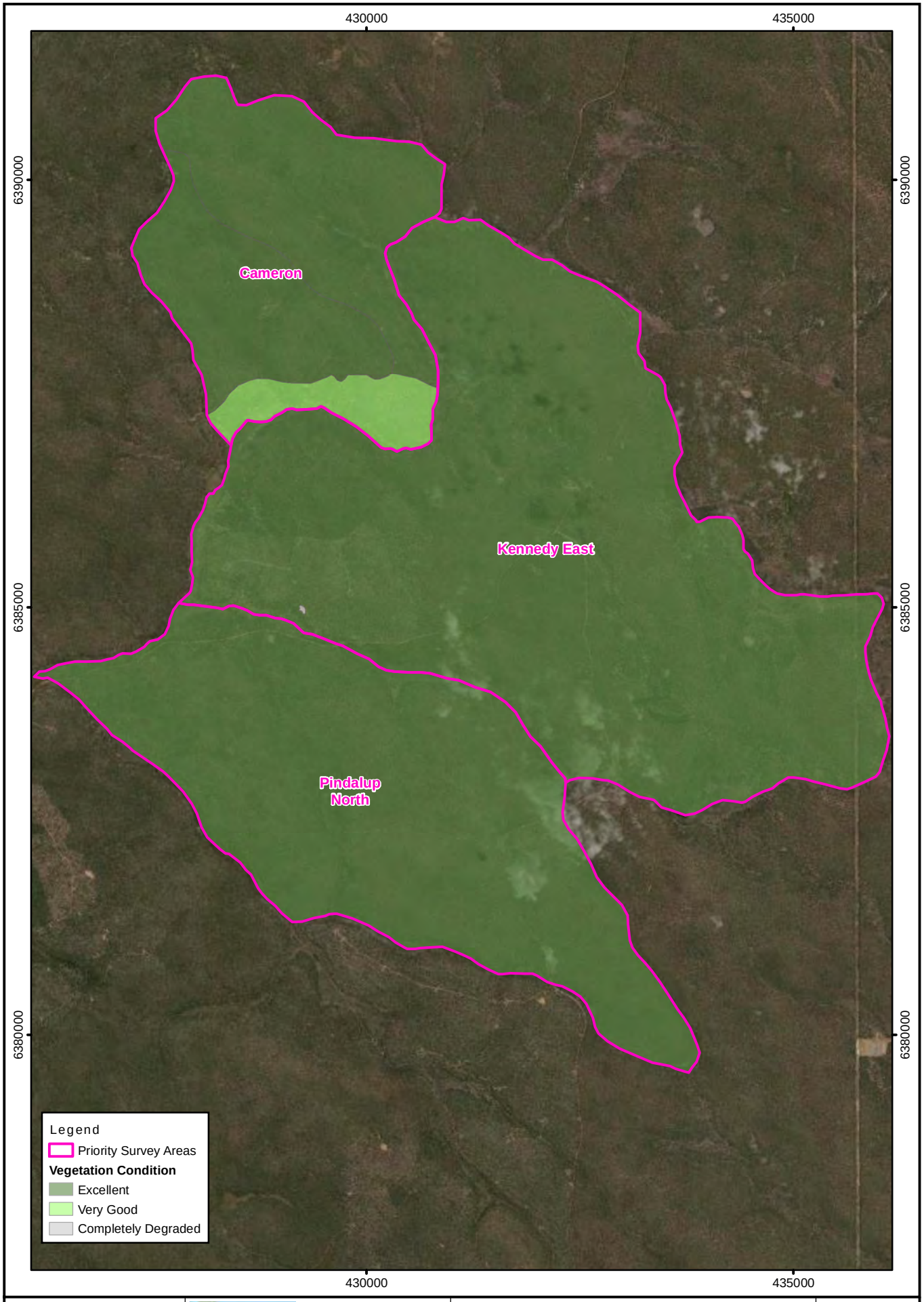
The vast majority of the Holyoake East survey area is in excellent condition, Figure 15. A small section in the southern part of Cameron had been logged and the northwest section had been subjected to a recent fire event.

5.7. Stump Observations

The number of stumps recorded in the 20m radius around each recording site is summarized in Figure 16. It is apparent that there are patches of forest supporting denser numbers of stumps with more than 4 stumps per 20m radius of recording sites. This data reflects the usage of the area for logging over many years.

5.8. Potential Habitat Trees

The potential habitat trees (based on the number of trees with diameters at breast height greater than 50cm) within the 20m radius of the recording sites is summarized in Figure 17. The results indicate the majority of the recording sites supported at least 1 to 4 trees and that there were a few patches which supported more than 5 trees.



N

0 0.45 0.9 km

Scale: 1:60,000
MGA94 (Zone 50)

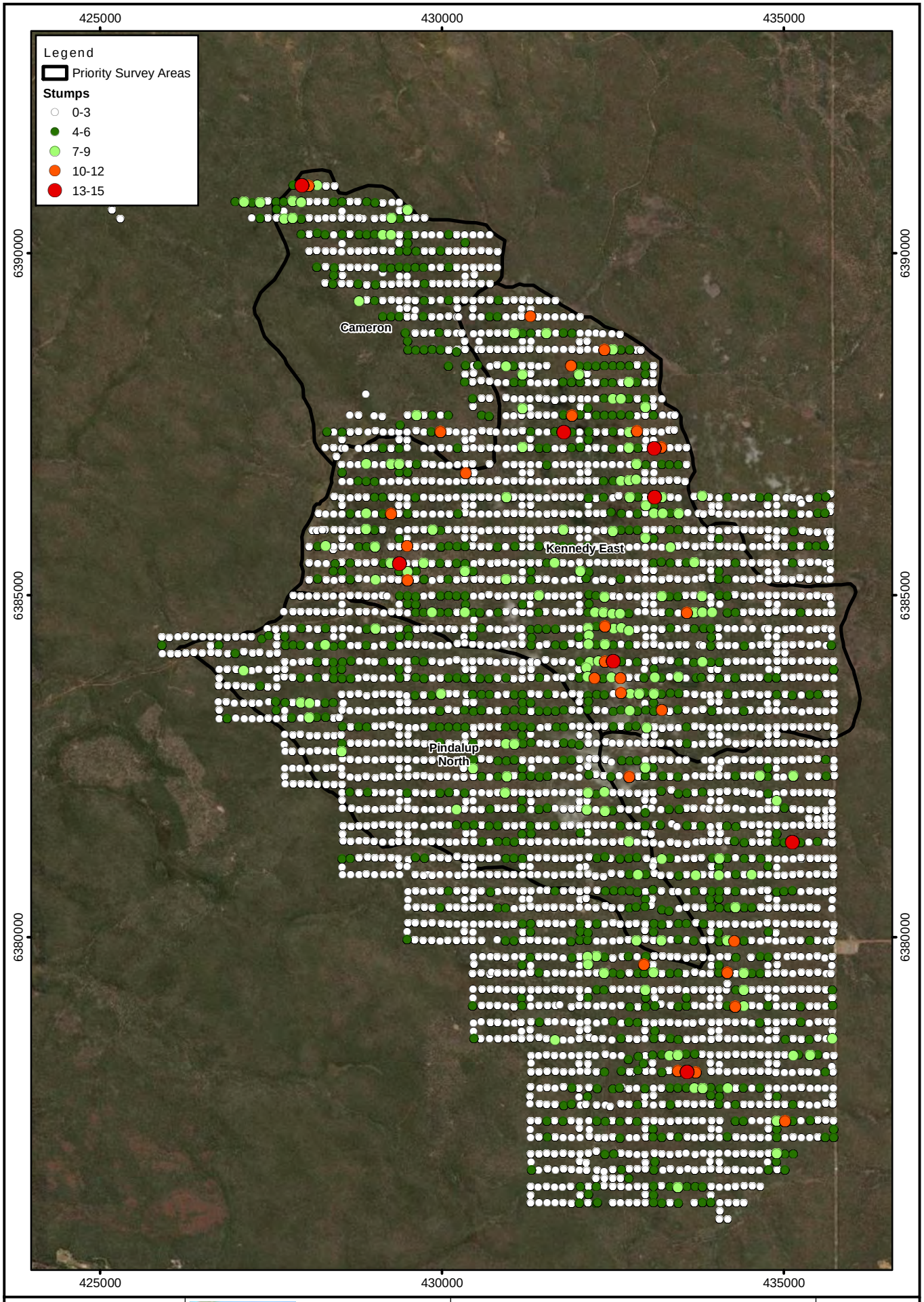
CAD Ref: a1992_F010_10_11

Date: May 2024 | Rev: A | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref:
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Holyoake East - Priority Areas
Vegetation Condition

Figure:
15



N

0 0.55 1.1 km

Scale: 1:75,000
MGA94 (Zone 50)

CAD Ref: a1992_F029_13

Date: December 2023 | Rev: A | A4

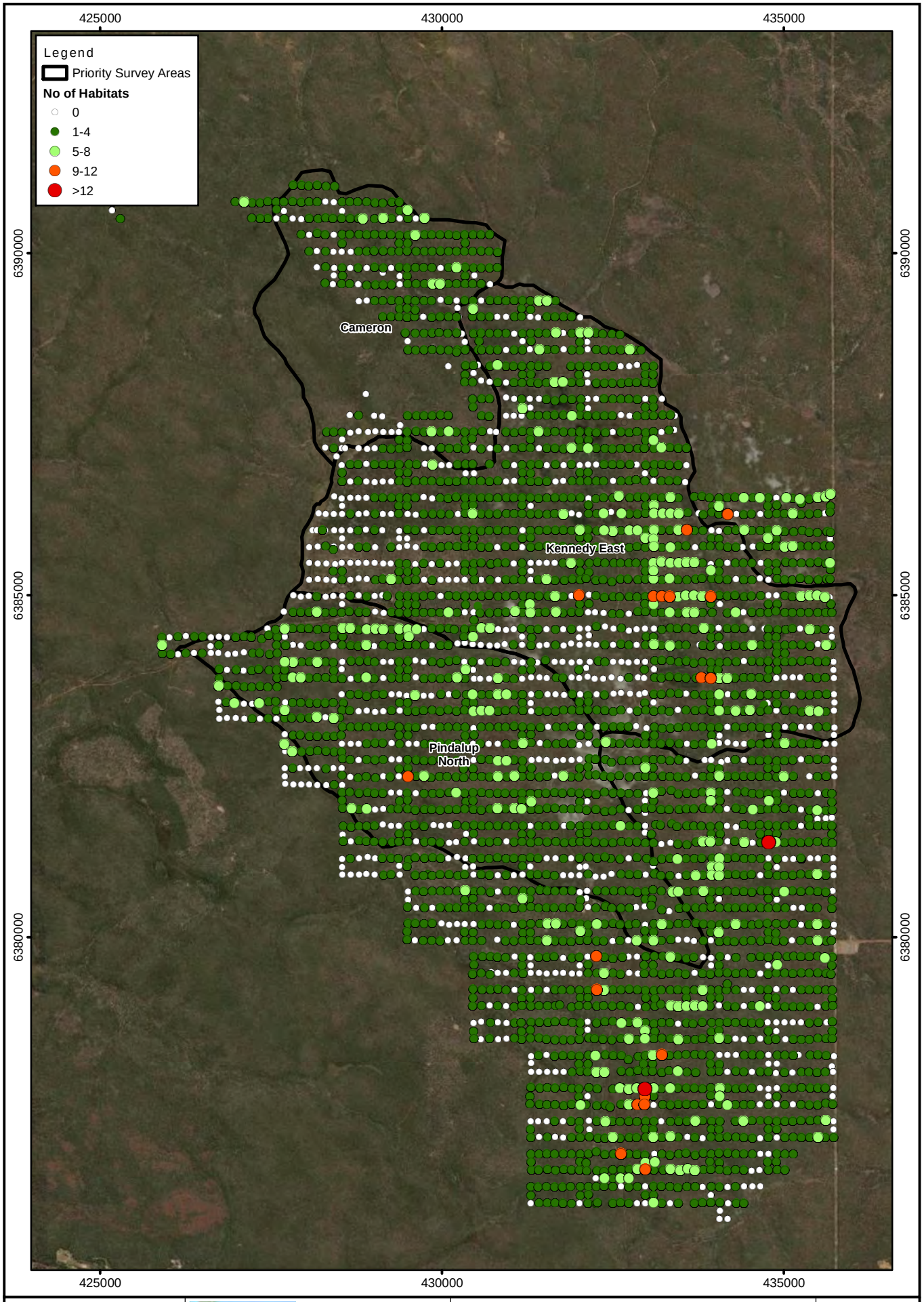
Mattiske Consulting Pty Ltd
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Holyoake - Priority Areas
MCPL Stumps

Figure:
16



N

0 0.55 1.1 km

Scale: 1:75,000
MGA94 (Zone 50)

CAD Ref: a1992_F029_14

Date: December 2023 | Rev: A | A4

Mattiske Consulting Pty Ltd
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Holyoake - Priority Areas
Potential Habitat Trees

Figure:
17

6. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the Holyoake East area. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed again in 2023 in line with some changes in nomenclature from 2022 to 2023.

The Holyoake East survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla - Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System (Heddle *et al.* 1980; Mattiske and Havel (1998).

Potential Flora

A total of 860 vascular plant taxa, representative of 267 genera and 85 families (Appendix B), have the potential to occur within the Holyoake East survey area (Mattiske Consulting 2022). The most commonly represented families were Fabaceae (110 taxa), Orchidaceae (66 taxa), Myrtaceae (68 taxa) and Proteaceae (63 taxa). The most commonly represented genera were *Acacia* (40 taxa), *Stylidium* (29 taxa), *Hibbertia* (22 taxa) and *Drosera* (20 taxa).

A total of seven threatened flora species and 25 priority flora species have the potential to occur in the Holyoake East survey area. Of the threatened flora species, *Anthocercis gracilis* (T) is the only potential species and this species occurs on granite outcrops.

A total of 80 introduced taxa have the potential to occur in the Holyoake East survey area; with six of the introduced species being declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2023). Four of the introduced taxa are listed Weeds of National Significance (DCCEEW 2023d). Some of these species may not occur in the less disturbed forest areas and as such reflect the wide radial approach to database searches.

Potential Vegetation Values

There are no TECs listed at Commonwealth or State level, or PECs listed at State level which would be likely to occur in the Holyoake East survey area. Although there are communities associated with granite outcrop areas that have been listed as PEC's at the State level to the north and east, on the basis of the database searches and previous observations, the occurrence of granite outcrops in the Holyoake East survey area is likely to be much lower and if present more localised in extent.

The Holyoake East survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023b) and as such was considered during the RFA process.

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the Holyoake East survey area. In view of the proximity of the Dwellingup as a forestry township it is unlikely that there will be additional old growth forests in the survey area. The Holyoake East has areas of dieback in some of the valley systems. The results for the dieback occurrence in these survey areas may also reflect the degree of sampling which is less intensive than in the western areas of the northern Jarrah forest.

Survey Effort

The survey effort in the Holyoake East survey areas includes data from the earlier transect studies within the northern valley systems to the more recent plots established on a range of the site-vegetation types within the survey area and the recording on a grid pattern and targeted searches across the survey area. The other aspect of the survey efforts relates to the coverage over a range of seasons in 2022 and 2023. The main limitation was related to a section of the north-west part of the survey area that had been burnt just prior to the proposed sampling. This latter area was mapped by extrapolating from the extensive nearby vegetation mapping; but there is an obvious need to revisit as soon as possible to undertake more detailed on site work.

In summary, the work undertaken to date on the Holyoake East survey area supplements extensive studies previously within and adjacent to the current survey area and as such meets the EPA (2016a and 2016b) guidelines. With the proposed supplementary flora and vegetation studies in the spring months of 2024 the effort exceeds the effort undertaken on many projects as it enables a detailed and comprehensive assessment of the survey area in the local and regional context.

Recorded Flora

A total of 474 vascular plant taxa, representative of 192 genera and 66 families (Appendix B), have been recorded in the Holyoake East survey area. The most commonly represented families were Fabaceae (65 taxa), Proteaceae (38 taxa), Asteraceae (39 taxa) and Myrtaceae (30 taxa). The most commonly represented genera were *Lomandra* (19 taxa), *Acacia* (18 taxa) and *Hibbertia* (15 taxa).

A total of 2 priority flora species (*Lasiopetalum cardiophyllum* P4 and *Senecio leucoglossus* P4) were recorded either within or near the Holyoake East survey area and a range extension of *Leucopogon darlingensis* subsp. *darlingensis* was recorded in the Holyoake East survey area.

A total of 28 introduced taxa were recorded in the Holyoake East survey area. None of the introduced species are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2023). None of the introduced taxa are listed Weeds of National Significance (DCCEEW 2023d). The majority of the introduced species are relatively short lived annuals.

Recorded Vegetation

A total of 19 site-vegetation types were defined and mapped in the Holyoake East survey area and an addition two mapping units (CL cleared land and PL – plantations). The site-vegetation types were defined on the basis of key species and site parameters as defined in Habel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years. It is clearly apparent that there are some dominant site-vegetation types that dominate the Holyoake East survey area (namely PS, S, TS and T which together cover 68.65% of the survey area)**.**

None of these site-vegetation types are restricted to the Holyoake East survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2023e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023b) within the Holyoake East survey area.

There are no priority ecological communities (PECs), as listed at State level by DBCA (2023a) within the Holyoake East survey area. At a State or National level none of the site-vegetation types have been listed as Threatened or Priority Ecological Communities.

The Holyoake East survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2023b) and as such was considered during the RFA process.

The vast majority of the Holyoake East survey area is in excellent condition. A small section in the southern part of Cameron had been logged and the northwest section had been subjected to a recent fire event.

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the Holyoake East survey area. In view of the proximity of the Dwellingup as a forestry township it is unlikely that there will be additional old growth forests in the survey area.

6. ACKNOWLEDGEMENTS

The authors would like to thank Alcoa of Australia Ltd for their assistance with this project.

7. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were mainly involved in this project:

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Mr L Rowles	Senior Botanist	Field Studies and Plant IDs	FB62000020-4,5
Mr Z Sims	Senior Botanist	Data collection and Field Studies	FB62000025-4,5
Ms L Cockram	Experienced Botanist	Plant Ids and Data	FB62000266-3,4
Mr A Pereira	Experienced Botanist	Data collection and Field Studies	FB62000035-4, 145-5
Ms L Ducki	Experienced Botanist	Data collection and Field Studies	FB62000394, 2
Mr D Rubick	Experienced Botanist	Data collection and Field Studies	FB62000328-2,3
Ms K Tribbeck	Experienced Botanist	Data collection and Field Studies	FB62000467, 2
Mr J C Mooney	Experienced Botanist	Data collection and Field Studies	FB62000416, 2
Ms A Rowe	Experienced Botanist	Data collection and field studies	FB62000329-2,3
Ms M Pollock	Botanist	Data collection and field studies	FB62000524
Ms J Marshall	Botanist	Data collection and field studies	FB62000572
Ms J Werny	Botanist	Data collection and field studies	FB62000587
Mr Z Gates	Botanist	Data collection and field studies	FB62000426
Ms K Craig/Smith	Botanist	Data collation, reporting	N/A
Ms B Farrar	Botanist	Data collation, reporting	N/A
R Jones	Botanist	Data collation, reporting	N/A
J Wescombe	Botanist	Data collation, reporting	N/A

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions (DBCA,2022a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act. Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from DBCA (2022b).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (DBCA 2019b). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from DBCA (2022b).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (28 June 2018)* (under Part 2, Division 2, Subdivision 1 of the BC Act; DBCA 2021c). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the DBCA (and former equivalent departments) have been identifying and informally listing TECs since 1994. Some of these TECs are also endorsed by the Federal Minister as threatened, and some of these are listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from DBCA (2022b).

CODE	CATEGORY	DEFINITION
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2022d) in the *Priority Ecological Communities for Western Australia – Version 28 (17 January 2019)*. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from DBCA (2022b).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2022).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- 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; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of vegetation condition categories

Note: Adapted from Keighery (1994).

CATEGORY	DEFINITION
1	Pristine or nearly so, no obvious sign of disturbance or damage caused by human activities since European settlement.
2	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.
3	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
ALLIACEAE	* *Allium triquetrum*				x								
AMARANTHACEAE	*Ptilotus drummondii*										x	x	
	Ptilotus manglesii				x	x	x					x	
AMARYLLIDACEAE	* *Narcissus papyraceus*				x								
ANARTHRIACEAE	*Lyginia barbata*											x	
	Lyginia imberbis											x	
APIACEAE	*Actinotus glomeratus*												x
	Apium prostratum subsp. *prostratum* var. *prostratum*				x								
	Centella asiatica					x						x	
	Daucus glochidiatus				x							x	x
	Pentapeltis peltigera				x	x	x	x	x	x	x	x	x
	Pentapeltis silvatica							x	x				
	Platysace compressa						x	x	x	x	x	x	x
	Platysace filiformis				x		x		x			x	
	Platysace tenuissima				x		x	x	x			x	x
	Platysace sp.											x	
	Schoenolaena juncea											x	
	Xanthosia atkinsoniana				x		x	x		x	x	x	x
	Xanthosia candida				x	x	x	x	x	x	x	x	x
	Xanthosia ciliata								x				x
	Xanthosia huegelii					x	x		x	x		x	x
	Xanthosia singuliflora											x	
	Xanthosia sp.					x			x			x	
	Apiaceae sp.											x	
APOCYNACEAE	* *Gomphocarpus fruticosus*				x								x
	Parsonsia diaphanophleba	P4			x								
ARALIACEAE	*Hydrocotyle callicarpa*				x	x						x	x
	Hydrocotyle hirta				x								
	Trachymene pilosa				x	x		x	x	x		x	x
	Trachymene sp.											x	
ASPARAGACEAE	* *Asparagus asparagoides*			x									
	Laxmannia sessiliflora subsp. *australis*				x								
	Laxmannia squarrosa						x				x	x	x
	Laxmannia sp.						x						
	Lomandra brittanii					x	x			x		x	x
	Lomandra caespitosa				x	x	x	x		x	x	x	x
	Lomandra drummondii				x		x	x				x	x
	Lomandra hermaphrodita				x	x	x	x		x	x	x	x
	Lomandra integra				x		x					x	x
	Lomandra micrantha					x	x	x				x	x
	Lomandra micrantha subsp. *micrantha*				x	x	x					x	
	Lomandra nigricans				x		x			x	x	x	x
	Lomandra odora												x
	Lomandra pauciflora											x	
	Lomandra preissii										x	x	x
	Lomandra purpurea				x		x	x			x	x	x
	Lomandra sericea				x		x	x	x		x	x	x
	Lomandra sonderi				x		x	x	x	x	x	x	x

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Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
ASPARAGACEAE (continued)	*Lomandra spartea*				x	x	x	x	x		x	x	x
	Lomandra suaveolens							x	x				
	Lomandra sp.				x	x	x	x	x	x	x	x	x
	Lomandra sp. 1											x	
	Lomandra sp. 2											x	
	Lomandra sp. 3											x	
	Lomandra sp. 4											x	
	Thysanotus anceps	P3			x								
	Thysanotus dichotomus				x		x	x	x	x		x	x
	Thysanotus fastigiatus				x			x	x			x	x
	Thysanotus manglesianus				x				x			x	x
	Thysanotus multiflorus					x	x	x	x		x	x	x
	Thysanotus patersonii				x							x	
	Thysanotus sparteus											x	
	Thysanotus tenellus					x						x	
	Thysanotus thyrsoideus				x	x	x	x	x			x	x
	Thysanotus sp.					x	x					x	x
ASTERACEAE	* *Arctotheca calendula*											x	
	Brachyscome iberidifolia				x							x	
	* *Chrysanthemoides monilifera*			x									
	* *Chrysanthemoides monilifera* subsp. *monilifera*			x									
	Craspedia variabilis				x	x						x	
	* *Dittrichia graveolens*											x	
	* *Erigeron sumatrensis*								x			x	
	* *Erigeron* sp.											x	
	Euchiton collinus				x								
	Euchiton sphaericus											x	
	* *Gamochaeta calviceps*											x	
	Hyalosperma cotula				x							x	
	Hyalosperma demissum				x								x
	Hyalosperma sp.											x	
	* *Hypochaeris glabra*				x	x	x		x	x	x	x	x
	* *Hypochaeris radicata*				x								
	* *Lactuca serriola* forma *serriola*				x								
	Lagenophora huegelii				x	x	x	x	x	x	x	x	x
	Lawrencella rosea											x	
	Millotia tenuifolia				x	x					x	x	x
	Millotia tenuifolia var. *tenuifolia*					x						x	
	Olearia paucidentata				x				x				
	Olearia sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628)											x	
	Panaetia lessonii				x							x	
	Podolepis gracilis				x							x	x
	Podotheca angustifolia				x							x	x
	* *Pseudognaphalium luteoalbum*											x	
	Pterochaeta paniculata				x		x	x	x		x	x	x
	Quinetia urvillei				x							x	x
	Rhodanthe citrina												x
	Rhodanthe corymbosa				x								
	Rhodanthe sp.											x	
	Senecio diaschides				x	x	x	x	x			x	
	Senecio hispidulus						x	x		x	x	x	x
	Senecio leucoglossus	P4			x		x		x	x	x	x	x
	Senecio multicaulis subsp. *multicaulis*				x								
	Senecio pinnatifolius												x
	Senecio quadridentatus						x	x	x		x	x	x

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
ASTERACEAE (continued)	* *Senecio vulgaris*							x				x	
	Senecio sp.						x	x	x	x	x	x	
	Siloxerus filifolius				x							x	
	Siloxerus humifusus											x	
	* *Sonchus asper*				x								
	* *Sonchus oleraceus*							x				x	
	* *Sonchus* sp.											x	
	Trichocline spathulata				x		x	x	x	x	x	x	x
	* *Ursinia anthemoides*						x					x	x
	* *Vellereophyton dealbatum*				x		x						
	Asteraceae sp.						x		x			x	
	Asteraceae sp. 1											x	
	Asteraceae sp. 2											x	
	Asteraceae sp. 3											x	
BORYACEAE	*Borya sphaerocephala*				x				x			x	
BRASSICACEAE	* *Sisymbrium officinale*				x								
	Lepidium sp.											x	
CAMPANULACEAE	*Isotoma hypocrateriformis*							x				x	x
	Isotoma scapigera											x	
	Lobelia anceps											x	
	Lobelia gibbosa								x			x	
	Lobelia heterophylla											x	
	Lobelia rhombifolia				x								x
	Lobelia rhytidosperma				x								
	Lobelia tenuior				x								
	Lobelia sp.										x	x	
	* *Wahlenbergia capensis*											x	
	Wahlenbergia preissii												x
	Wahlenbergia sp.											x	
CARYOPHYLLACEAE	* *Stellaria media*				x								
	* *Petrorhagia dubia*											x	
	Caryophyllaceae sp.											x	
CASUARINACEAE	*Allocasuarina fraseriana*				x		x	x	x		x	x	x
	Allocasuarina huegeliana											x	
	Allocasuarina humilis											x	
	Allocasuarina sp.								x			x	
CELASTRACEAE	*Stackhousia monogyna*						x	x	x	x		x	x
	Stackhousia pubescens				x								
	Stackhousia sp.								x		x		
	Tripterococcus brunonis						x					x	
CENTROLEPIDACEAE	*Aphelia cyperoides*					x							
	Centrolepis aristata					x						x	x
	Centrolepis mutica				x								
	Centrolepis pilosa												x
	Centrolepis polygyna				x								
	Centrolepis sp.											x	
CHENOPODIACEAE	* *Chenopodium album*				x								
	* *Chenopodium murale*				x								

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
COLCHICACEAE	*Burchardia congesta*				x	x	x	x	x	x		x	x
	Burchardia multiflora				x			x					
	Wurmbea dioica subsp. *alba*				x								
	Wurmbea sp.						x						
CRASSULACEAE	*Crassula colorata*											x	
CUPRESSACEAE	*Callitris ?acuminata*						x						
	* *Callitris endlicheri*				x								
CYPERACEAE	*Cyathochaeta avenacea*						x		x		x	x	x
	Cyathochaeta teretifolia	P3					x						
	* *Cyperus congestus*				x								
	* *Cyperus tenellus*											x	
	Gahnia aristata				x								
	Gahnia decomposita				x	x	x	x	x	x	x	x	
	Gahnia trifida				x		x	x					
	Lepidosperma apricola sens. lat.						x						
	Lepidosperma costale				x								
	Lepidosperma gracile						x					x	
	Lepidosperma leptostachyum						x						x
	Lepidosperma longitudinale				x								
	Lepidosperma persecans				x								
	Lepidosperma pubisquameum				x		x						
	Lepidosperma resinosum						x						
	Lepidosperma squamatum				x		x	x	x	x	x	x	x
	Lepidosperma tenue						x	x	x		x	x	
	Lepidosperma tetraquetrum				x	x	x	x	x	x	x	x	
	Lepidosperma sp.						x		x		x	x	
	Machaerina rubiginosa				x								
	Machaerina sp.										x		
	Mesomelaena tetragona											x	
	Morelotia octandra					x	x	x	x	x	x	x	x
	Netrostylis sp. Jarrah Forest (R. Davis 7391)				x	x	x	x	x	x	x	x	x
	Schoenus tenellus											x	
	Tricostularia compressa				x								
	Cyperaceae sp.						x		x		x	x	
DASYPOGONACEAE	*Kingia australis*						x	x	x			x	
DENNSTAEDTIACEAE	*Pteridium esculentum*					x	x	x	x	x	x	x	x
	Pteridium esculentum subsp. *esculentum*				x								
DILLENIACEAE	*Hibbertia acerosa*				x		x		x			x	x
	Hibbertia amplexicaulis				x	x	x	x	x	x	x	x	x
	Hibbertia commutata				x	x	x	x	x	x	x	x	x
	Hibbertia diamesogenos				x								
	Hibbertia glomerata												x
	Hibbertia glomerata subsp. *glomerata*				x			x					
	Hibbertia huegelii											x	
	Hibbertia hypericoides						x	x	x		x	x	
	Hibbertia hypericoides subsp. *hypericoides*				x								
	Hibbertia lasiopus											x	x
	Hibbertia ovata				x		x	x	x		x	x	x
	Hibbertia aff. *ovata*											x	
	Hibbertia perfoliata				x	x	x	x	x	x	x	x	x

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

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Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
DILLENIACEAE (continued)	*Hibbertia pilosa*											x	
	Hibbertia quadricolor				x								x
	Hibbertia semipilosa											x	
	Hibbertia serrata				x		x						
	Hibbertia silvestris				x			x	x		x	x	x
	Hibbertia stellaris				x								
	Hibbertia subvaginata				x			x			x	x	x
	Hibbertia vaginata											x	
	Hibbertia sp.				x		x	x	x	x		x	
DROSERACEAE	*Drosera bulbosa*					x						x	
	Drosera bulbosa subsp. *bulbosa*				x								
	Drosera calycina				x								
	Drosera drummondii				x								
	Drosera erythrorhiza				x	x	x	x	x	x		x	x
	Drosera gigantea							x					
	Drosera glanduligera				x								
	Drosera leucoblasta					x			x				
	Drosera macrantha												x
	Drosera menziesii												x
	Drosera occidentalis	P4			x								
	Drosera pallida				x					x			x
	Drosera platystigma											x	x
	Drosera rosulata				x								
	Drosera stolonifera				x	x			x				
	Drosera sp. Branched Styles (S.C. Coffey 193)				x								
	Drosera sp. (climbing)						x					x	
	Drosera sp.				x	x	x	x	x	x	x	x	x
	Drosera sp. 1											x	
	Drosera sp. 2											x	
ELAEOCARPACEAE	*Tetratheca hirsuta*					x	x	x	x			x	x
	Tetratheca hirsuta subsp. *hirsuta*				x								
	Tetratheca hirsuta subsp. *viminea*				x							x	
	Tetratheca hispidissima				x								
	Tetratheca nuda					x							
	Tetratheca setigera				x								
	Tetratheca similis	P3			x								
	Tetratheca virgata										x		
	Tetratheca sp.								x			x	
	Tremandra diffusa				x			x					
	Tremandra stelligera											x	
ERICACEAE	*Andersonia aristata*				x								
	Andersonia latiflora				x								x
	Andersonia lehmanniana											x	x
	Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	P3			x								
	Andersonia sp.						x		x				
	Leucopogon australis							x				x	
	Leucopogon capitellatus				x		x	x	x	x	x	x	x
	Leucopogon cordatus				x								
	Leucopogon darlingensis subsp. *darlingensis*	RE			x							x	
	Leucopogon glabellus				x								
	Leucopogon gracillimus						x						
	Leucopogon pulchellus				x								
	Leucopogon verticillatus				x		x	x	x	x	x	x	x

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				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
ERICACEAE	*Leucopogon* sp.						x		x				x
(continued)	*Styphelia concinna*				x				x				
	Styphelia discolor				x		x	x	x	x	x	x	x
	Styphelia epacridis				x							x	
	Styphelia nitens				x	x	x		x		x	x	x
	Styphelia pallida				x	x	x	x	x	x	x	x	
	Styphelia propinqua				x		x	x	x	x	x	x	x
	Styphelia stricta				x								
	Styphelia tenuiflora				x		x	x	x	x	x	x	x
	Styphelia tortifolia												
	Styphelia sp.						x	x	x			x	
	Ericaceae sp.						x					x	
EUPHORBIACEAE	*Amperea simulans*						x					x	
	Monotaxis grandiflora								x			x	x
	Monotaxis occidentalis				x		x	x	x			x	x
	Monotaxis sp.						x						
	Ricinocarpos graniticus				x								
	Stachystemon vermicularis				x								x
	Stachystemon ?vermicularis											x	
	Euphorbiaceae sp.						x					x	
FABACEAE	*Acacia alata*						x	x	x			x	
	Acacia alata var. *alata*				x		x				x		
	Acacia applanata				x							x	
	Acacia browniana				x		x	x	x	x	x	x	
	Acacia browniana var. *browniana*				x		x						
	Acacia browniana var. *endlicheri*							x					
	Acacia browniana var. *obscura*				x		x						
	Acacia celastrifolia				x		x		x			x	
	* *Acacia decurrens*				x								
	Acacia dentifera				x							x	
	Acacia divergens				x		x	x	x	x	x	x	
	Acacia drummondii												x
	Acacia drummondii subsp. *candolleana*				x		x	x	x	x	x	x	
	Acacia drummondii subsp. *drummondii*						x	x	x	x	x	x	
	Acacia extensa				x		x	x	x	x	x	x	
	Acacia horridula	P3			x								
	Acacia incurva				x							x	
	Acacia insolita subsp. *insolita*				x								
	Acacia lateriticola				x		x	x	x		x	x	x
	* *Acacia longifolia* subsp. *longifolia*				x								
	Acacia myrtifolia				x				x				
	Acacia nervosa				x		x		x		x	x	
	Acacia oncinophylla subsp. *oncinophylla*	P3			x								
	* *Acacia podalyriifolia*				x								
	Acacia preissiana				x		x		x				
	Acacia pulchella					x	x	x	x	x	x	x	x
	Acacia pulchella var. *glaberrima*				x								
	Acacia pulchella var. *goadbyi*				x								
	Acacia pulchella var. *pulchella*				x	x							
	* *Acacia pycnantha*								x				
	Acacia saligna				x							x	
	Acacia saligna subsp. Tweed River (B.R. Maslin 8596)				x								
	Acacia stenoptera				x								
	Acacia teretifolia				x								
	Acacia tetragonocarpa							x					

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				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
FABACEAE (continued)	*Acacia urophylla*				x		x	x	x	x	x	x	x
	Acacia varia											x	
	Acacia varia var. *varia*								x				
	Acacia willdenowiana				x		x	x	x			x	
	Acacia sp.					x	x					x	x
	Aotus cordifolia				x								
	Bossiaea angustifolia				x							x	
	Bossiaea aquifolium						x	x			x	x	x
	Bossiaea aquifolium subsp. *aquifolium*				x				x	x			
	Bossiaea eriocarpa				x		x					x	
	Bossiaea modesta	P2			x								
	Bossiaea ornata				x	x	x	x	x	x	x	x	x
	Callistachys lanceolata						x					x	
	Chorizema cordatum				x			x	x	x	x	x	x
	Chorizema dicksonii								x			x	
	Chorizema nanum				x								
	Chorizema rhombeum				x							x	x
	Chorizema ulotropis	P4			x								
	Daviesia brachyphylla				x								
	Daviesia cordata				x				x	x		x	
	Daviesia costata				x								x
	Daviesia decurrens						x		x			x	x
	Daviesia decurrens subsp. *decurrens*				x								
	Daviesia horrida											x	
	Daviesia incrassata											x	
	Daviesia longifolia				x								
	Daviesia physodes				x							x	x
	Daviesia preissii				x		x		x			x	
	Daviesia rhombifolia				x			x				x	x
	Daviesia sp.								x			x	
	Dillwynia laxiflora				x								
	Euchilopsis linearis				x								
	Eutaxia parvifolia											x	
	Eutaxia virgata											x	
	Gastrolobium bilobum				x							x	
	Gastrolobium calycinum				x							x	
	Gastrolobium cuneatum				x								
	Gastrolobium ebracteolatum											x	
	Gastrolobium spinosum					x						x	
	Gastrolobium villosum											x	
	?*Gastrolobium* sp.						x						
	* *Genista* sp. X *Genista monspessulana*			x									
	Gompholobium confertum											x	x
	Gompholobium knightianum						x	x	x			x	
	Gompholobium marginatum				x	x	x	x	x	x		x	x
	Gompholobium polymorphum				x		x		x	x		x	x
	Gompholobium preissii				x				x			x	x
	Gompholobium tomentosum						x					x	
	Gompholobium sp.								x			x	
	Hardenbergia comptoniana						x					x	
	Hovea chorizemifolia				x		x	x	x	x	x	x	x
	Hovea trisperma				x	x	x		x			x	x
	Hovea sp.							x				x	x
	Isotropis cuneifolia				x								
	Isotropis cuneifolia subsp. *cuneifolia*											x	
	Jacksonia furcellata				x			x	x			x	

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				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
FABACEAE (continued)	*Jacksonia sternbergiana*												
	Kennedia coccinea				x		x	x	x	x	x	x	x
	Kennedia prostrata				x	x		x	x	x	x	x	
	Labichea punctata						x	x	x	x	x	x	x
	* *Lathyrus latifolius*				x								
	* *Lotus uliginosus*												x
	Mirbelia dilatata				x		x	x	x	x	x	x	x
	Paraserianthes lophantha						x	x	x	x	x	x	
	Paraserianthes lophantha subsp. *lophantha*				x	x							
	Pultenaea reticulata				x								
	Sphaerolobium linophyllum											x	
	Sphaerolobium medium				x			x	x	x	x	x	x
	Sphaerolobium vimineum				x								
	Templetonia drummondii				x		x						
	Templetonia sp.										x	x	
	* *Trifolium dubium*												x
	* *Trifolium* sp.											x	
	Fabaceae sp.											x	
GENTIANACEAE	* *Centaurium erythraea*				x							x	
	* *Centaurium tenuiflorum*											x	
	Schenkia australis											x	
GERANIACEAE	*Pelargonium littorale*											x	
GOODENIACEAE	*Dampiera alata*											x	
	Dampiera hederacea								x				
	Dampiera linearis				x	x	x					x	x
	Dampiera sp.											x	
	Goodenia drummondii subsp. *megaphylla*				x								
	Goodenia micrantha											x	
	Goodenia ?pusilla											x	
	Goodenia trinervis				x								
	Goodenia sp.												x
	Lechenaultia biloba				x	x	x	x	x	x	x	x	x
	Scaevola calliptera				x	x	x	x	x			x	x
	Scaevola pilosa				x							x	x
	Scaevola repens var. *repens*											x	
	Scaevola sp.								x				
	Goodeniaceae sp.											x	
HAEMODORACEAE	*Anigozanthos bicolor*				x								
	Anigozanthos manglesii				x							x	
	Anigozanthos sp.										x	x	
	Conostylis aculeata											x	
	Conostylis aculeata subsp. *aculeata*				x							x	
	Conostylis pusilla				x				x			x	
	Conostylis serrulata				x		x	x	x	x	x	x	x
	Conostylis setigera				x		x	x	x		x	x	x
	Conostylis setigera subsp. *setigera*					x				x			
	Conostylis setosa				x		x	x	x		x	x	x
	Conostylis sp.						x		x	x	x	x	
	Haemodorum laxum											x	x
	Haemodorum spicatum												x
	Haemodorum sp.						x	x	x			x	x
	Tribonanthes longipetala				x								

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HAEMODORACEAE (continued)	Haemodoraceae sp.								x				
HALORAGACEAE	*Glischrocaryon angustifolium*											x	
	Glischrocaryon aureum								x		x	x	
	Gonocarpus benthamii								x				x
	Gonocarpus diffusus				x								
HEMEROCALLIDACEAE	*Agrostocrinum hirsutum*								x			x	
	Agrostocrinum scabrum											x	x
	Caesia micrantha											x	
	Chamaescilla corymbosa				x	x	x	x	x	x	x	x	x
	Chamaescilla corymbosa var. *corymbosa*				x	x							
	Dianella revoluta				x		x	x	x		x	x	x
	Johnsonia lupulina						x	x	x				x
	Stypandra glauca				x		x					x	
	Tricoryne elatior				x							x	x
	Tricoryne humilis				x							x	x
	Tricoryne sp.						x		x			x	
	?Hemerocallidaceae sp.						x						
HYPERICACEAE	* *Hypericum perforatum*				x							x	
HYPOXIDACEAE	*Pauridia gardneri*						x						
	Pauridia glabella											x	
	Pauridia occidentalis											x	
IRIDACEAE	* *Ixia fuscocitrina*				x								
	Orthrosanthus laxus												x
	Orthrosanthus laxus var. *laxus*				x								
	Patersonia babianoides				x							x	x
	Patersonia juncea				x				x				
	Patersonia occidentalis				x		x	x	x	x	x	x	x
	Patersonia pygmaea				x		x	x	x		x	x	x
	Patersonia rudis				x		x		x			x	
	Patersonia umbrosa				x								
	Patersonia sp.								x		x	x	
	* *Romulea rosea*											x	
	* *Sparaxis pillansii*				x								
JUNCACEAE	* *Juncus bufonius*												x
	* *Juncus microcephalus*				x								
	Juncus sp.						x					x	
JUNCAGINACEAE	*Cycnogeton huegelii*				x								
	Triglochin nana				x								
LAMIACEAE	*Hemiandra* sp. Jurien (B.J. Conn & M.E. Tozer BJC				x								
	Hemigenia incana				x			x				x	
	Hemigenia microphylla	P3			x							x	
	Hemigenia pritzelii				x		x	x	x	x	x	x	x
	Hemigenia wandooana				x								
	Hemigenia sp.						x						
	Lachnostachys verbascifolia var. *verbascifolia*				x								
	* *Lavandula stoechas* subsp. *stoechas*				x								

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LAMIACEAE (continued)	* *Stachys arvensis*				x								
	Lamiaceae sp.								x				
LAURACEAE	*Cassytha flava*				x								
	Cassytha glabella												x
	Cassytha racemosa				x								
	Cassytha racemosa forma *racemosa*				x								
	Cassytha sp.						x	x	x		x	x	
	Lauraceae sp.											x	
LENTIBULARIACEAE	*Utricularia inaequalis*				x								
	Utricularia petertaylorii				x								
	Utricularia violacea											x	
LINDSAEACEAE	*Lindsaea linearis*				x	x	x	x	x			x	
LOGANIACEAE	*Orianthera serpyllifolia*											x	x
	Orianthera serpyllifolia subsp. *angustifolia*				x							x	
	Phyllangium paradoxum					x							
LORANTHACEAE	*Nuytsia floribunda*						x	x					
MALVACEAE	*Commersonia corniculata*				x								
	Lasiopetalum cardiophyllum	P4			x							x	
	Lasiopetalum floribundum				x		x	x	x	x	x	x	x
	Lasiopetalum glabratum				x		x		x		x	x	x
	Lasiopetalum membranaceum	P3			x								
	Lasiopetalum pterocarpum	T	E	x									
	Lasiopetalum sp.								x				
	Thomasia macrocalyx				x				x				
	Thomasia paniculata				x		x	x	x	x	x	x	
	Thomasia pauciflora				x								x
	Thomasia sp.						x			x	x		
	Malvaceae sp.							x		x			
MENYANTHACEAE	*Liparophyllum latifolium*				x								
	Ornduffia parnassifolia											x	
MONTIACEAE	*Calandrinia* sp.							x					
MYRTACEAE	*Astartea pulchella*				x								
	Astartea scoparia				x	x	x	x	x	x	x	x	
	Babingtonia camphorosmae				x	x	x		x		x	x	
	Callistemon glaucus										x		
	Calothamnus graniticus subsp. *leptophyllus*	P4			x								
	Calothamnus planifolius					x							
	Calothamnus ?planifolius var. *pallidifolius*											x	
	Calothamnus quadrifidus subsp. *quadrifidus*				x								
	Calothamnus rupestris				x								
	Calothamnus sp.								x				
	Calytrix depressa				x								
	Calytrix flavescens											x	
	Calytrix fraseri											x	
	Calytrix leschenaultii				x				x		x		
	Calytrix sp.						x		x		x	x	
	Corymbia calophylla				x	x	x	x	x	x	x	x	x

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				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
MYRTACEAE (continued)	*Darwinia citriodora*						x						
	Darwinia thymoides				x								
	Darwinia thymoides subsp. St Ronans (J.J. Alford & G.J.	P4			x								
	Eucalyptus accedens						x						
	Eucalyptus aspersa				x								
	* *Corymbia ?citriodora*											x	
	Eucalyptus drummondii				x		x						
	Eucalyptus laeliae				x								
	Eucalyptus latens				x								
	Eucalyptus marginata				x	x	x	x	x	x	x	x	x
	Eucalyptus marginata subsp. *marginata*				x								
	Eucalyptus megacarpa						x	x	x	x	x	x	
	* *Eucalyptus microcorys*						x					x	
	Eucalyptus patens				x	x	x	x	x	x	x	x	x
	Eucalyptus rudis					x			x		x	x	
	Eucalyptus wandoo											x	
	Eucalyptus wandoo subsp. *wandoo*				x								
	Eucalyptus sp.								x			x	
	Homalospermum firmum						x						
	Hypocalymma angustifolium				x	x	x	x	x	x	x	x	x
	Hypocalymma cordifolium				x		x	x	x	x	x	x	
	Hypocalymma robustum						x	x	x		x	x	x
	Hypocalymma sp.						x		x				
	Kunzea baxteri				x								
	Kunzea micrantha				x							x	
	Kunzea micrantha subsp. *micrantha*				x								
	Kunzea recurva				x							x	x
	Leptospermopsis erubescens				x				x			x	
	Leptospermopsis oligandra											x	
	Melaleuca ?brevifolia											x	
	Melaleuca incana											x	
	Melaleuca incana subsp. *incana*				x	x						x	
	Melaleuca lateritia						x					x	
	Melaleuca ?microphylla											x	
	Melaleuca parviceps				x		x						
	Melaleuca pauciflora											x	
	Melaleuca preissiana					x	x	x	x			x	
	Melaleuca rhaphiophylla											x	
	Melaleuca trichophylla								x		x		
	Melaleuca viminea											x	
	Melaleuca viminea subsp. *viminea*											x	
	Melaleuca sp.								x			x	
	Pericalymma ellipticum				x		x	x	x		x	x	
	Taxandria linearifolia				x	x	x	x	x	x	x	x	
	Thryptomene australis subsp. *australis*				x								
	Verticordia densiflora var. *densiflora*											x	
	Verticordia fimbrilepis subsp. *fimbrilepis*	T	E	x									
	Verticordia huegelii var. *decumbens*				x								
	Verticordia huegelii var. *huegelii*				x							x	
	Verticordia plumosa var. *plumosa*						x						
	Verticordia sp.											x	
	Myrtaceae sp.						x		x				
OLACACEAE	*Olax benthamiana*				x							x	
OPHIOGLOSSACEAE	*Ophioglossum gramineum*				x								

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
ORCHIDACEAE	*Caladenia caesarea* subsp. *caesarea*				x								
	Caladenia flava				x		x	x					x
	Caladenia flava subsp. *flava*				x	x							
	Caladenia flava subsp. *sylvestris*				x								
	Caladenia hirta subsp. *hirta*				x								
	Caladenia latifolia												x
	Caladenia macrostylis				x								x
	Caladenia nana subsp. *nana*				x								
	Caladenia reptans									x			x
	Caladenia serotina				x								
	Caladenia x *spectabilis*				x								
	Caladenia uliginosa subsp. *candicans*				x								
	Caladenia uliginosa subsp. *uliginosa*				x								
	Caladenia xantha				x								
	Caladenia sp.					x	x			x		x	x
	Cryptostylis ovata				x		x				x		
	Cryptostylis sp.											x	
	Cyanicula gemmata				x								
	Cyanicula sericea				x								x
	Cyrtostylis huegelii				x								
	Cyrtostylis robusta												x
	Diuris longifolia				x								x
	Diuris micrantha	T	V	x									
	Diuris porrifolia				x								
	Diuris purdiei	T	E	x									
	Diuris setacea				x								
	Diuris sp.											x	
	Drakaea livida												x
	Elythranthera brunonis				x								x
	Eriochilus dilatatus											x	x
	Leporella fimbriata												x
	Leporella sp.						x						
	Leptoceras menziesii				x								
	Lyperanthus serratus				x								x
	Microtis alba				x								
	Microtis alboviridis				x								
	Microtis atrata				x								
	Microtis brownii				x								
	Microtis media								x				x
	Microtis orbicularis				x								
	Microtis sp.						x						
	Paracaleana nigrita				x								x
	Prasophyllum brownii				x								x
	Prasophyllum cyphochilum				x								
	Prasophyllum hians				x								
	Prasophyllum sp.											x	
	Pterostylis barbata				x								
	Pterostylis concava				x								
	Pterostylis glebosa				x								
	Pterostylis pyramidalis				x		x						x
	Pterostylis recurva				x								x
	Pterostylis vittata				x							x	x
	Pterostylis sp.				x		x	x	x	x	x	x	
	Pterostylis sp. 2											x	
	Pyrorchis nigricans				x	x	x	x	x	x		x	x
	Thelymitra benthamiana				x								
	Thelymitra crinita				x							x	x

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
ORCHIDACEAE (continued)	*Thelymitra flexuosa*				x								
	Thelymitra graminea				x								
	Thelymitra macrophylla				x	x						x	x
	Thelymitra spiralis				x								
	Thelymitra stellata	T	E	x									
	Thelymitra sp.				x	x						x	x
	Orchidaceae sp.						x		x	x	x	x	
	Orchidaceae sp. 1											x	
	Orchidaceae sp. 1											x	
OROBANCHACEAE	* *Bellardia trixago*				x								
	* *Orobanche minor*						x	x	x			x	
OXALIDACEAE	* *Oxalis corniculata*												x
	Oxalis exilis				x								
	* *Oxalis glabra*				x								
	* *Oxalis pes-caprae*				x	x							
	* *Oxalis* sp.								x			x	
PAPAVERACEAE	* *Eschscholzia californica*				x								
PHYLLANTHACEAE	*Lysiandra calycina*				x	x	x	x	x	x	x	x	x
	Poranthera huegelii				x								
	Poranthera microphylla				x								x
	Poranthera sp.											x	
PHYTOLACCACEAE	* *Phytolacca octandra*								x				
PINACEAE	* *Pinus canariensis*				x								
	* *Pinus pinaster*						x				x	x	
	* *Pinus radiata*			x									
	* *Pinus* sp.						x						
PITTOSPORACEAE	*Billardiera floribunda*				x								x
	Billardiera fusiformis				x		x	x	x		x	x	x
	Billardiera heterophylla												x
	Billardiera variifolia				x				x			x	x
	Billardiera sp.					x	x		x			x	
	Cheiranthera parviflora				x							x	
	Marianthus bicolor										x	x	
	Marianthus drummondianus						x		x		x	x	
	Marianthus tenuis				x								
	Marianthus sp.											x	x
	Pittosporaceae sp.						x					x	
PLANTAGINACEAE	* *Plantago lanceolata*				x								
POACEAE	* *Aira caryophyllea*											x	x
	* *Aira cupaniana*				x								
	Amphipogon amphipogonoides								x	x		x	x
	Amphipogon laguroides								x				
	Amphipogon laguroides subsp. *laguroides*				x								
	Amphipogon sp.					x		x					
	Austrostipa elegantissima											x	
	Austrostipa macalpinei											x	
	Austrostipa sp.						x					x	
	* *Briza minor*				x							x	x

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
POACEAE (continued)	* *Cortaderia selloana* subsp. *selloana*				x								
	* *Ehrharta calycina*				x								
	Eriachne sp.										x		
	* *Lagurus ovatus*				x								
	* *Lolium* sp.				x								
	Neurachne alopecuroidea				x	x	x	x	x	x	x	x	x
	* *Pentameris airoides*											x	
	Poa porphyroclados											x	
	Poa sp.											x	
	Rytidosperma caespitosum				x	x	x	x	x	x	x	x	x
	Rytidosperma setaceum				x							x	
	Rytidosperma sp.						x					x	
	Tetrarrhena laevis				x	x	x	x	x	x	x	x	x
	* *Vulpia myuros*												x
	Poaceae sp.					x	x	x	x		x	x	
	Poaceae sp. 1											x	
	Poaceae sp. 2											x	
PODOCARPACEAE	*Podocarpus drouynianus*						x					x	
POLYGALACEAE	*Comesperma calymega*				x				x			x	x
	Comesperma virgatum						x		x			x	x
	Comesperma sp.						x					x	
PRIMULACEAE	* *Lysimachia arvensis*				x	x		x	x	x		x	x
PROTEACEAE	*Adenanthos barbiger*				x		x		x		x	x	x
	Adenanthos cygnorum											x	
	Adenanthos obovatus						x					x	
	Banksia bipinnatifida											x	
	Banksia dallanneyi												x
	Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*				x	x	x	x	x	x	x	x	
	Banksia dallanneyi subsp. *sylvestris*						x					x	
	Banksia grandis				x	x	x	x	x	x	x	x	x
	Banksia littoralis				x	x	x	x	x		x	x	
	Banksia nivea												x
	Banksia nivea subsp. *nivea*											x	
	Banksia seminuda				x			x			x	x	
	Banksia sessilis				x		x		x	x	x	x	x
	Banksia sessilis var. *sessilis*				x								
	Banksia sphaerocarpa							x			x	x	
	Banksia sphaerocarpa var. *sphaerocarpa*				x								
	Banksia squarrosa subsp. *squarrosa*								x			x	
	Banksia undata var. *undata*				x								
	Banksia sp.									x	x		
	Conospermum acerosum				x								
	Conospermum capitatum							x				x	
	Conospermum capitatum subsp. *capitatum*											x	
	Conospermum capitatum subsp. *glabratum*						x						
	Conospermum flexuosum												x
	Conospermum sp.						x					x	
	Grevillea bipinnatifida								x			x	
	Grevillea centristigma				x								
	Grevillea dissectifolia	P3			x								
	Grevillea diversifolia								x				

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
PROTEACEAE (continued)	*Grevillea diversifolia* subsp. *diversifolia*				x								
	Grevillea manglesii							x	x				
	Grevillea monticola				x							x	
	Grevillea pilulifera				x								
	Grevillea pulchella							x	x			x	
	Grevillea quercifolia				x		x						
	Grevillea wilsonii				x				x	x	x	x	
	Hakea amplexicaulis				x		x	x	x	x	x	x	x
	Hakea cyclocarpa								x			x	
	Hakea incrassata				x							x	
	Hakea lasianthoides				x						x		
	Hakea lissocarpha				x	x	x	x	x	x	x	x	x
	Hakea marginata											x	
	Hakea oldfieldii	P3			x								
	Hakea petiolaris subsp. *petiolaris*				x								
	Hakea prostrata					x					x	x	
	Hakea ruscifolia				x				x		x	x	x
	Hakea trifurcata											x	
	Hakea undulata				x							x	x
	Hakea varia				x			x			x	x	
	Isopogon dubius											x	
	Isopogon sphaerocephalus						x					x	
	Isopogon sp. Darling Range (F. Hort 1662)				x								
	Persoonia elliptica				x		x	x	x		x	x	x
	Persoonia longifolia				x	x	x	x	x	x	x	x	x
	Petrophile heterophylla				x								
	Petrophile striata				x							x	
	Stirlingia simplex				x							x	
	Synaphea cuneata				x								
	Synaphea gracillima				x								
	Synaphea petiolaris						x					x	
	Synaphea sp.											x	
	Xylomelum occidentale						x	x				x	
	Proteaceae sp.											x	
PTERIDACEAE	*Cheilanthes austrotenuifolia*							x					
	Cheilanthes sp.											x	
RANUNCULACEAE	*Clematis pubescens*				x	x	x	x	x	x	x	x	x
	Ranunculus colonorum				x							x	
	* *Ranunculus muricatus*				x								
	Ranunculus sp.											x	
RESTIONACEAE	*Chordifex gracilior*	P3			x								
	Desmocladus fasciculatus				x	x	x	x	x		x	x	x
	Desmocladus flexuosus				x	x	x	x	x		x	x	x
	Hypolaena exsulca					x	x	x	x		x	x	x
	Leptocarpus coangustatus				x							x	
	Leptocarpus decipiens				x							x	
	Leptocarpus roycei				x								
	Leptocarpus scariosus				x							x	
	Leptocarpus sp.											x	
	Lepyrodia curvescens	P2			x				x				
	Lepyrodia glauca											x	
	Loxocarya cinerea				x		x					x	x

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
RESTIONACEAE (continued)	*Loxocarya striata*				x		x						
	Sporadanthus rivularis						x						
	Taraxis grossa				x								
	Restionaceae sp.						x		x			x	
RHAMNACEAE	*Cryptandra arbutiflora* var. *arbutiflora*											x	
	Cryptandra sp.											x	
	Stenanthemum coronatum				x								
	Stenanthemum nanum				x							x	
	Trymalium ledifolium					x	x	x	x	x	x	x	x
	Trymalium ledifolium var. *rosmarinifolium*				x								
	Trymalium odoratissimum											x	
	Trymalium odoratissimum subsp. *odoratissimum*				x		x	x	x	x	x		x
	Trymalium odoratissimum subsp. *trifidum*							x					
ROSACEAE	*Acaena echinata*											x	
	* *Prunus persica* var. *nucipersica*				x								
	* *Rubus anglocandicans*				x								
	* *Rubus ulmifolius*			x					x				
RUBIACEAE	*Opercularia apiciflora*											x	x
	Opercularia echinocephala				x		x	x	x	x	x	x	x
	Opercularia hispidula				x			x				x	x
	Opercularia vaginata								x			x	x
	Opercularia sp.						x		x	x		x	
RUTACEAE	*Asterolasia pallida*				x		x	x	x				
	Boronia capitata subsp. *gracilis*	P3			x								
	Boronia crenulata				x		x		x			x	x
	Boronia crenulata subsp. *crenulata*										x		
	Boronia crenulata subsp. *crenulata* var. *crenulata*				x			x					
	Boronia crenulata subsp. *viminea*											x	
	Boronia fastigiata				x		x	x	x	x	x	x	x
	Boronia molloyae				x		x		x		x	x	
	Boronia spathulata				x								
	Boronia sp.						x					x	
	Cyanothamnus defoliatus				x								
	Philotheca spicata				x		x	x	x			x	x
SALICACEAE	* *Salix* spp. except *S. babylonica, S.* x *calodendron* & *S.* x *reichardtii*			x									
SALVINIACEAE	* *Salvinia* x*molesta*			x									
SANTALACEAE	*Leptomeria cunninghamii*				x		x			x		x	
SAPINDACEAE	*Dodonaea viscosa* subsp. *angustissima*				x								
	Dodonaea sp.								x				
SOLANACEAE	*Anthocercis gracilis*	T	V	x									
STYLIDIACEAE	*Levenhookia pusilla*					x	x					x	x
	Levenhookia stipitata											x	x
	Levenhookia sp.					x						x	
	Stylidium affine											x	
	Stylidium amoenum				x		x	x	x	x	x	x	x

APPENDIX B: POTENTIAL VASCULAR PLANT SPECIES IN THE HOLYOAKE EAST AREA

Note: * denotes introduced species; T denotes threatened species; P1-P4 denotes priority species; SCC = State Conservation Code; FCC = Federal Conservation Code; CE = Critically Endangered, E = Endangered, V = Vulnerable.

Family	Species	SCC	FCC	Data source									
				EPBC	Naturemap	MCPL 2015a	MCPL 2015b	MCPL 2018	MCPL 2019b	MCPL 2019a	MCPL 2020	MCPL 2022, 2023	Permanent Forest
STYLIDIACEAE	*Stylidium androsaceum*				x								
(continued)	*Stylidium brunonianum*				x	x			x				
	Stylidium bulbiferum									x			
	Stylidium calcaratum												x
	Stylidium carnosum											x	
	Stylidium ciliatum				x				x		x		
	Stylidium crassifolium												
	Stylidium dichotomum												
	Stylidium diuroides												x
	Stylidium hispidum				x					x		x	x
	Stylidium ireneae	P4			x								
	Stylidium junceum												
	Stylidium lateriticola				x							x	
	Stylidium lineatum				x		x						
	Stylidium longitubum	P4											
	Stylidium piliferum						x	x	x	x	x	x	x
	Stylidium pulchellum												
	Stylidium pycnostachyum				x								
	Stylidium recurvum				x								
	Stylidium repens						x		x		x		x
	Stylidium rhynchocarpum				x								
	Stylidium scariosum				x								
	Stylidium schoenoides												x
	Stylidium tenue subsp. *majusculum*				x								
	Stylidium thesioides												
	Stylidium utricularioides												
	Stylidium sp.						x	x	x	x	x	x	
THYMELAEACEAE	*Pimelea argentea*				x								
	Pimelea ciliata							x				x	
	Pimelea ciliata subsp. *ciliata*				x							x	
	Pimelea imbricata var. *piligera*				x								
	Pimelea lehmanniana subsp. *nervosa*				x								
	Pimelea rara	P4			x								
	Pimelea suaveolens						x	x	x		x	x	x
	Pimelea suaveolens subsp. *suaveolens*				x					x			
	Pimelea sylvestris				x							x	
	Pimelea sp.						x	x	x		x	x	
VERBENACEAE	* *Verbena incompta*				x								
VIOLACEAE	*Pigea calycina*												x
	Pigea debilissima				x								x
	Pigea floribunda				x							x	
XANTHORRHOEACEAE	*Xanthorrhoea gracilis*				x	x	x	x	x	x	x	x	x
	Xanthorrhoea preissii				x	x	x	x	x	x	x	x	x
	Xanthorrhoea sp.				x				x			x	
ZAMIACEAE	*Macrozamia fraseri*				x								
	Macrozamia riedlei				x	x	x	x	x	x	x	x	x

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Anthocercis gracilis	Solanaceae	T	Vulnerable	Habit: Erect, spindly shrub, to 0.6 (-1) m high. Flower colour: yellow-green Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Sandy or loamy soils. Granite outcrops. IBRA Distribution: AVW, JAF Florabase records: 29	Moderate DBCA records in close proximity of the area. Occurs on similar soil profile as proposed site.
Diuris micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.3-0.6 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Brown loamy clay. Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 7	Low Has not been recorded by DBCA or by MCPL previously within the survey area
Diuris purdiei	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.35 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Grey-black sand, moist. Winter-wet swamps. IBRA Distribution: JAF, SWA Florabase records: 24	Low Has not been recorded by DBCA or by MCPL previously within the survey area
Lasiopetalum pterocarpum	Malvaceae	T	Endangered	Habit: Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines. IBRA Distribution: JAF Florabase records: 11	Low Occurs on the proposed site soil profile, however has not been recorded by DBCA or by MCPL previously within the survey area

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thelymitra dedmaniarum	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, to 0.8 m high. Flower colour: yellow Flowering period (indicated in green): **J F** M A M J **J** A S O **N D** Soils: Granite IBRA Distribution: JAF Florabase records: 4	Low Has not been recorded by DBCA or by MCPL previously within the survey area
Thelymitra stellata	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.25 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Sand, gravel, lateritic loam. IBRA Distribution: GES, JAF, SWA Florabase records: 20	Low Has not been recorded by DBCA or by MCPL previously within the survey area
Verticordia fimbrilepis subsp. *fimbrilepis*	Myrtaceae	T	Endangered	Habit: Shrub, 0.3-0.7 m high. Flower colour: pink-white Flowering period (indicated in green): **J F** M A M J J A S O N D Soils: Gravelly or clayey soils. Flats, road verges. IBRA Distribution: AVW, JAF Florabase records: 39	Low Occurs on the proposed site soil profile, however has not been recorded by DBCA or by MCPL previously within the survey area
Bossiaea modesta	Fabaceae	P2	-	Habit: Slender, trailing & twining shrub. Flower colour: yellow & red Flowering period (indicated in green): J F M A M J J A S O N D Soils: Soils derived from granite. Damp areas close to stream. IBRA Distribution: JAF, SWA Florabase records: 22	Moderate Occurs on similar soils and to the west of the survey area

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Lepyrodia curvescens	Restionaceae	P2	-	Habit: Dioecious, shortly creeping, tufted rhizomatous, herb, 0.24-0.4 m high, rhizomes on surface or to 1 cm deep. Flower colour: - Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Sand, laterite. Seasonally inundated swampland. IBRA Distribution: GES, JAF, SWA Florabase records: 20	Low Previously recorded by MCPL(209) within the Pinjarra farmlands. Associated with swamplands
Acacia horridula	Fabaceae	P3	-	Habit: Harsh, slender, single-stemmed shrub, 0.3-0.6 (-1) m high. Flower colour: yellow Flowering period (indicated in green): J F M A **M J J A** S O N D Soils: Gravelly soils over granite, sand. Rocky hillslopes. IBRA Distribution: JAF, SWA Florabase records: 33	Low Not previously recorded and doesn't occur within the same soil type
Acacia oncinophylla subsp. *oncinophylla*	Fabaceae	P3	-	Habit: Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Granitic soils IBRA Distribution: AVW, JAF, SWA Florabase records: 42	Moderate Occurs on granitic soils, although has been known to occur close to the Dwellingup townsite.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	Ericaceae	P3	-	Habit: Shrub, to 1.1 m high and 1.1 m wide. Flower colour: white-cream/mauve-pink Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Loam, clay, sand, gravel. Granite, slopes and drainage lines. IBRA Distribution: JAF Florabase records: 22	Moderate Occurs on similar soil types as survey area
Boronia capitata subsp. *gracilis*	Rutaceae	P3	-	Habit: Slender shrub, 0.3-0.6(-3) m high, branches pilose. Flower colour: pink Flowering period (indicated in green): F M A M **J J A S O N** D Soils: White/grey or black sand. Winter-wet swamps, hillslopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 28	Moderate Has not been previously recorded within the survey site. This species does occur on the soil types/ landforms within the survey area.
Chordifex gracilior	Restionaceae	P3	-	Habit: Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Peaty sand. Swamps. IBRA Distribution: JAF, SWA, WAR Florabase records: 31	Moderate Has been previously to the east of the survey area.
Cyathochaeta teretifolia	Cyperaceae	P3	-	Habit: Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2.0 m high, to 1.0 m wide. Flower colour: brown Flowering period (indicated in green): **J** F M A M J J A **S O N** D Soils: Grey sand, sandy clay. Swamps, creek edges. IBRA Distribution: JAF, SWA, WAR Florabase records: 39	Moderate Recorded previously by MCPL (2015)

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Grevillea manglesii subsp. *dissectifolia*	Proteaceae	P3	-	Habit: Spreading, virgate shrub, 1.5-3 (-5) m high, up to 33 m wide. Flower colour: white & red & brown Flowering period (indicated in green): J F M A M **J** J A **S O N** D Soils: Gravelly loam, moist. Roadsides. IBRA Distribution: JAF Florabase records: 27	Low Recorded in Dwellingup townsite.
Hakea oldfieldii	Proteaceae	P3	-	Habit: Open, straggling shrub, up to 2.5 m high. Flower colour: white-cream/yellow Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Red clay or sand over laterite. Seasonally wet flats. IBRA Distribution: AVW, ESP, JAF, MAL, SWA Florabase records: 58	High Recorded previously near the survey area in brown gravelly loam.
Hemigenia microphylla	Lamiaceae	P3	-	Habit: Erect shrub to 1 m high. Flower colour: mauve-purple-lilac Flowering period (indicated in green): **J** F M A M J J A S **O N D** Soils: Clay, sandy clay, grey peaty clay, granite. Winter wet flats, lower slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 25	High Associated with soil types/ landforms; has been recorded near the survey site.
Lasiopetalum membranaceum	Malvaceae	P3	-	Habit: Multi-stemmed shrub, 0.2-1 m high. Flower colour: pink-blue-purple Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Sand over limestone IBRA Distribution: JAF, SWA, WAR Florabase records: 35	Low Associated with soil types/ landforms not typically found within the survey site, although Previous DBCA records found in Dwellingup

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Tetratheca ?pilifera	Elaeocarpaceae	P3	-	Habit: Spreading shrub, 0.1-0.3 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Gravelly soils.7 IBRA Distribution: JAF, SWA Florabase records: 34	Low Typically found North of survey site in similar soil as the survey area, however has been previously recorded my MCPL (2019b)
Tetratheca similis	Elaeocarpaceae	P3	-	Habit: Spreading shrub, to 0.3 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J **A S** O N D Soils: Sandy clay with lateritic boulders. IBRA Distribution: AVW, JAF Florabase records: 20	Low Typically found North east of survey site.
Thysanotus anceps	Asparagaceae	P3	-	Habit: Rhizomatous, leafless perennial, herb, to 0.4 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: White or grey sand, lateritic gravel, laterite. IBRA Distribution: GES, JAF, SWA Florabase records: 17	Moderate Recorded previously in similar soil type/ landforms as the survey area.
Calothamnus graniticus subsp. *leptophyllus*	Myrtaceae	P4	-	Habit: Erect, multi-stemmed shrub, 1-2 m high. Flower colour: red Flowering period (indicated in green): J F M A M **J J A** S O N D Soils: Clay over granite, lateritic soils. Hillsides. IBRA Distribution: JAF, SWA Florabase records: 32	Moderate Recorded previously by DBCA at Dwellingup townsite in similar soil type/ landforms as the survey area.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Chorizema ulotropis	Fabaceae	P4	-	Habit: Sprawling, open, semi-prostrate shrub, to 0.45 m high. Flower colour: orange-yellow Flowering period (indicated in green): J F M A M J **J** **A** **S** O N D Soils: Moist to dry soils, white sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats. IBRA Distribution: ESP, JAF, MAL Florabase records: 24	Low Recorded previously by DBCA at Dwellingup townsite.
Darwinia thymoides subsp. St Ronans (J.J. Alford & G.J. Keighery 64)	Myrtaceae	P4	-	Habit: Low spreading shrub. Flower colour: orange-red Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: Yellow brown sand, clay, gravel, loamy clay over granite, Sand over laterite. Hilltops, slopes, valleys. IBRA Distribution: AVW, JAF Florabase records: 22	Moderate Previously recorded by DBCA east of the survey area. Occurs in similar soil type/ landforms as the survey area.
Drosera occidentalis	Droseraceae	P4	-	Habit: Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Flower colour: pink/white Flowering period (indicated in green): **J** F M A M J J A S **O** **N** **D** Soils: White/black sand over yellow clay, yellow sand, moist brown/grey clay/sand, peaty sand, sandy clay. Damp flats, flood plain. IBRA Distribution: JAF, SWA Florabase records: 18	Moderate Has been recorded near the survey area.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase) and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b).

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Lasiopetalum cardiophyllum	Malvaceae	P4	-	Habit: Erect, multi-stemmed shrub, 0.2-0.5 m high. Flower colour: pink Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Lateritic gravelly soils, sandy clay. Flats, hillslopes. IBRA Distribution: AVW, JAF Florabase records: 34	High Has been recorded within and near the survey area.
Parsonsia diaphanophleba	Apocynaceae	P4	-	Habit: Woody climber, to 10 m high. Flower colour: white/cream & pink Flowering period (indicated in green): **J F M A M J** J A **S** O N D Soils: Alluvial soils. Along rivers. IBRA Distribution: JAF, SWA Florabase records: 28	Low Has not been recorded by DBCA or by MCPL previously within the survey area, has been recorded south of Dwellingup, close to Linto Road.
Pimelea rara	Thymelaeaceae	P4	-	Habit: Shrub, 0.2-0.35 m high. Flower colour: white Flowering period (indicated in green): **J** F M A M J J A S O N **D** Soils: Lateritic soils. IBRA Distribution: JAF Florabase records: 52	Low DBCA record close to Nanga Road south of survey area, on a slope on yellow/red clay/gravel.
Senecio leucoglossus	Asteraceae	P4	-	Habit: Erect annual, herb, to 1.3 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Gravelly lateritic or granitic soils. Granite outcrops, slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 44	High Previously recorded by MCPL over multiple years. Has been recorded within survey area.

APPENDIX C: ASSESSMENT OF POTENTIAL THREATENED AND PRIORITY FLORA IN THE HOLYOAKE EAST SURVEY AREA

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Stylidium ireneae	Stylidiaceae	P4	-	Habit: Lax perennial, herb, (0.06-) 0.1-0.28 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sandy loam. Valleys near creek lines. IBRA Distribution: JAF, SWA, WAR Florabase records: 25	Moderate Has been recorded by DBCA or by MCPL previously near the survey area.
Stylidium longitubum	Stylidiaceae	P4	-	Habit: Erect annual (ephemeral), herb, 0.05-0.12 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sandy clay, clay. Seasonal wetlands. IBRA Distribution: GES, JAF, SWA Florabase records: 46	Low Has not been recorded by DBCA or by MCPL previously within the survey area.

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: WONS = Weeds of National Significance (Department of Agriculture, Fisheries and Forestry 2023e); WAOL = Western Australian Organism List (Department of Primary Industries and Regional Development 2023). IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; CEK – Central Kimberley; CEN – Central Ranges; COO – Coolgardie; DAL – Dampierland; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GIB – Gibson Desert; GSD – Great Sandy Desert; GVD – Great Victoria Desert; HAM – Hampton; JAF – Jarrah Forest; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NOK – Northern Kimberley; NUL – Nullarbor; PIL – Pilbara; SWA – Swan Coastal Plain; TAN – Tanami; VIB – Victoria Bonaparte; WAR – Warren; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Acacia decurrens*	No	Permitted - s11	-	-	-	Habit: Tree, 2-10 metres high. Flower colour: yellow Flowering period (indicated in green): J F M A M **J J A S** O N D Soils: Roadsides, creeklines & wasteland. IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 33	Low
**Acacia longifolia* subsp. *longifolia*	No	Permitted - s11	-	-	-	Habit: Rounded shrub or tree, 1-10 m high, phyllodes flat, 50-200 mm long; spikes simple; pods 4-10 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M **J J A S** O N D Soils: Sand & gravelly lateritic soils. IBRA Distribution: JAF, SWA, WAR Florabase records: 25	Low
**Acacia podalyriifolia*	No	Permitted - s11	-	-	-	Habit: Spreading tree, to 7 m high, glaucous, densely hairy phyllodes and flat, wide pods. Flower colour: yellow Flowering period (indicated in green): J F M A **M J J A** S O N D Soils: Grey sand, lateritic loam. IBRA Distribution: GES, JAF, SWA, WAR Florabase records: 29	Low
**Acacia pycnantha*	No	Permitted - s11	-	-	-	Habit: Shrub or tree, 2-8 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J **J A S O** N D Soils: Brown, sandy loam. IBRA Distribution: AWV, COO, ESP, JAF, MAL, SWA, WAR Florabase records: 55	Low

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: WONS = Weeds of National Significance (Department of Agriculture, Fisheries and Forestry 2023e); WAOL = Western Australian Organism List (Department of Primary Industries and Regional Development 2023). IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; CEK – Central Kimberley; CEN – Central Ranges; COO – Coolgardie; DAL – Dampierland; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GIB – Gibson Desert; GSD – Great Sandy Desert; GVD – Great Victoria Desert; HAM – Hampton; JAF – Jarrah Forest; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NOK – Northern Kimberley; NUL – Nullarbor; PIL – Pilbara; SWA – Swan Coastal Plain; TAN – Tanami; VIB – Victoria Bonaparte; WAR – Warren; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Aira caryophyllea*	No	Permitted - s11	-	-	-	Habit: Annual, grass-like or herb, 0.07-0.4 m high. Flower colour: green-purple Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: Clay, grey sand, peat, gravel. Winter-wet claypans. IBRA Distribution: AWV, COO, ESP, JAF, SWA, WAR Florabase records: 23	High
**Aira cupaniana*	No	Permitted - s11	-	-	-	Habit: Annual, grass-like or herb, 0.1-0.4 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J A **S** **O** **N** D Soils: Sandy clay, sand, loam. IBRA Distribution: AWV, COO, ESP, GES, JAF, MAL, SWA, WAR Florabase records: 191	Low
**Allium triquetrum*	No	Permitted - s11	-	-	-	Habit: Bulbaceous, perennial, herb, to 0.3 m high Flower colour: white Flowering period (indicated in green): J F M A M J J **A** **S** **O** N D Soils: Watercourse. Brown loam / clay. Slope. Grey sand. IBRA Distribution: AWV, JAF, SWA, WAR Florabase records: 34	Low
**Arctotheca calendula*	No	Permitted - s11	-	-	-	Habit: Decumbent or ascending annual, herb, 0.03-0.3 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils: Roadsides, waste places. IBRA Distribution: AVW, CAR, COO, ESP, GES, HAM, JAF, MAL, MUR, PIL, SWA, WAR, YAL Florabase records: 236	Moderate

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Asparagus asparagoides*	Yes	Declared Pest - s22(2)	-	Exempt	No Control Category, Whole of State	Habit: Rhizomatous and tuberous, perennial, herb and climber, 1-5 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A** **S** O N D Soils: Sand, loam, clay, granite. IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, SWA, WAR Florabase records: 78	Low
**Bellardia trixago*	No	Permitted - s11	-	-	-	Habit: Erect annual herb Flower colour: white/ cream/ pale pink Flowering period (indicated in green): J F **M** A M J J A **S** **O** **N** **D** Soils: Flat sandplain of deep grey sandy soil. Dried clay flat. Brown clay loam. gravelly brown-white clay-clayey sand over ironstone. IBRA Distribution: AVW, ESP, GES, JAF, SWA, WAR Florabase records: 110	Low
**Briza minor*	No	Permitted - s11	-	-	-	Habit: Tufted, glabrous annual, grass-like or herb, 0.15-0.5 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Loam, sand, clay, laterite IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, MUR, SWA, WAR, YAL Florabase records: 178	High
**Callitris endlicheri*	No	Permitted - s11	-	-	-	Habit: Slender erect tree Soils: Flat. Lateritic sandy clay. IBRA Distribution: JAF Florabase records: 1	Low

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
** Centaurium erythraea*	No	Permitted - s11	-	-	-	Habit: Biennial or annual, herb, 0.05-0.5 m high. Flower colour: pink/pink-red Flowering period (indicated in green): J F M A M J J A S O N D Soils: Damp habitats. IBRA Distribution: AVW, CER, COO, ESP, GAS, GES, GVD, HAM, JAF, MAL, OVP, SWA, WAR Florabase records: 111	Moderate
** Centaurium tenuiflorum*	No	Permitted - s11	-	-	-	Habit: Annual, herb, 0.15-0.53 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D Soils: Drainage lines, swamps. IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, SWA, WAR Florabase records: 83	Moderate
**Chenopodium album*	No	Permitted - s11	-	-	-	Habit: Erect annual, herb, 0.2-1(-1.7) m high. Flower colour: green Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand, loam, sandy clay. Weed in agricultural areas. IBRA Distribution: AVW, COO, ESP, JAF, MAL, SWA, WAR. YAL Florabase records: 51	Low
**Chenopodium murale*	No	Permitted - s11	-	-	-	Habit: Erect, much-branched annual, herb, 0.2-1 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J A S O N D Soils: Agricultural weed, cultivated & disturbed areas, coastal sites. IBRA Distribution: AVW, CAR, COO, ESP, GAS, , GES. HAM, JAF, MAL, MUR, NUL, PIL, SWA, WAR, YAL Florabase records: 121	Low

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: WONS = Weeds of National Significance (Department of Agriculture, Fisheries and Forestry 2023e); WAOL = Western Australian Organism List (Department of Primary Industries and Regional Development 2023). IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; CEK – Central Kimberley; CEN – Central Ranges; COO – Coolgardie; DAL – Dampierland; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GIB – Gibson Desert; GSD – Great Sandy Desert; GVD – Great Victoria Desert; HAM – Hampton; JAF – Jarrah Forest; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NOK – Northern Kimberley; NUL – Nullarbor; PIL – Pilbara; SWA – Swan Coastal Plain; TAN – Tanami; VIB – Victoria Bonaparte; WAR – Warren; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
* *Chrysanthemoides monilifera*	No	Declared Pest, Prohibited - s12	C1 Exclusion	Prohibited	Whole of State	Habit: Shrub, 0.8-3 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Swampy loam, lateritic sandy clay. Coastal areas, roadsides, waste areas. IBRA Distribution: JAF Florabase records: 47	Low
* *Chrysanthemoides monilifera* subsp. *monilifera*	Yes	Declared Pest, Prohibited - s12	C2 Eradication	Prohibited	Whole of State	Habit: Erect shrub, 0.8-3m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Red-brown loam, limestone rubble. Sandplains, coastal areas, roadsides & waste areas. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 47	Low
**Cortaderia selloana* subsp. *selloana*	No	Permitted - s11	-	-	-	Habit: Perennial erect grass Flower colour: cream-grey Soils: Hillside. Damp grey sand. Brown wet loam clay. IBRA Distribution: AVW, ESP, JAF,MAL, SWA, WAR Florabase records: 117	Low
**Corymbia citriodora*	No	Permitted - s11	-	-	-	Habit: Slender tall tree, bark smooth, pale orange-grey. Leaves with distinct lemon scent. Flower colour: white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Brown loam. IBRA Distribution: JAF, SWA Florabase records: 3	Moderate

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Cyperus congestus*	No	Permitted - s11	-	-	-	Habit: Tufted, colonial perennial, grass-like or herb (sedge), 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Grey sandy clay, sand. Swamps. IBRA Distribution: AVW, ESP, GES, JAF, SWA, WAR Florabase records: 110	Low
**Cyperus tenellus*	No	Permitted - s11	-	-	-	Habit: Tufted annual, grass-like or herb (sedge), 0.02-0.12 m high, stems filiform, 0.1-0.2mm diameter, with a solitary spikelet or 2-4 spikelet's in a pseudolateral cluster. Flower colour: green-brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: White or grey clayey sand, clay, brown loam, granite. Margins of swamps, rockpools on granite and other damp habitats. IBRA Distribution: AVW, COO, ESP, GES, JAF,MAL, SWA, WAR, YAL Florabase records: 122	Moderate
**Dittrichia graveolens*	No	Permitted - s11	-	-	-	Habit: Erect, bushy, viscid, aromatic annual, herb, 0.1-0.5(-1) m high. Flower colour: yellow/yellow-white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Variety of soils; weed of waste grounds; along rivers, roadsides. IBRA Distribution: AVW, COO, ESP, GES, HAM, JAF, MAL, MUR, SWA, WAR Florabase records: 93	Moderate

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Ehrharta calycina*	No	Permitted - s11	-	-	-	Habit: Caespitose perennial, grass-like or herb, 0.3-0.7 m high. Flower colour: green/purple/red Flowering period (indicated in green): J F **M A** M J J **A S** O N D Soils: White, grey or yellow sand, loam. IBRA Distribution: AVW, CAR, ESP, GES, HAM, JAF, MAL, MUR, SWA, WAR Florabase records: 96	Low
**Erigeron sumatrensis*	No		-	-	-	Habit: Annual herb to about 2 m high. Flower colour: cream Flowering period (indicated in green): **J F M A M J J A** S O N **D** Soils: Weed of pasture, road sides, cultivation, and wasteland. Widespread. IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, SWA, WAR Florabase records: 110	Moderate
**Eschscholzia californica*	No	Permitted - s11	-	-	-	Habit: Spreading annual or biennial, herb, to 0.3 m high. Flower colour: yellow/orange Flowering period (indicated in green): J F M A M J J A **S** O N D Soils: Sand, loam. IBRA Distribution: JAF, WAR Florabase records: 4	Low
**Eucalyptus microcorys*	No	Permitted - s11	-	-	-	Habit: Tree, 5-12 m high, bark rough grey, smooth on upper branches. Flower colour: white Flowering period (indicated in green): **J** F M A M J J **A S O N** D Soils: Brown loam over laterite, clay. Disturbed woodland, creekline. IBRA Distribution: JAF, WAR Florabase records: 8	Moderate

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Gamochaeta calviceps*	No	Permitted - s11	-	-	-	Habit: Annual, herb, to 0.15 m high Flower colour: yellow-brown Flowering period (indicated in green): J F M A M J J A S O **N** D Soils: Grey sandy clay, red-brown sandy loam, peaty sand over granite. Winter-wet depressions, river flats, road verges. IBRA Distribution: AVW, ESP, GES, JAF, SWA, WAR Florabase records: 20	Moderate
**Genista* sp. × *Genista monspessulana*	Yes	Permitted - s11	-	-	-	Habit: Erect shrub, 1-5 m high, leaves trifoliolate, petiolate, standard more or less glabrous. Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J **A** S O **N** D Soils: Loam, lateritic sand, black peaty sand. Edging rivers and roadsides. IBRA Distribution: AVW, ESP, GES, JAF, SWA, WAR Florabase records: 38	Low
** Gomphocarpus fruticosus*	No	Declared Pest - s22(2)	C3 Management	-	Shire of Boddington, Shire of Murray, Shire of Waroona	Habit: Erect perennial, herb or shrub, 0.5-1.5 m high. Flower colour: white/cream Flowering period (indicated in green): J **F** **M** **A** **M** **J** **J** A S O N D Soils: Disturbed sites. IBRA Distribution: AVW, ESP, JAF, MAL, NUL, SWA Florabase records: 44	Low

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Hypericum perforatum*	No	Permitted - s11	-	-	-	Habit: Erect perennial, herb, 0.3-0.9 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Roadsides, pastures. IBRA Distribution: AVW, CAR, JAF, WAR Florabase records: 32	Moderate
**Hypochaeris glabra*	No	Permitted - s11	-	-	-	Habit: Rosetted annual or perennial, herb, 0.08-0.5 m high, leaves smooth; flower heads up to 1.5 cm across. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Common weed of lawns, horticultural areas, roadsides & bushland. IBRA Distribution: AVW, CAR, COO, ESP, GES, JAF, LSD, MAL, MUR, SWA, WAR, YAL Florabase records: 353	High
**Hypochaeris radicata*	No	Permitted - s11	-	-	-	Habit: Rosetted annual, herb, 0.08-0.5 m high, leaves rough, bristly; flower heads up to 3 cm across Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Common weed of lawns, horticultural areas, roadsides & bushland. IBRA Distribution: AVW,ESP, JAF, MAL, SWA, WAR Florabase records: 73	Low

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Ixia fuscocitrina*	No	Permitted - s11	-	-	-	Habit: Cormous, perennial, herb, to 1 m high, perianth tube 0.5-2 cm long. Flower colour: yellow-orange-purple Flowering period (indicated in green): J F M A M J J **A S O** N D Soils: Lateritic loam, grey sand, sandy clay, granite. Road verges. IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 74	Low
**Juncus bufonius*	No	Permitted - s11	-	-	-	Habit: Annual, grass-like or herb, 0.04-0.3 m high. Flowering period (indicated in green): **J** F M A M J J A **S O N D** Soils: Granite. Swamps, seepage areas, creeks. IBRA Distribution: AVW, COO, ESP, GES, GVD, JAF, MAL, MUR, NUL, SWA, WAR, YAL Florabase records: 196	Low
**Juncus microcephalus*	No	Permitted - s1	-	-	-	Habit: Robust rhizomatous, colonial perennial, herb, 0.5-2 m high. Flowering period (indicated in green): **J F** M A M J J A S O **N D** Soils: Clay, sand, often wet. Drains, springs. IBRA Distribution: ESP, JAF, SWA, WAR Florabase records: 87	Low

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Lactuca serriola* forma *serriola*	No	Permitted - s11	-	-	-	Habit: Erect, climbing herb (with spiny leaves), to 2 m high. Flower colour: yellow Flowering period (indicated in green): **J F** M A M J J A S **O N D** Soils: White to brown sand, red loam, brown gravelly loam, black-brown alluvium. Dunes, flats, river banks, valleys, drainage lines. IBRA Distribution: AVW, CAR, COO, JAF, MUR, PIL, SWA Florabase records: 48	Low
**Lagurus ovatus*	No	Permitted - s11	-	-	-	Habit: Annual, grass-like or herb, 0.1-0.3 m high. White, grey, brown or black sand. Swamp edges, roadsides, dunes. Flower colour: white/other Flowering period (indicated in green): J F **M** A M J J **A S O N D** Soils: White, grey, brown or black sand. Swamp edges, roadsides, dunes. IBRA Distribution: ESP, HAM, JAF, SWA, WAR Florabase records: 77	Low
**Lathyrus latifolius*	No	Permitted - s11	-	-	-	Habit: Climber. Flower colour: purple/pink/white Flowering period (indicated in green): **J** F M A M J J A S O **N D** Soils: Sandy & lateritic soils. Roadsides, damp depressions. IBRA Distribution: ESP, JAF, SWA, WAR Florabase records: 7	Low

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Lavandula stoechas* subsp. *stoechas*	No	Permitted - s11	-	-	-	Habit: Aromatic shrub, 0.3-1 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J **J A S O N D** Soils: Sand, loam, clay, gravel. Often on road verges. IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 42	Low
**Lotus uliginosus*	No	Permitted - s11	-	-	-	Habit: Erect or ascending perennial, herb, 0.1-0.5 m high. Flower colour: yellow Flowering period (indicated in green): **J F M** A M J J A S O **N D** Soils: Grey sandy loam, mud, black sand, clay loam. Swamps, creeklines, disturbed & cultivated areas, road verges. IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 46	Low
**Lysimachia arvensis*	No	Permitted - s11	-	-	-	Habit: A annual herbaceous plant with low-growing stems usually only 5-30 cm long, but occasionally reaching up to 50 cm in length. Flower colour: purple/blue Flowering period (indicated in green): J F M A M J **J A S O N D** Soils: A common weed of pastures, crops, parks, lawns, gardens, roadsides, disturbed sites, waste areas, swamp margins, open woodlands, shrublands, grasslands, rocky outcrop vegetation and coastal environments. IBRA Distribution: AVW, CAR, COO, ESP, GAS, GES, HAM, JAF, MAL, MUR, NUL, PIL, SWA, WAR, YAL Florabase records: 364	High

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Narcissus papyraceus*	No	Permitted - s11	-	-	-	Habit: Bulbaceous, perennial, herb, to 0.35 m high. Flower colour: white Flowering period (indicated in green): J F M A M **J J** A S O N D Soils: Peaty or calcareous sand, loam, winter-wet. IBRA Distribution: GES, JAF, SWA Florabase records: 7	Low
**Orobanche minor*	No	Permitted - s11	-	-	-	Habit: Erect, parasitic herb, 0.1-0.45 m high. Flower colour: white-cream-purple/brown Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Shallow soils over granite, deep sand, calcareous soils, clay. Coastal dunes & cliffs, sandplains, roadsides, granite outcrops. IBRA Distribution: AVW, CAR, COO, ESP, GES, JAF, SWA, WAR Florabase records: 115	High
**Oxalis corniculata*	No	Permitted - s11	-	-	-	Habit: Creeping annual, herb, 0.02-0.2 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: A weed of lawns & gardens. IBRA Distribution: AVW, CEK, COO, DAL, ESP, JAF, MAL, PIL, SWA, VIB, WAR Florabase records: 40	Low
** Oxalis glabra*	No	Permitted - s11	-	-	-	Habit: Slender bulbaceous, perennial, herb, 0.05-0.2 m high. Flower colour: pink-purple/red & yellow Flowering period (indicated in green): J F M A **M J J A** S O N D Soils: Sand, clay, sandy clay, lateritic soils. Disturbed areas. IBRA Distribution: AVW, GES, JAF, SWA, WAR Florabase records: 60	Low

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Oxalis pes-caprae*	No	Permitted - s11	-	-	-	Habit: Bulbaceous and rhizomatous, perennial, herb, 0.1-0.3 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M **J J A S O** N D Soils: A common weed. IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, SWA, WAR, YAL Florabase records: 80	Low
**Pentameris airoides*	No	Permitted - s11	-	-	-	Habit: Annual or perennial. Culms 6–35 cm tall, 2–4 noded. Lateral branches simple. Leaves mostly basal. Ligule a fringe of hairs. Leaf-blades 3–6 cm long, 1–3 mm wide. Leaf-blade surface indumented. Flower colour: green Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Sand, loam, clay, gravel. Often on road verges. IBRA Distribution: AVW, CAR, COO, ESP, GES, JAF, MAL, MUR, SWA, YAL Florabase records: 236	Moderate
**Petrorhagia dubia*	No	Permitted - s11	-	-	-	Habit: Erect annual, herb, 0.1-0.7 m high. Flower colour: pink/pink-purple/white Flowering period (indicated in green): J F **M** A M J **J A S O N D** Soils: Sand, loam, clay. IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, MUR, SWA, WAR, YAL Florabase records: 150	Moderate

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: WONS = Weeds of National Significance (Department of Agriculture, Fisheries and Forestry 2023e); WAOL = Western Australian Organism List (Department of Primary Industries and Regional Development 2023). IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; CEK – Central Kimberley; CEN – Central Ranges; COO – Coolgardie; DAL – Dampierland; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GIB – Gibson Desert; GSD – Great Sandy Desert; GVD – Great Victoria Desert; HAM – Hampton; JAF – Jarrah Forest; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NOK – Northern Kimberley; NUL – Nullarbor; PIL – Pilbara; SWA – Swan Coastal Plain; TAN – Tanami; VIB – Victoria Bonaparte; WAR – Warren; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Phytolacca octandra*	No	Permitted - s11	-	-	-	Habit: Spreading, erect perennial, herb or shrub, 0.4-1.7 m high. Flower colour: white-pink-red Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand, sandy loam; particularly disturbed soils. IBRA Distribution: AVW, COO, ESP, JAF, SWA, WAR Florabase records: 52	Moderate
**Pinus canariensis*	No	Permitted - s11	-	-	-	Habit: Tree or (conifer), to 30 m high, leaves in threes, 15-30 cm long; female cones symmetrical, lacking spiny tips; seeds winged. Soils: Flat. Lateritic sandy clay. IBRA Distribution: JAF Florabase records: 2	Low
**Pinus pinaster*	No	Permitted - s11	-	-	-	Habit: Tree or (conifer), 2-40 m high, monoecious; leaves in pairs, 15-30 cm long; cones with numerous scales; seeds winged. Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand, grey sandy clay, loam. Gentle slopes, edge of tracks, disturbed land. IBRA Distribution: AVW, JAF, SWA, Florabase records: 13	Low
**Pinus radiata*	No	Permitted - s11	-	-	-	Habit: Tree or (conifer), 30-40 m high, monoecious; leaves in threes, 8-15 cm long; cones with numerous scales; seeds winged. Flowering period (indicated in green): J F M A M J J A S O N D Soils: Near plantations. IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 9	Low

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Plantago lanceolata*	No	Permitted - s11	-	-	-	Habit: Rosetted perennial, herb, 0.1-0.9 m high. Flower colour: green-yellow-brown Flowering period (indicated in green): **J F M** A M J J A S O **N D** Soils: Variety of soils. In gardens & other disturbed sites. IBRA Distribution: AVW, GES, JAF, NUL, SWA, WAR Florabase records: 68	Low
**Prunus persica* var. *nucipersica*	No	-	-	-	-	Habit: Erect shrub or small tree Flower colour: pink Flowering period (indicated in green): J F M A M J J A **S** O N D Soils: River edges, brown clay loam. IBRA Distribution: JAF, WAR Florabase records: 2	Low
**Pseudognaphalium luteoalbum*	No	-	-	-	-	Habit: Erect, densely lanate annual, herb, to 0.7 m high. Flower colour: yellow-white-cream Flowering period (indicated in green): J F M A **M J J A S O N D** Soils: Sand, loam, clay and peaty soils over limestone, granite, laterite, sandstone, gypsum. Plains, hillsides, riverbanks, wetlands, drainage areas. IBRA Distribution: AVW, CAR, CEN, COO, DAL, ESP, GAS, GES, GIB, GSD, GVD, JAF, LSD, MAL, MUR, NOK, NUL, PIL, SWA, TAN, WAR, YAL Florabase records: 212	Moderate

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Ranunculus muricatus*	No	Permitted - s11	-	-	-	Habit: Erect or prostrate annual, herb, 0.04-0.3 m high. Flower colour: yellow/green-yellow Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Peaty sand. Winter-wet situations, swamps or in running water. IBRA Distribution: JAF, SWA, WAR Florabase records: 49	Low
** Romulea rosea*	No	Permitted - s11	-	-	-	Habit: Cormous, perennial, herb, 0.1-0.4 m high. Flower colour: blue-pink Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: White-grey sandy clay, brown-red sandy loam, black sandy clay, gravel, granite, limestone. Hills, roadsides, weed of crops and pastures. IBRA Distribution: AVW, ESP, GES, JAF, SWA, WAR Florabase records: 137	Moderate
** Rubus anglocandicans*	No	Declared Pest - s22(2)	C3 Management	Exempt	Whole of State	Habit: Scrambling, rampant, sprawling shrub, to 4 m high. Flower colour: pink/white Flowering period (indicated in green): **J F** M A M J J A S O **N D** Soils: Grey sand, red-brown gravelly loam, red clay loam, granite, limestone. Hillsides, along river banks and watercourses, in roadside drains. IBRA Distribution: JAF, SWA, WAR Florabase records: 99	Low

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
* *Rubus ulmifolius*	No	Declared Pest - s22(2)	C3 Management	Exempt	Whole of State	Habit: Straggling perennial, herb or shrub, to 4 m high. Flower colour: pink/white/blue/purple Flowering period (indicated in green): **J** F M A M J J A S O **N** **D** Soils: Along creeks & drains. IBRA Distribution: JAF, SWA, WAR Florabase records: 45	Low
**Salix* spp. except *S. babylonica, S. × calodendron & S. × reichardtii*	Yes	-	-	-	-	Habit: Deciduous shrub or tree Flower colour: cream/yellow Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: - IBRA Distribution: - Florabase records: -	Low
* *Salvinia ×molesta*	Yes	Declared Pest, Prohibited - s12	C2 Eradication	Prohibited	Whole of State	Habit: Rhizomatous, herb or (fern), 0.05-0.2 m high, floating aquatic; leaves in whorls of 3: 2 floating leaves and 1 submerged root-like water-leaf. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N D Soils: Still or slow-flowing fresh water ponds and streams. IBRA Distribution: GES, JAF, PIL, SWA, VIB, WAR Florabase records: 18	Low
**Senecio vulgaris*	No	Permitted - s11	-	-	-	Habit: Erect, rather succulent annual, herb, 0.05-0.4(-0.75) m high. Flower colour: yellow Flowering period (indicated in green): **J** **F** M A M J **J** **A** **S** **O** **N** **D** Soils: Sandy soils. Cultivated or disturbed grounds. IBRA Distribution: JAF, SWA, WAR Florabase records: 28	Moderate

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

Note: WONS = Weeds of National Significance (Department of Agriculture, Fisheries and Forestry 2023e); WAOL = Western Australian Organism List (Department of Primary Industries and Regional Development 2023). IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; CEK – Central Kimberley; CEN – Central Ranges; COO – Coolgardie; DAL – Dampierland; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GIB – Gibson Desert; GSD – Great Sandy Desert; GVD – Great Victoria Desert; HAM – Hampton; JAF – Jarrah Forest; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NOK – Northern Kimberley; NUL – Nullarbor; PIL – Pilbara; SWA – Swan Coastal Plain; TAN – Tanami; VIB – Victoria Bonaparte; WAR – Warren; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Sisymbrium officinale*	No	Permitted - s11	-	-	-	Habit: Erect annual or biennial, herb, to 0.75 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O **N D** Soils: Still or slow-flowing fresh water ponds and streams. IBRA Distribution: JAF, MAL, SWA, WAR Florabase records: 7	Low
**Sonchus asper*	No	Permitted - s11	-	-	-	Habit: Erect, robust, spiny annual or biennial, herb, to 1.8 m high. Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J A S **O N D** Soils: White to grey sand, brown clayey loam, black sandy loam, black clayey peat. Dunes, valleys, seasonally wet areas, watercourses, lakes and wetlands, disturbed sites. IBRA Distribution: GES, JAF, PIL, SWA, VIB, WAR Florabase records: 102	Low
**Sonchus oleraceus*	No	Permitted - s11	-	-	-	Habit: Erect annual, herb, to 1.5 m high. Flower colour: yellow Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Variety of soils. Weed of waste places & disturbed ground. IBRA Distribution: AVW, CAR, CER, DAL, ESP, GAS, GES, GVD, HAM, JAF, LSD, MAL, MUR, NUR, OVP PIL, SWA, VIB, WAR, YAL Florabase records: 436	High

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Sparaxis pillansii*	No	Permitted - s11	-	-	-	Habit: Cormous, perennial, herb, to 0.4 m high. Flower colour: red-purple-yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Grey sand, brown-red loamy clay, gravel, laterite. Flats, hills, road verges, paddocks. IBRA Distribution: AVW, ESP, JAF, SWA, WAR Florabase records: 23	Low
**Stachys arvensis*	No	Permitted - s11	-	-	-	Habit: Ascending annual, herb, 0.06-0.3 m high. Flower colour: pink-purple Flowering period (indicated in green): J F M A M J J A S O N D Soils: Road verges, waste grounds. IBRA Distribution: AVW, GES, JAF, MAL, SWA, WAR Florabase records: 47	Low
**Stellaria media*	No	Permitted - s11	-	-	-	Habit: Sprawling annual, herb, 0.01-0.2 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J A S O N D Soils: Weed of gardens & disturbed areas. IBRA Distribution: AVW, ESP, GES, JAF, SWA, WAR Florabase records: 36	Low
**Trifolium dubium*	No	Permitted - s11	-	-	-	Habit: Prostrate or decumbent annual, herb, to 0.2 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: White sand, yellow-orange loam, brown gravelly clay, laterite. Road verges, track edges, settled areas. IBRA Distribution: AVW, ESP, GES, JAF, MAL, SWA, WAR Florabase records: 78	Moderate

APPENDIX D: ASSESSMENT OF POTENTIAL INTRODUCED (WEED) FLORA IN THE HOLYOAKE EAST SURVEY AREA

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Ursinia anthemoides*	No	Permitted - s11	-	-	-	Habit: Slender, erect annual, herb, 0.1-0.5 m high. Flower colour: yellow/orange/cream-white Flowering period (indicated in green): J F M A M J **J A S O N D** Soils: Weed of roadsides & waste places. IBRA Distribution: AVW, COO, GES, JAF, MAL, SWA, WAR, YAL Florabase records: 318	High
**Vellereophyton dealbatum*	No	Permitted - s11	-	-	-	Habit: Short-lived, erect to sprawling annual or perennial, herb, 0.05-0.4 m high. Flower colour: white-cream-yellow Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Variety of soils. Weed of damp places IBRA Distribution: AVW, COO, ESP, JAF, MAL, SWA, WAR Florabase records: 163	Low
**Verbena incompta*	No	-	-	-	-	Habit: Erect, woody herb Flower colour: purple Flowering period (indicated in green): **J** F M A M J J A S **O N D** Soils: Still or slow-flowing fresh water ponds and streams. IBRA Distribution: JAF, SWA, WAR Florabase records: 6	Low
**Vulpia bromoides*	No	Permitted - s11	-	-	-	Habit: Loosely tufted annual, grass-like or herb, 0.05-0.6 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Sandy loam, sand. IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, SWA, WAR Florabase records: 57	Low

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SPECIES	WONS	WAOL LEGAL STATUS	WAOL CONTROL CATEGORY	WAOL CONTROL CATEGORY	DECLARED AREAS	DESCRIPTION AND HABITAT	OCCURANCE LIKELIHOOD
**Vulpia myuros*	No	Permitted - s11	-	-	-	Habit: Tufted annual, grass-like or herb, 0.07-0.7 m high. Flower colour: green Flowering period (indicated in green): J F M A M J **J A S O N** D Soils: Sand, loam, lateritic gravel. IBRA Distribution: AVW, COO, ESP, GES, JAF, MAL, MUR, SWA, VIB, WAR, YAL Florabase records: 253	High
**Wahlenbergia capensis*	No	Permitted - s11	-	-	-	Habit: Slender, erect or ascending annual, herb, 0.1-0.5 m high. Flower colour: blue/blue-green Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Sandy soils; disturbed areas, plains. IBRA Distribution: AVW, ESP, GES, JAF, MAL, SWA, WAR Florabase records: 102	Moderate

ASSESSMENT OF FLORA AND VEGETATION VALUES

ALCOA OF AUSTRALIA

ONEIL, HUNTLY MINE, WA

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

Alcoa of Australia Limited

May 2024



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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BOM:	Bureau of Meteorology
DBCA:	Department of Biodiversity, Conservation and Attractions
DCCEEW:	Department of Climate Change, Energy, the Environment and Water
DPIRD:	Department of Primary Industries and Regional Development
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
MATTISKE:	Mattiske Consulting Pty Ltd
IBRA:	Interim Biogeographical Regionalisation for Australia
PEC:	Priority ecological community
RFA:	Regional Forest Agreement
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned in 2023 by GHD on behalf of Alcoa of Australia Ltd (Alcoa) to conduct an assessment of the flora and vegetation values within the ONeil survey areas, approximately 60 km south east of Perth, WA. Initially this work entailed a review of past mapping in the area by Mattiske Consulting (2009, 2012) and an updated desktop assessment of the area. Field studies were then undertaken in the early part of 2024 to search for additional threatened and priority flora and to extend the previous site-vegetation type mapping. The ONeil survey area is located in tenement ML 1SA and as such overlaps current Alcoa operational areas and previous mapping areas.

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the ONeil survey area. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed again in 2024 in line with some changes in nomenclature from 2022 to 2023.

The ONeil survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla - Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System.

Potential Flora

Based on the previous nearby surveys and the recent additional studies a total of 459 vascular plant taxa, representative of 168 genera and 59 families (Appendix B), have the potential to occur within the ONeil survey area (Mattiske Consulting 1998-2023). The most commonly represented families were Fabaceae (67 taxa), Proteaceae (53 taxa), Myrtaceae (38 taxa) and Asparagaceae (253 taxa).

A total of twelve threatened flora species and 37 priority flora species has the potential to occur in the ONeil survey area. Of the threatened flora species, all are considered to have a very low potential of occurring in the ONeil survey area due to the lack of suitable habitat and also know distributions away from the survey area.

In 2024, the data indicated that of the Priority flora species, six priority flora species have a high potential to be in the survey area and seven priority flora species have a moderate or moderate to high potential to be in the survey area.

On the basis of databases and previous surveys near or within the ONeil survey areas a total of 15 introduced taxa has the potential to occur in the ONeil survey area. None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

Potential Vegetation Values

There are no TECs listed at Commonwealth or State level, or PECs listed at State level which would be likely to occur in the ONeil survey area; although further north the vegetation associated with granite outcrops has been classified as a PEC and further east and southeast the vegetation associated with granites has been classified as a PEC near Mt Saddleback (DBCA 2023b) .

The ONeil survey area occurs within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2024b) and as such was considered during the RFA process.

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the ONeil survey area; although several occur on the areas adjacent to the survey area. In view of the proximity of the survey areas to the well-established North-East Road it is extremely unlikely that there will be additional old growth forests in the survey area. The ONeil survey area has areas of dieback in the valley systems.

Survey Effort

The survey effort in the ONeil survey areas includes multiple survey efforts by Mattiske Consulting (2009, 2012) from the earlier flora and vegetation studies to the more recent targeted work and assessment of sites in a range of the site-vegetation types within the survey area that extend northwards and southwards from those areas previously mapped. This effort extends the flora and vegetation studies undertaken in the Northern Jarrah Forest over some 40 years. The survey efforts include results from 2008 and 2009 through to 2012 and more recently in 2023 and 2024 in the ONeil area and in adjacent areas. These studies have been supplemented by extensive detailed plot and transect studies in the Northern Jarrah Forest over 40 years, including permanent sampling sites within the current Oneil area which are intended to be re-assessed in the spring months of 2024 and where required additional plots will be established to include the range of flora and vegetation values in the ONeil area.

It is important to recognise that the vegetation mapping efforts in seasons outside of the spring months can still be undertaken as the vegetation mapping relies on perennial species which persist through the seasons. Further the perennial species persist through different seasons and the key indicators can be recognized throughout the year. The site-vegetation types extend the vegetation mapping over large areas of the Northern Jarrah Forest and as such integrate the flora, vegetation and site values which provides additional and critical information to the understanding of patterns in the area. The site-vegetation type approach was developed by Dr J Havel (1975a, 1975b) in close consultation with Dr D Goodall from CSIRO in the mid 1970's. Whilst this approach may differ from some other studies in Western Australia the development by Havel and Goodall was undertaken to define a series of key indicators and site conditions that would enable a finer definition of the northern Jarrah Forest communities. Such an approach enabled the subdivision of the main forest types which relied heavily on the structural components and the dominant trees. The latter broader approach is evident in the regional mapping at a coarser level as undertaken for the Pre-European vegetation mapping as undertaken by Beard 1979. The adoption of the site-vegetation type approach also enabled consideration of representation in the wider Northern Jarrah Forest and as such is supplemented by the vegetation studies during the System 6 (Heddle *et al*. 1980) and the Regional Forest Agreement investigations (Mattiske and Havel 1998) supported by state and federal government agencies.

In summary, the work undertaken to date on the Oneil survey area supplements extensive studies previously within and adjacent to the current survey area and as such meets the EPA (2016a and 2016b) guidelines. With the proposed supplementary flora and vegetation studies in the spring months of 2024 the effort exceeds the effort undertaken on many projects as it enables a detailed and comprehensive assessment of the survey area in the local and regional context.

Recorded Flora

In the more recent targeted flora and vegetation studies a total of 353 vascular plant taxa, representative of 143 genera and 61 families (Appendix C) were recorded in the ONeil survey area in 2024. If added to the recent work in the nearby areas between 2009 and 2024 this leads to a total of 536 vascular plant species from 182 genera and 66 families (Appendix C) for the wider area within and near this survey area. The dominant families were Proteaceae (51 taxa), Fabaceae (45 taxa), Myrtaceae (37 taxa), Asparagaceae (18 taxa), Dilleniaceae (16 taxa), Ericaceae (16 taxa), Cyperaceae (15 taxa) and Asteraceae (15 taxa). This higher number of species appeared to be related to the wider valleys with increasing variation in soil types and the increased occurrence of shallow soils associated with the granite outcrops.

No threatened flora as listed at the Federal and State level were recorded within the ONeil survey area in 2024 (DBCA 2023a and DCCEEW 2024a). A total of 4 priority flora species (*Hibbertia ?ambita* P1, *Hibbertia hortiorum* P1, *Grevillea dissectifolia* P3 and *Senecio leucoglossus* P4) were recorded in the ONeil survey area. The *Hibbertia hortiorum* and *Hibbertia ?ambita* occurrences appear to reflect the more easterly occurrence of these two species and in addition appears to reflect the more detailed studies of the *Hibbertia* genera by Kevin Thiele (2019). The *Grevillea dissectifolia* occurs mainly in the broader valley systems with some shallower soils and has been recorded previously to the north-east of the ONeil survey area. The *Senecio leucoglossus* occurs as scattered plants through the wider northern Jarrah forest and as such is not restricted to the ONeil area.

A total of 11 introduced species were recorded on the 2024 survey areas and some 20 species over the wider area. None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

Recorded Vegetation

A total of 27 site-vegetation types were defined and mapped in the ONeil survey area and an additional two mapping units (CL cleared land and Rehabilitation areas). The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years. It is clearly apparent that there are some dominant site-vegetation types that dominate the ONeil survey area (namely P, PS, S, SP, ST, T and and TS which together cover 57.41% of the survey area). A total of some 11.17% of the survey area has been either cleared or rehabilitated within the ONeil survey area.

None of these site-vegetation types are restricted to the ONeil survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2024e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2024b) within the ONeil survey area.

There are no priority ecological communities (PECs), as listed at State level within the ONeil survey area. One of the difficulties faced in assessing the potential for PECs is that in many instances there is a lack of detailed data behind the delineation. In some sections of the Oneil area there are some of the values associated with the shallow soils of the granite outcrop areas that may have some values that overlap with the PEC as defined by DBCA 2023b for the outcrop areas to the north of the survey area and the outcrop areas near Mt Saddleback. As these areas occur on outcrop or shallow soil areas associated with outcrops it is unlikely that these areas would be disturbed. Further many of the values are represented in conservation areas to the (Monadnocks and to the east).

1. INTRODUCTION

Mattiske Consulting Pty Ltd (Mattiske) was commissioned by GHD on behalf of Alcoa of Australia Ltd (Alcoa) to conduct a desktop assessment and field assessment to evaluate the flora and vegetation values within the ONeil survey area, approximately 80 km south east of Perth, WA. Alcoa wishes to expand their mining operations into the ONeil survey area. The ONeil survey area is located in tenement ML1SA for Alcoa of Australia Ltd.

1.1. Location and Scope of Project

The ONeil survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province (Beard 1990), approximately 80 km south of Perth, WA (Figure 1). The ONeil survey area consists of one polygon located in tenement ML 1SA (Figure 2).

This report describes the potential and recorded flora and vegetation values of the proposed ONeil survey area and places them within a local and regional context.

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

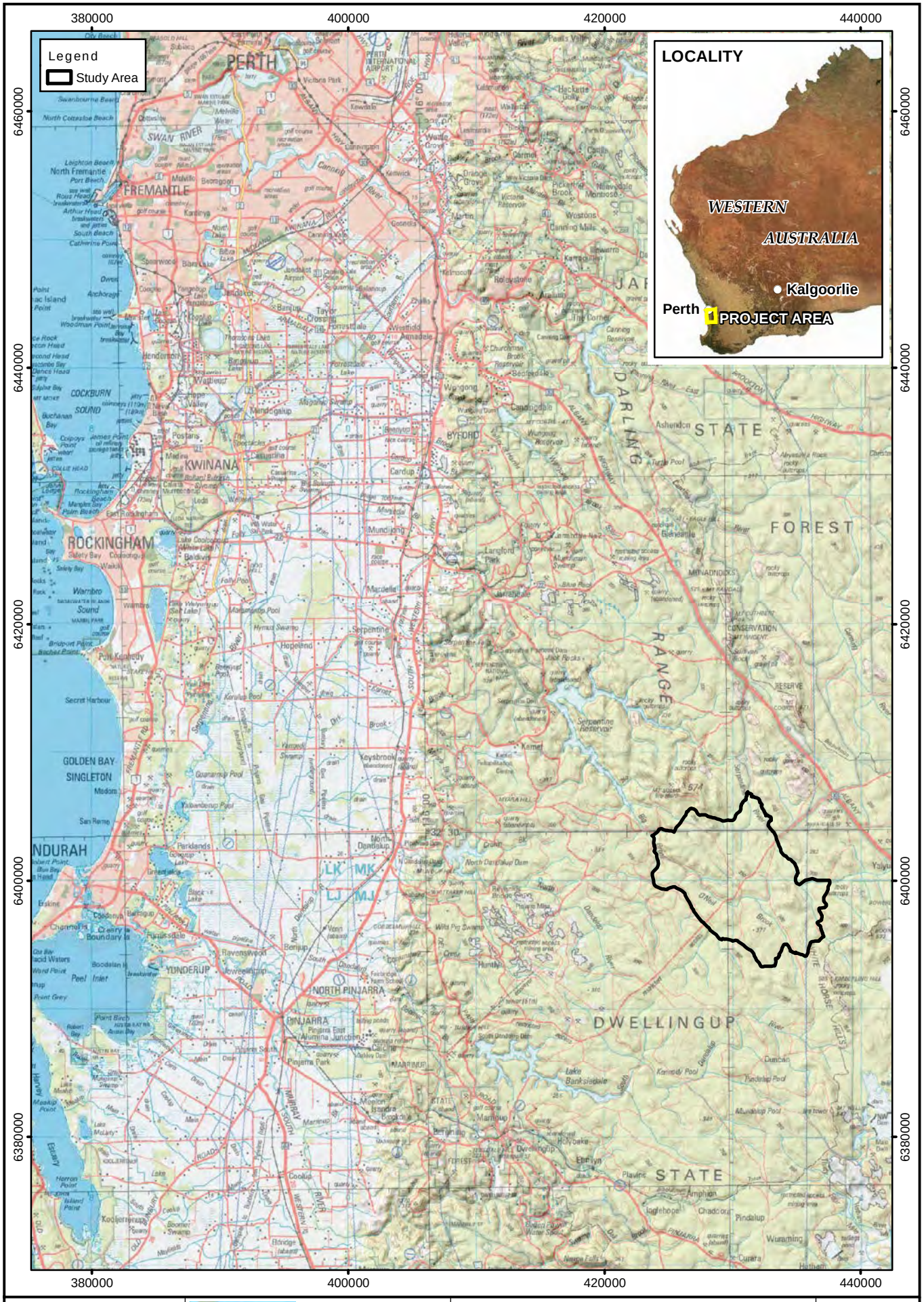
The following key Western Australian (state) legislation relevant to this survey includes the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) and *Regulations 2013*;
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

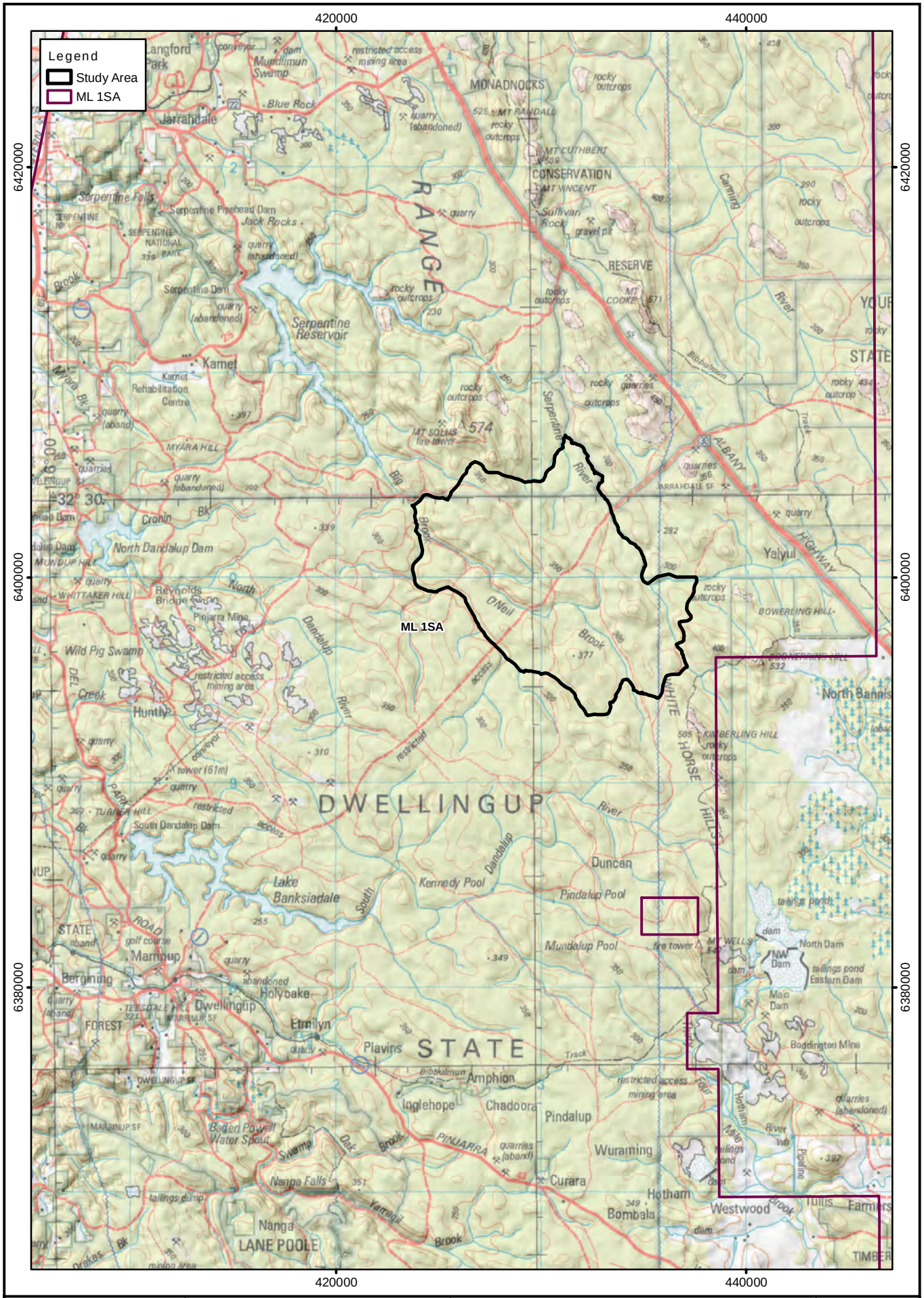
Furthermore, key Western Australian guidelines relevant to this survey are the:

- Environmental Factor Guideline: Flora and Vegetation (Environmental Protection Authority [EPA] 2016a);
- Technical Guidance – Flora and vegetation surveys for environmental impact assessment (EPA 2016b); and
- Commonwealth of Australia (2013) - Survey Guidelines for Australia's Threatened Orchids. Guidelines for detecting Orchids listed as "Threatened" under the *Environment Protection and Biodiversity Conservation Act 1999*.

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-A5.



N 0 3 6 km Scale: 1:400,000 MGA94 (Zone 50)	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640	**Oneil** **Locality**	Figure: **1**
CAD Ref: a1992_F025_01	Author: E M Matttiske | MCPL Ref:		
Date: August 2023 | Rev: A | A4	Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax (08) 9246 3202		


Legend
Study Area
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CONSERVATION
RESERVE
STATE
STATE
FOREST
Karnet
Serpentine Reservoir
North Dandalup Dam
South Dandalup Dam
Lake Banksiadale
Kennedy Pool
Pindalup Pool
Mundalup Pool
Yalyul
Duncan
Marrinup
Dwellingup
Holyoake
Etmilyn
Plavins
Amphion
Inglehope
Chadoora
Pindalup
Wuraming
Curara
Hotham
Bombala
Westwood
Nanga
LANE POOLE
Jarrahdale
Serpentine Falls
Serpentine Dam
Jack Rocks
Blue Rock
MONADNOCKS
MT RANDALL
MT CUTHBERT
MT VINCENT
Sullivan Rock
MT COOKE
MT SOLUS
Cronin
Reynolds Bridge
Pinjarra Mine
Wild Pig Swamp
Huntly
Tuarts Hill
Berginning
Boddington Mine
North Bannister
Farmers
Tullis
Nanga Falls
Bolgen Powell Water Spout
Oak Brook Swamp
Big Brook
O'Neil Brook
Dandalup River
Serpentine River
White Horse Hills
Albany Highway
Canning
Pinjarra
Yarragil
Brook
Track
Four
Hotham
Pipeline
Main Dam
NW Dam
North Dam
tailings pond
Eastern Dam
tailings dump
quarries (abandoned)
restricted access mining area
rocky outcrops
gravel pit
fire tower
tower (61m)
golf course
Karnet Rehabilitation Centre
Bibbulmun
Munglinup
Myara Bk
Cronin Bk
Creek
Swamp
Brook
River
Track
Dam
Bk
SF
MARRINUP SF
DWELLINGUP SF
JARRAHDALE SF
MUNDUP HILL
WHITTAKER HILL
MYARA HILL
TUARTS HILL
TEESDALE HILL
KINGERLING HILL
BOWERLING HILL
MT WELLS
SERPENTINE NATIONAL PARK
SERPENTINE NP
Karnet Rehabilitation Centre
quarry (abandoned)
quarry (aband)
quarries
tailings pond
tailings dump
dam
mining area
access
conveyor
restricted
Mattiske Consulting Pty Ltd
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2

2. OBJECTIVES

The objective of this assessment was to combined the earlier desktop assessment and the findings from the recent field studies of the ONeil survey area, including:

- A desktop assessment of the flora and vegetation of the ONeil survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- Review previous literature and current databases associated with the ONeil survey area;
- A summary of key findings from the detailed studies (plots, recording sites, transects and targeted surveys) the ONeil area;
- Review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA 2023a, 2023c) and plant collections held at the Western Australian Herbarium ([WAH] 1998 -), and plants listed by the Department of Climate Change, Energy and the Environment [DCCEEW] (2024b) under the EPBC Act;
- Review the conservation status of the vegetation types recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA 2023a, 2024c), and vegetation as listed by the Department of Climate Change, Energy and the Environment [DCCEEW] (2024e) under the EPBC Act; and
- Prepare a report summarising the findings.

3. METHODS

3.1. Desktop Assessment

The NatureMap (DBCA 2007-) and *EPBC Act* Protected Matters Search Tool (DCCEEW 2023b) databases were used to identify the possible occurrence of flora (including threatened and priority taxa) and threatened and priority ecological communities within the ONeil survey area.

In addition, historical documentation and vegetation mapping of the northern Jarrah forest subregion that provide resource material for the floristics and vegetation of the ONeil survey area was reviewed, including Mattiske Consulting Pty Ltd (2009-2012) reports on their flora and vegetation surveys in the ONeil region. Nomenclature of flora species was checked against and is consistent with Florabase (WAH 1998-).

3.2. Field Studies

To maintain consistency with previous mapping of the area, enabling spatial and temporal comparisons, flora and vegetation were assessed using site-type classification based on Heddle *et al.* (1980). Sites were pre-designated using a grid system overlaid on the survey area. Additional opportunistic sites were surveyed when changes in the vegetation, representing communities which would otherwise have been missed, were encountered whilst walking between designated survey sites. Site data was used to define vegetation types for each survey site located as a minimum on a 120m x 120m grid system within the survey area. This data was then used in combination with aerial imagery and field observations to map the vegetation of the survey area. Furthermore, searches for threatened, priority or Declared (plant) pests species were undertaken whilst walking between survey sites.

The following information was recorded at each vegetation assessment site:

GPS location	Easting, Northing and datum;
Soil types	gravels, sandy-gravels, sandy-loam-gravels, sandy-loams, loams, clay-loams, clays and peat;
Topography	ridge, upper slope, mid-slope, lower slope, valley floor and swamp;
Outcropping	type – granite, laterite, dolerite, and quantity – few, moderate, numerous;

Logging history	light, moderate or heavy, together with number of stumps within a 20 m radius;
Fire history	years since last fire; and
Dieback occurrence	*Phytophthora* spp. demarcation – field blazing, coloured flagging on trees, vegetation deaths, either old or recent.

At each site species were ranked according to the scale developed by Havel (1975a, 1975b). Tree and understorey species were assessed separately using the following method.

Tree species

Tree species (*Allocasuarina fraseriana, Banksia grandis, B. littoralis, B. seminuda, Corymbia calophylla, Eucalyptus marginata, E. megacarpa, E. patens, E. rudis, E. wandoo, Melaleuca preissiana, M. rhaphiophylla, Nuytsia floribunda, Persoonia elliptica, P. longifolia* and *Xylomelum occidentale*) were assessed within a 20 m radius from the observation point using the following scale:

0 absent;
1 one or two trees;
2 three to five trees;
3 more than five trees, but contributing less than one third of the total stand;
4 between one third and one half of the total stand; or
5 more than one half of the total stand.

Understorey species

Understorey species were assessed within a 5 m radius from the observation point using the following scale:

0 absent;
1 very rarely seen, only after a careful search;
2 present, observable, but in small numbers only;
3 common locally, but not uniform over the whole area;
4 common over the whole area; or
5 completely dominating the understorey.

The physiological stress was determined for each species within a 20 m radius from the observation point and ranked according to the following scale.

0 healthy, no evidence of stress;
1 odd plant showing signs of stress, not dead;
2 one or two dead plants, near death;
3 scattered stressed plants, (2-4) dead plants around survey site;
4 susceptible plants dying or dead (> 4 plants); or
5 "graveyard" death

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH). All plant specimens were identified through comparisons with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

3.3. Survey Limitations

A general assessment was made of the current survey area against a range of factors that may have limited the outcomes and conclusions of this report (Table 1).

Table 1: Potential flora and vegetation survey limitations for the ONeil survey area

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Reference resources such as mapping by Beard 1979, Mattiske and Havel 1998, previous vegetation mapping completed for Alcoa by E.M Mattiske and Associates together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora, which were the focus of the present survey will be thoroughly sampled on a grid pattern within the survey area.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Minor constraint:** The survey areas were sampled on a grid pattern. The botanists undertaking the field surveys have had extensive experience working with the flora of the Jarrah forest. Any flora which could not be identified in the field was collected for subsequent identification. Only minor constraint was the difficulty of assessing the total extent of the Priority 1 *Hibbertia hortiorum* records as this taxon was included in the earlier *Hibbertia commutata* records in previous assessments. Thiele (2019) split the *Hibbertia commutata* into multiple taxa and as a result the historical records for *Hibbertia commutata* may include more occurrences of the Priority species in the survey area. One of the difficulties faced is that flowers and stamen arrangements are critical to the identification of some of the recently defined species and as such the proposed targeted flora work in spring should provide greater clarity on occurrence and populations. The relationships of the Priority *Hibbertia* species and the other two Priority species with the site-vegetation types was also reviewed and summarized. Further field studies in the spring months of 2024 should assist in clarifying the occurrences and populations.
Mapping reliability	**Not a constraint:** The vegetation will be assessed on a grid pattern within the survey area. This together with opportunistic survey sites will provide high quality data enabling the survey area to be mapped with a high level of confidence.
Timing, weather, season, cycle	**Potential constraint:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). The sampling was undertaken in the autumn of 2024 after a very dry period from October 2023 to April 2024 which led toa potential constraint. The latter should be addressed during the spring months of 2024 when further intensive studies is proposed through the targeted flora work and also the establishment of permanent plots. The extensive work undertaken in the area and in adjacent areas reduces the risk of not covering the flora species. With regard to the conservation significant flora, the majority identified as potentially occurring within the survey area can be recorded out of season with the exception of some orchid species which do not flower as regularly and some *Drosera* species. Further detailed work will be undertaken in 2024.
Disturbances (fire flood, accidental human intervention, *etc.*)	**Potential Constraint:** Previous logging activities have been undertaken for many decades in this area. The forestry areas may have been burned recently; this will affect the ability to accurately define vegetation communities. These land uses and activities may influence surveys in the area.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** Vehicle access was not restricted in the survey areas.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** All botanists had direct and recent experience working in the Jarrah Forest and working for Alcoa, and thus were familiar with the local flora and vegetation values. Dr Mattiske has more than 40 years of ecological experience in flora and vegetation studies in the southwest forests.

4. RESULTS

The climate, geology, soils and landforms all influence the vegetation of the area and are described in this section. Potential flora, including threatened, priority and introduced species are described, along with possible vegetation communities, and placed within a local and regional context.

4.1. Climate

The survey area lies in the Northern Jarrah Forest subregion. Beard (1990) described the climate of this area as being warm Mediterranean, with rainfall of 600 – 1200 mm per annum and 5 - 6 dry months per year. Annual average rainfall at Dwellingup is 1221.3 mm (Bureau of Meteorology [BOM] 2024). Rainfall in 2022 and 2023 were lower than the longer term mean and the lack of substantial rain since October 2023 prior to the survey effort is clearly apparent in Figure 3. The trend of lowering rainfall is not replicated in similar changes to the temperature.

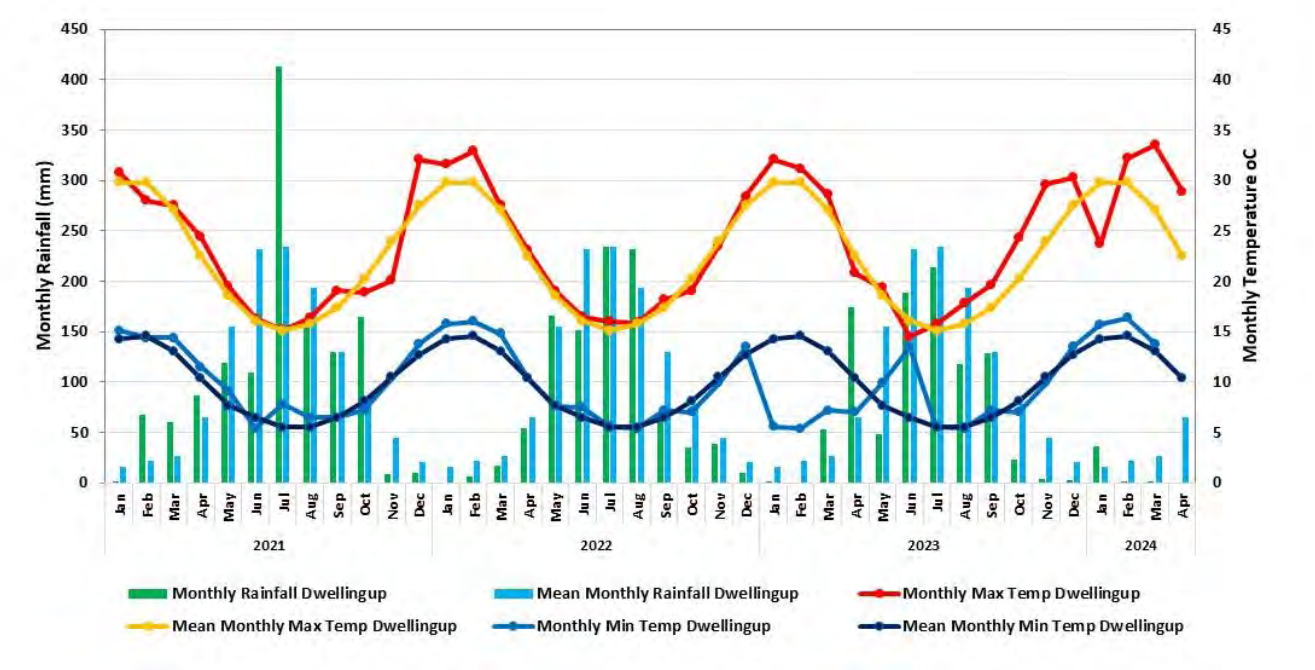
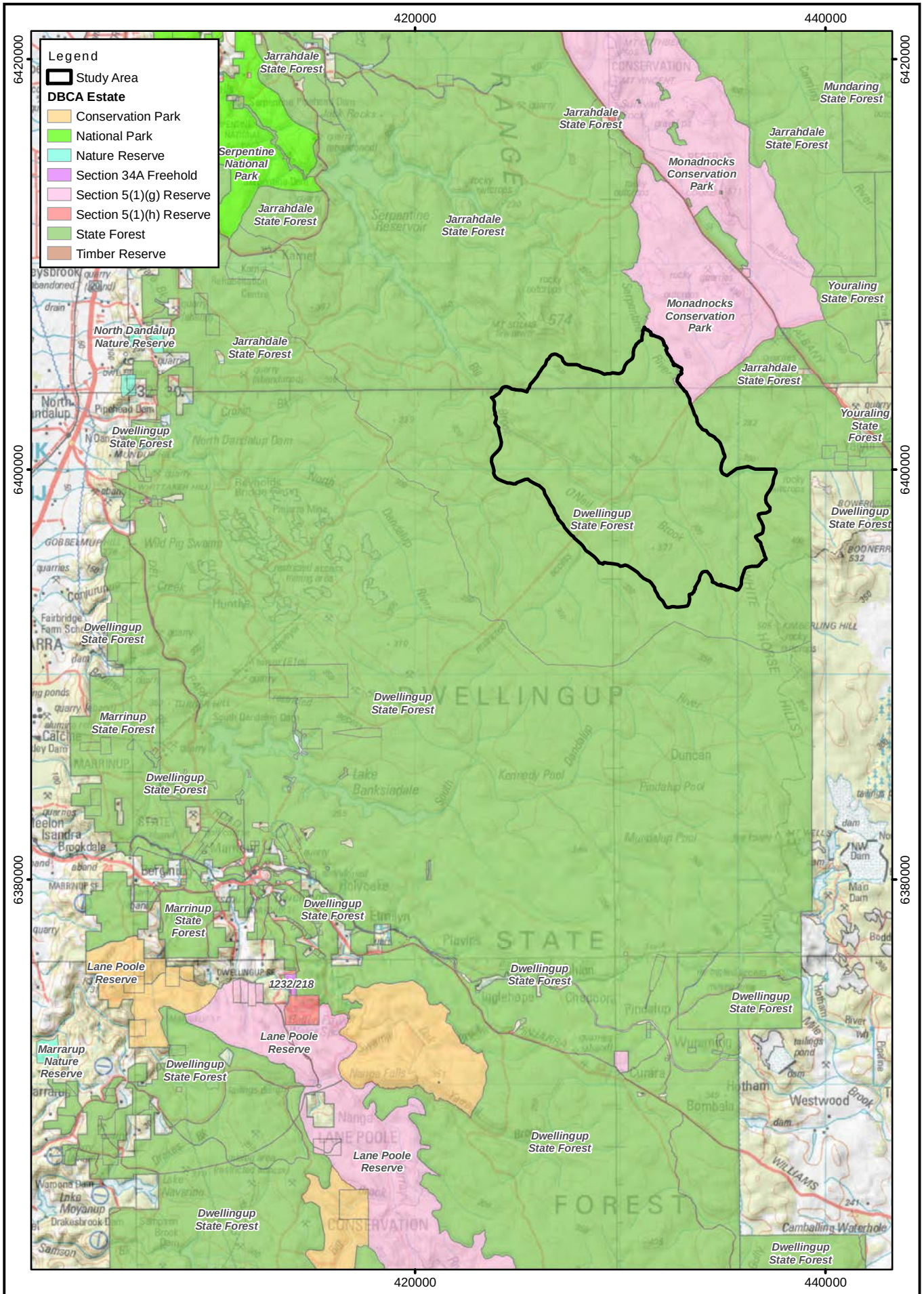


Figure 3: Climatic data for ONeil survey area (BOM 2024)
Long term average rainfall and temperature data from the Dwellingup weather station

4.2. DBCA Estates

The ONeil survey area is situated in State Forest to the north-east of Dwellingup (Figure 4).



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Oneil

DBCA Estates

Figure: **4**

4.3. Geology, Soils and Topography

The ONeil survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion encompasses the area to the east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of the Yilgarn Craton at an average elevation of 300 m (Beard 1990). The area is capped by extensive lateritic duricrust, dissected by drainage lines and broken by occasional granite hills. In the eastern section, the laterite becomes deeply dissected until it compresses isolated remnants. The duricrusted plateau of the Yilgarn Craton is characterised by lateritic gravels, consisting of 5 m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon. This overlay mottled yellow-brown clay subsoils and hard setting loamy soils, which become evident in the east (Beard 1990).

Furthermore, Western Australia is divided into twelve Systems, separated by natural and demographic boundaries (Department of Conservation and Environment 1980). The survey area lies within the Darling System (as known as System 6), which is further divided into provinces, with the survey area lying in The Darling Plateau province (Department of Conservation and Environment 1980).

The underlying geological units of The Darling Plateau province have been defined by Churchward and McArthur (1980), with three main landform and soil units occurring within the survey areas, these are:

Dwellingup: Gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions.

Yarragil: Valleys of the western part of the plateau; sandy gravels on the slopes; orange earth in swampy floors.

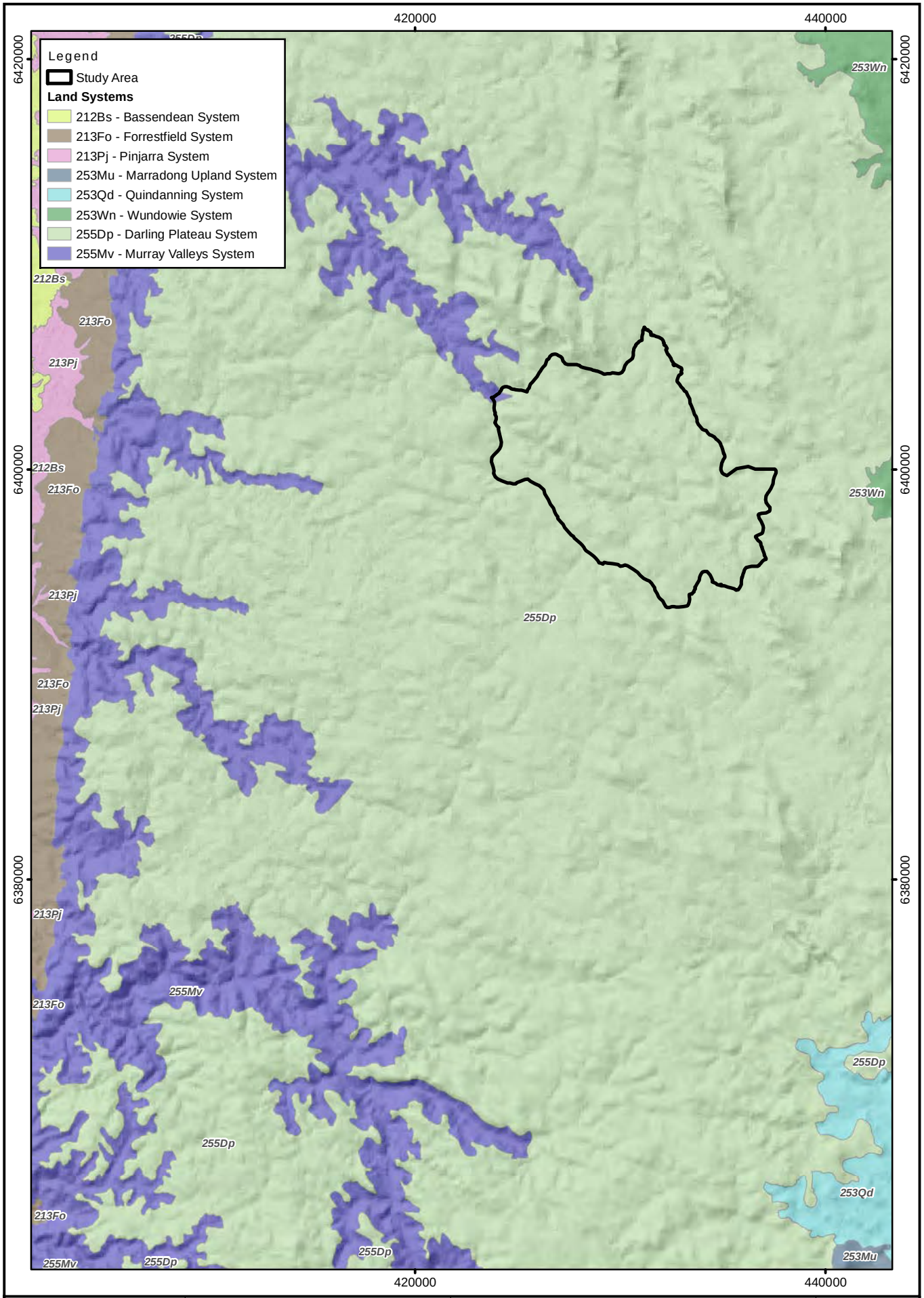
Cook: Hills rising above general plateau level ; mainly laterite but with some rock outcrop.

The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the ONeil survey area (Figure 5, Table 2) includes:

1. **Darling Plateau System (255Dp):** Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah-marri-wandoo forest and woodland.
2. **Murray Valleys System (255Mv):** Western Darling Range from the Avon Valley to Harvey. Deeply incised valleys with red loamy earths, shallow duplexes and rock outcrop and Jarrah-marri-wandoo forest and woodland with mixed shrubland.

Table 2: Extent of Land Systems intersecting the ONeil survey area

Land System	Mapping Unit	Total Extent (ha)	Area of Intersection with the ONeil survey area	Proportion of Current Extent (%)
Darling Plateau System	255Dp	820265.7327	10389.023	1.27
Murray Valleys System	255Mv	132255.57160	25.507554	0.02



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Land Systems

Figure: **5**

4.4. Regional Vegetation

The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent. In lower rainfall areas towards the east trees decrease in size, forming woodlands or low forests. This dry sclerophyllous forest typically comprises a dominant *Eucalyptus marginata* and *Corymbia calophylla* overstorey, a mid-storey of *Allocasuarina fraseriana* (Sheoak), *Banksia grandis* (Bull Banksia), *Persoonia longifolia* (Snottygobble), *Persoonia elliptica* (Spreading Snottygobble), and a groundcover of woody shrubs with grass trees *Xanthorrhoea preissii*, *Kingia australis* and the cycad *Macrozamia riedlei* (Dell and Havel 1989).

The Pre-European vegetation system present within the ONeil survey area (Figure 6, Table 3) includes:

1. **West and East Darling Systems**
    a. **Vegetation Association 3.3:** Medium forest, jarrah-marri.

Table 3: Extent of pre-European vegetation associations intersecting the ONeil survey area

System	Vegetation Association	State-wide Pre-European Extent (ha)	Area of Intersection with the ONeil survey area (ha)	Proportion of Current Extent (%)
West Darling	3.3	485225.883	9971.097	2.05
East Darling	3.3	303349.645	443.432742	0.15

Heddle *et al.* (1980) and Mattiske and Havel (1998) described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes (Regional Forest Agreement vegetation complexes) and determined how they relate to the landforms, soils and climatic conditions. Nine broad vegetation complexes occur in the ONeil survey area (Figure 7, Table 4), these are:

Dwellingup 1 (D1): Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.

Dwellingup 2 (D2): Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones.

Dwellingup 4 (D4): Open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* on lateritic uplands in semiarid and arid zones.

Cooke (Ce): Mosaic of Open Forest of E*ucalyptus marginata* subsp. *marginata* – *Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp*. thalassica* – *Corymbia calophylla* (semi-arid and arid zones) and on the deeper soils adjacent to outcrops closed heath of Myrtaceae-Proteaceae species and lithic complex on granite outcrops and associated soils in all climatic zones with some *Eucalyptus laeliae* (semi-arid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to perarid zones).

Murray 1 (My1): Open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* - *Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis* – *Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones.

Yarragil 1 (Yg1): Open forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.

Yarragil 2 (Yg2): Open Forest of *Eucalyptus marginata* subsp. *thalassica - Corymbia calophylla* on slopes, woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.

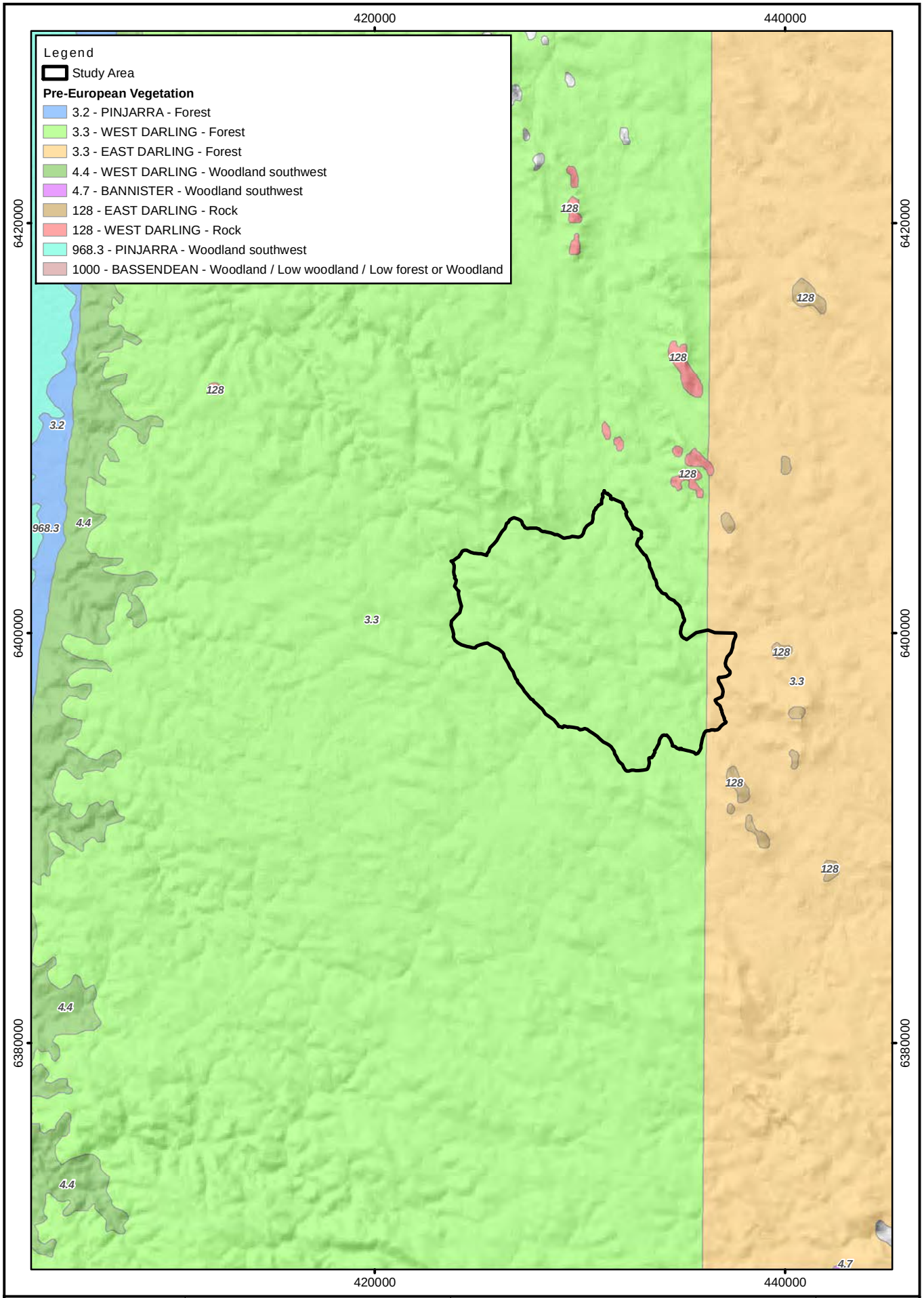
Pindalup (Pn): Open forest of *Eucalyptus marginata* subsp. *thalassica – Corymbia calophylla* on slopes and open woodland of *Eucalyptus wandoo* with some *Eucalyptus patens* on the lower slopes in semiarid and arid zones.

Swamp (S): Mosaic of open woodland of *Melaleuca preissiana – Banksia littoralis,* closed scrub of Myrtaceae spp., closed heath of Myrtaceae spp., and sedgelands of *Baumea* and *Leptocarpus* spp. On seasonally wet and moist sand, peat and clay soils on valley floors in all climatic zones.

More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area falling within the Northern Jarrah Forest subregion (JF1) of the Jarrah Forest (JAF) Region (DCCEEW 2024c). The vegetation of the Northern Jarrah Forest subregion consists of Jarrah – Marri forest, with Bullich and Blackbutt in the valleys to the west, grading to Wandoo and Marri woodlands to the east. Heath vegetation is the common understorey of forests and woodlands and occurs on granite rocks. The majority of the diversity between communities in this subregion occurs on lower slopes and near granite soils (Williams and Mitchell 2001).

Table 4: Extent of Vegetation Complexes intersecting the ONeil survey area

Area (Blocks)	Vegetation Complex	Vegetation Class	Total Extent (ha)	Area of Intersection with the ONeil survey area (ha)	Proportion of Current Extent (%)
Oneil	Dwellingup 1	D1	297624.846	3219.62	1.08
	Dwellingup 2	D2	120755.000	2190.44	1.81
	Dwellingup 4	D4	187588.996	77.96	0.04
	Cooke	Ce	51872.103	371.23	0.72
	Murray 1	My1	97562.811	25.49	0.03
	Yarragil 1	Yg1	113828.123	509.89	0.45
	Yarragil 2	Yg2	71234.370	1843.63	2.59
	Pindalup		236540.595	1502.94	0.64
	Swamp	S	76245.982	673.33	0.88



N

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Scale: 1:250,000
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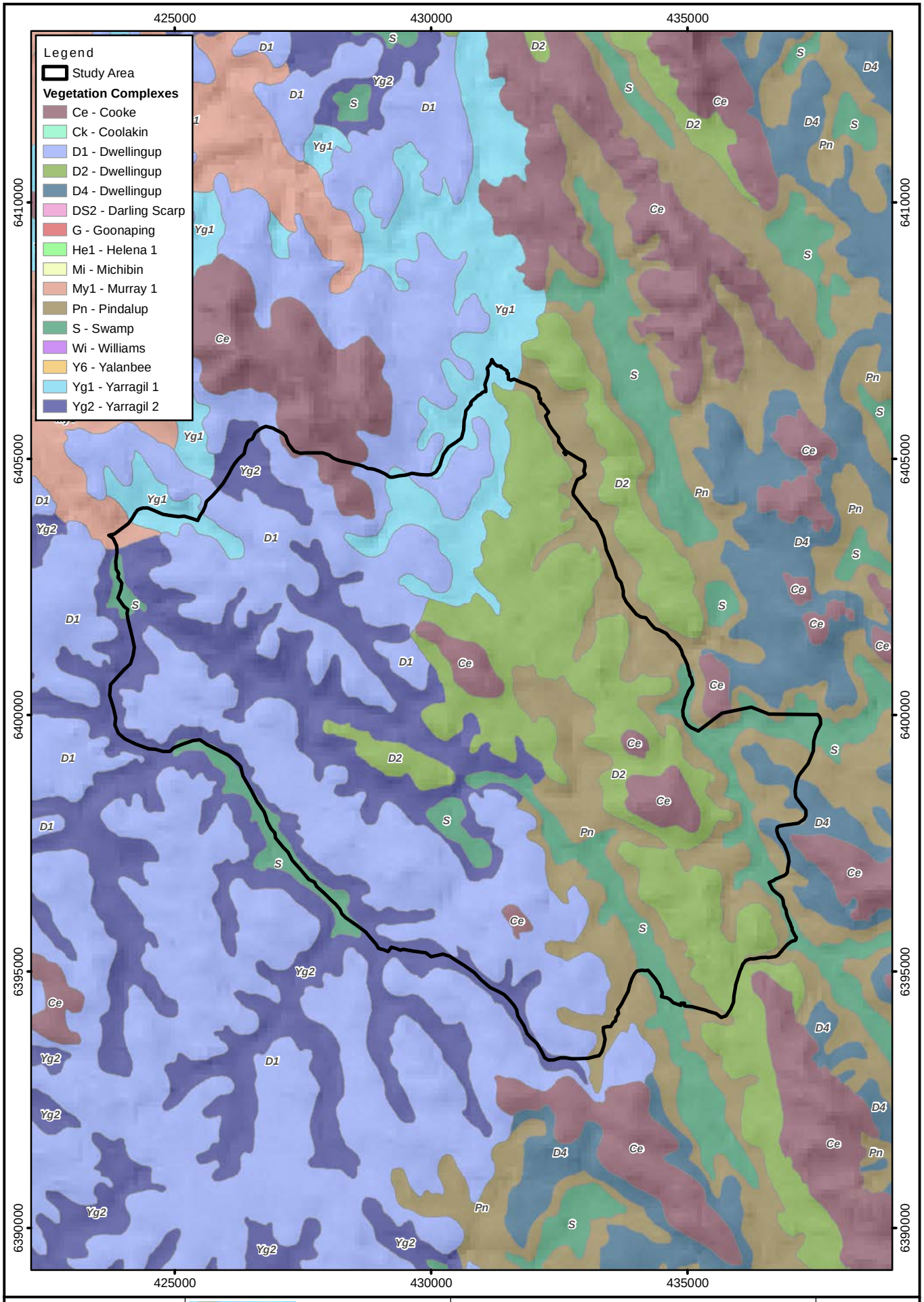
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Oneil

Pre-European Vegetation

Figure: **6**



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 50)

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Oneil

Vegetation Complexes

Figure: **7**

4.5. Potential Flora

Based on the previous nearby surveys and the recent additional studies a total of 459 vascular plant taxa, representative of 168 genera and 59 families (Appendix B), have the potential to occur within the ONeil survey area (Mattiske Consulting 1998-2023). The most commonly represented families were Fabaceae (67 taxa), Proteaceae (53 taxa), Myrtaceae (38 taxa) and Asparagaceae (253 taxa).

4.6 Potential Threatened and Priority Flora

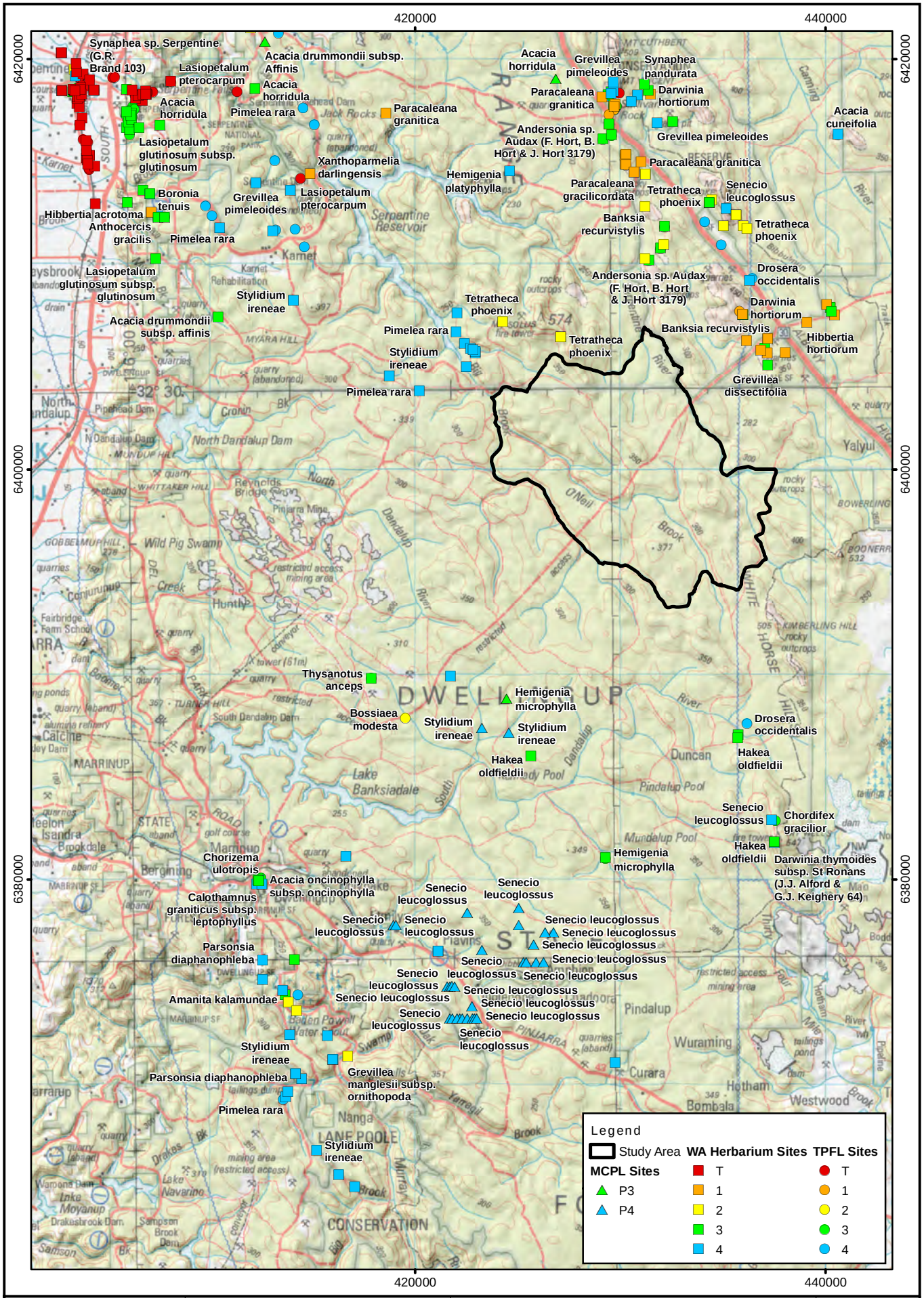
A total of twelve threatened flora species and 37 priority flora species has the potential to occur in the ONeil survey area. Of the threatened flora species, all are considered to have a very low potential of occurring in the ONeil survey area due to the lack of suitable habitat and also know distributions away from the survey area.

In 2024, the data indicated that of the Priority flora species, six priority flora species have a high potential to be in the survey area and seven priority flora species have a moderate or moderate to high potential to be in the survey area (Figure 8 and Appendix C).

The likelihood that these species would occur within the survey areas was determined using the following criteria:

- Known records within a 20 km radius of the centre of the survey area (as described above). More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).
- The likelihood was ranked Low, Moderate or High.

All potential threatened and priority flora are listed in Appendix B, along with their State and Federal Conservation Codes (see Appendix A for definitions), a description and an assessment of the likelihood of their occurrence in the ONeil survey area. In undertaking such an assessment of potential threatened and priority species there is a need to rely on state and federal databases that are not necessarily up to date. In considering likelihood of species due consideration was also given to nearby and previous findings of species and their site preferences.



N

0 2 4 km

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Oneil

Potential Threatened and Priority Flora

Figure: **8**

4.7 Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

On the basis of databases and previous surveys near or within the ONeil survey areas a total of 15 introduced taxa has the potential to occur in the ONeil survey area (Appendix C). None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

An assessment of the likelihood that the significant weed species (Weeds of National Significance and/or declared pest organisms) would occur within the ONeil survey area was determined using the following criteria:

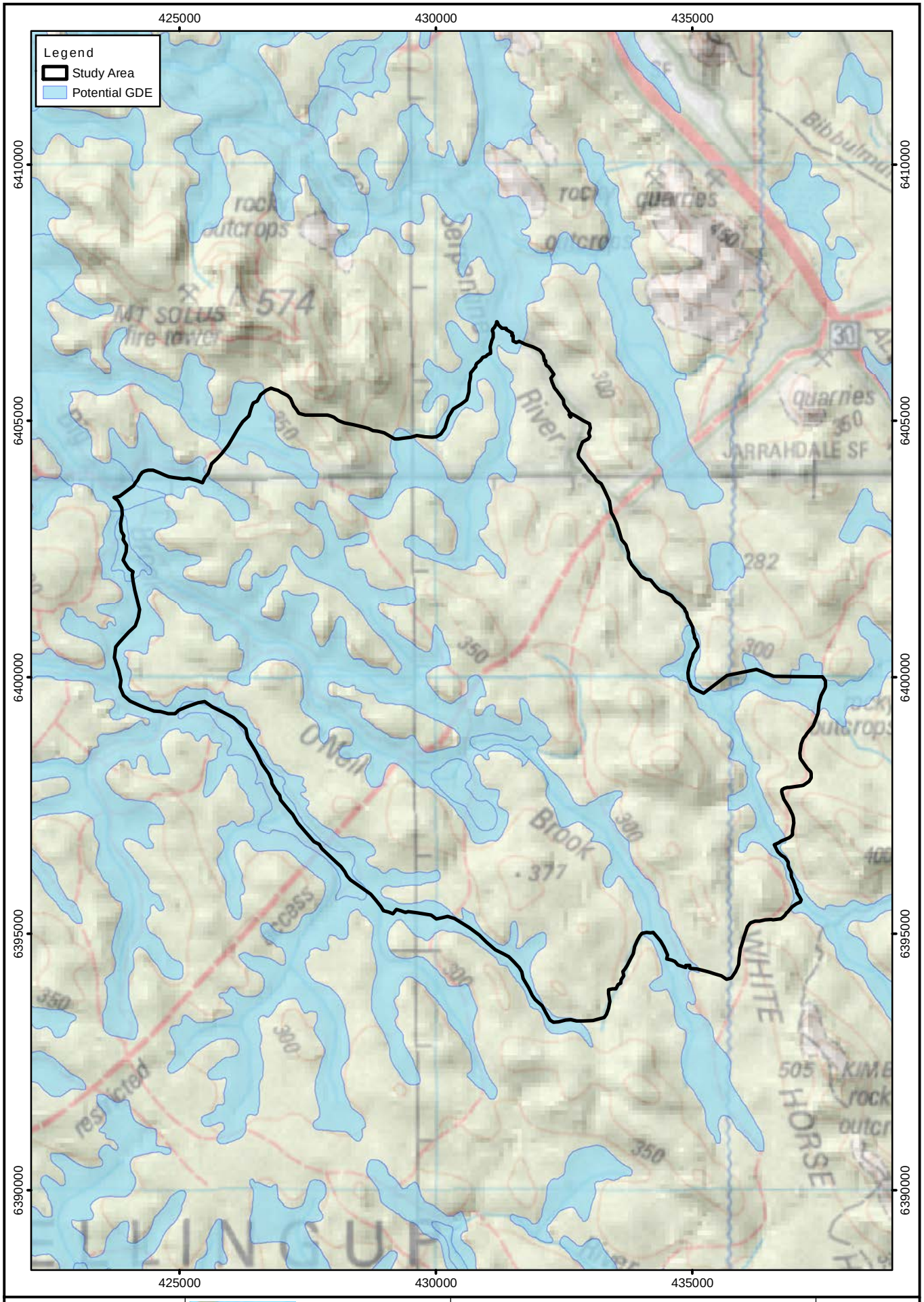
- Known records within a 10-20 km radius of the centre of the survey area, based on studies that overlap the survey area or that have been recorded in nearby areas
- More recent, proximal and numerous records were ranked higher.
- Potential presence of suitable habitat and landforms for the species within the survey area (e.g. soil type, bedrock type, topography, drainage lines, vegetation).

The majority of the weeds are relatively short-lived species that will not compete with native species unless the vegetation is cleared or disturbed.

4.8 Groundwater Dependant Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes (Yarragil 2 and Swamp), Figure 9. In view of the extensive flora and vegetation studies in the northern Jarrah forest subregion these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture in the absence of site-vegetation type data.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Acacia divergens, Boronia molloyae, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Eucalyptus patens, Hypocalymma angustifolium, Melaleuca preissiana, Melaleuca viminea* and *Taxandria linearifolia.*



N

0 0.75 1.5 km

Scale: 1:100,000
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Oneil

Potential GDE

Figure:

9

4.8 Old Growth Forests

Based on data from Department of Biodiversity, Conservation and Attractions, there are no old growth forests occurring in the ONeil survey area (Figure 10).

Due to the proximity of the ONeil survey area to the main North-East Road is unlikely that there will be additional old growth forests in the survey area.

The data as presented on the history of harvesting in the area reflects the age of logging on the ONeil survey area, see Figure 11. The data in Figure 11 reflects the more recent logging in the northern options which in part reflects the operational activities of Alcoa (pre mining). Some of the valley areas have not been logged for some time and as such reflect the linear patterns of these systems.

4.10 Previous Surveys

Mattiske Consulting has previously mapped the vegetation in the areas surrounding the ONeil survey area. Recent flora and vegetation studies relevant to the ONeil survey area include the previous flora and vegetation studies and transect monitoring has been done in the nearby Cameron block (including the sub-catchment Gordon) since 1993 (E.M. Mattiske and Associates 1993 to 1994; and Mattiske Consulting 1996 to 2006) and the ONeil survey areas (Mattiske Consulting Pty Ltd 2009, 2012, 2024).

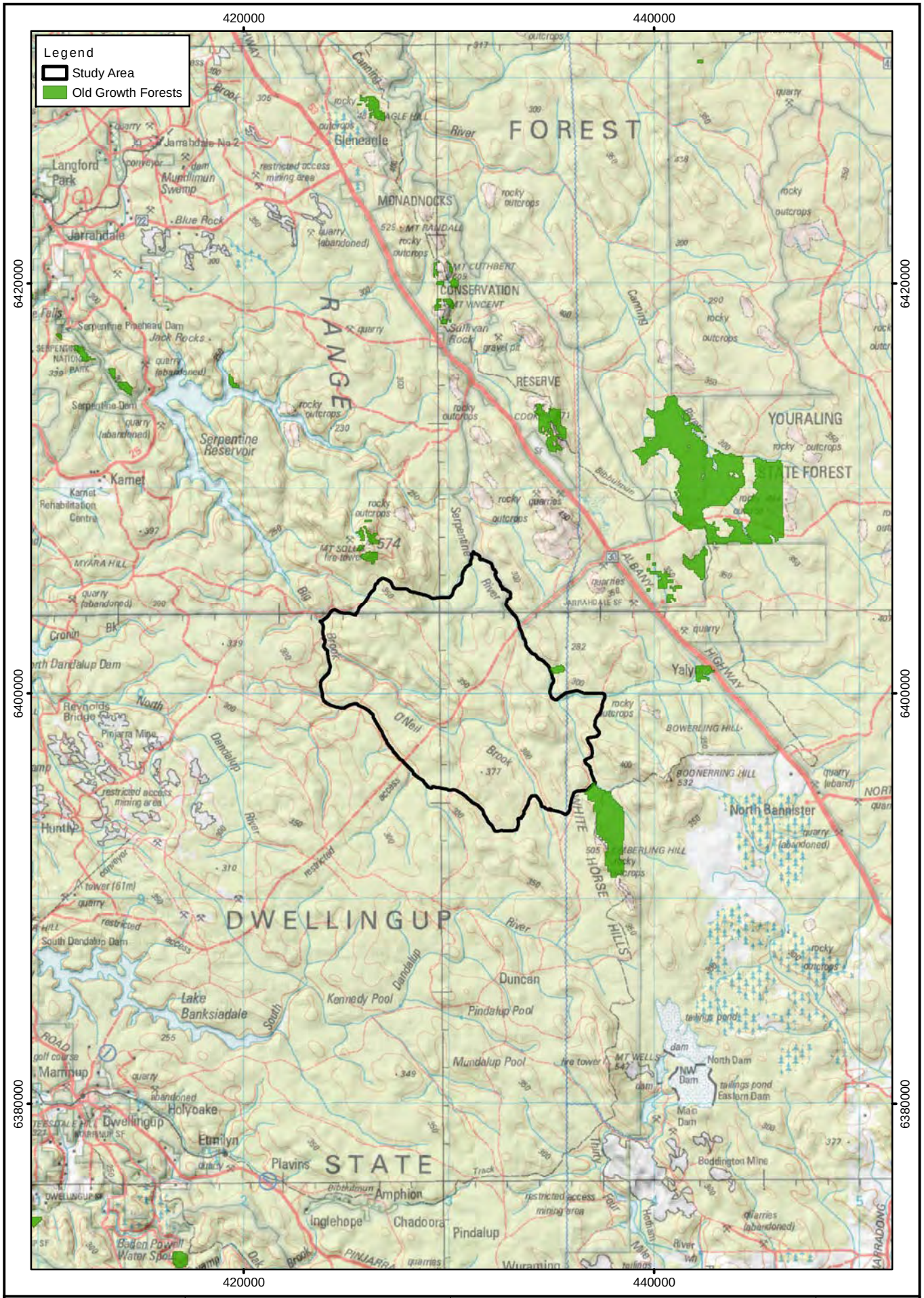
The survey effort in the ONeil survey areas includes multiple survey efforts by Mattiske Consulting from the earlier flora and vegetation studies to the more recent targeted work and assessment of sites in a range of the site-vegetation types within the survey area that extend northwards and southwards from those areas previously mapped. This effort extends the flora and vegetation studies undertaken in the Northern Jarrah Forest over some 40 years.

4.11 Potential Threatened and Priority Ecological Communities

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2024e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023c) with the potential to occur within the ONeil survey area.

There are no TECs listed at Commonwealth or State level, or PECs listed at State level which would be likely to occur in the ONeil survey area; although further north the vegetation associated with granite outcrops has been classified as a PEC and further east and southeast the vegetation associated with granites has been classified as a PEC near Mt Saddleback (DBCA 2023b) .

One of the difficulties faced in assessing the potential for PECs is that in many instances there is a lack of detailed data behind the delineation. In some sections of the Oneil area there are some of the values associated with the shallow soils of the granite outcrop areas that may have some values that overlap with the PEC as defined by DBCA 2023b for the outcrop areas to the north of the survey area and the outcrop areas near Mt Saddleback. As these areas occur on outcrop or shallow soil areas associated with outcrops it is unlikely that these areas would be disturbed. Further many of the values are represented in conservation areas to the (Monadnocks and to the east).



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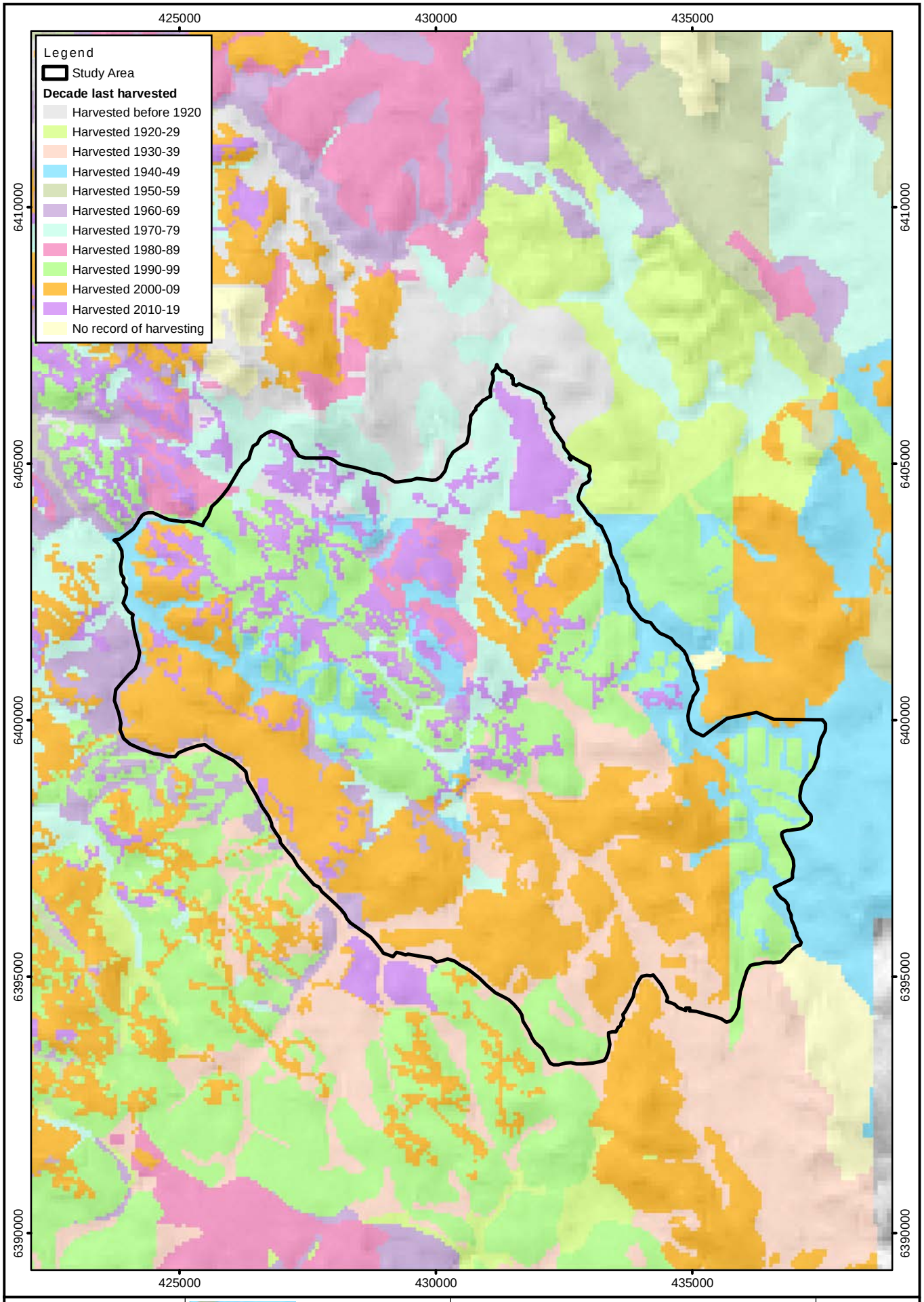
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Oneil East

Old Growth Forest

Figure:

10



N

0 0.75 1.5 km

Scale: 1:100,000
MGA94 (Zone 50)

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Oneil

Harvested Year

Figure:

11

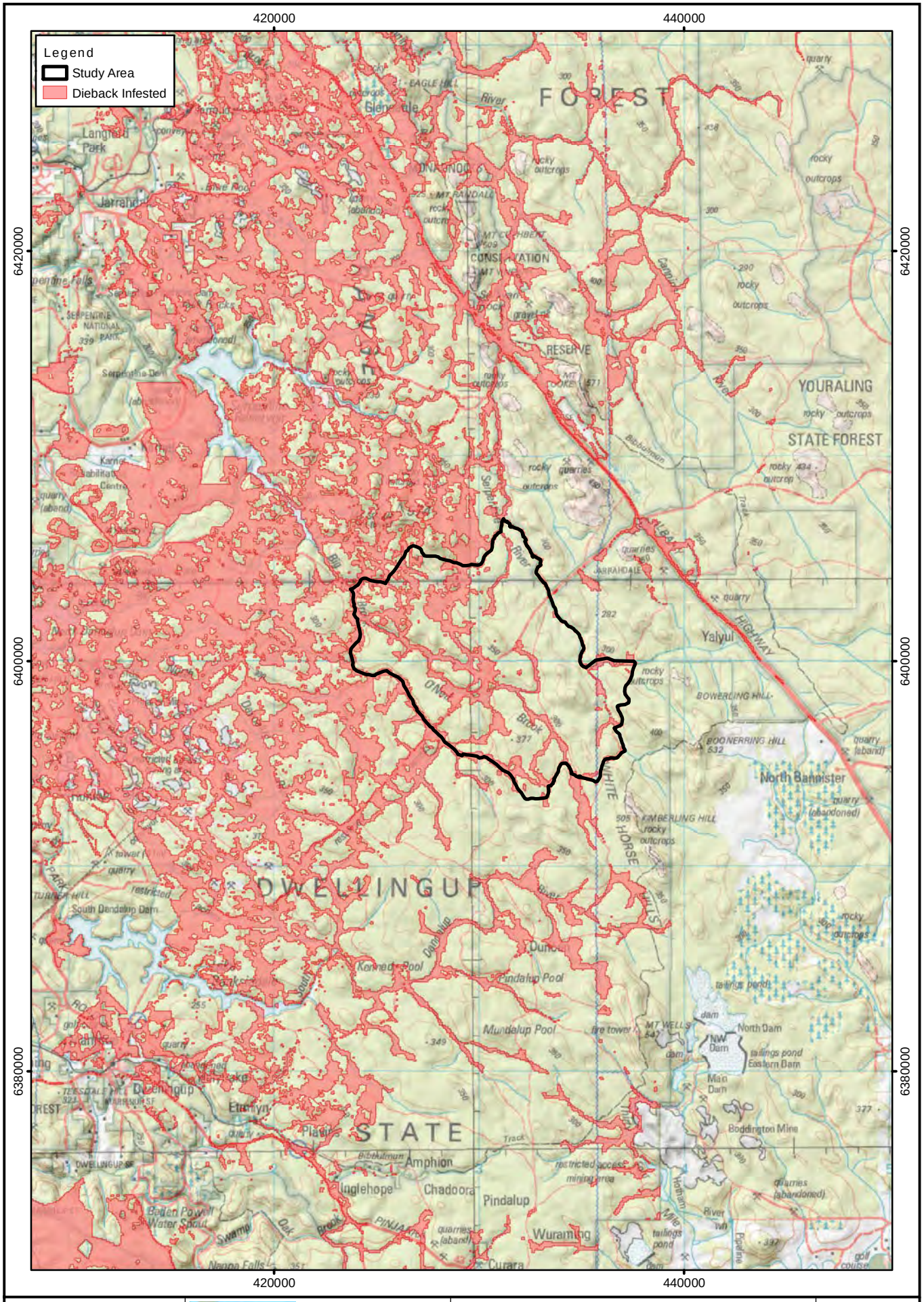
4.12 Wetlands of International Importance (Ramsar)

The Peel-Yalgorup System, a listed Ramsar Wetland of International Importance, is located adjacent to the City of Mandurah and consists of shallow estuaries, freshwater marshes and coastal saline lakes that include the Harvey Estuary, Peel Inlet, Lake McLarty, Lake Mealup and ten Yalgorup National Park wetlands (DCCEEW 2024f). The fringing vegetation is mainly samphire, rushes, sedges and paperbark communities. The Peel-Yalgorup System supports a wide variety of waterbirds, invertebrates and estuarine and marine fish and is considered the most important area for waterbirds in south-western Australia (DCCEEW 2024f). Whilst these potential values were recognized in the National database search (DCCEEW 2024f) these wetlands occur west of the survey area and not in the ONeil survey area.

4.13 Review of Dieback Occurrence

The dieback data as shown on Figure 12 reflects the most up to date dieback interpretation data from both DBCA and Glevan Consulting for the ONeil r survey area. Sections of the ONeil survey area have been infested with the dieback disease caused by *Phytophthora cinnamomi*. In the survey area the dieback infections are concentrated to the valleys systems. There may be some differences also in coverage and sampling in some of the areas of the ONeil survey area.

In the summer of 2023/2024 the vegetation of the south west was influenced by a lack of rain since October 2023. The latter dry conditions led to the extensive loss of condition of shrubs and trees has been evident, particularly near granite outcrop areas. This loss of condition in the plant species and vegetation may at times be confused with the evidence of decline from the dieback disease.



N 0 2 4 km Scale: 1:250,000 MGA94 (Zone 50)	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640	**Oneil** **Dieback**	Figure: **12**
CAD Ref: a1992_F025_09	Author: E M Matttiske | MCPL Ref:		
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5 RESULTS

5.1 Survey Effort

The survey effort is summarized in Table 5 and Figure 13 and in the following text.

- Detailed studies were undertaken by the Mattiske Consulting teams from 2009 to 2024 for defining and mapping the site-vegetation types.
- Additional targeted flora and vegetation mapping was undertaken in autumn months of 2024.
- It is intended to establish permanent plots and re-assess some long term monitoring transects in the area in the spring months of 2024 to supplement the earlier detailed studies in some of the valley systems.

The survey efforts include results from 2009 through to 2012 and more recently in 2023 and 2024 in the ONeil area and in adjacent areas. These studies have been supplemented by extensive detailed plot and transect studies in the Northern Jarrah Forest over 40 years, including permanent sampling sites within the current Oneil area which are intended to be re-assessed in the spring months of 2024 and where required additional plots will be established to include the range of flora and vegetation values in the ONeil area.

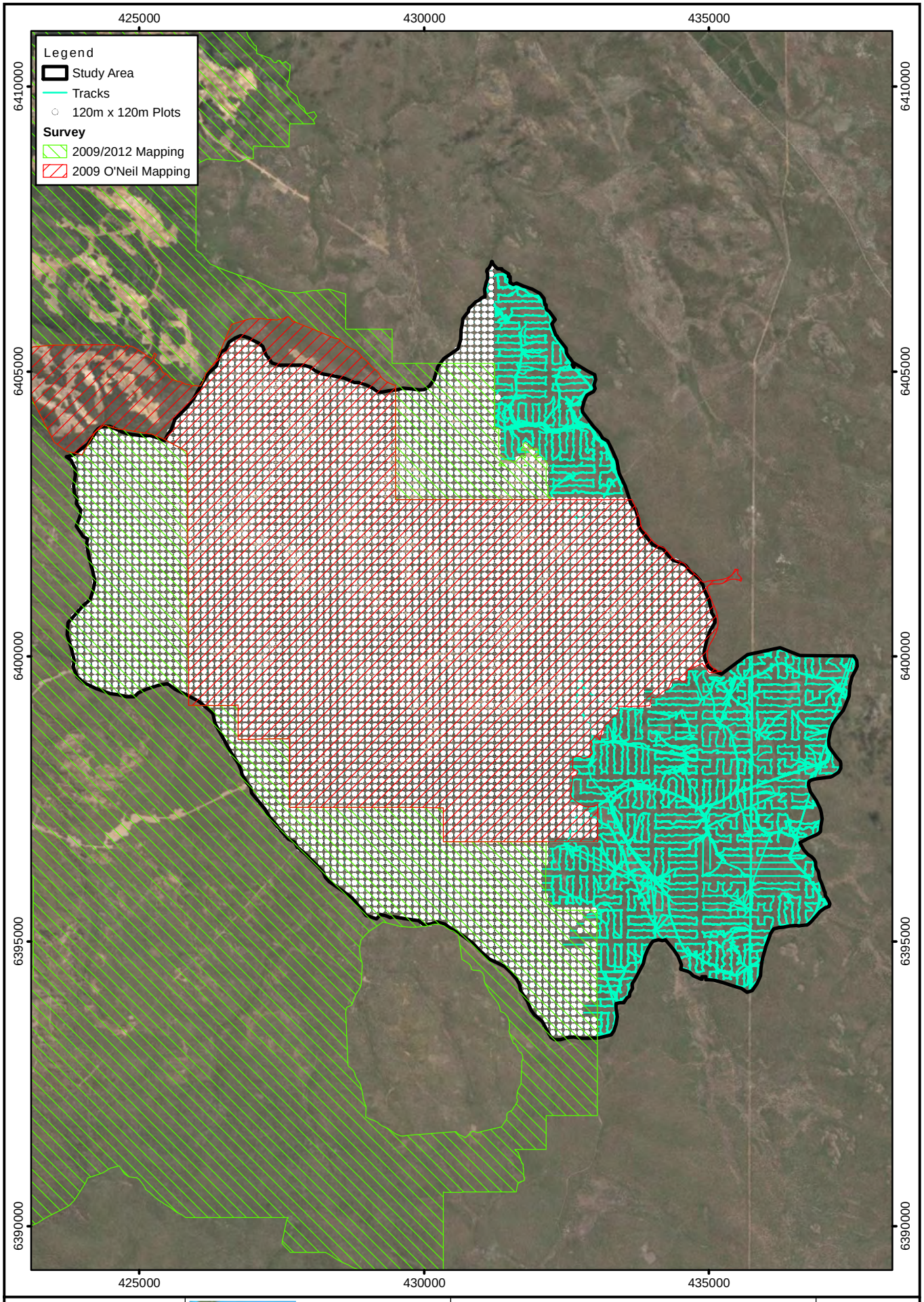
It is important to recognise that the vegetation mapping efforts in seasons outside of the spring months can still be undertaken as the vegetation mapping relies on perennial species which persist through the seasons. Further the perennial species persist through different seasons and the key indicators can be recognized throughout the year. The site-vegetation types extend the vegetation mapping over large areas of the Northern Jarrah Forest and as such integrate the flora, vegetation and site values which provides additional and critical information to the understanding of patterns in the area. The site-vegetation type approach was developed by Dr J Havel (1975a, 1975b) in close consultation with Dr D Goodall from CSIRO in the mid 1970's. Whilst this approach may differ from some other studies in Western Australia the development by Havel and Goodall was undertaken to define a series of key indicators and site conditions that would enable a finer definition of the northern Jarrah Forest communities. Such an approach enabled the subdivision of the main forest types which relied heavily on the structural components and the dominant trees. The latter broader approach is evident in the regional mapping at a coarser level as undertaken for the Pre-European vegetation mapping as undertaken by Beard 1979. The adoption of the site-vegetation type approach also enabled consideration of representation in the wider Northern Jarrah Forest and as such is supplemented by the vegetation studies during the System 6 (Heddle *et al*. 1980) and the Regional Forest Agreement investigations (Mattiske and Havel 1998) supported by state and federal government agencies.

Table 5 provides a summary of the number of recording sites in each site-vegetation type. The more restricted site-vegetation types are obviously less well represented in the recording sites. None of the site-vegetation types are restricted to the survey area.

Table 5: Sampling Intensity in the respective areas of each Site-Vegetation Type

Site-vegetation Type	No Recording Sites	ONeil (ha)	% Total Survey Area
A	120	91.579	0.88
AC	536	398.385	3.83
AD	46	40.755	0.39
AX	2	1.556	0.01
AY	34	31.460	0.30
C	4	5.308	0.05
CL	206	142.206	1.37
CW	284	198.684	1.91
D	1484	1050.352	10.09
DA	30	21.988	0.21
DG	268	187.469	1.80
E	-	0.125	0.00
G	60	44.491	0.43
G1	16	15.733	0.15
P	116	85.408	0.82
PS	1988	1409.863	13.54
PT	2	2.287	0.02
PW	342	251.249	2.41
R	226	170.902	1.64
R/G	6	6.152	0.06
Rehab	1418	1020.812	9.80
S	3744	2661.758	25.56
SP	796	565.198	5.43
ST	544	388.111	3.73
SW	750	570.587	5.48
T	434	318.305	3.06
TS	766	549.993	5.28
W	216	153.078	1.47
Y	24	16.982	0.16
YG	24	13.751	0.13
		10414.530	100.00

In summary, the work undertaken to date on the Oneil survey area supplements extensive studies previously within and adjacent to the current survey area and as such meets the EPA (2016a and 2016b) guidelines. With the proposed supplementary flora and vegetation studies in the spring months of 2024 the effort exceeds the effort undertaken on many projects as it enables a detailed and comprehensive assessment of the survey area in the local and regional context.



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Scale: 1:90,000
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Oneil
Survey Effort

Figure:
13

5.2 Flora

In the more recent targeted flora and vegetation studies a total of 353 vascular plant taxa, representative of 143 genera and 61 families (Appendix C) were recorded in the ONeil survey area in 2024. If added to the recent work in the nearby areas between 2009 and 2023 this leads to a total of 536 vascular plant species from 182 genera and 66 families (Appendix C) for the wider area within and near this survey area. The recent 2024 studies recorded taxa in the following dominant families - Proteaceae (51 taxa), Fabaceae (45 taxa), Myrtaceae (37 taxa), Asparagaceae (18 taxa), Dilleniaceae (16 taxa), Ericaceae (16 taxa), Cyperaceae (15 taxa) and Asteraceae (15 taxa). This higher number of species appeared to be related to the wider valleys with increasing variation in soil types and the increased occurrence of shallow soils associated with the granite outcrops.

5.3 Threatened and Priority Flora

A total of 4 priority flora species (*Hibbertia ?ambita* P1, *Hibbertia hortiorum* P1, *Grevillea dissectifolia* P3 and *Senecio leucoglossus* P4) were recorded in the ONeil survey area. The *Hibbertia hortiorum* and *Hibbertia ?ambita* occurrences appear to reflect the more easterly occurrence of these two species and in addition appears to reflect the more detailed studies of the *Hibbertia* genera by Kevin Thiele (2019). Recent work indicates that the *Hibbertia* Priority species occur outside of this ONeil survey area and as a result the findings suggest that there may be larger populations in a wider area Florabase, WAH 1998 -). Currently *Hibbertia ambita i*s known from 17 records and *Hibbertia hortiorum* is known from 12 records at the State Herbarium collection. *Hibbertia hortinorum* was recorded largely in the valley systems in the south0eastern section of the ONeil survey area. This distribution appears to align with the occurrences on the regional databases (Figure 8).

Grevillea dissectifolia (P3) has mainly been recorded in the valley systems in the southern section of the survey area. This species is known from 24 records at the State Herbarium and was previously known as *Grevillea manglesii* subsp. *dissectifolia* on older records.

Senecio leucoglossus (P4) has mainly been recorded extensively as scattered plants through the northern Jarrah forest. One specimen of this species wase confirmed at the State Herbarium (ACC10469/E). This species tends occur on lateritic soils and is known from 45 specimens at the State Herbarium. This species general mainly occurs in Jarrah-Marri-Bull Banksia (*Eucalyptus marginata – Corymbia calophylla – Banksia grandis*) forests. This species was recorded at three locations within the ONeil survey area, but has been recorded regularly as scattered occurrences in other forest areas by the Mattiske team.

5.4 Introduced Species

A total of 11 introduced species were recorded on the 2024 survey areas and some 20 species over the wider area, Appendix C. None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

5.5 Vegetation

A total of 27 site-vegetation types were defined and mapped in the ONeil survey area and an addition two mapping units (CL cleared land and Rehabilitation areas), Table 6 and Figures 14.1 and 14.2. The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years.

The results presented in Table 6 for each site-vegetation type also reflect the extent of the site-vegetation types and their percentage representation in the survey area. It is clearly apparent that there are some dominant site-vegetation types that dominate the ONeil survey area (namely P, PS, S, SP, ST, T and TS which together cover 57.41% of the survey area). A total of some 11.17% of the survey area has been either cleared or rehabilitated within the ONeil survey area.

Table 6: Summary of site-vegetation types as defined for the ONeil survey area based on Havel (1975a and 1975b) site-vegetation types as defined for the northern Jarrah forest

	SVT Code	Description	Total Area (ha)	% Survey Area
Swamps and Broad Valleys	A	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense stands of *Melaleuca viminea, Hakea varia, Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	91.579	0.88
	AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana - Eucalyptus patens - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	398.385	3.83
	AD	Low open woodland of *Eucalyptus rudis* and *Eucalyptus marginata* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	40.755	0.39
	AX	Open Woodland *of Eucalyptus rudis – Melaleuca preissiana* with dense understorey of mixed *Melaleuca* species on clay soils in swamps.	1.556	0.01
	AY	Open woodland of *Eucalyptus wandoo* over *Hakea varia, Hypocalymma angustifolium, Babingtonia camphorosmae* and *Gastrolobium calycinum* over herbs and sedges on clay-loams in seasonally wetter valley floors.	31.460	0.30
	D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae, Daviesia decurrens, Davieisa preissii* and *Acacia extensa* on clay loams to gravelly clay-loams.	1050.352	10.09
	DA	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with patches of *Melaleuca preissiana, Banksia littoralis* over mixed low understorey species, including *Babingtonia camphorosmae* and *Astartea scoparia* on clay loams to gravelly clay-loams.	21.988	0.21
	DG	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with mixed low understorey species, including *Grevillea bipinnatifida* and *Babingtonia camphorosmae,* on clay loams to gravelly clay-loams.	187.469	1.80
	E	Open Forest to Woodland of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Kingia australis, Mesomelaena tetragona* and *Babingtonia camphorosmae* on sandy gravels on lower slopes.	0.125	0.001
Valley Floors and Lower Slopes	C	Woodland to Open Forest of *Eucalyptus patens – Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	5.308	0.05
	CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	198.684	1.91
	W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	153.078	1.47
	Y	Open woodland of *Eucalyptus wandoo* over *Hypocalymma angustifolium* and *Babingtonia camphorosmae* over herbs and sedges on clay-loams on seasonally moister lower slopes.	16.982	0.16
	YG	Open woodland of *Eucalyptus wandoo* over *Hypocalymma angustifolium, Babingtonia camphorosmae, Grevillea bipinnatifida* and *Allocasuarina humilis* over herbs and sedges on clay-loams on seasonally moister lower slopes underlain by outcrops.	13.751	0.13
Slopes with seasonal soil moisture	SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	570.587	5.48
	PW	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels.	251.249	2.41
Shallow Outcrop Areas	R	Open Woodland of *Eucalyptus marginata - Corymbia calophylla* on fringes of granite outcrops or shallow soils.	170.902	1.64
	R/G	pen Woodland of *Eucalyptus marginata - Corymbia calophylla* with patches of Heath of Proteaceae – Myrtaceae species on fringes of granite outcrops or shallow soils.	6.152	0.06
	G	Mosaic of Open Woodland of *Eucalyptus marginata – Corymbia calophylla*, mixed Proteaceae – Myrtaceae heath and Lithic Complex associated with granite outcrops.	44.491	0.43
	G1	Mixed Proteaceae – Myrtaceae heath and Lithic Complex associated with granite outcrops.	15.733	0.15

Table 6: Summary of site-vegetation types as defined for the ONeil survey area based on Havel (1975a and 1975b) site-vegetation types as defined for the northern Jarrah forest (continued)

	SVT Code	Description	Total Area (ha)	% Survey Area
Slopes and Ridges - Sandy Loam Gravels	P	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii* and *Adenanthos barbiger* and low shrubs, herbs and sedges on sandy gravels.	85.408	0.82
	PT	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	2.287	0.02
	PS	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	1409.863	13.54
	SP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	565.198	5.43
	S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy-gravels.	2661.758	25.56
	ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus, Leucopogon verticillatus, Pteridium esculentum, Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	388.111	3.73
	TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	549.993	5.28
	T	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly soils.	318.305	3.06
Other Areas	CL	Cleared Areas	142.206	1.37
	Rehab	Rehabilitation Areas	1020.812	9.80
	Total		**10414.527**	

None of these site-vegetation types are restricted to the ONeil survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

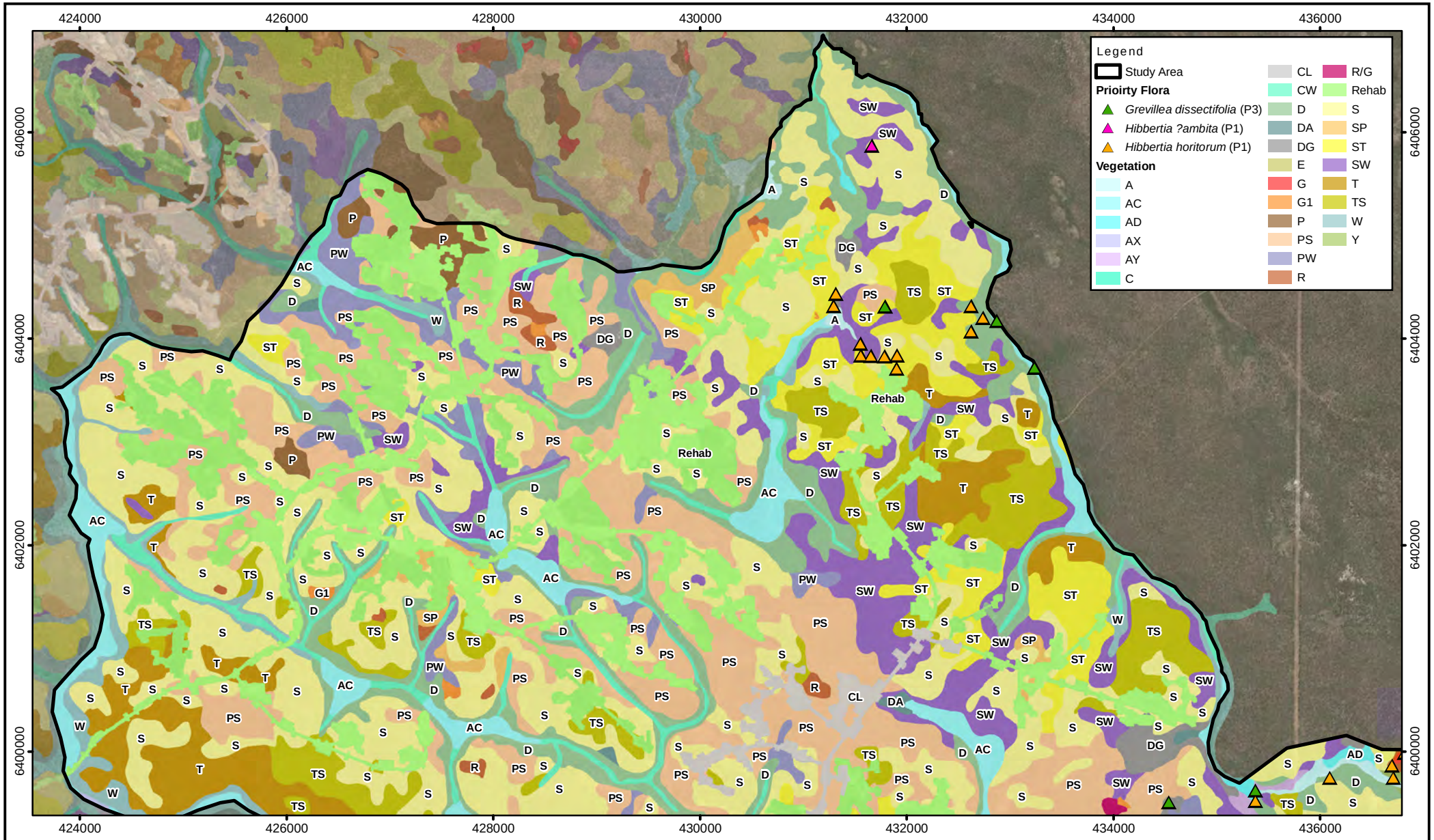
The condition of the vegetation is excellent, except for the degraded areas in the rehabilitation areas that are still regenerating and completely degraded in Cleared areas, Figure 15.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2024e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2023c) within the ONeil survey area.

There are no PECs listed at State level which would be likely to occur in the ONeil survey area; although further north the vegetation associated with granite outcrops has been classified as a PEC and further east and southeast the vegetation associated with granites has been classified as a PEC near Mt Saddleback (DBCA 2023b) .

At a State or National level none of the site-vegetation types have been listed as Threatened or Priority Ecological Communities.

Source:



Notes:

N

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Scale: 1:50,000
MGA94 (Zone 50)

CAD Ref: a1992_F025_20

Date: May 2024 | Rev: A | A4

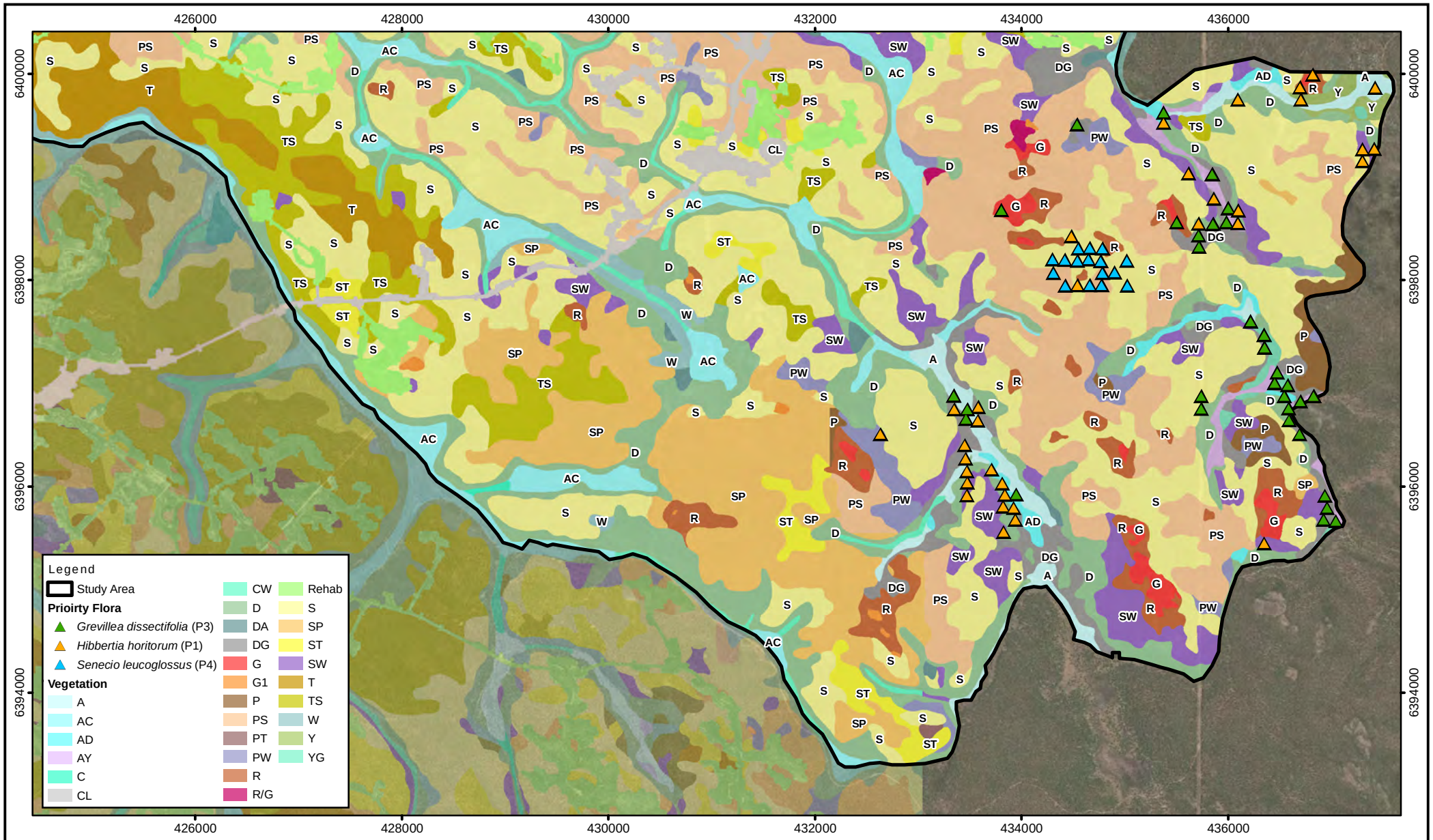
Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Matttiske | MCPL Ref:
Drawn: CAD Resources ~ www.cadresources.com.au
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Oneil
Vegetation
Sheet 1 of 2

Figure:

14.1

Source:



Notes:

N

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Scale: 1:50,000
MGA94 (Zone 50)

CAD Ref: a1992_F025_20

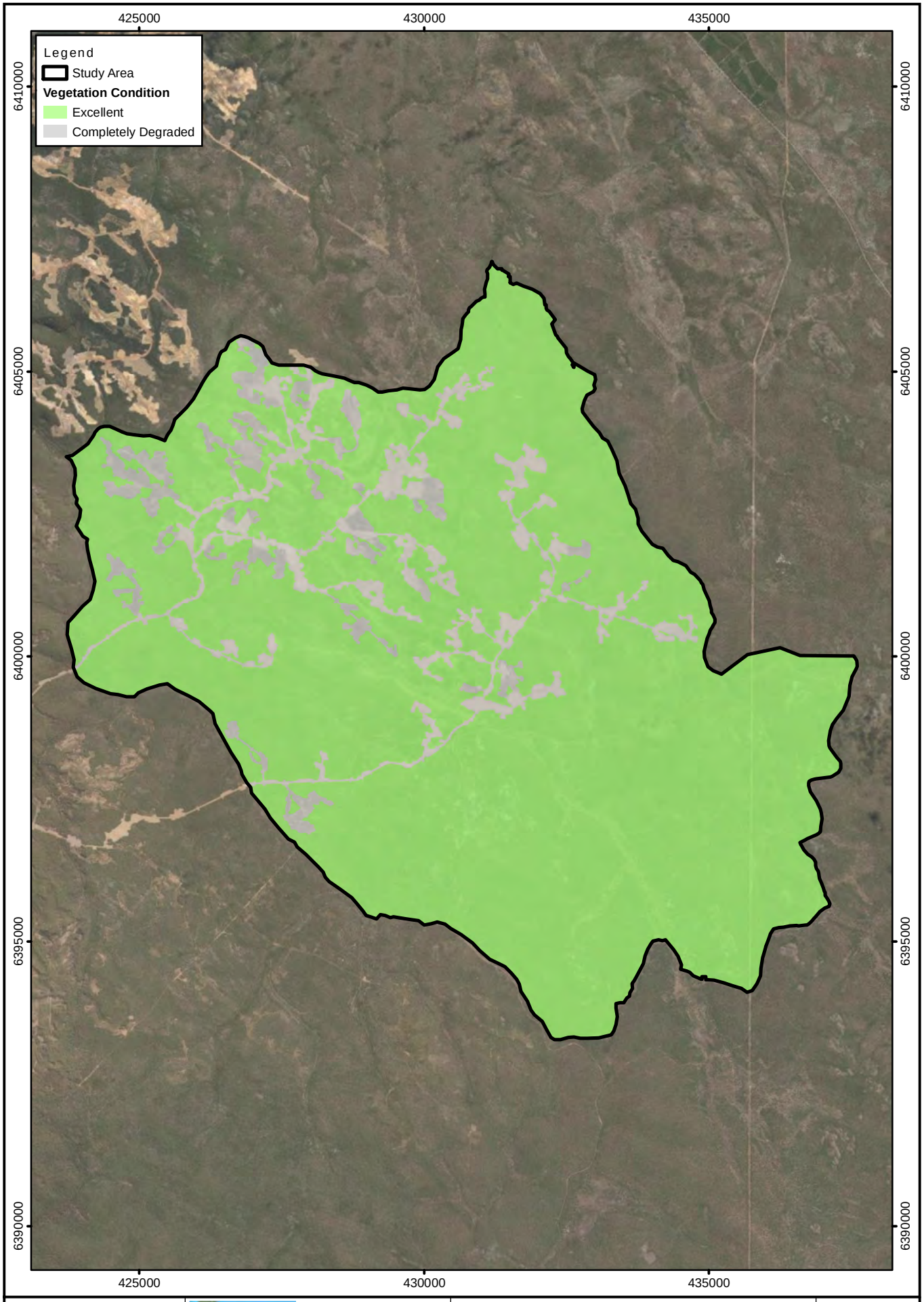
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Oneil
Vegetation
Sheet 2 of 2

Figure:

14.2



N

0 0.7 1.4 km

Scale: 1:90,000
MGA94 (Zone 50)

CAD Ref: a1992_F025_18

Date: April 2024 | Rev: A | A4

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Oneil

Vegetation Condition

Figure:

15

6 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the ONeil survey area. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed again in 2024 in line with some changes in nomenclature from 2022 to 2024.

The ONeil survey area lies within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla - Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System (Heddle *et al.* 1980; Mattiske and Havel (1998).

Survey Effort

The survey effort in the ONeil survey areas includes multiple survey efforts by Mattiske Consulting (2009, 2012) from the earlier flora and vegetation studies to the more recent targeted work and assessment of sites in a range of the site-vegetation types within the survey area that extend northwards and southwards from those areas previously mapped.

In summary, the work undertaken to date on the Oneil survey area supplements extensive studies previously within and adjacent to the current survey area and as such meets the EPA (2016a and 2016b) guidelines. With the proposed supplementary flora and vegetation studies in the spring months of 2024 the effort exceeds the effort undertaken on many projects as it enables a detailed and comprehensive assessment of the survey area in the local and regional context.

Recorded Flora

In the more recent targeted flora and vegetation studies a total of 353 vascular plant taxa, representative of 143 genera and 61 families were recorded in the ONeil survey area in 2024. If added to the recent work in the nearby areas between 2009 and 2024 this leads to a total of 536 vascular plant species from 182 genera and 66 families for the wider area within and near this survey area. The dominant families were Proteaceae (51 taxa), Fabaceae (45 taxa), Myrtaceae (37 taxa), Asparagaceae (18 taxa), Dilleniaceae (16 taxa), Ericaceae (16 taxa), Cyperaceae (15 taxa) and Asteraceae (15 taxa). This higher number of species appeared to be related to the wider valleys with increasing variation in soil types and the increased occurrence of shallow soils associated with the granite outcrops.

No threatened flora as listed at the Federal and State level were recorded within the ONeil survey area in 2024 (DBCA 2023a and DCCEEW 2024a).

A total of 4 priority flora species (*Hibbertia ?ambita* P1, *Hibbertia hortiorum* P1, *Grevillea dissectifolia* P3 and *Senecio leucoglossus* P4) were recorded in the ONeil survey area. The *Hibbertia hortiorum* and *Hibbertia ?ambita* occurrences appear to reflect the more easterly occurrence of these two species and in addition appears to reflect the more detailed studies of the *Hibbertia* genera by Kevin Thiele (2019). The *Grevillea dissectifolia* occurs mainly in the broader valley systems with some shallower soils and has been recorded previously to the north-east of the ONeil survey area. The *Senecio leucoglossus* occurs as scattered plants through the wider northern Jarrah forest and as such is not restricted to the ONeil area.

A total of 11 introduced species were recorded on the 2024 survey areas and some 20 species over the wider area. None of the weeds are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD 2024) and none are listed as Weeds of National Significance (DCCEEW 2024d).

Recorded Vegetation

A total of 27 site-vegetation types were defined and mapped in the ONeil survey area and an additional two mapping units (CL cleared land and Rehabilitation areas). The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years. It is clearly apparent that there are some dominant site-vegetation types that dominate the ONeil survey area (namely P, PS, S, SP, ST, T and TS which together cover 57.41% of the survey area). A total of some 11.17% of the survey area has been either cleared or rehabilitated within the ONeil survey area.

None of these site-vegetation types are restricted to the ONeil survey area; however all of the northern jarrah forest has not been mapped at this finer scale it is not feasible to provide a percentage representation of each site-vegetation type.

The results reflect an increase in the representation of site-vegetation types associated with outcrop areas (G, G1, R/G, R, DG and YG) and also in the occurrence of a range of site-vegetation types that reflect the broader valleys and swamp areas associated with Yarragil 2 and Pindalup vegetation complexes. This shift is also apparent in several Priority species that occur north-east and east of the survey area in the broader valley systems.

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* or listed by the DCCEEW (2024e) or at State level pursuant to Part 2 of the *BC Act* and as listed by DBCA (2024b) within the ONeil survey area.

There are no priority ecological communities (PECs), as listed at State level within the ONeil survey area; although some of the values associated with the shallow soils of the granite outcrop areas have some values that overlap the PEC as defined by DBCA 2023b for the outcrop areas to the north of the survey area and the outcrop areas near Mt Saddleback.

6. ACKNOWLEDGEMENTS

The authors would like to thank Alcoa of Australia Ltd for their assistance with this project.

7. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

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Mr D Rubick	Experienced Botanist	Data collection and Field Studies	FB62000328-2,3
Ms K Tribbeck	Experienced Botanist	Data collection and Field Studies	FB62000467, 2
Ms A Rowe	Experienced Botanist	Data collection and field studies	FB62000329-2,3
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R Jones	Botanist	Data collation, reporting	N/A
J Wescombe	Botanist	Data collation, reporting	N/A

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions (DBCA 2024a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act. Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from DBCA (2024a).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (DBCA 2024a). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from DBCA (2024a).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (26 May 2023)* (under Part 2, Division 2, Subdivision 1 of the BC Act; DBCA 2023b). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the DBCA (and former equivalent departments) have been identifying and informally listing TECs since 1994. Some of these TECs are also endorsed by the Federal Minister as threatened, and some of these are listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from DBCA (2023b).

CODE	CATEGORY	DEFINITION
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2023a) in the *Priority Ecological Communities for Western Australia – Version 35 (19 June 2023)*. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from DBCA (2023a).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2024).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- 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; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of vegetation condition categories

Note: Adapted from Keighery (1994).

CATEGORY	DEFINITION
1	Pristine or nearly so, no obvious sign of disturbance or damage caused by human activities since European settlement.
2	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.
3	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Anthocercis gracilis	Solanaceae	T	Vulnerable	Habit: Erect, spindly shrub, to 0.6 (-1) m high. Flower colour: yellow-green Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Sandy or loamy soils. Granite outcrops. IBRA Distribution: AVW, JAF Florabase records: 30	**Very Low** On eastern and western fringes of northern Jarrah forest
Banksia mimica	Proteaceae	T	Endangered	Habit: Prostrate, lignotuberous shrub, 0.15-0.4 m high. Flower colour: yellow-brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White or grey sand over laterite, sandy loam. IBRA Distribution: JAF, SWA Florabase records: 40	**Very Low** Occurs to the north on the SWA and south JAF
Caladenia huegelii	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.25-0.6 m high. Flower colour: green & cream & red Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Grey or brown sand, clay loam. IBRA Distribution: JAF, SCP Florabase records: 43	**Very Low** Location outside species known range. Species not known within central part of northern Jarrah forest.
Diuris drummondii	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.5-1.05 m high. Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J A S O **N** **D** Soils: Low-lying depressions, swamps IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 55	**Very Low** Dependent on suitable low-lying depressions/habitat conditions.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Diuris micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.3-0.6 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Brown loamy clay. Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 9	**Very Low** Dependent on suitable depressions/habitat conditions.
Diuris purdiei	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.35 m high. Flower colour: yellow Flowering period (indicated in green): only after a summer or early autumn fire J F M A M J J A **S** **O** N D Soils: Grey-black sand, moist. Winter-wet swamps. IBRA Distribution: JAF, SWA Florabase records: 26	**Very Low** Dependent on suitable swamps/habitat conditions.
Drakaea micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.15-0.3 m high. Flower colour: red & yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White-grey sand. IBRA Distribution: JAF, SWA, WAR Florabase records: 50	**Very Low** Outside species range. Species not known within the Northern Jarrah Forest.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eleocharis keigheryi	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Clay, sandy loam. Emergent in freshwater: creeks, claypans. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 59	**Very Low** Not recorded within proximity. Dependent on appropriate hydrology on site.
Lasiopetalum pterocarpum	Malvaceae	T	Endangered	Habit: Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines. IBRA Distribution: JAF Florabase records: 11	**Very Low** Restricted to creeklines near Darling Scarp.
Morelotia australiensis	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O **N D** Soils: Sand, sandy loam. Flats, well-drained areas. IBRA Distribution: JAF, SWA Florabase records: 49	**Very Low** North of survey area near Darling Scarp

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thelymitra stellata	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.25 m high. Flower colour: yellow & brown Flowering period (indicated in green): **J F M A M J J A S O N** D Soils: Sand, gravel, lateritic loam. IBRA Distribution: GES, JAF, SWA Florabase records: 20	**Very Low** Spread between Three Springs and Pinjarra.
Verticordia fimbrilepis subsp. *fimbrilepis*	Myrtaceae	T	Endangered	Habit: Shrub, 0.3-0.7 m high. Flower colour: pink-white Flowering period (indicated in green): **J** F M A M J J A S O N **D** Soils: Gravelly or clayey soils. Flats, road verges. IBRA Distribution: AVW, JAF Florabase records: 39	**Very Low** Species habitat within north-eastern extent of JAF and AVW (EPBC Conservation Advice, 2021)
Darwinia hortiorum	Myrtaceae	P1	-	Habit: Low spreading shrub, 10-25cm Flower colour: green-cream Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Loam soils over laterite or granite slopes associated with outcrops IBRA Distribution: JAF Florabase records: 9	**Medium** Species habitat within north-eastern extent of JAF
Hibbertia acrotoma	Dilleniaceae	P1	-	Habit: Openly branched, spreading to prostrate shrub to 0.5m. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S** O N D Soils: Loam soils over laterite or granite IBRA Distribution: JAF, SWA Florabase records: 7	**Very Low** Edge of Darling Scarp between Serpentine & Oakley Dam

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hibberta hortiorum	Dilleniaceae	P1	-	Habit: Mat-forming shrubs to 0.1m high or less. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Laterite IBRA Distribution: JAF Florabase records: 12	**High** Species known from mainly north-eastern areas of northern Jarrah forest
Paracaleana granitica	Orchidaceae	P1	-	Habit: Perennial, herb, to 0.07 m high. Flower colour: green-purple Flowering period (indicated in green): J F M A M J J A S **O** **N** **D** Soils: Growing on moss mats, granite. Outcrops. IBRA Distribution: JAF Florabase records: 7	**Low** Mainly north of survey area and more common on north-eastern section of northern Jarrah forest
Banksia recurvistylis	Proteaceae	P2	-	Habit: Shrub, spreading, 2m to 3m wide and 1.5m high Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J A S O **N** **D** Soils: In cracks in granite outcrops, brown clays, sand and gravel with lateritic boulders IBRA Distribution: JAF Florabase records: 7	**Medium** Mainly north of survey area and more common on north-eastern section of northern Jarrah forest
Bossiaea modesta	Fabaceae	P2	-	Habit: Slender, trailing and twining shrub. Flower colour: yellow/red Flowering period (indicated in green): J F M A M J J A S **O** **N** **D** Soils: On soils derived from granite IBRA Distribution: JAF Florabase records: 22	**Low-Moderate** Mainly north of survey area, although been recorded west of survey area in the northern Jarrah forest

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Calectasia grandiflora	Dasypogonaceae	P2	-	Habit: Rhizomatous, perennial, herb (or undershrub), to 0.65 m high, without stilt roots. Flower colour: blue/purple Flowering period (indicated in green): J F M A M **J J A S O N** D Soils: On soils derived from granite. Damp areas close to streams. IBRA Distribution: JAF, SWA, AVW Florabase records: 12	**Very Low** Species not known in the area near the survey area, mainly near the Darling Scarp and Perth
Grevillea ornithopoda	Proteaceae	P2	-	Habit: Spreading, virgate shrub, 1-3 (-5) m high, up to 3 m wide. Flower colour: cream-white Flowering period (indicated in green): J F M A **M J J A S O N** D Soils: Loam, loam over clay, sand, clay. Edge of river bank and creek, dunes IBRA Distribution: JAF, SWA Florabase records: 20	**Low Moderate** Within species range, recorded south, west and north of survey area.
Tetratheca phoenix	Elaeocarpaceae	P2	-	Habit: Few-branched shrub (subshrub), to 0.25 m high. Flower colour: dark pink-magenta Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Brown gravelly loam over granite. Mid to Upper slopes, near granite outcrops. IBRA Distribution: JAF Florabase records: 10	**High** Within species range. Recorded near survey area

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia drummondii subsp. *affinis*	Fabaceae	P3	-	Habit: Erect shrub, 0.3-1 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J **J** **A** S O N D Soils: Lateritic gravelly soils. IBRA Distribution: AVW, JAF, SWA Florabase records: 37	**Very Low** Mainly north-east of Perth in northern forests
Acacia horridula	Fabaceae	P3	-	Habit: Harsh, slender, single-stemmed shrub, 0.3-0.6 (-1) m high. Flower colour: yellow Flowering period (indicated in green): J F M A **M** **J** **J** **A** S O N D Soils: Gravelly soils over granite, sand. Rocky hillslopes. IBRA Distribution: JAF, SWA Florabase records: 33	**Low-Moderate** Mainly north of survey area and on Darling Scarp
Acacia oncinophylla subsp. *oncinophylla*	Fabaceae	P3	-	Habit: Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A** **S** **O** N D Soils: Granitic soils IBRA Distribution: AVW, JAF, SWA Florabase records: 42	**Low-Moderate** Within species range but associated with granitic soils.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Adenanthos cygnorum subsp. *chamaephyton*	Proteaceae	P3	-	Habit: Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Flower colour: white-cream-pink-green/green Flowering period (indicated in green): **J F** M A M J **J A S O N D** Soils: Grey sand, lateritic gravel. IBRA Distribution: AVW, JAF, SWA Florabase records: 22	**Moderate** Within species range. Recorded at O'Neil (MCPL 2009)
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	Ericaceae	P3	-	Habit: Shrub, to 1.1 m high and 1.1 m wide. Flower colour: white-cream/mauve-pink Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Loam, clay, sand, gravel. Granite, slopes and drainage lines. IBRA Distribution: JAF Florabase records: 23	**Moderate** Within species range, mainly to the north and north-east of survey area.
Conospermum scaposum	Proteaceae	P3	-	Habit: Erect shrub, 0.2-0.45(-0.75) m high. Flower colour: blue Flowering period (indicated in green): **J F** M A M J J A S **O N D** Soils: White-grey sand, sandy clay. Low swampy areas, road verges. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 47	**Low-Moderate** Species recorded at Myara North (MCPL 2019/20); however mainly north-east of Jarrah forest

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Cyathochaeta teretifolia	Cyperaceae	P3	-	Habit: Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2.0 m high, to 1.0 m wide. Flower colour: brown Flowering period (indicated in green): **J** F M A M J J A **S** **O** **N** D Soils: Grey sand, sandy clay. Swamps, creek edges. IBRA Distribution: JAF, SWA, WAR Florabase records: 40	**Moderate** Dependent on habitat hydrology requirements on-site.
Grevillea dissectifolia (formerly known as *Grevillea manglesii* subsp. *dissectifolia)*	Proteaceae	P3	-	Habit: Erect shrub, 1-2.5m high. Flower colour: white-pink Flowering period (indicated in green): J F M A M **J** **J** **A** **S** **O** N D Soils: Sands, loam and laterite and near lateritic boulders IBRA Distribution: JAF Florabase records: 24	**High** Species records nearby and mainly north to north-east of survey area.
Hakea oldfieldii	Proteaceae	P3	-	Habit: Open straggling shrub up to 2.5m. Flower colour: white-cream to yellow Flowering period (indicated in green): J F M A M J J **A** **S** **O** N D Soils: Red clay or sand over laterite, seasonally wet flats IBRA Distribution: GES, SWA, AVW, JAF. MAL, ESP Florabase records: 66	**Low** Soil conditions less likely in survey area and occurs mainly south, southeast and east of survey area
Halgania corymbosa	Boraginaceae	P3	-	Habit: Erect shrub, 0.35-1 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils: Gravelly soils, soils over granite. IBRA Distribution: JAF, SWA Florabase records: 18	**Very Low** Species records to the west of the Darling Scarp and either north or east of survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hemigenia microphylla	Lamiaceae	P3	-	Habit: Slender shrub, 0.4-1.8 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Sandy-clay, peaty clay, granite and winter wet depressions. IBRA Distribution: JAF, SWA, WAR Florabase records: 26	**Low - Moderate** Mainly west and south, although localised occurrence south of survey area.
Isopogon autumnalis	Proteaceae	P3	-	Habit: Shrub 0.5-1 m high. Flower colour: cream, yellow Flowering period (indicated in green): **J F M A M J** J A S O N D Soils: Sandy soils. IBRA Distribution: GES, JAF, SWA Florabase records: 59	**Very Low** Records to the west of the Darling Scarp.
Lasiopetalum glutinosum subsp. *glutinosum*	Malvaceae	P3	-	Habit: Shrub to 0.8 m high. Flower colour: pink-purple Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Lateritic gravel and clay, clay loam, sandy clay over granite. Slopes, granite outcrops. IBRA Distribution: AVW, JAF, SWA Florabase records: 48	**Very Low** Records mainly north or west near Darling Scarp.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Lepyrodia heleocharoides	Restionaceae	P3	-	Habit: Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N **D** Soils: Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps. IBRA Distribution: JAF, SWA Florabase records: 20	**Very Low** Mainly west of in southern forested areas
Meionectes tenuifolia	Haloragaceae	P3	-	Habit: Annual semi-aquatic herb, to 0.35 m high. Flower colour: orange-red-brown, green Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Grey sand or grey-brown clay, shallow soils. Seasonally inundated flat, edge of swamp. IBRA Distribution: JAF, SWA Florabase records: 27	**Low** Dependent on suitable habitat.
Stackhousia sp. Red-blotched corolla (A. Markey 911)	Celastraceae	P3	-	Habit: Erect herb or shrub, approximately 0.2 m high. Flower colour: cream-yellow Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Brown loamy sand, clayey sand over laterite, white sandy clay over granite, grey clay. Slopes. IBRA Distribution: AVW, GES, JAF Florabase records: 9	**Very Low** Mainly west and north of survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thysanotus anceps	Asparagaceae	P3	-	Habit: Rhizomatous, leafless perennial, herb, to 0.4 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: White or grey sand, lateritic gravel, laterite. IBRA Distribution: GES, JAF, SWA Florabase records: 17	**Moderate** Recorded west of survey area.
Acacia oncinophylla subsp. patulifolia	Fabaceae	P4	-	Habit: Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Granitic soils, occasionally on laterite. IBRA Distribution: JAF, SWA Florabase records: 31	**Low-Moderate** Recorded mainly to north and north-west.
Aponogeton hexatepalus	Aponogetonceae	P4	-	Habit: Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Flower colour: green-white Flowering period (indicated in green): J F M A M J **J A S O** N D Soils: Mud. Freshwater: ponds, rivers, claypans. IBRA Distribution: JAF, SWA Florabase records: 30	**Very Low** Mainly on Swan Coastal Plain and southern forests.
Calothamnus graniticus subsp. *leptophyllus*	Myrtaceae	P4	-	Habit: Erect, multi-stemmed shrub, 1-2 m high. Flower colour: red Flowering period (indicated in green): J F M A M **J J A** S O N D Soils: Clay over granite, lateritic soils. Hillsides. IBRA Distribution: JAF, SWA Florabase records: 32	**Low** Nearby records within SWA and then occurs of survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Cyanothamnus tenuis	Rutaceae	P4	-	Habit: Procumbent or erect & slender shrub, 0.1-0.5 m high. Flower colour: blue/pink-white Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Laterite, stony soils, granite. IBRA Distribution: JAF, SWA Florabase records: 45	**Low** Mainly west on coastal plain and then on eastern fringes of Jarrah forest.
Drosera occidentalis	Droseraceae	P4	-	Habit: Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Flower colour: pink/white Flowering period (indicated in green): **J** F M A M J J A S **O N D** Soils: White/black sand over yellow clay, yellow sand, moist brown/grey clay/sand, peaty sand, sandy clay. Damp flats, flood plain. IBRA Distribution: JAF, SWA Florabase records: 23	**Moderate-High** Nearby records within coastal plain and on eastern area of Jarrah forest.
Grevillea pimeleoides	Proteaceae	P4	-	Habit: Non-lignotuberous shrub, 0.4-2.4 m high. Flower colour: yellow-orange Flowering period (indicated in green): J F M A **M J J A S O N** D Soils: Gravelly soils over granite. Rocky hillsides. IBRA Distribution: JAF Florabase records: 36	**Low** Species recorded mainly to north of survey area and then localised site near Albany.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Parsonsia diaphanophleba	Apocynaceae	P4	-	Habit: Woody climber, to 10 m high. Flower colour: white/cream & pink Flowering period (indicated in green): **J F** M **A M J** J A **S** O N D Soils: Alluvial soils. Along rivers. IBRA Distribution: JAF, SWA Florabase records: 28	**Very Low** Species occurs on alluvial soils along rivers; mainly on coastal plain and south of survey area.
Pimelea rara	Thymelaeaceae	P4	-	Habit: Shrub, 0.2-0.35 m high. Flower colour: white Flowering period (indicated in green): **J** F M A M J J A S O N **D** Soils: Lateritic soils. IBRA Distribution: JAF Florabase records: 52	**High** Species recorded near survey area.
Senecio leucoglossus	Asteraceae	P4	-	Habit: Erect annual, herb, to 1.3 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Gravelly lateritic or granitic soils. Granite outcrops, slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 45	**High** Species recorded near and within survey area.
Stylidium ireneae	Stylidiaceae	P4	-	Habit: Lax perennial, herb, (0.06-) 0.1-0.28 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: Sandy loam. Valleys near creek lines. IBRA Distribution: JAF, SWA, WAR Florabase records: 30	**High** Species recorded near survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN ONEIL SURVEY AREAS

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Verticordia lindleyi subsp. *lindleyi*	Myrtaceae	P4	-	Habit: Erect shrub, 0.2-0.75 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand, sandy clay. Winter-wet depressions. IBRA Distribution: GES, JAF, SWA Florabase records: 83	**Very Low** Nearby records within SWA. Grows on sand, sandy clay.

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Amaranthaceae		*Ptilotus drummondii*		x		x
		Ptilotus drummondii var. *drummondii*		x		
		Ptilotus manglesii	x	x	x	x
		Ptilotus sp.				x
Anarthriaceae		*Lyginia barbata*		x		x
		Lyginia imberdis		x		
Apiaceae		*Pentapeltis peltigera*	x	x	x	x
		Platysace compressa	x		x	x
		Platysace filoformis		x		x
		Platysace tenuissima	x	x		x
		Platysace sp.			x	x
		Xanthosia atkinsoniana	x	x	x	x
		Xanthosia candida	x	x	x	x
		Xanthosia ciliata		x		
		Xanthosia huegelii	x	x		x
		Xanthosia singuliflora		x	x	x
		Apiaceae sp.			x	
Araliaceae		*Trachymene pilosa*		x	x	x
Asparagaceae		*Dichopogon capillipes*				x
		Lomandra brttanii	x	x		
		Lomandra caespitosa	x	x	x	x
		Lomandra drummondii		x		
		Lomandra hermaphrodita	x	x	x	x
		Lomandra integra	x	x		
		Lomandra micrantha	x	x	x	x
		Lomandra micrantha subsp. micrantha		x		
		Lomandra nigricans		x	x	x
		Lomandra odora		x		
		Lomandra preissii	x	x		x
		Lomandra purpurea	x			x
		Lomandra sericea	x	x	x	x
		Lomandra sonderi	x	x	x	x
		Lomandra spartea	x	x	x	x
		Lomandra sp.		x	x	x
		Sowerbaea laxiflora	x			
		Thysanotus arenarius		x		
		Thysanotus dichotomus	x	x		x
		Thysanotus fastigiatus	x	x		x
		Thysanotus manglesianus		x		x
		Thysanotus sparteus		x		x
		Thysanotus tenellus		x		
		Thysanotus multiflorus	x	x	x	x
		Thysanotus thyrsoideus	x	x	x	x
		Thysanotus sp.		x	x	x
Asteraceae	*	*Conyza sumatrensis*	x			
		Craspedia variabilis	x	x		
		Helichrysum luteoalbum		x		
		Hyalosperma cotula		x		x
	*	*Hypochaeris glabra*	x	x	x	x
		Lagenophora huegelii	x	x	x	x
		Millotia tenuifolia		x		

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Asteraceae		*Ozothamnus cordatus*	x			
(continued)		*Podolepis lessonii*		x		
	*	*Pseudognaphalium luteoalbum*				x
		Pterochaeta paniculata		x		x
		Senecio diaschides	x	x		x
		Senecio hispidulus	x	x	x	x
		Senecio hispidulus var. hispidulus		x		
	P4	*Senecio leucoglossus*	x	x	x	x
		Senecio quadridentatus		x		x
	*	*Senecio vulgaris*		x		
		Senecio sp.		x		x
	*	*Sonchus asper*		x		
	*	*Sonchus* sp.				x
		Siloxerus humifusus		x		
		Trichocline spathulata	x	x	x	x
	*	*Ursinia anthemoides*		x		x
		Waitzia acuminata		x		
		Waitzia suaveolens				x
		Waitzia suaveolens var. suaveolens		x		
		Asteraceae sp.		x		x
Boryaceae		*Borya sphaerocephala*				x
Campanulaceae		*Isotoma hypocrateriformis*		x		
		Lobelia gibbosa		x		x
		Lobelia heterophylla		x		x
		Lobelia rhombifolia		x		
		Lobelia sp.				x
	*	*Wahlenbergia capensis*		x		x
Caryophyllaceae	*	*Petrorhagia dubia*				x
		Caryophyllaceae sp.		x		
Casuarinaceae		*Allocasuarina fraseriana*	x	x	x	x
		Allocasuarina humilis	x	x		x
Centrolepidaceae		*Centrolepis aristata*				x
Colchicaceae		*Burchardia congesta*		x	x	x
Cupressaceae		*Callitris* sp.				x
Cyperaceae		*Baumea vaginalis*		x		
		Cyathochaeta avenacea	x	x		x
		Gahnia decomposita		x	x	x
		Gahnia trifida	x	x		
		Lepidosperma brunonianum		x		
		Lepidosperma drummondii				x
		Lepidosperma gladiatum		x		
		Lepidosperma gracile				x
		Lepidosperma leptostachyum		x		
		Lepidosperma longitudinale		x		x
		Lepidosperma pubisquameum	x	x		x
		Lepidosperma squamatum	x	x		x
		Lepidosperma tenue	x	x		x
		Lepidosperma tetraquetrum		x	x	x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Cyperaceae		*Lepidosperma tuberculatum*		x		x
(continued)		*Lepidosperma* sp.		x	x	x
		Mesomelaena ?graciliceps		x		
		Mesomelaena tetragona	x	x		
		Morelotia octandra	x	x		x
		Netrostylis sp. Jarrah Forest (R. Davis 7391)	x	x	x	x
		Schoenus brevisetis		x		
		Schoenus clandestinus		x		
		Schoenus sp.		x		x
		Cyperaceae sp.			x	
Dasypogonaceae		*Kingia australis*		x		
Dennstaedtiaceae		*Pteridium esculentum*	x	x	x	x
Dilleniaceae		*Hibbertia acerosa*	x	x	x	x
	P1	*Hibbertoa ?ambita*				x
		Hibbertia amplexicaulis	x	x	x	x
		Hibbertia commutata	x	x	x	x
		Hibbertia commutata (hairy)		x		
		Hibbertia diamesogenos		x		
		Hibbertia glomerata subsp. *glomerata*				x
		Hibbertia gracilipes	x			
	P1	*Hibbertia hortiorum*			x	x
		Hibbertia huegelii		x		x
		Hibbertia hypericoides		x		x
		Hibbertia inconspicua	x			
		Hibbertia lasiopus	x	x		x
		Hibbertia lasiopus/quadricolor	x			
		Hibbertia microphylla				x
		Hibbertia ovata		x	x	x
		Hibbertia pachyrrhiza		x		
		Hibbertia perfoliata	x	x	x	x
		Hibbertia pilosa		x		x
		Hibbertia prolata				x
		Hibbertia quadricolor		x		
		Hibbertia rhadinopoda	x			
		Hibbertia silvestris		x		x
		Hibbertia stellaris	x	x		
		Hibbertia sp.			x	x
Droseraceae		*Drosera erythrorhiza*	x	x		
		Drosera platystigma		x		
		Drosera sp.		x	x	x
		Drosera sp. Climbing			x	x
Elaeocarpaceae		*Platytheca galioides*		x		
Ericaceae		*Andersonia aristata*				x
		Andersonia caerulea		x		
		Andersonia lehmanniana				x
		Andersonia sp.				x
		Leucopogon australis	x	x		x
		Leucopogon capitellatus	x	x	x	x
		Leucopogon glabellus		x		
		Leucopogon pulchellus		x		

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Ericaceae		*Leucopogon verticillatus*	x	x	x	x
(continued)		*Leucopogon* sp. Boddington (D. Halford 80746)				x
		Leucopogon sp.		x		x
		Styphelia conostephioides		x		
		Styphelia discolor	x	x	x	x
		Styphelia erectifolia		x		x
		Styphelia nitens	x	x	x	x
		Styphelia pallida	x	x	x	x
		Styphelia propinqua	x	x	x	x
		Styphelia pubescens				x
		Styphelia tenuiflora	x	x	x	x
		Styphelia sp.				x
		Ericaceae sp.			x	
Euphorbiaceae		*Monotaxis gracilis*	x			
		Monotaxis grandiflora		x		
		Monotaxis grandiflora var. *grandiflora*		x		
		Monotaxis occidentalis	x	x	x	x
		Stachystemon vermicularis		x		
Fabaceae		*Acacia alata*	x	x	x	x
		Acacia applanata	x			x
		Acacia barbinervis		x		
		Acacia browniana	x		x	x
		Acacia celstrifolia		x		
		Acacia divergens	x	x	x	
		Acacia drummondii subsp. candolleana	x	x		
		Acacia drummondii subsp. drummondii	x	x	x	x
	*	*Acacia elata*		x		
		Acacia ephedroides				x
		Acacia extensa	x	x		x
		Acacia incurva	x	x		
		Acacia lateriticola		x	x	x
		Acacia nervosa	x	x		x
		Acacia obovata		x		
		Acacia preissiana	x			x
		Acacia pulchella	x	x		x
		Acacia pulchella var. glaberrima		x		
		Acacia saligna	x			x
		Acacia stenoptera		x		x
		Acacia urophylla	x	x		x
		Acacia varia		x		
		Acacia willdenowniana	x	x		x
		Acacia sp.		x		x
		Aotus cordifolia P3		x		
		Bossiaea aquifolium	x	x	x	x
		Bossiaea ornata	x	x	x	x
		Callistachys lanceolata		x		
		Chorizema cordatum		x		x
		Chorizema dicksonii	x			x
		Chorizema rhombeum	x	x		
		Daviesia decurrens	x	x		x
		Daviesia divaricata				x
		Daviesia horrida	x	x		x
		Daviesia incrassata	x	x		x
		Daviesia inflata		x		

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Fabaceae		*Daviesia longifolia*		x		
(continued)		*Daviesia physodes*	x	x		x
		Daviesia preissii	x	x		x
		Daviesia rhombifolia	x	x		x
		Eutaxia parvifolia		x		
		Eutaxia virgata		x		
		Gastrolobium calycinum		x		x
		Gastrolobium ebracteolatum			x	
		Gastrolobium spinosum	x	x		x
		Gompholobium capitatum	x	x		
		Gompholobium confertum	x			
		Gompholbium cyaninum		x		x
		Gompholobium knightianum	x	x		x
		Gompholobium marginatum	x	x	x	x
		Gompholobium polymorphum	x	x	x	x
		Gompholobium preissii	x	x	x	
		Gompholobium preissii		x		x
		Gompholobium tomentosum		x		x
		Gompholobium venustum		x		
		Gompholobium sp.		x		
		Hardenbergia comptoniana		x		
		Hovea chorizemifolia	x	x		x
		Hovea trisperma		x	x	
		Jacksonia furcellata		x		x
		Jacksonia horrida		x		
		Kennedia coccinea	x	x		x
		Kennedia prostrata	x	x	x	x
		Labichea punctata	x			x
		Mirbelia dilatata	x	x		x
		Mirbelia spinosa	x			
		Sphaerolobium linophyllum				x
		Sphaerolobium medium	x	x		x
		Sphaerolobium vimineum		x		
		Sphaerolobium sp.				x
		Templetonia drummondii				x
	*	*Trifolium* sp.		x		
		Fabaceae sp.				x
Gentianaceae	*	*Centaurium erythraea*				
Goodeniaceae		*Dampiera alata*	x	x		x
		Dampiera linearis	x	x	x	x
		Lechenaultia biloba	x	x	x	x
		Scaevola calliptera	x	x	x	x
		Scaevola pilosa	x	x		
		Scaevola sp.				x
Haemodoraceae		*Anigozanthos humilis*				x
		Anigozanthos manglesii		x		x
		Conostylis aculeata	x			
		Conostylis aculeata subsp*. aculeata*				x
		Conostylis pusilla				x
		Conostylis serrulata	x	x	x	x
		Conostylis setigera	x	x		x
		Conostylis setigera subsp. *setigera*	x	x		
		Conostylis setosa	x	x	x	x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Haemodoraceae		*Conostylis sp.*		x		x
(continued)		*Haemodorum discolor*		x		
		Haemodorum ?simplex		x		
		Haemodorum sp.		x	x	
		Haemodoraceae sp.		x	x	x
Haloragaceae		*Glischrocaryon aureum*	x	x		x
		Gonocarpus benthamii				x
		Gonocarpus cordiger	x	x		
		Gonocarpus sp.		x		
Hemerocallidaceae		*Agrostocrinum hirsutum*		x		
		Agrostocrinum scabrum	x			
		Chamaescilla corymbosa	x	x	x	
		Dianella revoluta				x
		Dianella revoluta var. divaricata	x	x		
		Tricoryne elatior	x	x		x
		Tricoryne humilis		x		x
		Tricoryne sp.				x
Hypericaceae	*	*Hypericum perforatum*		x		x
Iridaceae		*Patersonia babianoides*	x	x		
		Patersonia juncea		x		
		Patersonia occidentalis	x	x	x	x
		Patersonia pygmaea	x	x	x	x
		Patersonia rudis	x	x		x
		Patersonia rudis subsp. *rudis*		x		
		Patersonia sp.				x
Lamiaceae		*Hemiandra pungens*		x		x
		Hemigenia incana		x		x
		Hemigenia pritzelii	x	x		x
		Lachnostachys verbascifolia				x
Lauraceae		*Cassytha racemosa*	x	x		
		Cassytha sp.		x	x	x
Lentibulariaceae		*Utricularia multifida*		x		
Lindsaeaceae		*Lindsaea linearis*	x	x		x
Loganiaceae		*Logania serpyllifolia*	x	x		
		Logania serpyllifolia subsp. angustifolia		x		
		Orianthera serpyllifolia				x
Loranthaceae		*Nuytsia floribunda*		x		
Malvaceae		*Lasiopetalum floribundum*	x	x	x	x
		Lasiopelatum glabratum	x	x		x
		Thomasia paniculata	x	x	x	x
Myrtaceae		*Astartea scoparia*	x	x	x	x
		Babingtonia camphorosmae	x	x	x	x
		Beaufortia macrostemon		x		
		Calothamnus planifolius		x		

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Myrtaceae		*Calothamnus planifolius* var. *planifolius*				x
(continued)		*Calothamnus quadrifidus*		x		
		Calytrix ?angulata		x		
		Corymbia calophylla	x	x	x	x
		Darwinia citriodora				x
		Darwinia thymoides				x
		Eucalyptus aspersa		x		x
		Eucalyptus marginata	x	x	x	x
		Eucalyptus megacarpa	x	x	x	x
		Eucalyptus patens	x	x	x	x
		Eucalyptus rudis	x	x		x
		Eucalyptus wandoo				x
		Hypocalymma angustifolium	x	x	x	x
		Hypocalymma cordifolium	x	x	x	x
		Hypocalymma robustum		x		x
		Hypocalymma sp.				x
		Kunzea ericifolia		x		
		Kunzea micrantha		x		
		Kunzea recurva	x	x		x
		Leptospermopsis erubescens		x		x
		Melaleuca incana	x		x	x
		Melaleuca incana subsp. incana	x	x		
		Melaleuca lateritia		x		x
		Melaleuca parviceps		x		x
		Melaleuca pauciflora	x	x	x	x
		Melaleuca preissiana	x	x	x	x
		Melaleuca rhaphiophylla		x		x
		Melaleuca ?subtrigona				x
		Melaleuca trichophylla		x		
		Melaleuca viminea	x	x		x
		Melaleuca viminea subsp. *viminea*		x		
		Melaleuca sp.		x		x
		Pericalymma ellipticum	x	x		x
		Taxandria linearifolia	x	x	x	x
		Verticordia acerosa var. *preissii*				x
		Verticordia densiflora		x		x
		Verticordia densiflora var. *cespitosa*				x
		Verticordia huegelii var. decumbens				x
		Verticordia huegelii var. huegelii		x		
		Verticordia pennigera		x		
		Verticordia plumosa var. plumosa		x		x
		Verticordia serrata var. serrata				x
		Verticordia serrata		x		
		Verticordia sp.				x
		Myrtaceae sp.		x		x
Olacaceae		*Olax benthamiana*	x			x
Orchidaceae		*Caladenia flava*		x		
		Caladenia flava subsp. *flava*		x		
		Caladenia sp.		x	x	
		Cyrtostylis heugelii	x			
		Elythranthera brunonis		x		
		Elythranthera sp.		x		
		Eriochilus dilatatus	x			
		Microtis media	x			

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Orchidaceae		*Pterostylis vittata*	x			
(continued)		*Pterostylis* sp.		x	x	x
		Pyrorchis nigricans	x			
		Thelymitra crinita	x			
		Thelymitra sp.		x		
		Orchidaceae sp.		x	x	x
Orobanchaceae	*	*Orobanche minor*				x
	*	*Parentucellia latifolia*		x		
Oxalidaceae		*Oxalis* sp.			x	
Phyllanthaceae		*Lysiandra calycina*	x	x	x	x
		Poranthera huegelii		x		
Philydraceae		*Philydrella drummondii*		x		
Pittosporaceae		*Billardiera floribunda*	x	x		
		Billardiera fusiformis		x		x
		Billardiera heterophylla	x			
		Billardiera variifolia	x	x		x
		Billardiera sp.		x		x
		Marianthus bicolor	x			
		Marianthus drummondianus	x	x		x
Plantaginaceae	*	*Plantago lanceolata*	x			
Poaceae	*	*Aira caryophyllea*	x	x		x
	*	*Aira cupaniana*		x		
		Amphipogon amphipogonoides	x	x		x
		Amphipogon laguroides subsp. laguroides		x		
		Amphipogon turbinatus		x		
		Austrostipa campylachne		x		
		Austrostpa elegantissima	x			
		Neurachne alopecuroidea	x	x		x
	*	*Pentaschistis airoides*		x		x
		Rytidosperma acerosum		x		
		Rytidosperma caespitosum	x	x	x	x
		Rytidosperma setacea		x		
		Rytidosperma sp.		x		
		Tetrarrhena laevis	x	x	x	x
		Poaceae sp.		x	x	x
Podocarpaceae		Podocarpus drouynianus				x
Polygalaceae		*Comesperma calymega*	x	x		x
		Comesperma confertum	x			
		Comesperma polygaloides		x		
		Comesperma virgatum	x	x		x
		Comesperma sp.				x
Primulaceae	*	*Lysimachia arvensis*				x
		Samolus junceus				x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Proteaceae		*Adenanthos barbiger*		x	x	x
		Adenanthos cygnorum		x		x
		Adenanthos cygnorum subsp. cygnorum		x		
		Adenanthos meisneri				x
		Adenanthos obovatus		x		
		Banksia armata var. *armata*		x		x
		Banksia bipinnatifida subsp. *bipinnatifida*		x		x
		Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*	x	x	x	x
		Banksia dallanneyi subsp. *sylvestris*		x		x
		Banksia grandis	x	x	x	x
		Banksia littoralis	x	x	x	x
		Banksia seminuda	x	x	x	
		Banksia sessilis	x	x		x
		Banksia sphaerocarpa var. *sphaerocarpa*		x		x
		Banksia squarrosa		x		x
		Banksia squarrosa subsp. *squarrosa*		x		
		Conospermum amoenum		x		
		Conospermum amoenum subsp. *amoenum*				x
		Conospermum canaliculatum subsp. canaliculatum				x
		Conospermum capitatum	x	x		
		Conospermum capitatum subsp. *capitatum*				x
		Conospermum capitatum subsp. *glabratum*		x		
		Conospermum stoechadis				x
		Grevillea bipinnatifida		x		x
		Grevillea dissectifolia				x
	P3	*Grevillea diversifolia*		x		x
		Grevillea diversifolia subsp. diversifolia		x		
		Grevillea manglesii subsp. manglesii		x		
		Grevillea monticola				x
		Grevillea pulchella		x		x
		Grevillea pulchella subsp. ascendens		x		x
		Grevillea quercifolia	x	x		x
		Grevillea trifida		x		
		Grevillea wilsonii		x		x
		Hakea amplexicaulis	x	x	x	x
		Hakea cyclocarpa				x
		Hakea erinacea		x		x
		Hakea incrassata	x	x		x
		Hakea lissocarpha	x	x	x	x
		Hakea marginata		x		x
		Hakea prostrata	x	x		x
		Hakea ruscifolia	x	x		x
		Hakea trifurcata		x		x
		Hakea undulata		x		x
		Hakea varia	x	x		x
		Hakea sp.		x		x
		Isopogon crithmifolius		x		
		Isopogon dubius		x	x	x
		Isopogon pallidus				x
		Isopogon sphaerocephalus		x		x
		Persoonia angustiflora	x	x		x
		Persoonia elliptica	x	x		x
		Persoonia longifolia	x	x	x	x
		Petrophile heterophylla		x		
		Petrophile seminuda				x
		Petrophile serruriae		x		x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Proteaceae		*Petrophile striata*	x	x		x
(continued)		*Petrophile* sp.				x
		Stirlingia latifolia		x		x
		Stirlingia simplex		x		
		Synaphea cuneata				x
		Synaphea damopsis	x	x		
		Synaphea gracillima	x	x		
		Synaphea petiolaris	x	x		x
		Synaphea sp.				x
		Xylomelum occidentale	x	x		
Pteridaceae		*Cheilanthes sieberi*				x
Ranunculaceae		*Clematis pubescens*	x	x	x	x
		Ranunculus colonorum	x	x		
		Ranunculus sp.			x	
		Ranunculaceae sp.			x	
Restionaceae		*Alexgeorgea nitens*		x		x
		Desmocladus fasciculatus	x	x	x	x
		Desmocladus flexuosus		x	x	x
		Desmocladus sp.				x
		Hypolaena exsulca	x	x		x
		Lepidobolus chaetocephalus		x		
		Lepidobolus preissianus		x		x
		Lepidobolus preissianus subsp. *preissianus*		x		
		Leptocarpus canus	x	x		
		Leptocarpus coangustatus		x		
		Leptocarpus scariosus	x	x		
		Leptocarpus tenax		x		
		Leptocarpus sp.				x
		Lepyrodia glauca				x
		Lepyrodia riparia		x		
		Loxocarya cinerea	x	x		x
		Restionaceae sp.				x
Rhamnaceae		*Cryptandra arbutiflora*	x	x		x
		Trymalium ledifolium	x	x	x	x
		Trymalium odoratissimum	x	x	x	x
		Trymalium odoratissimum subsp. odoratissimum		x		
Rubiaceae		*Opercularia apiciflora*	x	x		x
		Opercularia echinocephala	x	x	x	x
		Opercularia hispidula	x	x		
Rutaceae		*Asterolasia pallida s*ubsp. *pallida*		x		
		Boronia crenulata	x	x		x
		Boronia crenulata var. *crenulata*				x
		Boronia crenulata subsp*. viminea*		x		
		Boronia fastigiata	x	x	x	x
		Boronia molloyae		x		
		Boronia sp.				x
		Philotheca spicata	x	x	x	x
Santalaceae		*Exocarpos sparteus*		x		
		Leptomeria cunninghamii	x	x	x	x

APPENDIX C: VASCULAR PLANT SPECIES NEAR AND WITHIN THE ONEIL SURVEY AREAS, 1998 TO 2024

Note: *Denotes introduced species; P1 and P4 denote Priority Flora Species (DBCA 2401)

Family		Species	1998	2009	2023	2024
Sapindaceae		*Dodonaea ceratocarpa*		x		x
Stackhousiaceae		*Stackhousia monogyna*	x	x		x
		Tripterococcus brunonis	x	x		x
Stylidiaceae		*Levenhookia pusilla*		x		x
		Levenhookia stipitata				x
		Levenhookia sp.		x		x
		Stylidium affine				x
		Stylidium amoenum	x	x	x	x
		Stylidium bulbiferum				x
		Stylidium brunonianum		x		
		Stylidium calcaratum		x		
		Stylidium canaliculatum	x			
		Stylidium ciliatum				x
		Stylidium dichotomum		x		x
		Stylidium diuroides subsp. diuroides		x		
		Stylidium hispidum				x
		Stylidium junceum	x	x		
		Stylidium piliferum	x	x	x	x
		Stylidium pulchellum		x		
		Stylidium recurvum				x
		Stylidium repens		x		
		Stylidium scariosum				x
		Stylidium schoenoides		x		
		Stylidium thesioides		x		
		Stylidium sp.				x
Thymelaeceae		*Pimelea ciliata*	x	x		x
		Pimelea ciliata subsp. ciliata		x		
		Pimelea lehmanniana	x	x		
		Pimelea spectabilis		x		
		Pimelea suaveolens	x	x	x	x
		Pimelea sp.			x	x
Tremandraceae		*Tetratheca hirsuta*	x	x	x	x
		*Tetratheca hirsuta s*ubsp. v*iminea*				x
Violaceae		*Hybanthus floribundus*	x			x
Xanthorrhoeaceae		*Xanthorrhoea gracilis*	x	x	x	x
		Xanthorrhoea preissii	x	x	x	x
Zamiaceae		*Macrozamia riedlei*	x	x	x	x

APPENDIX D: LOCATION OF PRIORITY SPECIES RECORDED ON ONEIL SURVEY AREAS IN 2024

Note P1 - P4 Prioirty species defined in DBCA 2024a; SCC - State Conservation Code

EASTING	NORTHING	DATUM	GRID REF	SCC	Species	RANK
431660	6405866	GDA94	L4224 3228	P1	Hibbertia ?ambita	2
432618	6404069	GDA94	M4305 3232	P1	Hibbertia horitorum	2
432620	6404311	GDA94	M4305 1632	P1	Hibbertia horitorum	3
431555	6403833	GDA94	L4312 0820	P1	Hibbertia horitorum	1
431551	6403948	GDA94	L4308 4020	P1	Hibbertia horitorum	4
431291	6404314	GDA94	L4308 1604	P1	Hibbertia horitorum	1
436449	6396998	GDA94	N4425 2448	P1	Hibbertia horitorum	3
433940	6395674	GDA94	M4506 3260	P1	Hibbertia horitorum	2
436216	6397595	GDA94	N4421 2432	P1	Hibbertia horitorum	2
436353	6397343	GDA94	N4421 4040	P1	Hibbertia horitorum	2
436349	6397465	GDA94	N4421 3240	P1	Hibbertia horitorum	2
434540	6397949	GDA94	M4419 4040	P1	Hibbertia horitorum	1
437424	6399863	GDA94	N4406 3252	P1	Hibbertia horitorum	1
437301	6399151	GDA94	N4410 4044	P1	Hibbertia horitorum	1
437300	6399265	GDA94	N4410 3244	P1	Hibbertia horitorum	4
437416	6399269	GDA94	N4410 3252	P1	Hibbertia horitorum	3
436704	6399746	GDA94	N4406 4004	P1	Hibbertia horitorum	2
436694	6399864	GDA94	N4406 3204	P1	Hibbertia horitorum	2
436817	6399988	GDA94	N4406 2412	P1	Hibbertia horitorum	2
435372	6399522	GDA94	M4412 1636	P1	Hibbertia horitorum	1
435614	6399032	GDA94	M4416 0852	P1	Hibbertia horitorum	1
436093	6399746	GDA94	N4405 4024	P1	Hibbertia horitorum	1
432247	6403716	GDA94	M4309 1608	P1	Hibbertia horitorum	2
432262	6403596	GDA94	M4309 2408	P1	Hibbertia horitorum	2
432264	6403460	GDA94	M4309 3208	P1	Hibbertia horitorum	2
432382	6403833	GDA94	M4309 0816	P1	Hibbertia horitorum	2
432870	6404070	GDA94	M4305 3248	P1	Hibbertia horitorum	2
432734	6404200	GDA94	M4305 2440	P1	Hibbertia horitorum	2
431906	6403833	GDA94	L4312 0844	P1	Hibbertia horitorum	2
431901	6403707	GDA94	L4312 1644	P1	Hibbertia horitorum	2
431781	6403827	GDA94	L4312 0836	P1	Hibbertia horitorum	2
431651	6403830	GDA94	L4312 0828	P1	Hibbertia horitorum	2
431311	6404430	GDA94	L4308 0804	P1	Hibbertia horitorum	2
436347	6395448	GDA94	N4509 0840	P1	Hibbertia horitorum	2
436826	6396872	GDA94	N4426 3212	P1	Hibbertia horitorum	1
433820	6395800	GDA94	M4506 2452	P1	Hibbertia horitorum	2
433924	6395788	GDA94	M4506 2460	P1	Hibbertia horitorum	2
433811	6396027	GDA94	M4506 0852	P1	Hibbertia horitorum	2
433837	6395918	GDA94	M4506 1652	P1	Hibbertia horitorum	2
433472	6396035	GDA94	M4506 0828	P1	Hibbertia horitorum	2
433467	6395910	GDA94	M4506 1628	P1	Hibbertia horitorum	2
433467	6396144	GDA94	M4502 4028	P1	Hibbertia horitorum	1
433824	6395556	GDA94	M4506 4052	P1	Hibbertia horitorum	1
433704	6396160	GDA94	M4502 4044	P1	Hibbertia horitorum	1
432632	6396506	GDA94	M4501 1632	P1	Hibbertia horitorum	2

APPENDIX D: LOCATION OF PRIORITY SPECIES RECORDED ON ONEIL SURVEY AREAS IN 2024

Note P1 - P4 Prioirty species defined in DBCA 2024a; SCC - State Conservation Code

EASTING	NORTHING	DATUM	GRID REF	SCC	Species	RANK
433456	6396267	GDA94	M4502 3228	P1	Hibbertia horitorum	3
433447	6396399	GDA94	M4502 2428	P1	Hibbertia horitorum	2
433461	6396651	GDA94	M4502 0828	P1	Hibbertia horitorum	2
433576	6396635	GDA94	M4504 0836	P1	Hibbertia horitorum	1
433580	6396766	GDA94	M4426 4036	P1	Hibbertia horitorum	2
433473	6396747	GDA94	M4426 4028	P1	Hibbertia horitorum	1
433348	6396746	GDA94	M4426 4020	P1	Hibbertia horitorum	2
433344	6396877	GDA94	M4426 3220	P1	Hibbertia horitorum	3
435852	6398542	GDA94	N4413 4008	P1	Hibbertia horitorum	4
435860	6398786	GDA94	N4413 2408	P1	Hibbertia horitorum	3
435845	6399022	GDA94	N4413 0808	P1	Hibbertia horitorum	1
436001	6398693	GDA94	N4413 3216	P1	Hibbertia horitorum	3
436099	6398673	GDA94	N4413 3224	P1	Hibbertia horitorum	2
436093	6398550	GDA94	N4413 4024	P1	Hibbertia horitorum	3
434479	6398424	GDA94	M4419 0856	P1	Hibbertia horitorum	1
435712	6398544	GDA94	M4416 4060	P1	Hibbertia horitorum	1
433235	6403714	GDA94	M4310 1612	P3	Grevillea dissectifolia	2
432869	6404170	GDA94	M4305 2448	P3	Grevillea dissectifolia	2
431788	6404307	GDA94	L4308 1636	P3	Grevillea dissectifolia	1
436589	6396638	GDA94	N4501 0856	P3	Grevillea dissectifolia	4
436692	6396504	GDA94	N4502 1604	P3	Grevillea dissectifolia	3
436542	6396872	GDA94	N4425 3256	P3	Grevillea dissectifolia	5
436584	6396754	GDA94	N4425 4056	P3	Grevillea dissectifolia	4
437042	6395660	GDA94	N4506 3228	P3	Grevillea dissectifolia	2
436923	6395673	GDA94	N4506 3220	P3	Grevillea dissectifolia	4
436957	6395787	GDA94	N4506 2420	P3	Grevillea dissectifolia	5
436937	6395906	GDA94	N4506 1620	P3	Grevillea dissectifolia	4
436449	6396998	GDA94	N4425 2448	P3	Grevillea dissectifolia	3
436576	6396978	GDA94	N4425 2456	P3	Grevillea dissectifolia	4
436700	6396821	GDA94	N4426 3204	P3	Grevillea dissectifolia	2
436826	6396872	GDA94	N4426 3212	P3	Grevillea dissectifolia	4
436475	6397101	GDA94	M4425 1648	P3	Grevillea dissectifolia	4
433946	6395920	GDA94	M4506 1660	P3	Grevillea dissectifolia	1
433461	6396651	GDA94	M4502 0828	P3	Grevillea dissectifolia	1
433473	6396747	GDA94	M4426 4028	P3	Grevillea dissectifolia	1
433344	6396877	GDA94	M4426 3220	P3	Grevillea dissectifolia	2
435738	6396873	GDA94	M4428 3260	P3	Grevillea dissectifolia	2
435739	6396748	GDA94	M4428 4060	P3	Grevillea dissectifolia	3
436216	6397595	GDA94	N4421 2432	P3	Grevillea dissectifolia	3
436353	6397343	GDA94	N4421 4040	P3	Grevillea dissectifolia	3
436349	6397465	GDA94	N4421 3240	P3	Grevillea dissectifolia	3
435852	6398542	GDA94	N4413 4008	P3	Grevillea dissectifolia	3
435845	6399022	GDA94	N4413 0808	P3	Grevillea dissectifolia	2
436001	6398693	GDA94	N4413 3216	P3	Grevillea dissectifolia	2
435983	6398556	GDA94	N4413 4016	P3	Grevillea dissectifolia	1

APPENDIX D: LOCATION OF PRIORITY SPECIES RECORDED ON ONEIL SURVEY AREAS IN 2024

Note P1 - P4 Prioirty species defined in DBCA 2024a; SCC - State Conservation Code

EASTING	NORTHING	DATUM	GRID REF	SCC	Species	RANK
433804	6398677	GDA94	M4414 3252	P3	Grevillea dissectifolia	2
435711	6398432	GDA94	M4420 0860	P3	Grevillea dissectifolia	3
435500	6398556	GDA94	M4416 4044	P3	Grevillea dissectifolia	3
435719	6398320	GDA94	M4420 1660	P3	Grevillea dissectifolia	2
435372	6399621	GDA94	M4412 0836	P3	Grevillea dissectifolia	2
434535	6399506	GDA94	M4411 1640	P3	Grevillea dissectifolia	1
434299	6398198	GDA94	M4419 2424	P4	Senecio leucoglossus	1
434422	6397944	GDA94	M4419 4032	P4	Senecio leucoglossus	2
434765	6398179	GDA94	M4419 2456	P4	Senecio leucoglossus	2
434781	6398304	GDA94	M4419 1656	P4	Senecio leucoglossus	2
434646	6398196	GDA94	M4419 2448	P4	Senecio leucoglossus	2
434542	6398184	GDA94	M4419 2440	P4	Senecio leucoglossus	4
434898	6398071	GDA94	M4420 3204	P4	Senecio leucoglossus	2
434548	6398304	GDA94	M4419 1640	P4	Senecio leucoglossus	2
434658	6398309	GDA94	M4419 1648	P4	Senecio leucoglossus	2
434416	6398195	GDA94	M4419 2432	P4	Senecio leucoglossus	2
434781	6398066	GDA94	M4419 3256	P4	Senecio leucoglossus	1
434307	6398066	GDA94	M4419 3224	P4	Senecio leucoglossus	3
434658	6397947	GDA94	M4419 4048	P4	Senecio leucoglossus	1
434774	6397950	GDA94	M4419 4056	P4	Senecio leucoglossus	1
435019	6398184	GDA94	M4420 2412	P4	Senecio leucoglossus	2
435022	6397943	GDA94	M4420 4012	P4	Senecio leucoglossus	2

SUMMARY OF FLORA AND VEGETATION VALUES ON HUNTLY AND LAREGO AREAS

ALCOA OF AUSTRALIA

WA

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

Alcoa of Australia Limited

November 2024



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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BOM:	Bureau of Meteorology
DBCA:	Department of Biodiversity, Conservation and Attractions
DCCEEW:	Department of Climate Change, Energy, the Environment and Water
DPIRD:	Department of Primary Industries and Regional Development
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
MATTISKE:	Mattiske Consulting Pty Ltd
IBRA:	Interim Biogeographical Regionalisation for Australia
PEC:	Priority ecological community
RFA:	Regional Forest Agreement
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Alcoa of Australia Limited's (Alcoa) Western Australia (WA mining operations comprise the Huntly and Willowdale bauxite mines, within the northern Jarrah Forest (NJF) IBRA subregion, Mining Lease 1SA) ML1SA; Figure 1.

Alcoa has approval to mine within ML1SA for the Huntly and Willowdale bauxite mines, subject to submitting annual five-year mine pans and associated environmental management plans known as the Mining and Management Programs (MMP).

The following is a summary of the work completed by E.M. Mattiske and Associates (pre 1994) and Mattiske Consulting Pty. Ltd. (Mattiske Consulting post 1994) for Alcoa of Australia Limited on the respective areas for the Huntly and Willowdale ERD Development 2024.

The Huntly North (O'Neil, Myara and McCoy), Huntly South (Huntly, Del Park, White and Holyoake regions) and Willowdale (Larego and Orion survey areas) lie within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System.

Survey Effort

Due to the survey effort the surveys spanned over multiple months in different years. As indicated for the respective areas, it is apparent that the amount of survey (even prior to the EPA Guidance Statement in 2016b) well exceeded the standards of the earlier period of survey work between 1980's and 1996.

The work has been undertaken over multiple seasons and as the perennial species and landforms and soils are critical to the classification of the site-vegetation types there has been more than enough data to assess the site-vegetation types. In recent years since the delineation of the conservation values of flora species and communities a greater emphasis has been placed on these particular values with baseline flora and vegetation studies, targeted searches and multiple research projects associated with plots and transects over multiple years.

Flora

The flora in the southwest forests includes some 3500 taxa and as such in most historical and recent surveys in the northern Jarrah Forest ranges from 300 to 750 taxa per survey area. In recent decades there has been a growing emphasis on restricted or threatened flora species or those species that may threatened the occurrence of other species. This report concentrates on the conservation significant species and the weed species.

The data collected to date on the threatened and priority flora includes records from Mattiske Consulting since 1980's, Eco Logical (2024) intensive and targeted flora studies in proposed clearance areas in the Willowdale areas in the spring of 2023, *Ecologia* (2024) and Biologic (2024) intensive and targeted flora studies in Huntly-Myara proposed clearance areas in the spring months of 2023.

The early work of Mattiske was undertaken when the native flora species were defined as threatened or priority and as such many of the earlier records have not been included in this report for the Huntly South area as the data is not in a format that can rapidly integrated into this report. The data is available and is intended to be integrated in 2025 into a combined data set. The latter is not a small task as many of the surveys were undertaken prior to current software types.

In summarizing the key potential conservation flora, it is important to recognize that the current practice of radial searches tend to bring in potential species that do not occur in the northern Jarrah Forest, let alone the specific areas as summarized for this report.

The recent works by Mattiske in the Huntly and Willowdale areas have been summarized in relation to coverage of threatened and priority flora species, weeds and site-vegetation types. Mattiske (1985 to 2023 has recorded some ten Priority flora species within the respective areas, namely potentially *Hibbertia ?ambita* (P1), *Hibbertia hortiorum* (P1), *Acacia horridula* (P3), *Conospermum scaposum* (P3), *Grevillea dissectifolia* (P3), *Thysanotus anceps* (P3),*Grevillea pimeleoides* (P4), *Lasiopetalum cardiophyllum* (P4), *Stylidium ireneae* (P4) and *Senecio leucoglossus* (P4), During this period many species have also changed names by specialists and also conservation status so there is an ongoing need to update datasets. An example of the latter is the revision of the *Hibbertia commutata* group by Thiele (2019) which was split into 27 taxa including Priority species. Such gaps in part have been addressed through the recent additional targeted work in 2023.

Eco Logical (2024) preclearance surveys were undertaken in spring 2023 and as a result no threatened flora species and three Priority flora species were recorded in the Willowdale areas. The three Priority flora species included *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1), *Grevillea prominens* (P3) and *Senecio leucoglossus* (P4).

Ecologia (2024) database searches identified 58 significant plant taxa within 20 km of the survey area (excluding records from the Swan Coastal Plain). Only three significant flora species were recorded in the field surveys including *Tetratheca phoenix* (P2), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4). No threatened flora species were recorded in the targeted survey areas.

Biologic (2024) databases searches identified 72 significant plant taxa within the 20km of the survey area. Only four significant flora species were recorded in field surveys including *Acacia horridula* (P3), *Thysanotus anceps* (P3), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4). No threatened flora species were recorded in the targeted survey areas.

Mattiske (2024) database searches identified the potential for 12 threatened flora species and 37 priority flora species to occur in the O'Neil Transport Corridor survey area. Of the threatened flora species, all were considered to have a very low potential of occurring in the O'Neil Transport survey area due to the lack of suitable habitat and also know distributions away from the survey area. A total of 2 priority flora species (*Hibbertia hortiorum* P1 and *Senecio leucoglossus* P4) were recorded in the O'Neil Transport Corridor survey area. The *Hibbertia hortiorum* appeared relatively regularly and in part reflected the recent split of *Hibbertia commutata* into multiple species by Kevin Thiele (2019).

Vegetation

Investigations by Diels (1906), Loneragan (1978), Beard (1979a, 1979b), Abbott and Loneragan (1986), Bell and Heddle (1989) and Dell and Havel (1989) reflect the depth of interest in the patterns of flora and vegetation in the south-west forests. The more regional broad scale mapping by Beard (1979a,1979b) in the northern Jarrah Forest was refined at a more detailed level by Heddle et al. (1980) and Mattiske and Havel (1998) through the expansion of the understanding of the key relationships of landforms and soils and plant species. The work by Heddle et al. (1980) and Mattiske and Havel (1998) led to regional mapping of vegetation complexes and ecological vegetation systems that were similar in approach to that utilized in the Regional Forest Agreement studies for Victorian and Tasmanian forests. A total of 35 site-vegetation types were defined and mapped in the survey areas and additional disturbance, cleared and rehabilitation areas. The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah Forest and as refined and developed by Mattiske over the last 40 years.

These site-vegetation types have been developed and based on the earlier work by Havel (1975a, 1975b) and more recently his Ph.D. Thesis (Havel 2000) where additional details were provided on the approach that is similar to other approaches globally where forests occur as continuums with several key species and a range of species that reflect subtle shifts in landforms, soils and soil moisture availability.

A total of 35 site-vegetation types were defined and mapped in the survey areas and additional disturbance, cleared and rehabilitation areas. The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah Forest and as refined and developed by Mattiske over the last 40 years.

Threatened and Priority Ecological Communities

During the earlier phases of the surveys no Threatened Ecological Communities (TECs) were listed on the survey areas on the Darling Ranges. Recently, it was recognized that the *Empodisma* peatland of southwestern Australia has the potential to occur in the swamps if peat is present. These would occur in the A or AC site-vegetation types. To date the suggested potential locations have not been assessed for the presence of peat; however *Empodisma gracillimum* has been recorded previously in a restricted area by the Mattiske team. This species is largely restricted to coastal areas in the southwest (WAH 1998-) and as such more work is required.

The desktop assessment highlighted several other potential TECs; however these are restricted to the Swan Coastal Plain or the Wheatbelt and as such do not extend into the Jarrah forest area on the Darling Ranges.

There are two priority ecological communities (PECs), as listed at State level by DBCA (2024b, 2024c) that occur within the Huntly North (Myara) survey area; only one of these is a botanical PEC.

The priority ecological communities that occur in the Huntly North survey area are:

- Granite communities of the northern Jarrah forest (P3)
    - Jarrahdale area – Monadnocks, Blue Rock; insufficient information to distinguish discrete community type/s (DBCA 2024b, 2024c).
- Litter Dependant Invertebrate Community of the northern Jarrah Forest (P2)
    - Chandler Block, Northern Jarrah Forest; insufficient evidence that this is a discrete community type (DBCA 2024b, 2024c).

There is a potential that the site-vegetation types associated with granite outcrops (site-vegetation types G and R), and the Cooke vegetation complex as defined by Mattiske and Havel (1998) may have affinities with the PEC.

The alignment of the communities with the DBCA defined PEC raises some issues due to the lack of consistent and detailed data on the granites. Alcoa is currently reviewing these values and this will be refined in conjunction with other data collected during surveys on the G and R site-vegetation types to assist in the refinement of the detail associated with this PEC. The location of the granite are associated with the G and R site-vegetation types as defined in the varying reports.

The significant issue that relates to the granites is the complexity of the structural and floristic components as they reflect varying depths or soil over the outcrop and as such vary from lithic complexes dominated by mosses and lichen species, through heath communities dominated by Proteaceae and Myrtaceae species to open woodlands of Jarrah-Marri or Wandoo over low shrubs on the fringes of the exposed granites.

All survey areas occur within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2024b) and as such were considered during the RFA process.

Groundwater Dependent Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes (Murray 1, Murray 2, Yarragil 1, Yarragil 2, Swamp and Pindalup). The site-vegetation types associated with these vegetation complexes and as such are potential groundwater dependant ecosystems include A, AC, AD, AW, AY, C, CW, W, D, E, SW and PW.

In view of the extensive flora and vegetation studies in the northern Jarrah Forest subregion these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture in the absence of site-vegetation type data.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Acacia divergens, Boronia molloyae, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Eucalyptus patens, Hypocalymma angustifolium, Melaleuca preissiana, Melaleuca viminea* and *Taxandria linearifolia.*

Wetlands of International Importance (Ramsar)

The Peel-Yalgorup System, a listed Ramsar Wetland of International Importance, is located adjacent to the City of Mandurah and more than 40km from the nearest survey area on the Darling Ranges. The Peel-Yalgorup System consists of shallow estuaries, freshwater marshes and coastal saline lakes that include the Harvey Estuary, Peel Inlet, Lake McLarty, Lake Mealup and ten Yalgorup National Park wetlands (DCCEEW 2024f). The fringing vegetation is mainly samphire, rushes, sedges and paperbark communities. The Peel-Yalgorup System supports a wide variety of waterbirds, invertebrates and estuarine and marine fish and is considered the most important area for waterbirds in south-western Australia (DCCEEW 2024f). Whilst these potential values were recognized in the National database search (DCCEEW 2024f) these wetlands occur west of the survey areas.

Dieback Occurrence

The dieback data reflects the most up to date dieback interpretation data from both DBCA and Glevan Consulting for the survey areas. In the survey area the dieback infections are concentrated to the valleys systems. There may be some differences also in coverage and sampling in some of the survey areas.

Dieback as caused by *Phytophthora cinnamomi* influences species and communities in different ways and as such most impacts are concentrated around soils with more seasonal soil moisture levels. In recent studies, the presence of dieback has been taken into consideration in vegetation condition mapping.

Old Growth and Harvesting

Based on data from Department of Biodiversity, Conservation and Attractions, there is limited old growth forests occurring in these respective survey areas. This in part appears to reflect the proximity of historical logging and wood production activities near Jarrahdale and Dwellingup. The data as presented on the history of harvesting in the areas reflects the more recent logging in the pre-mining activities of Alcoa. Some of the valley areas have not been logged for some time and as such reflect the linear patterns of these systems and the differences in overstorey tree species.

1. INTRODUCTION

Mattiske Consulting Pty Ltd (Mattiske) was commissioned by Alcoa of Australia Ltd (Alcoa) to summarize survey efforts to date on flora and vegetation values in the Huntly North, Huntly South and Larego areas as covered by highlighted areas in Figure 1.

1.1 Environmental Legislation and Guidelines

The following key Commonwealth (Federal) legislation relevant to this desktop assessment is:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The following key Western Australian (state) legislation relevant to this assessment include:

- *Biodiversity Conservation Act 2016* (BC Act) and *Regulations* 2018;
- *Biodiversity and Agriculture Management Act 2007* (BAM Act); and
- *Environmental Protection Act 1986* (EP Act).

Further, key Western Australian Guidelines relevant to this assessment includes:

- Environmental Factor Guideline: Flora and Vegetation (Environmental Protection Authority [EPA] 2016a); and
- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).

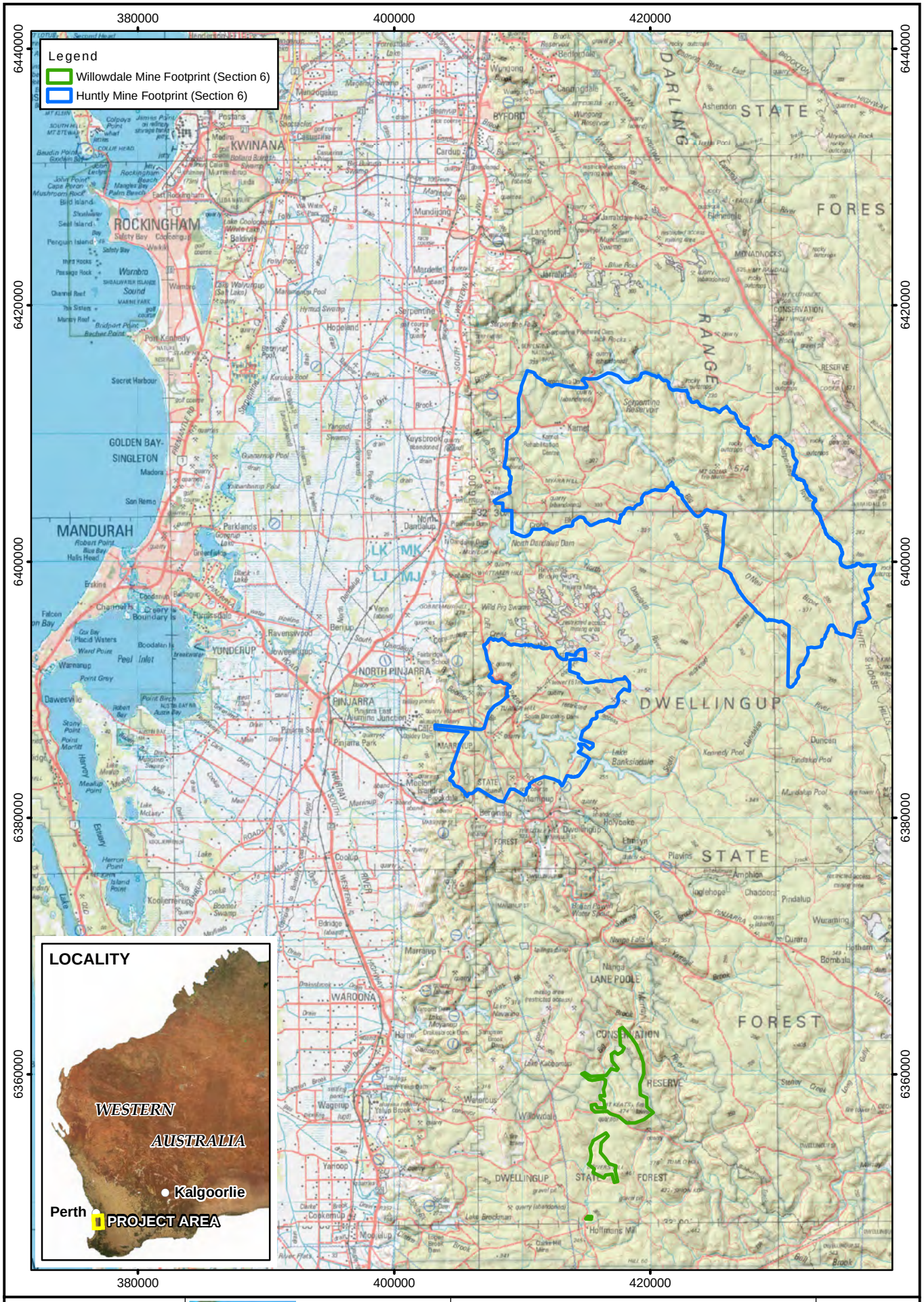
At this juncture it is important to recognize the extent of work undertaken over some 4 decades throughout the northern Jarrah forest by Dr Libby Mattiske and her team members. The work in the northern Jarrah forest commenced for Alcoa in the early 1980's and consequently significant field studies have been undertaken prior to the EPA Guidelines and Technical Guidance statements as releases by the EPA in (2016a and 2016b respectively).

As indicated in the following sections and by the summarizes in the following pages the earlier work exceeded many other projects undertaken in Western Australia at the time. This early work was supplemented by regional studies and assessments undertaken by Dr Mattiske Dr Havel through the 1975 Jarrah forest studies by Havel (1975a and 1975b), System 6 publications (Heddle et al., 1980) and the Regional Forest Agreement mapping Mattiske and Havel (1998) and the comprehensive Ph.D. thesis by Dr Havel (2000). The latter work enabled a comprehensive regional perspective with multiple scales of interpretation to place the detailed work into a regional context.

The latter does not down play the earlier work by authors such as Diels (1906), Lange (1960) and Beard (1979a, 1979b) and the mor recent work by Williams and Mitchell (2001).



Figure 1: Regional Context and Study Areas (note highlighted blue (Huntly North and Huntly South and highlighted green Willowdale areas)



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Date: September 2024 | Rev: A | A4

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Willowdale and Huntly Mine Footprints
Locality

Figure: **2**

2. OBJECTIVES

The objective of this assessment was to summarize the work undertaken to date on the respective areas as highlighted in Figure 2. At this juncture it should be recognized that the guidance statements of the EPA (2016a and 2016b) were introduced after a substantial amount of work had been undertaken in the northern Jarrah forest over some 40 years from the early 1980's to 2016.

The work undertaken for Alcoa prior to the 2016 achieved and would have met many of the current expectations of the EPA. Consequently, while the objective of this report to summarize the information was attempted it was not feasible to capture some of the expected data coverage in several weeks. Therefore it was not feasible to address all of the points raised in the initial review of the draft.

The scope of works (SoW) provided by Alcoa was to undertake a desktop assessment of the Huntly and Willowdale Mine Footprints (Section 6) areas (Study Area; Figure 1; 41,182 ha) and provide a desktop report that consolidates all completed Havel vegetation and targeted flora surveys to date including:

- Summary of surveys completed and survey timing
- Details on survey methodology
- Commentary on vegetation types and association with TECs/PECs, GDEs, and old growth forest.
- Commentary on local and regional distribution of vegetation types
- Commentary on distribution of conservation significant fauna recorded
- Likelihood of Occurrence Assessment of conservation significant flora

3. METHODS

An overview of the timing of the surveys is presented in Figure 3 which reflects the work undertaken for Alcoa on the respective areas between 1980's and 2023. Work is still currently underway in several areas on the ML1SA lease area. The main reports are summarized in the Reference List as attached.

In addition to the baseline flora and vegetation mapping projects (Figure 4), there has been substantial detailed transect and plot work associated with valley systems, creeklines, rehabilitation assessments and detailed studies on specific areas associated with direct and indirect impacts (e.g. Studies on vegetation near haul road crossings).

This report concentrates on the specific survey efforts associated with baseline flora and vegetation studies on the respective areas. The key point to make that since the beginning of the baseline work in the Alcoa lease areas the following minimum standard has been applied with at times additional work added to supplement this approach.

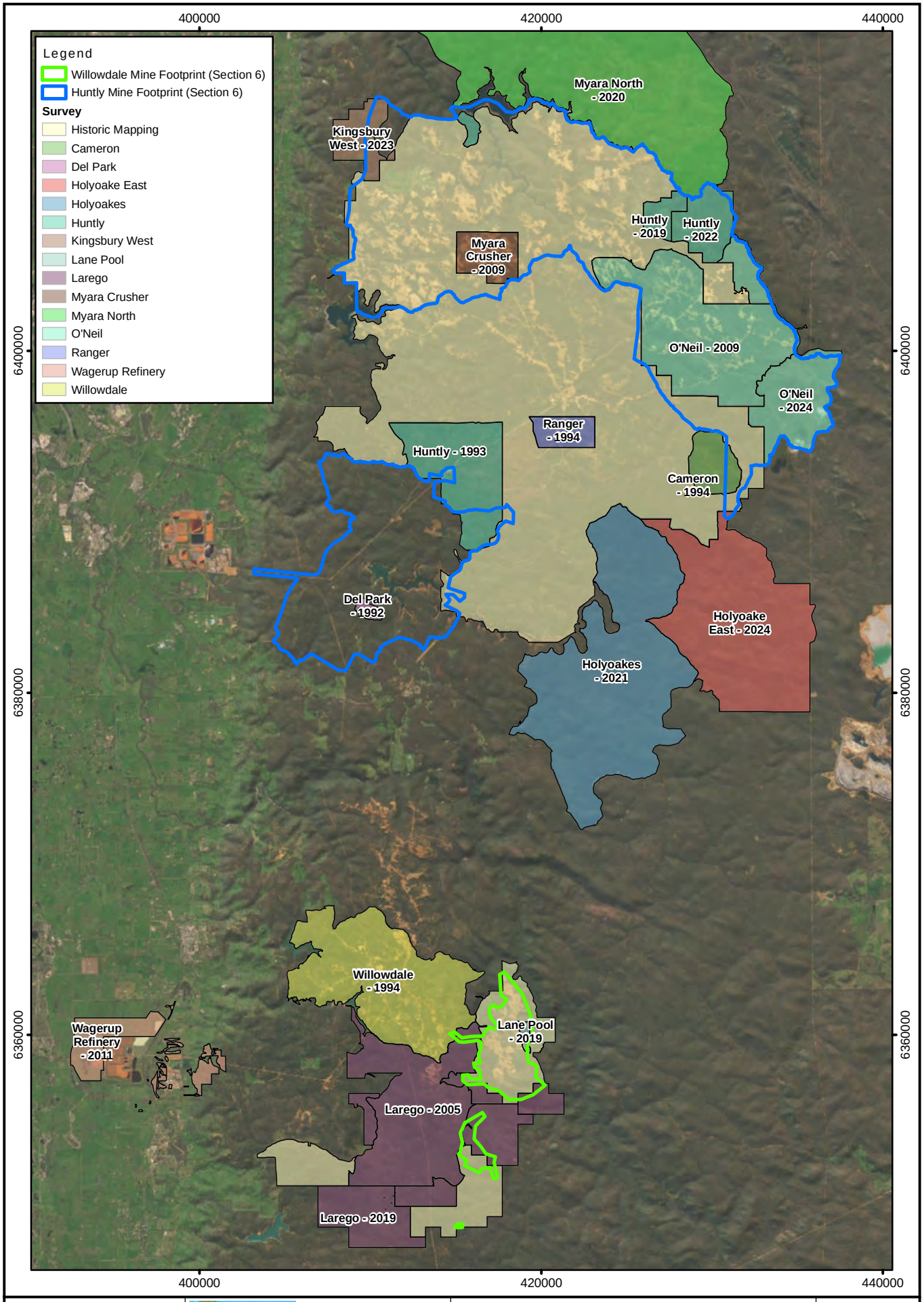
Initially, survey efforts were based on the following methodology and for consistency it has been continued
as the bare minimum in the respective survey areas.

3.1 Methodologies

Initially, the flora studies were based on detailed field collections and then using collections at the State Herbarium to confirm specimens. Databases such as Florabase (WAH1998-), NatureMap (DBCA 2007-) and Dandjoo (2022-) and the *EPBC Act* Protected Matters Search Tool (DCCEEW 2024b) were not available in the early phases of ecological studies in the southwest forests. In addition, the locational data for some species at the State Herbarium relied on notes rather than GPS equipment. Since the early period of recording many species have changed names or been split into multiple taxa by specialist taxonomists. This then entails a need for updating the names of species recorded. This shift in support databases and effort should be acknowledged in any review of work undertaken to date on Alcoa leases and in many other areas of the northern Jarrah forest.

Similarly, the definition and details on the conservation species at a State level was not readily available until the development of Florabase (1998-) and the Department of Biodiversity, Conservation and Attractions TPFL database of threatened and priority flora species. The conservation status at a federal level was similarly restricted initially and now is available more readily through databases managed by the Department of Climate Change, Energy, the Environment and Water. This shift in both datasets at the State and Federal levels over the last 4 decades reflects the increased prioritisation of these values.

In addition, historical documentation and vegetation mapping of the northern Jarrah forest area was initially undertaken at a very broad scale by Diels (1906) and Beard (1979a, 1979b). The detailed studies in the 1970's by Havel through the development of the site-vegetation types (Havel 1975a, 1975b) facilitated research into the definition of groupings within the continuum of the forested areas and also clearer understanding of the relationships between the underlying landforms, soils and site conditions with a range of key species and structural components.. This work was further developed in the late 1970's by Mattiske (nee Heddle) in conjunction with Loneragan and Havel (Heddle et al. 1980) during the System 6 studies of the northern Jarrah forest. In the 1990's further detailed studies during the Regional Forest agreement process the regional mapping of the vegetation complexes by Mattiske and Havel (1998) and Havel (2000) assisted in a further understanding of the vegetation values. As indicated the Pre-European vegetation datasets by Beard and more recent researchers provides a broad scale interpretation of the regional vegetation, whilst the vegetation complexes and the site-vegetation type mapping undertaken by Mattiske provides substantially greater detail on the vegetation values in the northern Jarrah forest.



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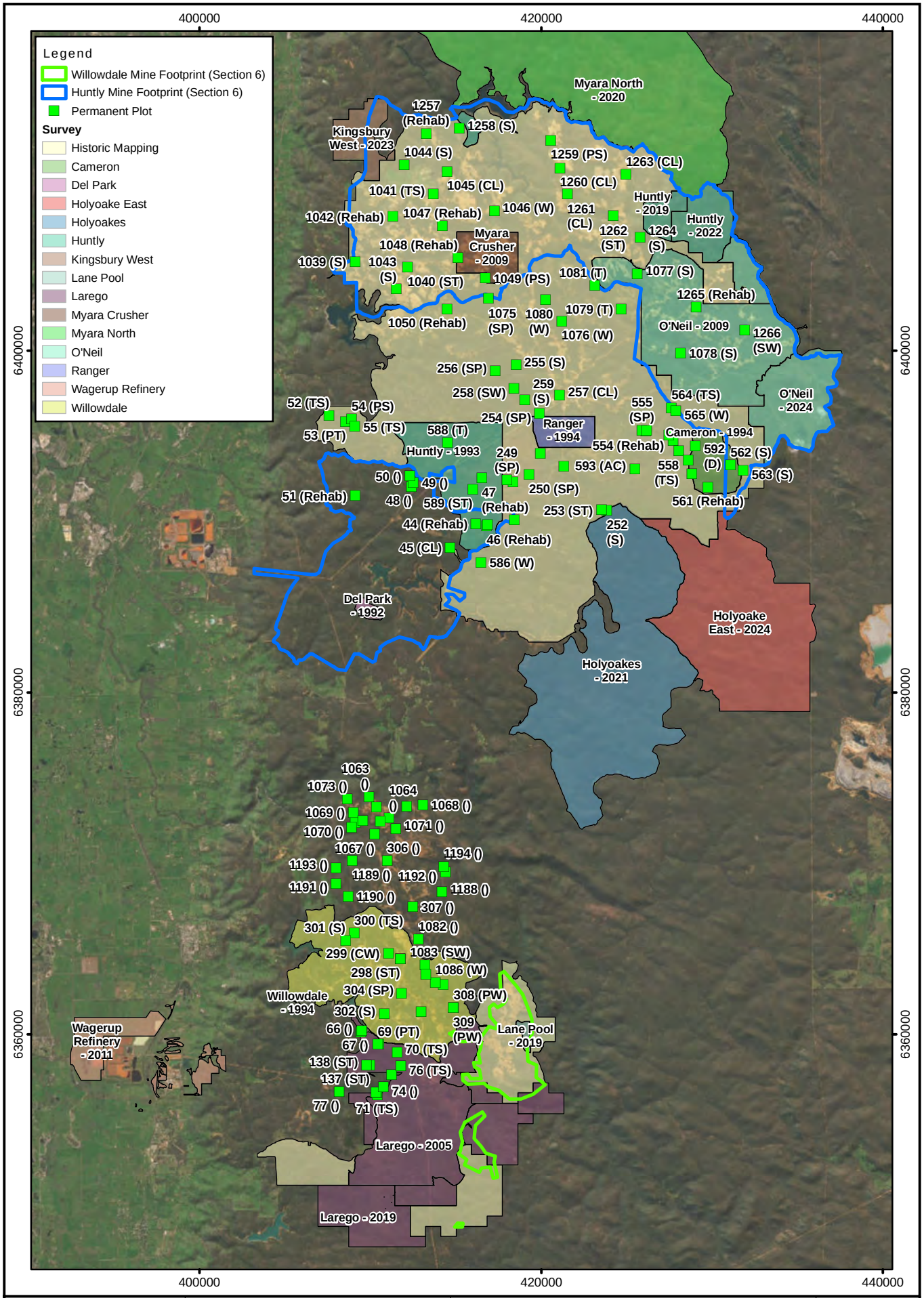
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Willowdale and Huntly Mine Footprints
Survey Effort

Figure: **3**



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Willowdale and Huntly Mine Footprints
Survey Effort Permanent Plots

Figure: **4**

3.2 Site assessments

Sites were pre-designated using a grid system (minimum of 120m x 120m) overlaid on the survey area. These sites were initially located through transects based on foot traverses and refenced to Reference Trees (trees with codes on the lower trunks). It is only through the development of the GPS and IPAD and associated software as well as detailed aerial imagery that survey standards were improved in the northern Jarrah forest. The consistency of the 120m x 120m grid system was related to the Alcoa gridding system of 120m, 60m and 15m and as such provides a sound and consistent approach that predates all the EPA guidance statements (2016a and 2016b).

Additional opportunistic sites were surveyed when changes in the vegetation, representing communities which would otherwise have been missed, were encountered whilst walking between designated survey sites. Examples included additional sites near rapidly changing vegetation, landforms and soils such as on the fringes of the creeklines. Site data was used to define vegetation types for each survey site. This data was then used in combination with aerial imagery and field observations to map the vegetation of the survey area. Opportunistic collections of Threatened, Priority or Declared (plant) pests species were undertaken whilst walking between survey sites. In many instances some conservation species were not recognized or defined in earlier years, some were defined and then delisted by State and Federal agencies as more information was collated, some taxonomic studies refined species and taxon names and consequently distributions so the data each year requires auditing to check current currency (this applies to data collected even with the last 2 years).

The following information was recorded at each vegetation assessment site:

GPS location Easting, Northing and datum;
Soil types gravels, sandy-gravels, sandy-loam-gravels, sandy-loams, loams, clay-loams, clays and peat;
Topography ridge, upper slope, mid-slope, lower slope, valley floor and swamp;
Outcropping type – granite, laterite, dolerite, and quantity – few, moderate, numerous;
Logging history light, moderate or heavy, together with number of stumps within a 20 m radius;
Fire history years since last fire; and
Dieback occurrence *Phytophthora* spp. demarcation – field blazing, coloured flagging on trees, vegetation deaths, either old or recent.

Recent fire events (<3 years restricts vegetation assessments), dieback restricts coverage of species and recent logging raises safety issues in terms of access and difficulty of traversing areas efficiently.

At each site species were ranked according to the scale developed by Havel (1975a, 1975b). Tree and understorey species were assessed separately using the following method.

Tree species

Tree species (*Allocasuarina fraseriana, Banksia grandis, B. littoralis, B. seminuda, Corymbia calophylla, Eucalyptus marginata, E. megacarpa, E. patens, E. rudis, E. wandoo, Melaleuca preissiana, M. rhaphiophylla, Nuytsia floribunda, Persoonia elliptica, P. longifolia* and *Xylomelum occidentale*) were assessed within a 20 m radius from the observation point using the following scale:

0 absent;
1 one or two trees;
2 three to five trees;
3 more than five trees, but contributing less than one third of the total stand;
4 between one third and one half of the total stand; or
5 more than one half of the total stand.

Understorey species

Understorey species were assessed within a 5 m radius from the observation point using the following scale:

0 absent;
1 very rarely seen, only after a careful search;
2 present, observable, but in small numbers only;
3 common locally, but not uniform over the whole area;
4 common over the whole area; or
5 completely dominating the understorey.

The physiological stress was determined for each species within a 20 m radius from the observation point and ranked according to the following scale.

0 healthy, no evidence of stress;
1 odd plant showing signs of stress, not dead;
2 one or two dead plants, near death;
3 scattered stressed plants, (2-4) dead plants around survey site;
4 susceptible plants dying or dead (> 4 plants); or
5 “graveyard” death

During the more recent field survey, botanists had access to all relevant data in the Esri iOS application, Collector for ArcGIS on Apple iPads (provided and maintained by CAD Resources). Data layers accessible in the field included the development envelope, the boundaries of the survey area surrounding the proposed airstrip obstacle light and associated 10 m spaced search transect lines, locations of all known conservation significant flora from both historical and contemporary surveys, and aerial imagery supplied or acquired by CAD Resources.

The locations of any conservation significant flora were recorded with the Esri iOS application, Collector for ArcGIS. During the field survey botanists also had access to detailed data on all potential conservation significant species, which may potentially be encountered during the field survey. The State NatureMap (DBCA 2007-) and EPBC Act Protected Matters Search Tool (DCCEEW 2024b) databases have evolved and developed over these decades with constant needs for updating.

All plant specimens collected during the field surveys were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH 1998-). All plant specimens were identified through comparisons with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH. As noted earlier there are taxonomic revision patterns that influence recordings and data is regularly checked for consistency with current nomenclature.

3.3 Data Analysis

Data analysis of recording sites was undertaken by reference to the interpretation of the presence of keystone species as developed and defined by Havel (1975a and 1975b) and as further developed by Mattiske over some 40 years of extensive vegetation mapping in the northern Jarrah forest. In addition, the position in the landscape, the type or landform and soils and the presence of granite outcrops were taken into consideration in the delineation of site-vegetation types. To enable integration with the surrounding vegetation mapping undertaken over these 40 years by Havel (1975b) and E. Mattiske and Associates (1985-1993) and Mattiske Consulting (2006-2024) the definition of the site-vegetation types were maintained with only slight changes to accommodate local variants.

3.4 Survey Effort

Due to the survey effort the surveys spanned over multiple months in different years. As indicated for the respective areas summarized on Figure 3 it is apparent that the amount of survey (even prior to the EPA Guidance Statement in 2016b) well exceeded the standards of the earlier period of survey work between 1980's and 1996. If one compares the survey effort in these decades with other assessments it is clearly apparent that the latter is supported by the following summary in Table 1. If one then calculates the number of person survey days undertaking 20 grid site assessments and associated searching for species over these areas then more than 2960 days of survey have been undertaken on these respective areas (this excludes the work on the plots and the multiple assessments of the Del Park former CSIRO catchment (Mattiske 1985, 1993). The work has been undertaken over multiple seasons and as the perennial species and landforms and soils are critical to the classification of the site-vegetation types there has been more than enough data to assess the site-vegetation types.

The survey effort to date has included (see Figure 3):

. More than 4,000 kilometres of foot transects which includes the mapping efforts and targeted searches within these respective areas and as such is supplemented by more extensive surveys in the wider northern Jarrah forest for a range of clients. This does not include the foot traverses by Ecologia Environment and Eco Logical Australia Pty Ltd;

. 27,990 recording sites on a grid system which varied slightly from 120m x 120m with some sites closer than this average and some slightly wider. This pattern of recording is consistent with previous ecological studies in the northern Jarrah forest for both Alcoa and other clients in nearby areas;

. Targeted searches of additional extreme sites that are variable within the Yarragil, Pindalup, Swamp and Cooke vegetation complexes;

. A total of 50 permanent plots have been established in the respective areas (Table1, Figure 4) and in the Myara and O'Neil areas detailed studies have been undertaken on the valley systems within the formerly recognised Cameron and Gordon catchments located within the O'Neil over decades of research both by staff of Alcoa and the Mattiske teams of botanists.

. Detailed and consistent data collection on position in the landscape, soils, flora, vegetation and vegetation condition; and

. Consistent interpretation in line with previous site-vegetation studies where there is a greater reliance on key indicator species and a series of site parameters. Such an approach differs from the EPA guidance statement, but if the latter was followed the dominance of some tree and understorey species in the analyses would lead to a less comprehensive delineation of biodiversity values and also be inconsistent with the approach adopted on all other Alcoa leases where detailed flora and vegetation studies have been undertaken in the past by the Mattiske team and site personnel.

A overview of the timing of the surveys is presented in Figure 3 which reflects the work undertaken for Alcoa on the respective areas between 1980's and 2023. In addition to the baseline flora and vegetation mapping projects, there has been substantial detailed transect and plot work associated with valley systems, creeklines, rehabilitation assessments and detailed studies on specific areas associated with direct and indirect impacts (e.g. Studies on vegetation near haul road crossings).

Initially, survey efforts were based on the following methodology and for consistency it has been continued as the bare minimum in the respective survey areas. Most site-vegetation type studies were undertaken over multiple seasons in different areas and details plot and transect work in spring months. As the site-vegetation type key indicators are perennial unless there were fires or dieback the seasonal efforts did not impact the interpretations of the communities.

Table 1: Summary of Survey Effort on these specific Huntly North, Huntly South and Willowdale Areas (does not include distance from plot and transect studies or targeted work)

Area	Survey Timing	Area (ha)	No. of Grid Sites	No. of Permanent Plots (excludes rehabilitation plots)	Traverses on Grid Systems and Targeted searches
Huntly Mine Footprint – North	Multiple seasons 1990 to1994, (plots and transects in spring), Multiple seasons in 2009, 2019, 2022, 2024	29322.979	19006	15 older and 30 new	>2800 km
Huntly Mine Footprint – South	Multiple seasons 1985, 1988, 1993 and pre-1993	9273.800	6,010	5 older	>900 km
Willowdale Mine Footprint	2005, March to July 2019	2136.062	2.974	0 in area, mostly west of area	>300km
TOTAL	1985 - 2024	41182.842	27990	50 (within the Huntly North, Huntly South and Willowdale areas)	>4000 km

Note: some of historical work on Huntly South in the 1980's and 1990's predated digital capture and as such is not included in the following summary. It is recognized that capture of the older work is required for Del Park CSIRO catchment (done twice) and remainder of Huntly South once in period from 1979 to 1993.

Targeted searches includes the detailed work by Mattiske, Biologic Environmental, *Ecologia* Environment and Eco Logical Australia Pty Ltd. Initially targeted searches were 120m apart transects and the over time the recent work has increased to 20m transect spacing in 2023/2024.

3.5 Survey Limitations

A general assessment was made of the surveys against a range of factors that may have limited the outcomes and conclusions of the surveys (Table 2).

Table 2: Summary of Potential Survey Limitations

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Reference resources such as mapping by Havel 1975a and 1975b, Beard 1979, Heddle et al 1980, Mattiske and Havel 1998, previous vegetation mapping completed for Alcoa by E.M Mattiske and Associates (pre 1994) and Mattiske Consulting Pty Ltd (post 1994) together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora, which were the focus of the present survey were thoroughly sampled on a grid pattern within the survey area and additional species were recorded during the surveys and in areas where more detailed studies were undertaken on transects and plots in a variety of landforms, soils, vegetation types.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Minor constraint:** The survey areas were sampled on a grid pattern. The botanists undertaking the field surveys have had extensive experience working with the flora of the Jarrah forest. Any flora which could not be identified in the field was collected for subsequent identification. In some instances the survey efforts were undertaken in several seasons and as such in many ways this assisted in the coverage of some annual species.
Mapping reliability	**Not a constraint:** The vegetation were assessed on a grid pattern within the survey area. This together with opportunistic survey sites will provide high quality data enabling the survey area to be mapped with a high level of confidence. The site-vegetation type interpretations rely on perennial species along with landforms and soil types so the types can be identified at any time the seasonal conditions are not a constraint.
Timing, weather, season, cycle	**Minor constraint:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). With regard to the conservation significant flora, the majority identified as potentially occurring within the survey area can be recorded out of season with the exception of some orchid species which do not flower as regularly and some *Drosera* species. In view the efforts spanning spring months as well on the various areas, this is considered to be a minor constraint.
Disturbances (fire flood, accidental human intervention, *etc*.)	**Minor constraint:** Survey efforts largely have been undertaken after 3 years since any fires in the forests. Therefore these have placed some constraint on mapping times, but as such this is considered to have been a minor constraint.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** Vehicle access was not restricted in the survey areas.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** All botanists had direct and recent experience working in the Jarrah Forest and working for Alcoa, and thus were familiar with the local flora and vegetation values. Dr Mattiske has more than 40 years of ecological experience in flora and vegetation studies in the southwest forests. The more experienced staff over many years have also contributed substantially to work in the southwest forests and as such many have had more than 5 years of experience in the forest areas.

4. KEY VALUES

The geology, soils and landforms all influence the occurrence of flora and vegetation of the area and are described in this section. Potential flora, including threatened, priority and introduced species are described, along with possible vegetation communities, and placed within a local and regional context.

4.1 DBCA Estate

The survey areas are situated in State Forest within ML1SA (Figure 5) in Huntly North and Huntly South areas and the Willowdale extends slightly from the State Forest into a Conservation Park and Lane Poole Reserve which have been declared since the initial work was undertaken. The northern area abuts and overlaps the survey area in Huntly North (this is a gap in coverage of the site-vegetation type mapping for the Huntly North areas, see section on site-vegetation types below).

4.2 Geology, Soils and Topography

The survey areas are situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion encompasses the area to the east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of the Yilgarn Craton at an average elevation of 300 m (Beard 1990). The area is capped by extensive lateritic duricrust, dissected by drainage lines and broken by occasional granite hills. In the eastern section, the laterite becomes deeply dissected until it compresses isolated remnants. The duricrusted plateau of the Yilgarn Craton is characterised by lateritic gravels, consisting of 5 m or more of ironstone gravels in a yellow sandy matrix, and related lateritic podzolic soils with ironstone gravels in a sandy surface horizon. These overlay mottled yellow-brown clay subsoils and hard setting loamy soils, which become evident in the east (Beard 1990).

Furthermore, Western Australia is divided into twelve Systems, separated by natural and demographic boundaries (Department of Conservation and Environment 1980). The survey area lies within the Darling System (as known as System 6), which is further divided into provinces, with the survey area lying in The Darling Plateau province (Department of Conservation and Environment 1980).

The underlying geological units of The Darling Plateau province have been defined by Churchward and McArthur (1980), with three main landform and soil units occurring within the survey areas, these are:

Darling Scarp: Very steep slopes with shallow red and yellow earths and much rock outcrop.

Dwellingup: Gently undulating landscape with duricrust on ridges; sands and gravels in shallow depressions.

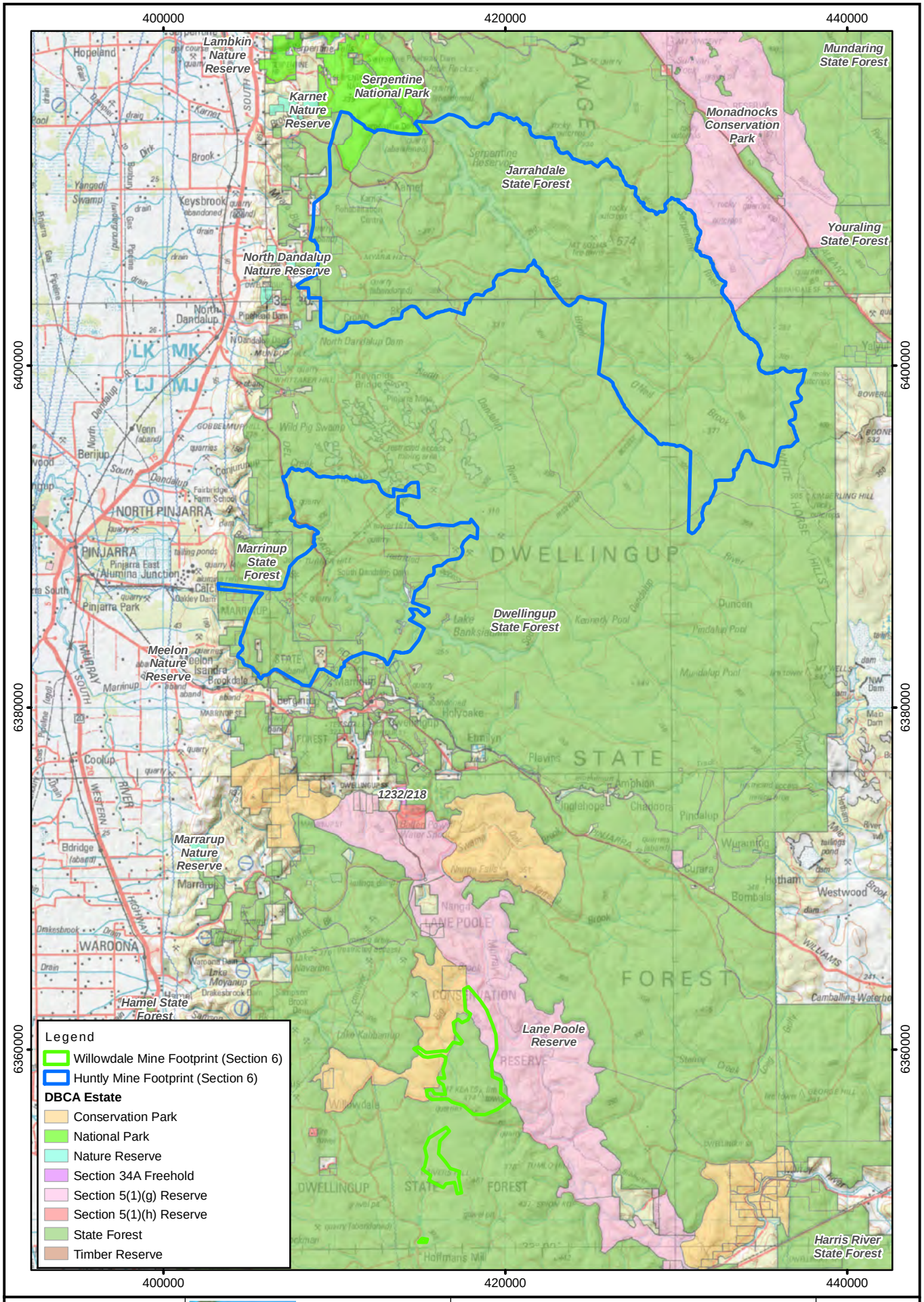
Helena: Very deeply incised valleys with steep rocky slopes and some shallow red or yellow earths.

Murray: Deeply incised valleys with red and yellow earths on slopes, narrow alluvial terraces.

Yarragil: Valleys of the western part of the plateau; sandy gravels on the slopes; orange earth in swampy floors.

Pindalup: Valleys of the central part of the plateau , gravelly duplex soils on slopes; some rock outcrop; grey sands, duplex yellow soils and orange earths in broad floors.

Cook: Hills rising above general plateau level ; mainly laterite but with some rock outcrop.



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Willowdale and Huntly Mine Footprints
DBCA Estates

Figure: **5**

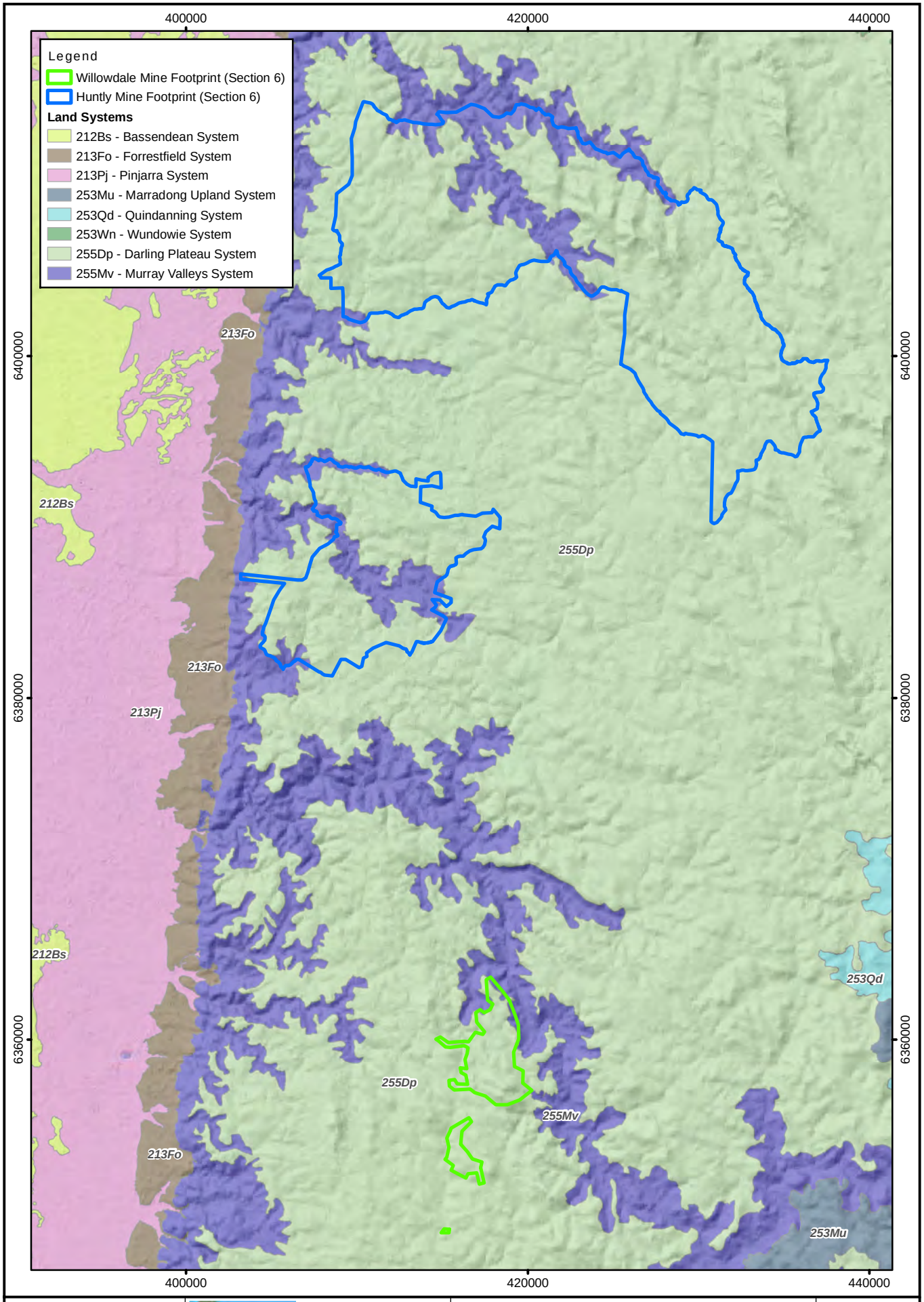
The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the survey areas (Figure 6, Table 3) includes:

- **Darling Plateau System (255Dp):** Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah- marri-wandoo forest and woodland.

- **Murray Valleys System (255Mv):** Western Darling Range from the Avon Valley to Harvey. Deeply incised valleys with Red loamy earths, shallow duplexes and rock outcrop and Jarrah-marri-wandoo forest and woodland

Table 3: Extent of Land Systems intersecting the Survey areas

and System	Mapping Unit	Total Extent (ha)	Total Area (ha)	Proportion of Current Extent (%)
Huntly North - Darling Plateau System	255Dp	820265.77	25178.89	3.07
Huntly North - Murray Valleys System	255Mv	132255.57	4144.09	3.13
Huntly South - Darling Plateau System	255Dp	820265.77	7622.73	0.93
Huntly South - Murray Valleys System	255Mv	132255.57	2101.07	1.59
Willowdale - Darling Plateau System	255Dp	820265.77	2028.96	0.25
Willowdale - Murray Valleys System	255Mv	132255.57	107.10	0.08



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Willowdale and Huntly Mine Footprints
Land Systems

Figure: **6**

4.3 Regional Vegetation

The survey area is situated within Beard's (1990) Northern Jarrah Forest subregion of the Southwest Province. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. Dell and Havel (1989) broadly classified the Jarrah Forest as an open forest in its northern extent and as a tall forest in its southern extent. In lower rainfall areas towards the east trees decrease in size, forming woodlands or low forests. This dry sclerophyllous forest typically comprises a dominant *Eucalyptus marginata* and *Corymbia calophylla* overstorey, a mid-storey of *Allocasuarina fraseriana* (Sheoak), *Banksia grandis* (Bull Banksia), *Persoonia longifolia* (Snottygobble), *Persoonia elliptica* (Spreading Snottygobble), and a groundcover of woody shrubs with grass trees *Xanthorrhoea preissii*, *Kingia australis* and the cycad *Macrozamia riedlei* (Dell and Havel 1989).

The Pre-European vegetation system present within the survey areas (Figure 7, Table 4) includes:

1. **West Darling System**

   Vegetation Association 3.3: Mainly jarrah and marri *Eucalyptus marginata, Corymbia calophylla.*
   Vegetation Association 128: Bare areas; rock outcrops.

2. **West Darling System**

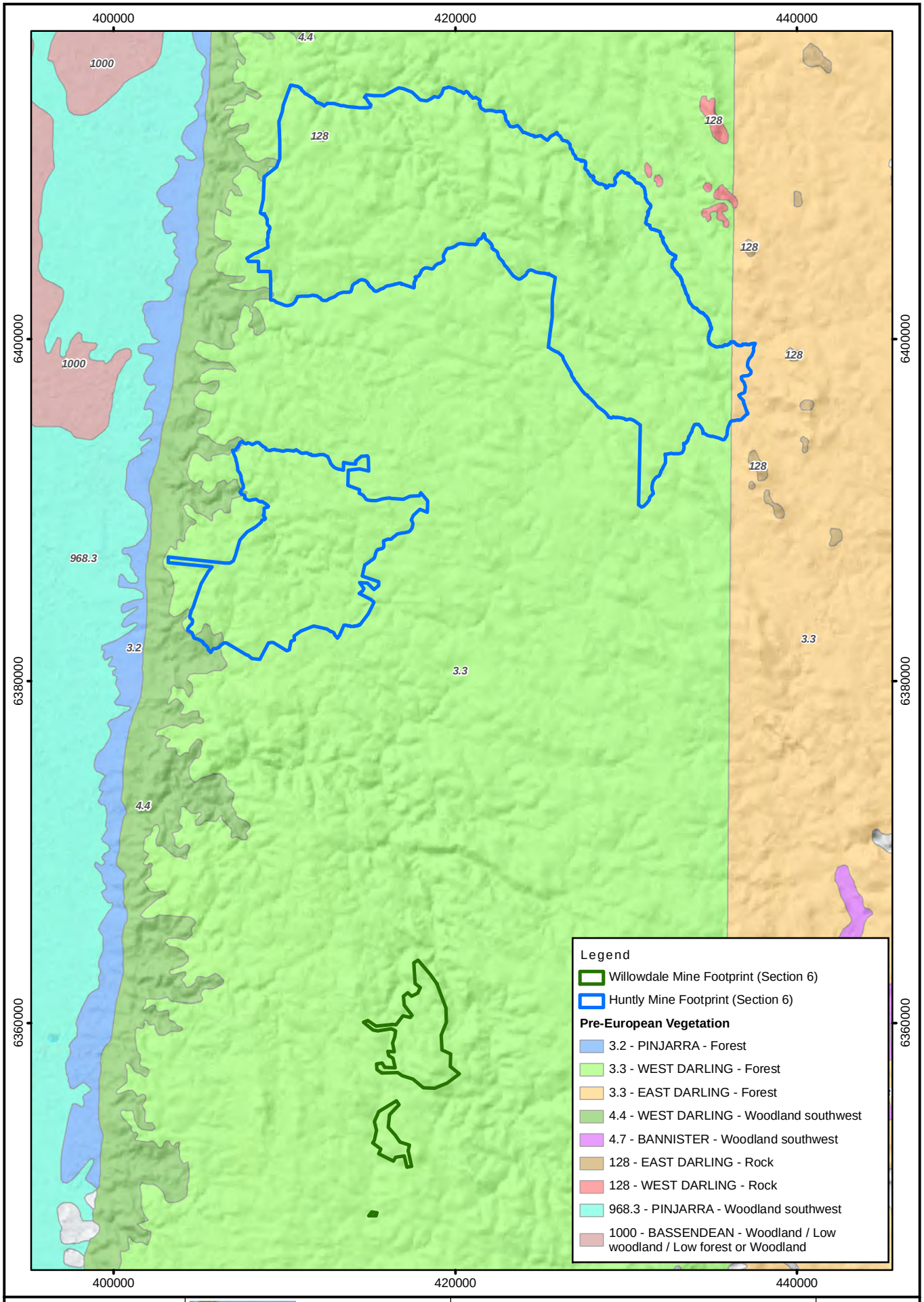
   Vegetation Association 4.4: Jarrah, marri and wandoo *Eucalyptus marginata, Corymbia calophylla, Eucalyptus. wandoo.*

3. **East Darling System**

Vegetation Association 3.3: Mainly jarrah and marri *Eucalyptus marginata, Corymbia calophylla*

Table 4: Extent of Pre-European Vegetation intersecting the Survey areas

Pre-European Vegetation	Mapping Unit	Total Extent (ha)	Total Area (ha)	Proportion of Current Extent (%)
Huntly North – West Darling	128	1449.098	27.82	1.92
Huntly North – East Darling	3.3	303349.645	398.87	0.13
Huntly North – West Darling	3.3	485225.883	28884.16	5.95
Huntly North – West Darling	4.4	52122.777	12.13	0.02
Huntly South – West Darling	3.3	485225.883	9571.67	1.97
Huntly South – West Darling	4.4	52122.777	152.13	0.29
Willowdale – West Darling	3.3	485225.883	2136.06	0.44



N

0 2 4 km

Scale: 1:300,000
MGA94 (Zone 50)

CAD Ref: a1992_F044_08

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Willowdale and Huntly Mine Footprints

Pre-European Vegetation

Figure: **7**

4.4 Vegetation Complexes

Heddle *et al.* (1980) and Mattiske and Havel (1998) described the dominant pre-European vegetation of the Darling System in a series of vegetation complexes (Regional Forest Agreement vegetation complexes) and determined how they relate to the landforms, soils and climatic conditions. Nine broad vegetation complexes occur in the survey areas (Figure 8, Table 5), these are:

Cooke (Ce): Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata – Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp*. thalassica – Corymbia calophylla* (semi-arid and arid zones) and on the deeper soils adjacent to outcrops closed heath of Myrtaceae-Proteaceae species and lithic complex on granite outcrops and associated soils in all climatic zones with some *Eucalyptus laeliae* (semi-arid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to perarid zones).

Darling Scarp (DS2): Mosaic of open forest of *Eucalyptus marginata subsp. marginata – Corymbia calophylla*, with some admixtures with *Eucalyptus laeliae* in the north (subhumid zone) with woodland of *Eucalyptus wandoo* (subhumid and semiarid zones), low woodland of *Allocasuarina huegeliana* on shallow soils over granite outcrops, closed heath of Myrtaceae – Proteaceae species and lithic complex on or near granite outcrops in all climate zones.

Dwellingup 1 (D1): Open forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.

Dwellingup 2 (D2): Open forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones.

Dwellingup 4 (D4): Open forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones.

Helena 1 (He1): Mosaic of open forest of C*orymbia calophylla – Eucalyptus patens - Eucalyptus marginata* subsp. *marginata* with some *Eucalyptus rudis* on the deeper soils ranging to closed heath and lithic complex on shallow soils associated with granite on steep slopes of valleys in humid and subhumid zones.

Murray 1 (My1): Open forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla - Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis – Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones.

Pindalup (Pn): Open forest of *Eucalyptus marginata* subsp. *thalassica – Corymbia calophylla* on slopes and open woodland of *Eucalyptus wandoo* with some *Eucalyptus patens* on the lower slopes in semiarid and arid zones.

Yarragil 1 (Yg1): Open forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.

Yarragil 2 (Yg2): Open forest of *Eucalyptus marginata* subsp. *thalassica - Corymbia calophylla* on slopes, woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.

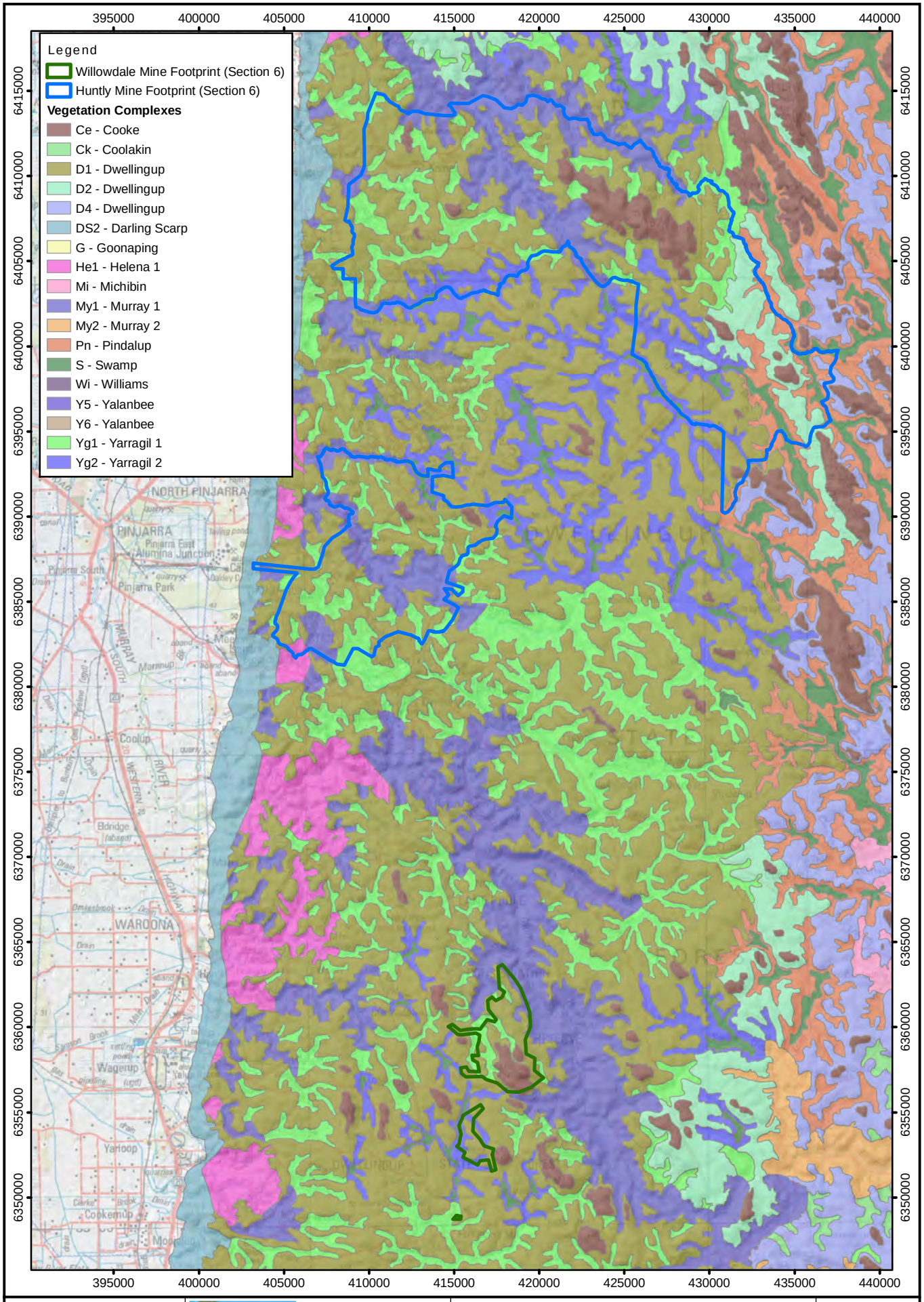
Swamp (S): Mosaic of open woodland of *Melaleuca preissiana – Banksia littoralis,* closed scrub of Myrtaceae spp., closed heath of Myrtaceae spp., and sedgelands of *Baumea* and *Leptocarpus* spp. On seasonally wet and moist sand, peat and clay soils on valley floors in all climatic zones.

More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area falling within the Northern Jarrah Forest subregion (JF1) of the Jarrah Forest (JAF) Region (DCCEEW 2024c). The vegetation of the Northern Jarrah Forest subregion consists of Jarrah – Marri forest, with Bullich and Blackbutt in the valleys to the west, grading to Wandoo and Marri woodlands to the east. Heath vegetation is the common understorey of forests and woodlands and occurs on granite rocks. The majority of the diversity between communities in this subregion occurs on lower slopes and near granite soils (Williams and Mitchell 2001).

Table 5: Extent of Vegetation Complexes intersecting the SurveyaAreas

Note: Total extent relies on data managed by DBCA for representation of vegetation complexes

Area (Blocks)	Vegetation Complex	Vegetation Code	Total Extent (ha)	Area of Intersection with the Huntly and Larego survey areas (ha)	Proportion of Current Extent (%)
Huntly North	Cooke	Ce	51872.103	2241.302	4.32
	Dwellingup 1	D1	297624.846	11950.490	4.01
	Dwellingup 2	D2	120755.000	2190.442	1.81
	Dwellingup 4	D4	187588.996	87.951	0.05
	Murray 1	My1	97562.811	4229.121	4.34
	Pindalup	Pn	236540.595	1472.212	0.62
	Swamp	S	76245.982	621.429	0.82
	Yarragil 1	Yg1	113828.123	4038.352	3.55
	Yarragil 2	Yg2	71234.370	2491.680	3.50
Huntly South	Cooke	Ce	51872.103	140.558	0.27
	Darling Scarp	DS2	45933.954	13.400	0.03
	Dwellingup 1	D1	297624.846	4708.344	1.58
	Helena 1	He1	22572.756	72.890	0.32
	Murray 1	My1	97562.811	2286.048	2.34
	Swamp, S	S	76245.982	131.005	0.17
	Yarragil 1	Yg1	113828.123	2041.258	1.79
	Yarragil 2	Yg2	71234.370	330.298	0.46
Willowdale	Cooke	Ce	51872.103	399.662	0.77
	Dwellingup 1	D1	120755.000	1127.142	0.93
	Murray 1	My1	97562.811	143.500	0.15
	Swamp	S	76245.982	12.214	0.02
	Yarragil 1	Yg1	113828.123	330.806	0.29
	Yarragil 2	Yg2	71234.370	122.738	0.17



N

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Scale: 1:301,057
MGA94 (Zone 50)

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Willowdale and Huntly Mine Footprints
Vegetation Complexes

Figure: **8**

4.5 Threatened and Priority Ecological Communities

During the earlier phases of the surveys no Threatened Ecological Communities (TECs) were listed on the survey areas on the Darling Ranges. Recently, it was recognized that the *Empodisma* peatland of southwestern Australia has the potential to occur in the swamps if peat is present. These would occur in the A or AC site-vegetation types. To date the suggested potential locations have not been assessed for the presence of peat; however *Empodisma gracillimum* has been recorded previously in a restricted area by the Mattiske team. This species is largely restricted to coastal areas in the southwest (WAH 1998-) and as such more work is required.

The desktop assessment highlighted several other potential TECs; however these are restricted to the Swan Coastal Plain or the Wheatbelt and as such do not extend into the Jarrah forest area on the Darling Ranges.

There are two priority ecological communities (PECs), as listed at State level by DBCA (2024b, 2024c) that occur within the Huntly North (Myara) survey area; only one of these is a botanical PEC.

The priority ecological communities that occur in the Huntly North survey area are:

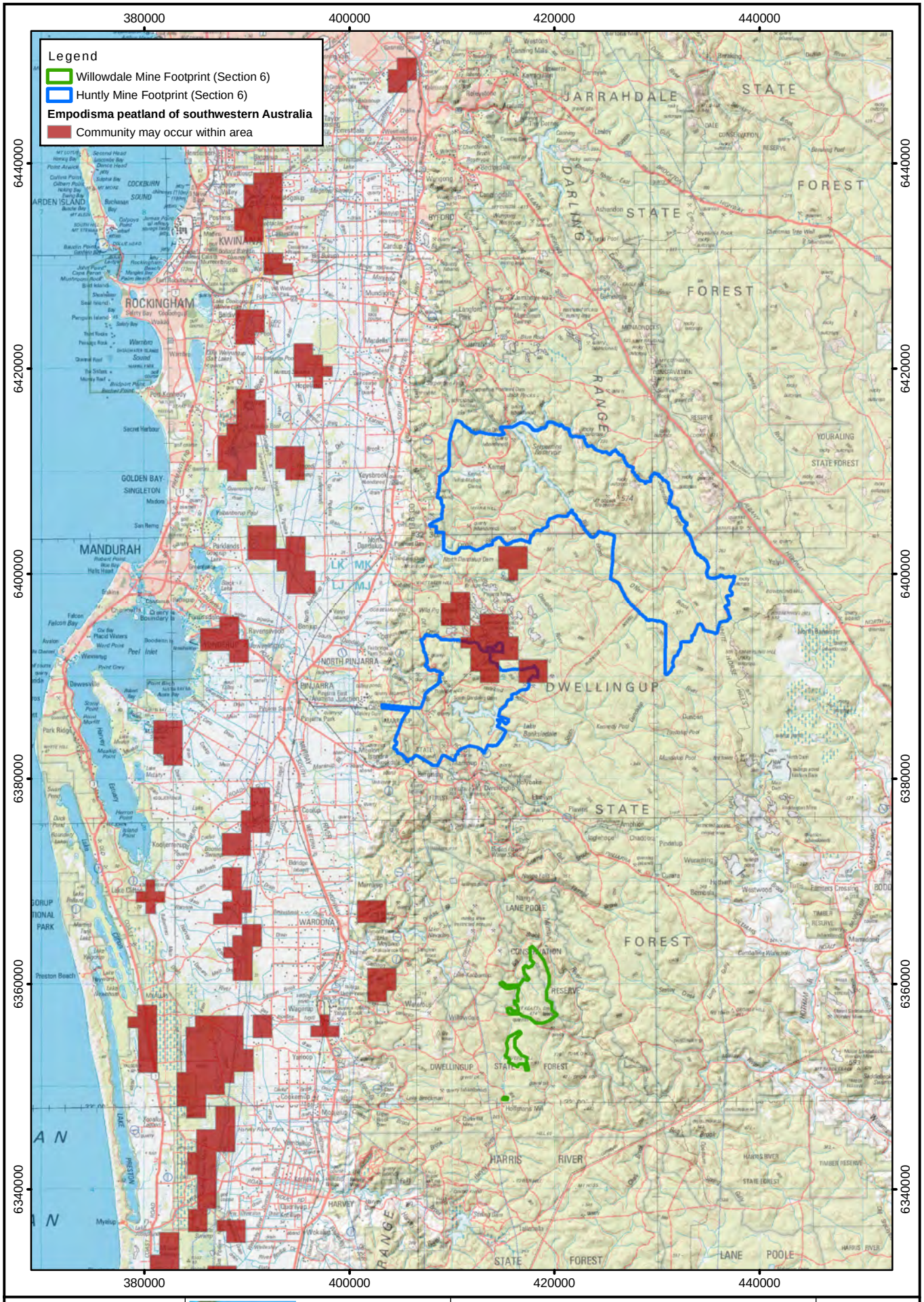
- Granite communities of the northern Jarrah forest (P3)
    - Jarrahdale area – Monadnocks, Blue Rock; insufficient information to distinguish discrete community type/s (DBCA 2024b, 2024c).
- Litter Dependant Invertebrate Community of the northern Jarrah Forest (P2)
    - Chandler Block, Northern Jarrah Forest; insufficient evidence that this is a discrete community type (DBCA 2024b, 2024c).

There is a potential that the site-vegetation types associated with granite outcrops (site-vegetation types G and R), and the Cooke vegetation complex as defined by Mattiske and Havel (1998) may have affinities with the PEC.

The alignment of the communities with the DBCA defined PEC raises some issues due to the lack of consistent and detailed data on the granites. Alcoa is currently reviewing these values and this will be refined in conjunction with other data collected during surveys on the G and R site-vegetation types to assist in the refinement of the detail associated with this PEC. The location of the granite areas is summarize on Figure 10 and as such these areas are associated with the G and R site-vegetation types as defined in the varying reports.

The significant issue that relates to the granites is the complexity of the structural and floristic components as they reflect varying depths or soil over the outcrop and as such vary from lithic complexes dominated by mosses and lichen species, through heath communities dominated by Proteaceae and Myrtaceae species to open woodlands of Jarrah-Marri or Wandoo over low shrubs on the fringes of the exposed granites.

All survey areas occur within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2024b) and as such were considered during the RFA process.



N

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Scale: 1:500,000
MGA94 (Zone 50)

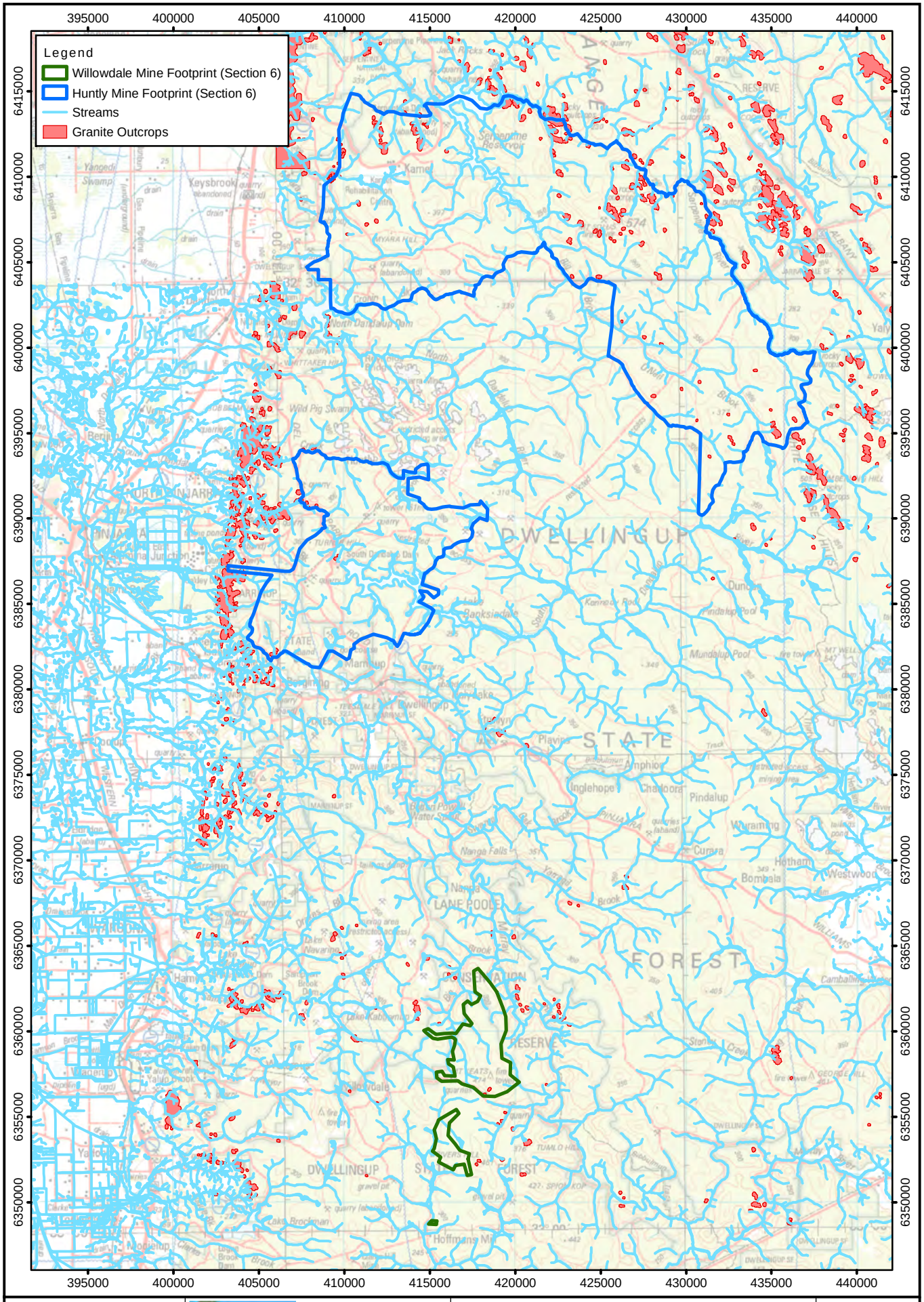
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Willowdale and Huntly Mine Footprints
Potential Empodisma peatlands

Figure: **9**



N

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Scale: 1:300,000
MGA94 (Zone 50)

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Willowdale and Huntly Mine Footprints

Granite Outrops and Streams

Figure: **10**

4.6 Threatened and Priority Flora

In assessing threatened species there has been a tendency to rely on radial searches that at times can lead to the coverage of more potential conservation flora species than is relevant. An example of the latter is the potential inclusion of threatened species that are restricted to either the Darling Scarp or Swan Coastal Plain and that do not extend into the Darling Range of project areas on the Darling Range are excluded in this updated summary, namely:

Diuris drummondii (SCC – T, FCC - V) – Very Unlikely as mainly on Swan Coastal Plain and southern forest and southern Wheatbelt and restricted north of Brookton Highway in wet creek, swampy area

Diuris micrantha (SCC – T, FCC - V) - Unlikely as mainly on Swan Coastal Plain and Wheatbelt and restricted to lateritic soils near Byford

Diurus purdiei (SCC – T, FCC – E) – Unlikely as scattered collections along Swan Coastal Plain, furthest inland 20 km east of Armadale, as far south as Pinjarra and surrounds.

Eleocharis keigheryi (SCC – T, FCC - V) – Very Unlikely as restricted to seasonally wetter areas associated with creeks and clay pans. Mainly on wetter areas on Swan Coastal Plain and in Wheatbelt.

Grevillea flexuosa (SCC – T, FCC - V) – Very Unlikely as this species is restricted to areas north of Great Eastern Highway

Synaphea sp. Fairbridge Farm (D. Papenfus 696) (SCC – T, FCC - CE) - Very unlikely, restricted to Swan Coastal Plain

Synaphea sp. Pinjarra Plain (A.S. George 17182) (SCC – T, FCC – E) - Very unlikely, restricted to Swan Coastal Plain

Synaphea sp. Serpentine (G.R. Brand 103) (SCC – T, FCC - CE) - Very unlikely, restricted to Swan Coastal Plain

Synaphea stenoloba (SCC – T, FCC – E) - Very unlikely, restricted to Swan Coastal Plain

Verticordia plumosa var*. ananeotes* (SCC – T, FCC – E) - Very Unlikely - occurs on Darling Scarp, Swan Coastal Plain and southern Swan Coastal Plain near Bunbury

In addition, the following species have a low or low to moderate likelihood of occurring in either the Huntly North or Huntly South areas as they mainly on the fringes of the Albany Highway with the Monadnocks to the north-east of the Myara North survey area or west of both project areas on the Darling Scarp, Table 6 and Appendix B. It is worth noting that some of the species have changed conservation status in recent months (WA Herb 1998-). The results in Table 6 reflect the significance of the granite outcrops on the Darling Scarp, within the Monadnocks and the shallow occurrence of granite under some layers of laterite, loams and sands on the slopes north of Albany Highway for species such as *Verticordia fimbrilepis* subsp*. fimbrilepis.*

Note in defining the site-vegetation type codes the second letter is added to reflect some secondary influence (e.g. on the sandy-loam alluvial lower slopes of valleys which supports a range of site-vegetation types including the D site-vegetation type, when there are some influences of sub-surface outcropping the G letter is added after the D); thereby indicating a variation that relates to some species reflecting this shallow outcropping.

TABLE 6: Updated Review of Threatened and Priority Flora

Note: State (SCC; Department of Biodiversity, Conservation and Attractions 2024a, 2024c) and Federal (FCC; DCCEEW 2024a, 2024b) conservation code definitions. A range of species were included in the 20km radius desktop search and depending on location (based collections in State Herbarium - Florabase), previous records over some 40 years and updated searching on DBCA databases and also site conditions were ranked as likelihood of Low, Moderate or High. SVT Code – site-vegetation code based on Havel (1975a and 1975b) – Mattiske Consulting 2021 and 2024 and Vegetation Complexes (Mattiske and Havel 1998). Note Likelihood assessment reviewed on the basis of extended survey efforts and updated review of Florabase dataset.

Species	Family	SCC	FCC	Likelihood of Occurrence	20km Radius Search Vegetation complex outside Occurrence	Lateritic Soils on Uplands and Slopes	Granite Outcrops	Valley Systems and Swamps	Site-Vegetation Type SVTs) (Mattiske 2021, 2024)	Vegetation Complexes (Mattiske and Havel 1998)
Andersonia sp. Saxatilis (F. & J. Hort 3324)	Ericaceae	T	Not listed	Low	Been recorded in granite outcrop areas on the "G" site vegetation type in the Monadnocks area to the north of Albany Highway.		X		G	Cooke (Ce)
Anthocercis gracilis	Solanaceae	T	V	Low	Been recorded mainly on Darling Scarp, in isolated occurrences north of Albany Highway and eastward to Wheatbelt. Associated with open woodlands and heath communities on granite outcrops.		X		G and R	Cooke (Ce), Darling Scarp (DS2), Helena 1 (He1),
Lasiopetalum pterocarpum	Malvaceae	T	E	Low	Recorded on Darling Scarp, DS2, Murray 1, My1 and Helena 1, He1, so may extend to granite outcrops. Not in lateritic soils.		X		G and R	Cooke (Ce), Darling Scarp (DS2) Helena 1 (He1), Murray 1 (My1) (near granites for Murray 1 and Helena 1)
Morelotia australiensis R.L. Barrett and K.L. Wilson (formerly *Tetraria australiensis*)	Cyperaceae	T	V	Low-Moderate	Found along Swan Coastal Plain, north of Albany Highway in Monadnocks Reserve and near Bunbury on southern Swan Coastal Plain		X	X	G, R and D	Cooke (Ce), Yarragil 2 (Yg2) (broader valleys)
Verticordia fimbrilepis subsp. *fimbrilepis*	Myrtaceae	T	E	Low	Recorded in Jarrah Forest north of Albany Highway, Avon Wheatbelt (mainly near Pingelly, Narrogin an Katanning)		X	X	G, R and on shallow granites which may occur with some laterite on slopes (DG)	Cooke (Ce) (mainly north of Albany Highway - granite outcrops or near surface granite with some overlaying soils)

The recent works by Mattiske in the Huntly and Willowdale areas have been summarized in relation to coverage of threatened and priority flora species, weeds and site-vegetation types. Mattiske (1985 to 2023) has recorded some ten Priority flora species within the respective areas, namely potentially *Hibbertia ?ambita* (P1), *Hibbertia hortiorum* (P1), *Acacia horridula* (P3), *Conospermum scaposum* (P3), *Grevillea dissectifolia* (P3), *Thysanotus anceps* (P3),*Grevillea pimeleoides* (P4), *Lasiopetalum cardiophyllum* (P4), *Stylidium ireneae* (P4) and *Senecio leucoglossus* (P4), During this period many species have also changed names by specialists and also conservation status so there is an ongoing need to update datasets. An example of the latter is the revision of the *Hibbertia commutata* group by Thiele (2019) which was split into 27 taxa including Priority species. Such gaps in part have been addressed through the recent additional targeted work in 2023.

Eco Logical (2024) preclearance surveys were undertaken in spring 2023 and as a result no threatened flora species and three Priority flora species were recorded in the Willowdale areas. The three Priority flora species included *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1), *Grevillea prominens* (P3) and *Senecio leucoglossus* (P4).

Ecologia (2024) database searches identified 58 significant plant taxa within 20 km of the survey area (excluding records from the Swan Coastal Plain). Only three significant flora species were recorded in the field surveys including *Tetratheca phoenix* (P2), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4). No threatened flora species were recorded in the targeted survey areas.

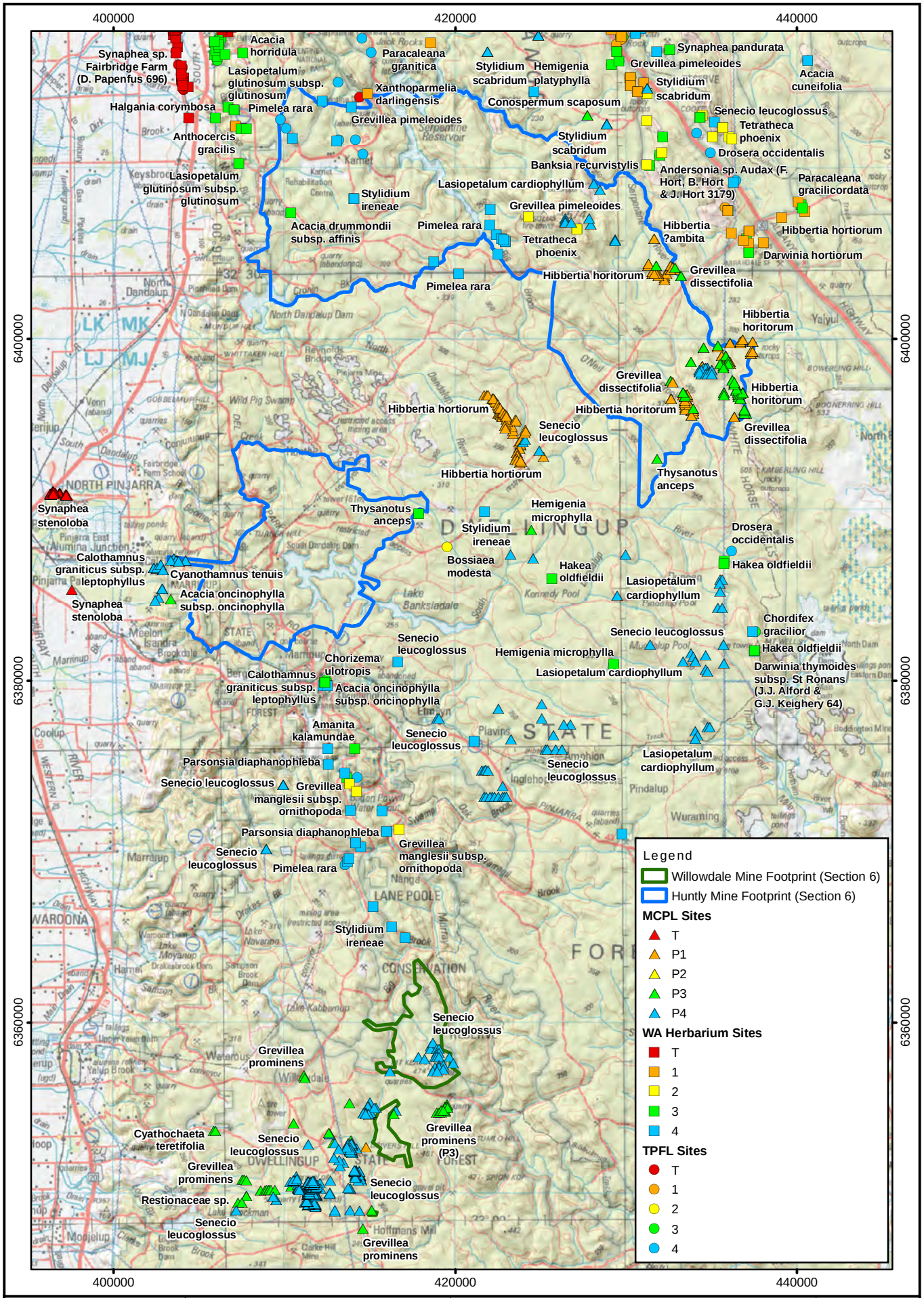
Biologic (2024) databases searches identified 72 significant plant taxa within the 20km of the survey area. Only four significant flora species were recorded in field surveys including *Acacia horridula* (P3), *Thysanotus anceps* (P3), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4). No threatened flora species were recorded in the targeted survey areas.

Mattiske (2024) database searches identified the potential for 12 threatened flora species and 37 priority flora species to occur in the O'Neil Transport Corridor survey area. Of the threatened flora species, all were considered to have a very low potential of occurring in the O'Neil Transport survey area due to the lack of suitable habitat and also know distributions away from the survey area. A total of 2 priority flora species (*Hibbertia hortiorum* P1 and *Senecio leucoglossus* P4) were recorded in the O'Neil Transport Corridor survey area. The *Hibbertia hortiorum* appeared relatively regularly and in part reflected the recent split of *Hibbertia commutata* into multiple species by Kevin Thiele (2019).

The data from these survey efforts has been combined and integrated with previous records on Figure 11, Table 7 and Appendix B.

Table 7: Summary of Recorded Significant Flora in the respective areas of Huntly North, Huntly South, Willowdale (2 sub areas)

Conserv-ation Status	Threatened and Priority Flora	Site-Vegetation Type	Huntly North	Huntly South	Willowdale	Nearby but outside
P1	*Hibbertia ?ambita*	S	X			Mainly eastwards
P1	*Hibbertia hortiorum*	S, ST, T, TS, D, SW, DG, YG, AD, A, Y, R, AC, PT,	X			X
P1	*Netrostylis* sp. Nannup (P.A. Jurjevich 1133*)*	AC			X	X
P2	*Bossiaea modesta*	D				X
P2	*Tetratheca phoenix*		X			X
P3	*Acacia drummondii* subsp. *affinis*	D, PS, S				X
P3	*Acacia horridula*		X	X		X
P3	*Conospermum scaposum*	DA				X
P3	*Cyathochaeta teretifolia*	CW				X
P3	*Grevillea dissectifolia*	A, AC, AD, AY, D, DG, ST, S, G, YG	X			X
P3	*Grevillea prominens*	S, W, T, TS, PS, CW, AC			X	X
P3	*Hemigenia microphylla*	S				X
P3	*Thysanotus anceps*	SP	X	X		
P4	*Calothamnus graniticus* subsp. *leptophyllus*			X		Mainly Swan Coastal Plain
P4	*Cyanothamnus tenuis*			X		
P4	*Grevillea pimeleoides*	G1	X			
P4	*Lasiopetalum cardiophyllum*	D, P, PS, S, TS, DG, R	X			X
P4	*Senecio leucoglossus*	S, PS, T, TS, D, SP, PT, PW, , TP, P, SW	X		X	X
P4	*Stylidium ireneae*	AC	X	X		X
P4	*Stylidium scabridum*	CW, PS, P, D, S				X



N

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Scale: 1:300,000
MGA94 (Zone 50)

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Willowdale and Huntley Mine Footprints
Threatened and Priority Flora

Figure: **11**

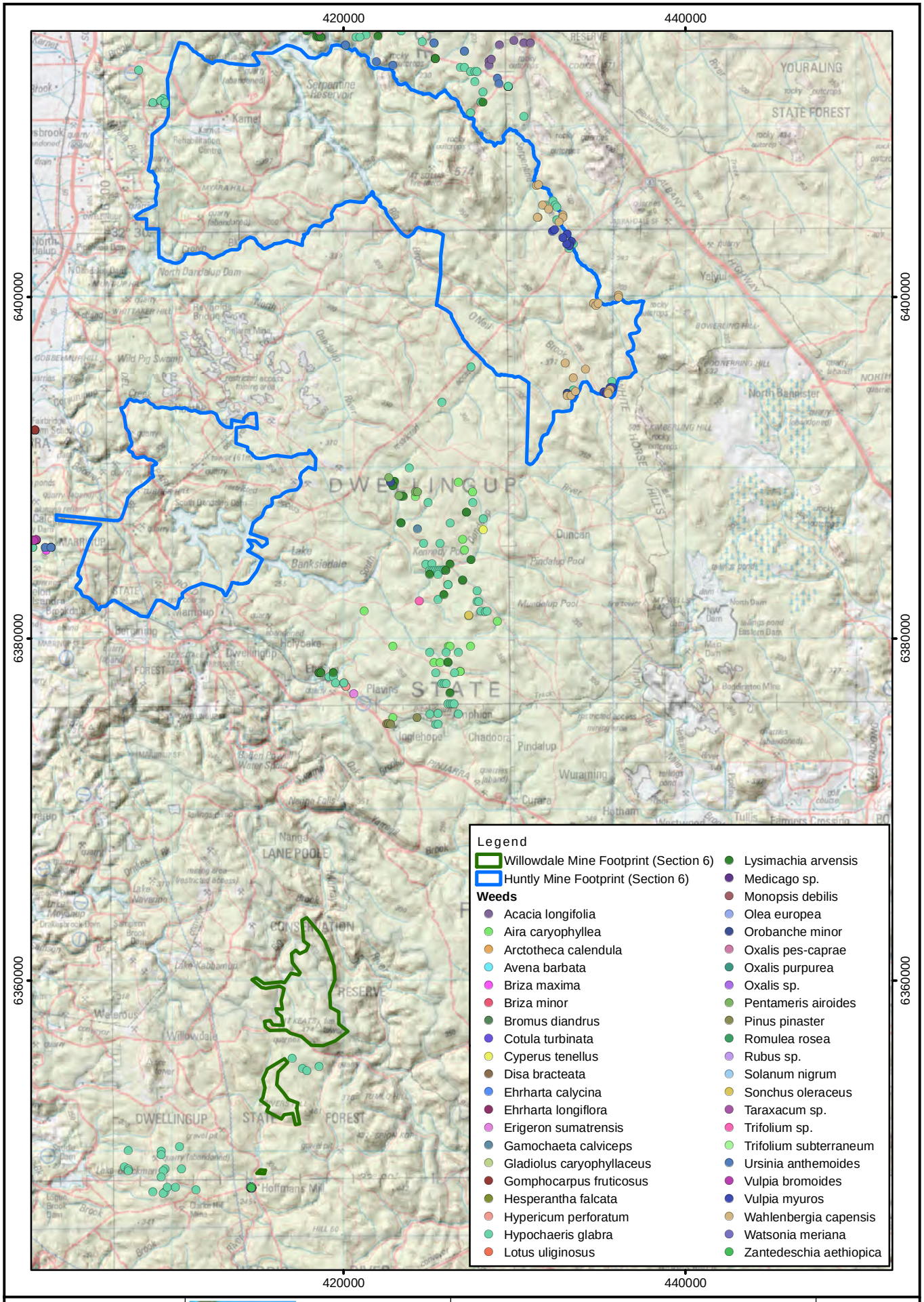
4.7 Introduced and Weed Species

A range of introduced species that have the potential to be recorded are summarized in Appendix C and others that have been recorded are summarized on Figure 12. As historical data sets are integrated the number of recorded locations of weeds is expected to increase, particularly near cleared, modified and disturbed areas. At this juncture it is important to recognize that many annual species do not persist over time in denser revegetation or forest areas.

In summary there is the potential for some 30 WONS weeds as listed under the EPBC Act 1999 by the Department of Climate Change, Energy, the Environment and Water (2024d) and 51 Declared weeds as listed under the BAM Act by the Department of Primary Industries and Regional Development (2024), Appendix C.

Many of these weeds occur primarily on agricultural holdings on the wider region and as such many are not expected to occur in the less disturbed forest areas. The main weeds in the Huntly and Willowdale areas included **Rubus* sp. (Blackberries), **Zantedeschia aethiopica* (Arum lily), **Watsonia meriana*, **Olea europea* (Olives), **Gomphocarpus fruticosus* and **Asparagus asparagoides* (Bridle creeper). Whilst others have been recorded these species appeared to pose the greatest threats in valley systems and forest areas near disturbed environments.

Many weeds have been recorded historically, the latter gaps on Figure 12 reflect the gaps in combining historical databases rather than their absence in the areas. Many weeds do not pose major threats to the community values as many are annuals and not aggressive.



N

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Scale: 1:300,000
MGA94 (Zone 50)

CAD Ref: a1992_F044_20

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Willowdale and Huntly Mine Footprints

Weeds

Figure: **12**

4.8 Site-vegetation Types

A total of 35 site-vegetation types were defined and mapped in the survey areas and additional disturbance, cleared and rehabilitation areas, Table 8 and Figure 13. The site-vegetation types were defined on the basis of key species and site parameters as defined in Havel (1975a and 1975b) for the Jarrah forest and as refined and developed by Mattiske over the last 40 years.

Table 8: Summary of site-vegetation types as defined for the survey areas based on Havel (1975a and 1975b)

	SVT Code	Description	Huntly North (ha)	Huntly South (ha)	Willowdale (ha)
Swamps and Broad Valleys	A	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana* - *Eucalyptus patens* - *Banksia littoralis* with dense stands of *Melaleuca viminea, Hakea varia, Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	113.19	1.307	
	AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana* - *Eucalyptus patens* - *Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses.	725.496	144.229	35.335
	AD	Low open woodland of *Eucalyptus rudis* and *Eucalyptus marginata* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	31.652		
	AW	Low open woodland of *Eucalyptus patens* and *Melaleuca preissiana* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	1.573		
	AX	Open Woodland *of Eucalyptus rudis – Melaleuca preissiana* with dense understorey of mixed *Melaleuca* species on clay soils in swamps.			
	AY	Open woodland of *Eucalyptus wandoo* over *Hakea varia, Hypocalymma angustifolium, Babingtonia camphorosmae* and *Gastrolobium calycinum* over herbs and sedges on clay-loams in seasonally wetter valley floors.	27.917		
	D	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Alllocasuarina fraseriana - Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae, Daviesia decurrens, Davieisa preissii* and *Acacia extensa* on clay loams to gravelly clay-loams.	1586.830	10.110	29.483
	DA	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Allocasuarina fraseriana - Hakea prostrata* on lower slopes with patches of *Melaleuca preissiana, Banksia littoralis* over mixed low understorey species, including *Babingtonia camphorosmae* and *Astartea scoparia* on clay loams to gravelly clay-loams.	32.729		
	DG	Open Forest of *Eucalyptus marginata -Corymbia calophylla – Eucalyptus patens - Allocasuarina fraseriana - Hakea prostrata* on lower slopes with mixed low understorey species, including *Grevillea bipinnatifida* and *Babingtonia camphorosmae,* on clay loams to gravelly clay-loams.	214.818		
	E	Open Forest to Woodland of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Kingia australis, Mesomelaena tetragona* and *Babingtonia camphorosmae* on sandy gravels on lower slopes.	112.377		6.189

Table 8: Summary of site-vegetation types as defined for the survey areas based on Havel (1975a and 1975b) (continued)

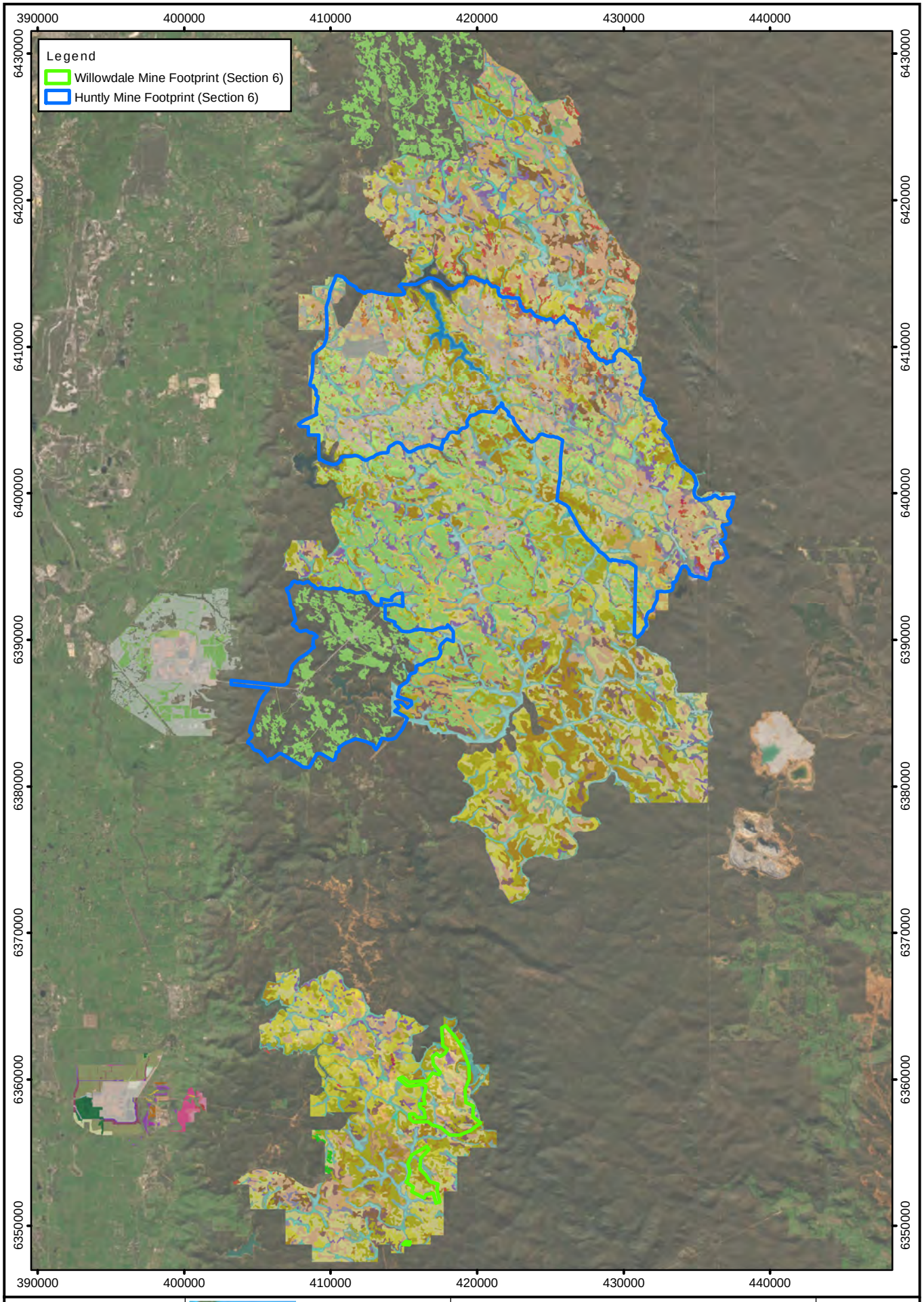
	SVT Code	Description	Huntly North (ha)	Huntly South (ha)	Willowdale (ha)
Valley Floors and Lower Slopes	C	Woodland to Open Forest of *Eucalyptus patens – Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	7.423	29.691	-
	CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa - Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	824.992	0.171	48.643
	CQ	Open Forest of *Eucalyptus patens – Corymbia calophylla - Banksia littoralis* with dense *Taxandria linearifolia, Tryamalium odoratissmum* subsp. *odoratissimum,* and *Astartea scoparia* in understorey on creek-lines and water-courses.			7.887
	W	Open Forest of *Eucalyptus megacarpa - Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	989.000	70.727 (WD variant 1.361)	93.518
	Q	Open forest of *Eucalyptus marginata, Corymbia calophylla, Eucalyptus patens* over *Trymalium odoratissimum* subsp. *odoratissimum, Acacia extensa* and *Lysiandra calycina* on lower slopes on alluvial loam soils.	31.783	10.525	15.926
	Y	Open woodland of *Eucalyptus wandoo* over *Hypocalymma angustifolium* and *Babingtonia camphorosmae* over herbs and sedges on clay-loams on seasonally moister lower slopes.	6.917	-	-
	YG	Open woodland of *Eucalyptus wandoo* over *Hypocalymma angustifolium, Babingtonia camphorosmae, Grevillea bipinnatifida* and *Allocasuarina humilis* over herbs and sedges on clay-loams on seasonally moister lower slopes underlain by outcrops.	13.751	-	-
Slopes with seasonal soil moisture	SW	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	933.077	36.549 (SW-D 0.215)	76.230
	PW	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels.	800.412	-	12.208
Shallow Outcrop Areas	R	Open Woodland of *Eucalyptus marginata - Corymbia calophylla* on fringes of granite outcrops or shallow soils.	526.005	-	0.816
	R/G	pen Woodland of *Eucalyptus marginata - Corymbia calophylla* with patches of Heath of Proteaceae – Myrtaceae species on fringes of granite outcrops or shallow soils.	6.152	-	-
	G	Mosaic of Open Woodland of *Eucalyptus marginata – Corymbia calophylla*, mixed Proteaceae – Myrtaceae heath and Lithic Complex associated with granite outcrops.	85.384	-	1.033
	G1	Mixed Proteaceae – Myrtaceae heath and Lithic Complex associated with granite outcrops.	393.948	-	-
	G2	Open Woodland of *Allocasuarina huegeliana* over shrubs and lithic complex and herbs	1.048	-	-

Table 8: Summary of site-vegetation types as defined for the survey areas based on Havel (1975a and 1975b) (continued)

	SVT Code	Description	Huntly North (ha)	Huntly South (ha)	Willowdale (ha)
Slopes and Ridges - Sandy Loam Gravels	P	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii* and *Adenanthos barbiger* and low shrubs, herbs and sedges on sandy gravels.	361.201	-	3.657
	PG	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Grevillea bipinnatifida* and *Adenanthos barbiger* and low shrubs, herbs and sedges on sandy gravels.	0.308	-	-
	PT	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	47.299	21.189	68.940
	PS	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	3598.863	-	218.152
	SP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	873.875	20.200 (SP-D 8.819)	51.139
	S	Open Forest of *Eucalyptus marginata - Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy-gravels.	6119.405	42.478	626.454
	ST	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus, Leucopogon verticillatus, Pteridium esculentum, Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	770.420	103.122	139.473
	TS	Open Forest of *Eucalyptus marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly to gravelly soils.	2052.175	19.653	538.870
	T	Open Forest of *Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravelly soils.	736.985	34.771	136.338
	TP	Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata - Corymbia calophylla* with scattered understorey, including *Clematis pubescens*, *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *aquifolium* on sandy-loam gravels.	15.162	-	10.776
	Z	Open forest of *Eucalyptus marginata* and *Corymbia calophylla* over *Macrozamia riedlei, Xanthorrhoea preissii, Hakea lissocarpha* and *Lysiandra calycina* on sandy-loam to sandy-loam gravel soils on slopes.	12.788	-	-
	Total		**22054.96**	**509.534**	**2121.067**

Table 8: Summary of site-vegetation types as defined for the survey areas based on Havel (1975a and 1975b) (continued)

	SVT Code	Description	Huntly North (ha)	Huntly South (ha)	Willowdale (ha)
Other Areas	DAM	Dam	329.023	-	-
	CL	Cleared Areas	3555.738	-	-
	CL Other	Cleared Areas	365.445	161.459	-
	Rehab	Rehabilitation Areas	2198.135	2926.133	-
	Other	Other Areas	819.764	6080.999	14.996
	Total		**7268.105**	**9168.591**	**14.996**



N

0 2.5 5 km

Scale: 1:350,000
MGA94 (Zone 50)

CAD Ref: a1992_F044_02

Date: September 2024 | Rev: A | A4

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Willowdale and Huntly Mine Footprints

Site-Vegetation Type Mapping

Figure:

13

4.9 Groundwater Dependant Ecosystems

The potential groundwater dependent ecosystems were determined on the basis of the extent of the vegetation complexes (Murray 1, Murray 2, Yarragil 1, Yarragil 2, Swamp and Pindalup). The site-vegetation types associated with these vegetation complexes and as such are potential groundwater dependant ecosystems include A, AC, AD, AW, AY, C, CW, W, D, E, SW and PW.

In view of the extensive flora and vegetation studies in the northern Jarrah forest subregion these vegetation complexes support species and site-vegetation types that prefer and occur on seasonally moister and wetter soils. This approach was considered to represent a precautionary approach in the absence of detailed groundwater level data at the time of selecting the potential groundwater dependent ecosystems at this juncture in the absence of site-vegetation type data.

Key indicator plant species that are generally accepted as indicators of moister soils and, hence, potential groundwater dependent ecosystems include – *Banksia littoralis, Hakea varia, Acacia divergens, Boronia molloyae, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae, Eucalyptus patens, Hypocalymma angustifolium, Melaleuca preissiana, Melaleuca viminea* and *Taxandria linearifolia.*

4.10 Wetlands of International Importance (Ramsar)

The Peel-Yalgorup System, a listed Ramsar Wetland of International Importance, is located adjacent to the City of Mandurah and more than 40km from the nearest survey area on the Darling Ranges. The Peel-Yalgorup System consists of shallow estuaries, freshwater marshes and coastal saline lakes that include the Harvey Estuary, Peel Inlet, Lake McLarty, Lake Mealup and ten Yalgorup National Park wetlands (DCCEEW 2024f). The fringing vegetation is mainly samphire, rushes, sedges and paperbark communities. The Peel-Yalgorup System supports a wide variety of waterbirds, invertebrates and estuarine and marine fish and is considered the most important area for waterbirds in south-western Australia (DCCEEW 2024f). Whilst these potential values were recognized in the National database search (DCCEEW 2024f) these wetlands occur west of the survey areas.

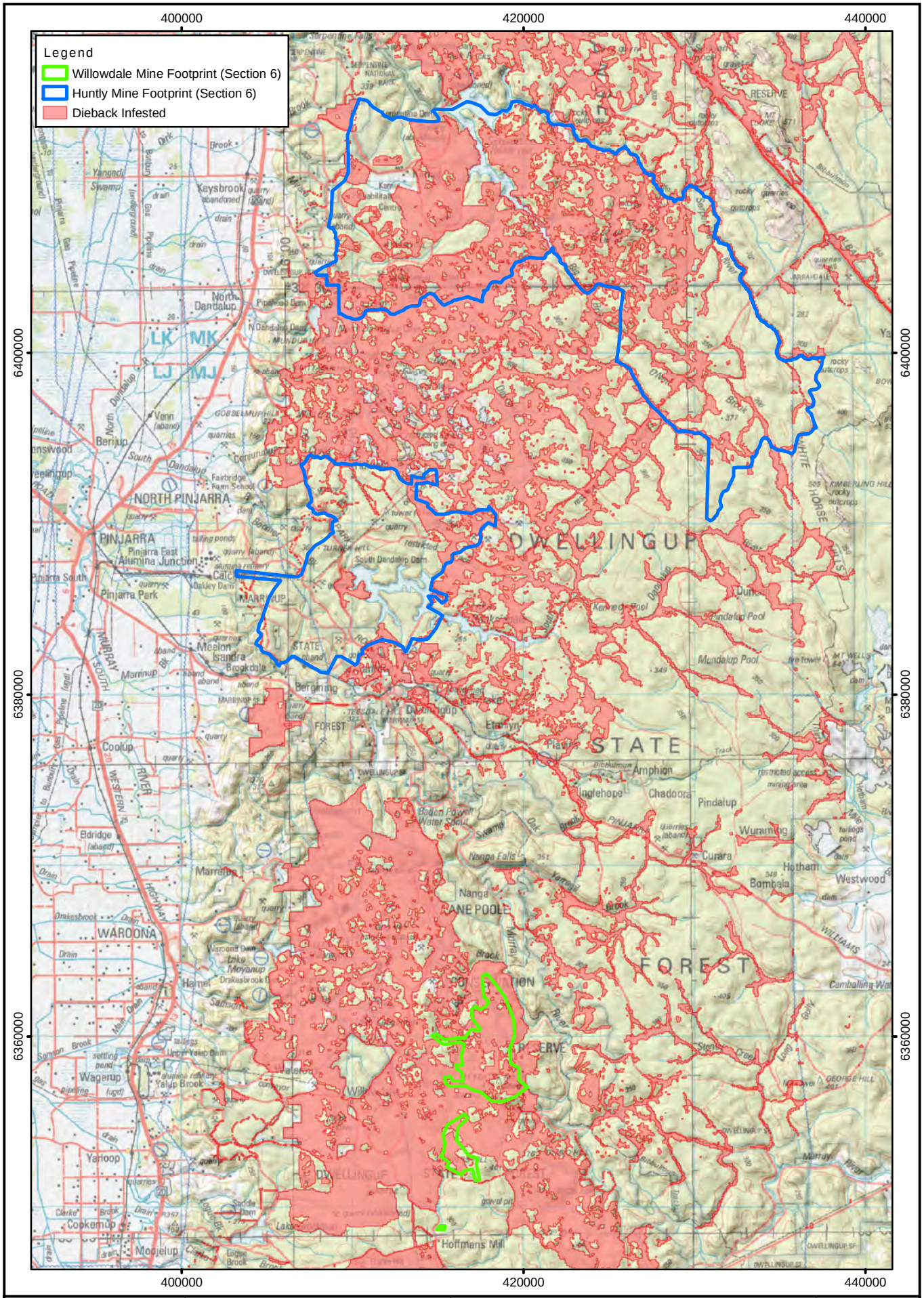
4.11 Review of Dieback Occurrence

The dieback data as shown on Figure 14 reflects the most up to date dieback interpretation data from both DBCA and Glevan Consulting for the survey areas. In the survey area the dieback infections are concentrated to the valleys systems. There may be some differences also in coverage and sampling in some of the survey areas.

4.12 Old Growth and Harvesting

Based on data from Department of Biodiversity, Conservation and Attractions, there is limited old growth forests occurring in these respective areas (Figure 15). This in part appears to reflect the proximity of historical logging and wood production activities near Jarrahdale and Dwellingup.

The data as presented on the history of harvesting in the area reflects the more recent logging in the pre-mining activities of Alcoa (Figure 16). Some of the valley areas have not been logged for some time and as such reflect the linear patterns of these systems and the differences in overstorey tree species.



N

0 2 4 km

Scale: 1:300,000
MGA94 (Zone 50)

CAD Ref: a1992_F044_11

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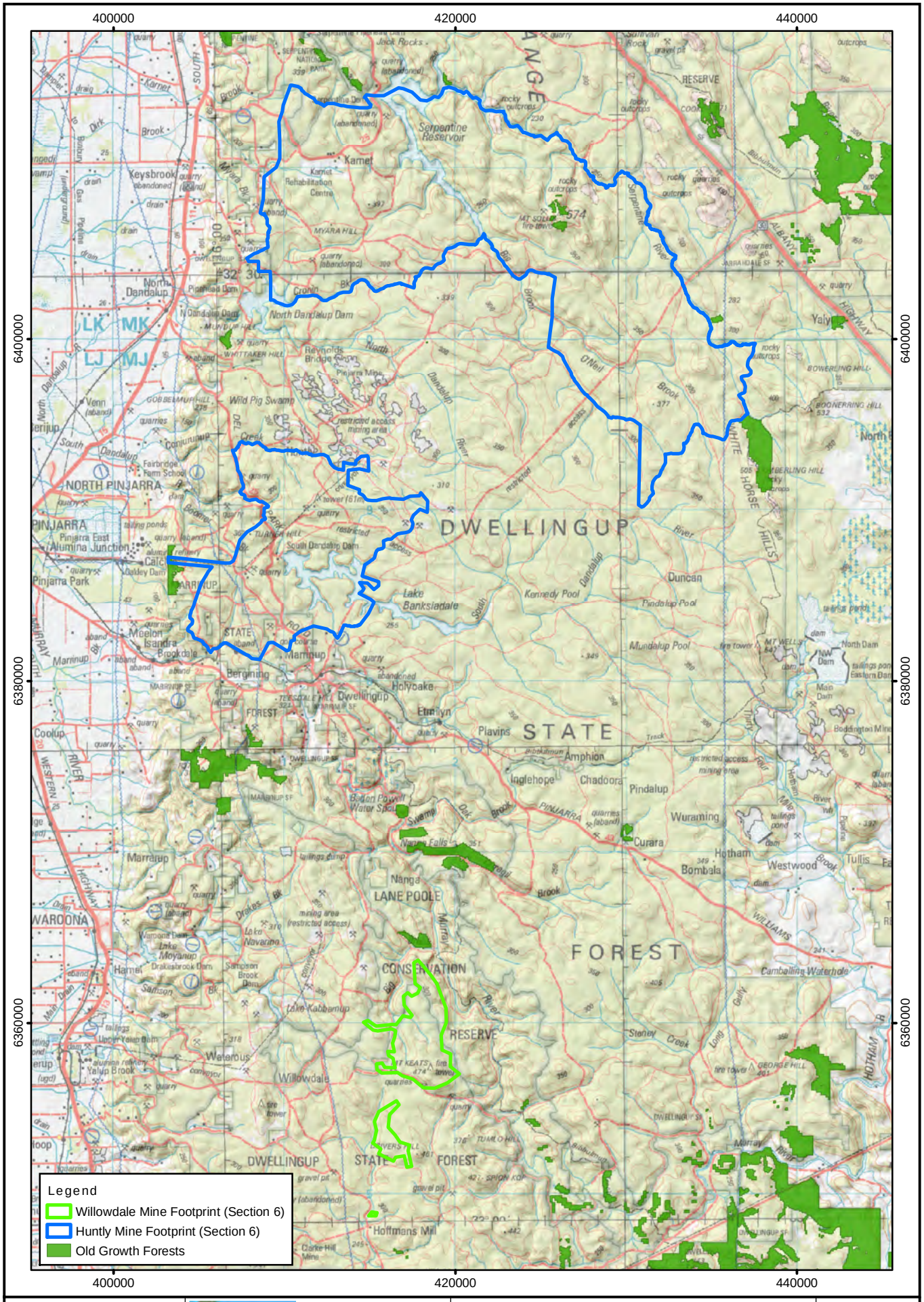
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Willowdale and Huntly Mine Footprints
Dieback

Figure:
14



N

0 2 4 km

Scale: 1:300,000
MGA94 (Zone 50)

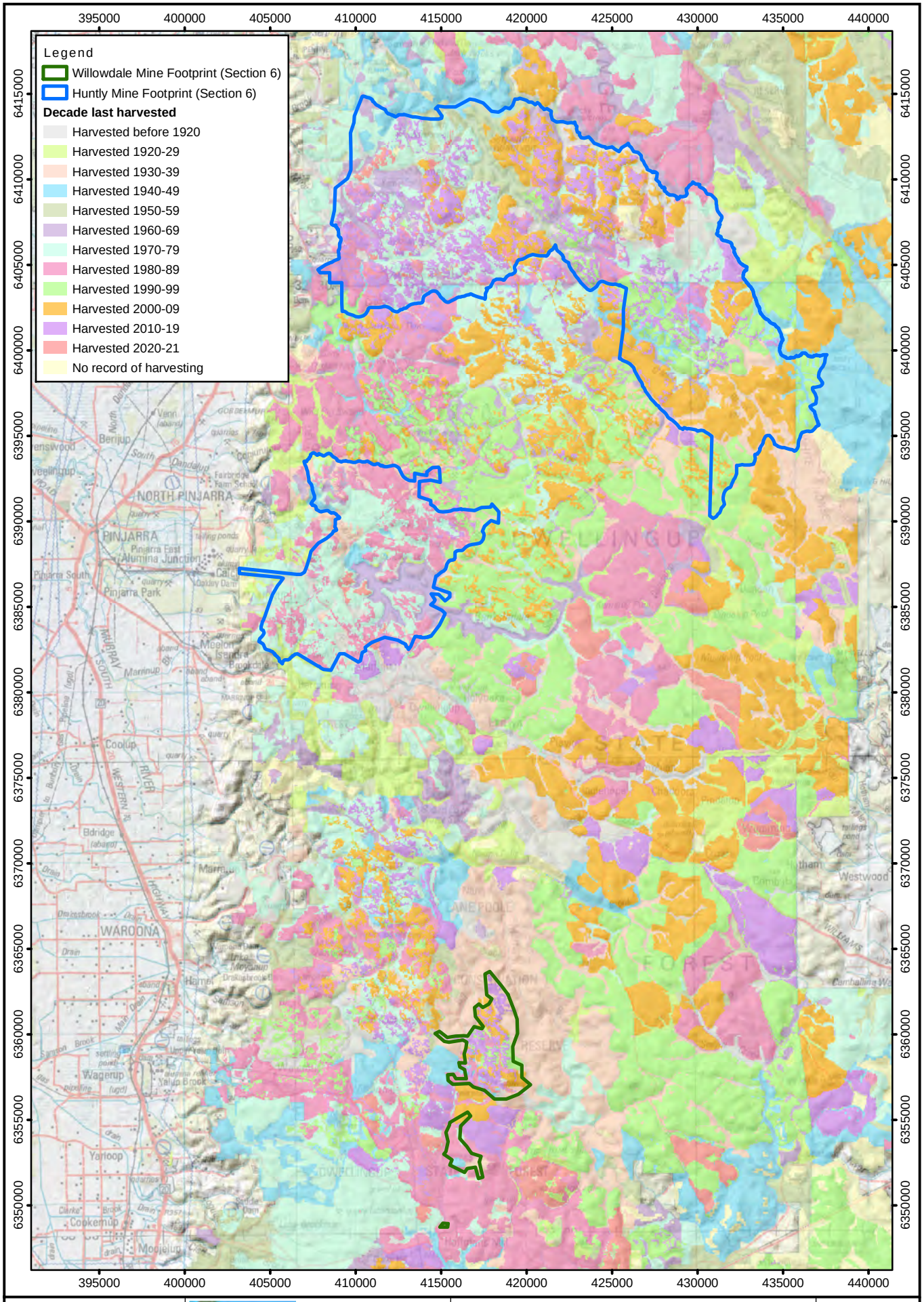
CAD Ref: a1992_F044_10

Date: September 2024 | Rev: A | A4

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Willowdale and Huntly Mine Footprints
Old Growth Forest

Figure:
15



N

0 2,300 4,600 m

Scale: 1:300,000
MGA94 (Zone 50)

CAD Ref: a1992_F044_12

Date: September 2024 | Rev: A | A4

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Willowdale and Huntly Mine Footprints
Harvested Year

Figure:
16

5. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Various databases were used to identify the possible occurrence of flora (including introduced, threatened and priority taxa) and threatened and priority ecological communities within the survey areas. Historical documentation of the floristics and vegetation mapping of the region, along with results of previous flora and vegetation surveys in the nearby areas, were reviewed again in 2024 in line with some changes in nomenclature.

The survey areas lie within the Northern Jarrah Forest subregion of the Southwest Botanical Province. The geology of the region comprises lateritic duricrust, with drainage lines and occasional granite hills. The Northern Jarrah Forest subregion is characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla* - *Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understoreys. The vegetation of the region has been extensively studied, and has been described in a series of vegetation complexes of the Darling System (Heddle *et al.* 1980; Mattiske and Havel (1998).

Survey Effort

Due to the survey effort the surveys spanned over multiple months in different years. As indicated for the respective areas summarized it is apparent that the amount of survey (even prior to the EPA Guidance Statement in 2016b) well exceeded the standards of the earlier period of survey work between 1980's and 1996. Since this time the efforts by Alcoa employees and a range of consultants has increased markedly. This report is only a small subset of the effort over >40 years.

At times, there is a debate about when survey work should be undertaken, however as indicated by reviewing the data for species on Florabase (WAH 1998-) it is evident that many species growth, flower and fruit in multiple seasons and the emphasis on spring surveys are influenced by variations in seasonal conditions and also the variations in regeneration and growth patterns of many species.

The earlier work of Havel (1975a and 1975b) in particular developed a system that was reliant on mainly perennial species and landforms and soils so that seasonal condition for vegetation mapping were less critical in the classification of the site-vegetation types.

In recent years since the delineation of the conservation values of flora species and communities a greater emphasis has been placed on these particular values with baseline flora and vegetation studies, targeted searches and multiple research projects associated with plots and transects over multiple years.

Flora

Surveys in the northern Jarrah forest ranges from 300 to 750 taxa per survey area. In recent decades there has been a growing emphasis on restricted or threatened flora species or those species that may threatened the occurrence of other species. This report concentrates on the conservation significant species and the weed species.

The data collected to date on the threatened and priority flora includes records from Mattiske Consulting since 1980's, Eco Logical (2024) intensive and targeted flora studies in proposed clearance areas in the Willowdale areas in spring 2023, *Ecologia* (2024) and Biologic (2024) intensive and targeted flora studies in Huntly-Myara proposed clearance areas in the spring months of 2023.

The early work of Mattiske was undertaken when the native flora species were defined as threatened or priority and as such many of the earlier records have not been included in this report for the Huntly South area as the data is not in a format that can rapidly integrated into this report. The data is available

and is intended to be integrated in 2025 into a combined data set. The latter is not a small task as many of the surveys were undertaken prior to current software types.

In summarizing the key potential conservation flora, it is important to recognize that the current practice of radial searches tend to bring in potential species that do not occur in the northern Jarrah forest, let alone the specific areas as summarized for this report. This was the case for some of the reporting on different areas as the radial searches covered species that occurred in the northern sections of the Jarrah forest, the Darling Scarp and the Swan Coastal Plain.

The recent works by Mattiske in the Huntly and Willowdale areas have been summarized in relation to coverage of threatened and priority flora species, weeds and site-vegetation types. Mattiske (1985 to 2023 has recorded some ten Priority flora species within the respective areas, namely potentially *Hibbertia ?ambita* (P1), *Hibbertia hortiorum* (P1), *Acacia horridula* (P3), *Conospermum scaposum* (P3), *Grevillea dissectifolia* (P3), *Thysanotus anceps* (P3),*Grevillea pimeleoides* (P4), *Lasiopetalum cardiophyllum* (P4), *Stylidium ireneae* (P4) and *Senecio leucoglossus* (P4), During this period many species have also changed names by specialists and also conservation status so there is an ongoing need to update datasets. An example of the latter is the revision of the *Hibbertia commutata* group by Thiele (2019) which was split into 27 taxa including Priority species. Such gaps in part have been addressed through the recent additional targeted work in 2023.

Eco Logical (2024) preclearance surveys were undertaken in spring 2023 and as a result no threatened flora species and three Priority flora species were recorded in the Willowdale areas. The three Priority flora species included *Netrostylis* sp. Nannup (P.A. Jurjevich 1133) (P1), *Grevillea prominens* (P3) and *Senecio leucoglossus* (P4).

Ecologia (2024) database searches identified 58 significant plant taxa within 20 km of the survey area (excluding records from the Swan Coastal Plain). Only three significant flora species were recorded in the field surveys including *Tetratheca phoenix* (P2), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4). No threatened flora species were recorded in the targeted survey areas.

Biologic (2024) databases searches identified 72 significant plant taxa within the 20km of the survey area. Only four significant flora species were recorded in field surveys including *Acacia horridula* (P3), *Thysanotus anceps* (P3), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4). No threatened flora species were recorded in the targeted survey areas.

Mattiske (2024) database searches identified the potential for 12 threatened flora species and 37 priority flora species to occur in the O'Neil Transport Corridor survey area. Of the threatened flora species, all were considered to have a very low potential of occurring in the O'Neil Transport survey area due to the lack of suitable habitat and also know distributions away from the survey area. A total of 2 priority flora species (*Hibbertia hortiorum* P1 and *Senecio leucoglossus* P4) were recorded in the O'Neil Transport Corridor survey area. The *Hibbertia hortiorum* appeared relatively regularly and in part reflected the recent split of *Hibbertia commutata* into multiple species by Kevin Thiele (2019).

Vegetation

Investigations by Diels (1906), Loneragan (1978), Beard (1979a, 1979b), Abbott and Loneragan (1986), Bell and Heddle (1989) and Dell and Havel (1989) reflect the depth of interest in the patterns of flora and vegetation in the south-west forests. The more regional broad scale mapping by Beard (1979a,1979b) in the northern Jarrah forest was refined at a more detailed level by Heddle et al. (1980) and Mattiske and Havel (1998) through the expansion of the understanding of the key relationships of landforms and soils and plant species. The work by Heddle et al. (1980) and Mattiske and Havel (1998) led to regional mapping of vegetation complexes and ecological vegetation systems that were similar in approach to that utilized in the Regional Forest Agreement studies for Victorian and Tasmanian forests. A total of 35 site-vegetation types were defined and mapped in the survey areas and additional

disturbance, cleared and rehabilitation areas. These site-vegetation types have been developed and based on the earlier work by Havel (1975a, 1975b) and more recently his Ph.D. Thesis (Havel 2000) where additional details were provided on the approach that is similar to other approaches globally where forests occur as continuums with several key species and a range of species that reflect subtle shifts in landforms, soils and soil moisture availability.

The development of the site-vegetation types and vegetation complexes by Havel and Mattiske has led to a means of addressing key species and communities that reflect particular site conditions and as such provide increased background information for management of the forests and also rehabilitation activities.

Threatened and Priority Ecological Communities

During the earlier phases of the surveys no Threatened Ecological Communities (TECs) were listed on the survey areas on the Darling Ranges. Recently, it was recognized that the *Empodisma* peatland of southwestern Australia has the potential to occur in the swamps if peat is present. These would occur in the A or AC site-vegetation types. To date the suggested potential locations have not been assessed for the presence of peat; however *Empodisma gracillimum* has been recorded previously in a restricted area by the Mattiske team. This species is largely restricted to coastal areas in the southwest (WAH 1998-) and as such more work is required.

The desktop assessment highlighted several other potential TECs; however these are restricted to the Swan Coastal Plain or the Wheatbelt and as such do not extend into the Jarrah forest area on the Darling Ranges.

There are two priority ecological communities (PECs), as listed at State level by DBCA (2024b, 2024c) that occur within the Huntly North (Myara) survey area; only one of these is a botanical PEC.

The priority ecological communities that occur in the Huntly North survey area are:

- Granite communities of the northern Jarrah forest (P3)
    - Jarrahdale area – Monadnocks, Blue Rock; insufficient information to distinguish discrete community type/s (DBCA 2024b, 2024c).
- Litter Dependant Invertebrate Community of the northern Jarrah Forest (P2)
    - Chandler Block, Northern Jarrah Forest; insufficient evidence that this is a discrete community type (DBCA 2024b, 2024c).

There is a potential that the site-vegetation types associated with granite outcrops (site-vegetation types G and R), and the Cooke vegetation complex as defined by Mattiske and Havel (1998) may have affinities with the PEC.

The alignment of the communities with the DBCA defined PEC raises some issues due to the lack of consistent and detailed data on the granites. Alcoa is currently reviewing these values and this will be refined in conjunction with other data collected during surveys on the G and R site-vegetation types to assist in the refinement of the detail associated with this PEC. The location of the granite areas is associated with the G and R site-vegetation types as defined in the varying reports.

The significant issue that relates to the granites is the complexity of the structural and floristic components as they reflect varying depths or soil over the outcrop and as such vary from lithic complexes dominated by mosses and lichen species, through heath communities dominated by Proteaceae and Myrtaceae species to open woodlands of Jarrah-Marri or Wandoo over low shrubs on the fringes of the exposed granites.

All survey areas occur within the Regional Forest Agreement (RFA) area of the southwest forests DCCEEW (2024b) and as such were considered during the RFA process.

Wetlands of International Importance (Ramsar)

The Peel-Yalgorup System, a listed Ramsar Wetland of International Importance, is located adjacent to the City of Mandurah and more than 40km from the nearest survey area on the Darling Ranges. The Peel-Yalgorup System consists of shallow estuaries, freshwater marshes and coastal saline lakes that include the Harvey Estuary, Peel Inlet, Lake McLarty, Lake Mealup and ten Yalgorup National Park wetlands (DCCEEW 2024f). The fringing vegetation is mainly samphire, rushes, sedges and paperbark communities. The Peel-Yalgorup System supports a wide variety of waterbirds, invertebrates and estuarine and marine fish and is considered the most important area for waterbirds in south-western Australia (DCCEEW 2024f). Whilst these potential values were recognized in the National database search (DCCEEW 2024f) these wetlands occur west of the survey areas.

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The data as presented on the history of harvesting in the area reflects the historical clearing activities and more recent logging in the pre-mining activities of Alcoa. Some of the valley areas have not been logged for some time and as such reflect the linear patterns of these systems and the differences in overstorey tree species.

6. ACKNOWLEDGEMENTS

The authors would like to thank Alcoa of Australia Ltd for their assistance with this project.

7. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were mainly involved in this project:

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species
Note: Adapted from section 179 of the *EPBC Act*.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016 - WA* (*BC Act*) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Biodiversity Conservation (Listing of Native Species) (Flora) Order 2023*; Department of Biodiversity, Conservation and Attractions (DBCA) (DBCA 2023a), and are categorised under Division 1 (threatened species – critically endangered), Division 2 (threatened species - endangered), and Division 3 (threatened species – vulnerable)**.** A flora species is defined as **threatened flora** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the *BC Act*. Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species
Note: Adapted from *BC Act*

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1, Division 1 of the *Biodiversity Conservation (Listing of Native Species) (Flora) Order 2023*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 1 Division 2 of the *Biodiversity Conservation (Listing of Native Species) (Flora) Order 2023*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 1 Division 3 of the *Biodiversity Conservation (Listing of Native Species) (Flora) Order 2023*).

Priority flora species are defined as "possibly threatened species that do not the criteria for listing under the BC Act because of insufficient survey or are otherwise data deficient" or species that are "adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or are conservation dependent for other than taxonomic reasons" (DBCA 2023c). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority [EPA] 2016a). DBCA categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species
Note: Adapted from DBCA (2023c).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the *EPBC Act*, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities
Note: Adapted from section 181 and section 182 of the *EPBC Act*.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Threatened ecological communities (TECs) are listed in the *Biodiversity Conservation (Threatened Ecological Communities) Order 2023* (under Part 2, Division 2, of the *BC Act*; DBCA 2023d). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the *BC Act*. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

Table A2.2 State definition of threatened ecological communities
Note: Summarised from *BC Act* and DBCA 2023b

CODE	CATEGORY	DEFINITION
CO	**Collapsed ecological communities**	An ecological community is eligible for listing as a collapsed ecological community if either: **1.** there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or **2.** the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure
CR	**Critically Endangered**	An ecological community is eligible for listing as critically endangered if it is considered to be facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future when the best available evidence indicates that it meets **any** of the following criteria: **1.** The geographic distribution has been reduced by at least 80% or is less than 2000 km^2 for a single community **or** there are less than 2 areas of at least 100 km^2 **and** there is observed or inferred decline or threatening processes causing further decline; or **2.** Environmental degradation has occurred based on change in an abiotic or biotic variable affecting at least 80% of the extent of the ecological community **3.** Quantitative analysis that estimates the probability of ecological community collapse to be: at least 50% within 50 years.
EN	**Endangered**	An ecological community is eligible for listing in the category of endangered if it is considered to be facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future when the best available evidence indicates that it meets any of the following criteria: **1.** The geographic distribution has been reduced by, at least 50% or the geographic distribution is less than 20,000 km^2 for a single community **or** there are less than 20 areas of at least 100 km^2 **and** there is observed or inferred decline or threatening processes causing further decline; **2.** Environmental degradation has occurred based on change in an abiotic or biotic variable affecting either at least 50% of the extent of the ecological community; **3.** Quantitative analysis that estimates the probability of ecological community collapse to be: at least 20% within 50 years.
VU	**Vulnerable**	An ecological community is eligible for listing in the category of vulnerable at if it is considered to be facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future when the best available evidence indicates that it meets any of the following criteria: **1.** The geographic distribution has been reduced by, at least 30% or the geographic distribution is less than 50,000 km^2 for a single community **or** there are less than 50 areas of at least 100 km^2 **and** there is observed or inferred decline or threatening processes causing further decline; or **2.** Environmental degradation has occurred based on change in an abiotic or biotic variable affecting either at least 30% of the extent of the ecological community; or **3.** Quantitative analysis that estimates the probability of ecological community collapse to be at least 10% within 100 years.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by DBCA (2023b) in the *Priority Ecological Communities for Western Australia – Version 35 (19 June 2023)*. Similarly, to priority flora, PECs are not afforded legislative protection, however are considered significant under the EPA's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. DBCA categorises PECs into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities
Note: Adapted from DBCA (2023c).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat or for which current threats exist. Communities may be included if they are well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not under immediate threat (within approx. 10 yrs.) of destruction or degradation. Communities may be included if they are well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	**Priority 3** (Poorly known ecological communities)	Communities may be included if they are well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them. This category includes three sub-categories: (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation. (ii) Communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approx. 10 yrs.). (iii) Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across their range from processes such as grazing by, inappropriate fire regimes, clearing, hydrological change, etc
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or that have been recently removed from the threatened list.)	Ecological communities that are adequately known and either rare but not threatened, near threatened, or have recently been removed from the threatened list. These communities require regular monitoring. (i) Rare: ecological communities known from few occurrences that are considered to have been adequately surveyed, and that are not currently threatened, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near threatened: ecological communities that are considered to have been adequately surveyed and that do not qualify as conservation dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (*BAM Act*) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the *BAM Act*, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the *BAM Act* is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development [DPIRD] 2023).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (*EP Act*) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- 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; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE EREMAEAN AND NORTHERN BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of vegetation condition categories

Note: Adapted from Trudgen (1988).

CATEGORY	DEFINITION
Excellent	Pristine or nearly so, no obvious sign of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely of almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

Note: Refer to Appendix A for State (SCC; WA Herb 1998-) and Federal (FCC; EPBC Act, DCCEEW 2024a, 2024b) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Andersonia gracilis	Ericaceae	T	Vulnerable	Habit: Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Flower colour: white-pink-purple Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps. IBRA Distribution: GES, SWA Florabase records: 29	**Very Low** Mainly outside survey areas in different bioregions
Andersonia sp. Saxatilis (F. & J. Hort 3324)	Ericaceae	T	-	Habit: Single-stemmed shrub to 0.6 m high. Flower colour: white-pink Flowering period (indicated in green): **J** F M A M J J A **S O** N D Soils: Dry, brown loam, clay over granite. Slope, outcrops, granite and laterite. IBRA Distribution: JAF Florabase records: 6	**Moderate** **M**ainly north near Modanocks and Albany Highway
Anthocercis gracilis	Solanaceae	T	Vulnerable	Habit: Erect, spindly shrub, to 0.6 (-1) m high. Flower colour: yellow-green Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Sandy or loamy soils. Granite outcrops. IBRA Distribution: AVW, JAF Florabase records: 29	**Very Low** Mainly on Darling Scarp and granites

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Note: Refer to Appendix A for State (SCC; WA Herb 1998-) and Federal (FCC; EPBC Act, DCCEEW 2024a, 2024b) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Banksia mimica	Proteaceae	T	Endangered	Habit: Prostrate, lignotuberous shrub, 0.15-0.4 m high. Flower colour: yellow-brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White or grey sand over laterite, sandy loam. IBRA Distribution: JAF, SWA Florabase records: 40	**Very Low** Occurs to the north on the SWA and south JAF
Caladenia huegelii	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.25-0.6 m high. Flower colour: green & cream & red Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Grey or brown sand, clay loam. IBRA Distribution: JAF, SCP Florabase records: 43	**Very Low** Location outside species known range. Species not known within central part of northern Jarrah forest, but has been recorded on north-eastern sandy areas of northern Jarrah Forest.
Diuris drummondii	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.5-1.05 m high. Flower colour: yellow Flowering period (indicated in green): **J** F M A M J J A S O **N** **D** Soils: Low-lying depressions, swamps IBRA Distribution: AVW, JAF, SWA, WAR Florabase records: 55	**Very Low** Dependent on suitable low-lying depressions/habitat conditions.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Diuris micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.3-0.6 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Brown loamy clay. Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 7	**Very Low** Mainly on Swan Coastal Plain and in Wheatbelt
Diuris purdiei	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.35 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Grey-black sand, moist. Winter-wet swamps. IBRA Distribution: JAF, SWA Florabase records: 2	**Very Low** Mainly on Swan Coastal Plain
Drakaea elastic	Orchidaceae	T	CR	Habit: Tuberous, perennial, herb, 0.12-0.3 m high. Flower colour: red, yellow & green Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: White or grey sand. Low- lying situations adjoining winter- wet swamps. IBRA Distribution: SWA Florabase records: 18	**Very Low** One record listed in TPFL database as located within 10 km of survey area. Found adjacent to the SW Highway in dry sand. Occurs on the Swan Coastal Plain.
Drakaea micrantha	Orchidaceae	T	Vulnerable	Habit: Tuberous, perennial, herb, 0.15-0.3 m high. Flower colour: red & yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White-grey sand. IBRA Distribution: JAF, SWA, WAR Florabase records: 49	**Very Low** Has not been recorded by DBCA or by MCPL previously within the survey area.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

Note: Refer to Appendix A for State (SCC; WA Herb 1998-) and Federal (FCC; EPBC Act, DCCEEW 2024a, 2024b) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Drosera oreopodion	Droseraceae	T	-	Habit: Fibrous-rooted, rosetted perennial, herb, to 0.035 m high, to 0.015 m wide. Flower colour: White Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Clayey sand sometimes mixed with lateritic pebbles. IBRA Distribution: JAF, SWA Florabase records: 6	**Very Low** Recorded near Armadale and Albany Highway
Eleocharis keigheryi	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Flower colour: green Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils: Clay, sandy loam. Emergent in freshwater: creeks, claypans. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 56	**Very Low** Not been recorded by DBCA or by MCPL previously within the survey area. Mainly on Swan Coastal Plain and in Wheatbelt
Eucalyptus x *balanites*	Myrtaceae	T	Endangered	Habit: Mallee to 5 m high, bark rough, flaky. Flower colour: white Flowering period (indicated in green): **J** **F** M A M J J A S **O** **N** **D** Soils: Sandy soils with lateritic gravel. IBRA Distribution: GES, SWA Florabase records: 11	**Very Low** Has not been recorded by DBCA or by MCPL previously within the survey area. Distribution and soil type is not suitable

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Grevillea flexuosa	Proteaceae	T	Vulnerable	Habit: Irregular, few-branched, non-lignotuberous shrub, to 2 m high. Flower colour: creamy-yellow Flowering period (indicated in green): J F M A M J **J A S O** N D Soils: Red-brown sand with laterite & gravel, sand over granite. Ridgetop plateau & associated breakaways. IBRA Distribution: JAF Florabase records: 43	**Very Low** Not been recorded by DBCA or by MCPL previously within the survey area. Occurs north of Mundaring
Lasiopetalum pterocarpum	Malvaceae	T	Endangered	Habit: Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines. IBRA Distribution: JAF Florabase records: 11	**Low** Has the potential to occur western areas of Darling Ranges near granites on steeper slopes.
Morelotia australiensis	Cyperaceae	T	Vulnerable	Habit: Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O **N D** Soils: Sand, sandy loam. Flats, well-drained areas. IBRA Distribution: JAF, SWA Florabase records: 37	**Low** Not been recorded by DBCA or by MCPL previously within the survey area. Occurs on Swan Coastal Plain, been recorded northeast of sites.

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Proteaceae	T	Critically Endangered	Habit: Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S **O** N D Soils: Sandy with lateritic pebbles. Near winter-wet flats. IBRA Distribution: JAF, SWA Florabase records: 31	**Very Low** Not been recorded by DBCA or by MCPL previously within the survey area. Occurs on Swan Coastal Plain.
Synaphea sp. Pinjarra Plain (A.S. George 17182)	Proteaceae	T	Endangered	Habit: Erect, clumped shrub (sub-shrub), to 0.8 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S** **O** **N** D Soils: Grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite. Flats, seasonally wet areas, railroad reserves often with wet depressions or drains. IBRA Distribution: SWA Florabase records: 63	**Very Low** Not been recorded by DBCA or by MCPL previously within the survey area. Occurs on Swan Coastal Plain
Synaphea sp. Serpentine (G.R. Brand 103)	Proteaceae	T	Critically Endangered	Habit: Erect shrub 0.3-0.6 m high and to 0.5 m wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Sand, loamy sand, clay-loam, clay soil. Flats, gentle slope to wetland, seasonally wet areas. IBRA Distribution: SWA Florabase records: 36	**Very Low** Not been recorded by DBCA or by MCPL previously within the survey area. Occurs on Swan Coastal Plain

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

Note: Refer to Appendix A for State (SCC; WA Herb 1998-) and Federal (FCC; EPBC Act, DCCEEW 2024a, 2024b) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thelymitra dedmaniarum	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, to 0.8 m high. Flower colour: yellow Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Granite IBRA Distribution: JAF Florabase records: 4	**Very Low** Has not been recorded by DBCA or by MCPL previously within the survey area and occurs north of Mundaring
Thelymitra stellata	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.25 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A S **O N** D Soils: Sand, gravel, lateritic loam. IBRA Distribution: GES, JAF, SWA Florabase records: 20	**Very Low** Has not been recorded by DBCA or by MCPL previously within the survey area and occurs mainly north of Perth on sandplains
Verticordia fimbrilepis subsp. *fimbrilepis*	Myrtaceae	T	Endangered	Habit: Shrub, 0.3-0.7 m high. Flower colour: pink-white Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Gravelly or clayey soils. Flats, road verges. IBRA Distribution: AVW, JAF Florabase records: 39	**Very Low** Occurs mainly north of Albany Highway and in Wheatbelt
Verticordia plumosa var. *ananeotes*	Myrtaceae	T	Endangered	Habit: Erect, sparsely branched shrub, 0.3-0.5 m high. Flower colour: pink-purple/white Flowering period (indicated in green): J F M A M J J A S O **N D** Soils: Sandy loam. Seasonally inundated plains. IBRA Distribution: JAF, SWA Florabase records: 23	**Very Low** Not been recorded by DBCA or by MCPL previously within the survey area. Occurs on Swan Coastal Plain and Darling Scarp

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Anthotium sp. Darling Range (F. Hort & B. Hort 2431)	Goodeniaceae	P1	-	Habit: Prostrate, spreading perennial, herb, to 0.05 m high. Flower colour: pink/mauve/purple/blue Flowering period (indicated in green): J F M A M J J A S O **N** **D** Soils: Yellow, grey or brown clayey sand, loam. Slopes, low plains, drainage lines of swamp flats. IBRA Distribution: JAF Florabase records: 16	**Very Low** Been recorded north of Albany Highway, mainly near Brookton Highway.
Calytrix simplex subsp. *simplex*	Myrtaceae	P1	-	Habit: Shrub, ca 0.2 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: Grey clay loam soil, red-brown gravelly loam. Flats and slopes on laterite, swamp. IBRA Distribution: JAF, SWA Florabase records: 5	**Very Low** Recorded on eastern fringes of the northern Jarrah forest and north of survey areas
Darwinia hortiorum	Myrtaceae	P1	-	Habit: Erect to spreading, densely branched shrub to 0.7 m high and 0.8 m wide. Flower colour: reddish-brown & green & yellow-red Flowering period (indicated in green): J F M A M J J A **S** **O** **N** **D** Soils: Shallow granitic soils, loam or loam/clay associated with laterite. Granite outcrops and drainage lines to granite outcrops. IBRA Distribution: JAF Florabase records: 8	**Moderate** Recorded on granites, mainly north-east of survey areas near Monadnocks

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Drosera paleacea	Droseraceae	P1		Habit: Fibrous-rooted, rosetted perennial, herb, to 0.03 m high, to 0.015 m wide. Flower colour: white-cream Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: White sand, sandy clay. IBRA Distribution: AVW, WAR Florabase records: 16	**Very Low** Occurs on Swan Coastal Plain and southern coastal areas near Albany
Hemigenia rigida	Lamiaceae	P1	-	Habit: Upright or spreading shrub, 0.1-0.6 (-1) m high. Flower colour: blue-purple/violet Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops IBRA Distribution: AVW Florabase records: 4	**Very Low** In Wheatbelt, not in survey areas
Hibbertia acrotoma	Dilleniaceae	P1	-	Habit: Openly branched, spreading to prostrate shrub to 0.5m. Flower colour: yellow Flowering period (indicated in green): **J F M A M J J A S** O N D Soils: Loam soils over laterite or granite IBRA Distribution: JAF, SWA Florabase records: 7	**Very Low** Edge of Darling Scarp between Serpentine & Oakley Dam
Hibbertia ?ambita	Dilleniaceae	P1		Habit: Shrub Flower colour: Yellow Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Lateritic sandy loam. IBRA Distribution: JAF Florabase records: 17	**Low** Recorded in eastern sections of Huntly North, mainly east of survey areas

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hibbertia hortiorum	Dilleniaceae	P1		Habit: Prostrate shrub Flower colour: Yellow Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Lateritic yellowish sandy loam. IBRA Distribution: JAF Florabase records: 12	**Moderate** Recorded in eastern sections of Huntly North
Hibbertia polyancistra	Dilleniaceae	P1	-	Habit: Erect shrub 0.3-0.45 (-0.6) m high. Flower colour: yellow Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Shallow soil over granite. IBRA Distribution: JAF Florabase records: 8	**Very Low** Occurs north-east of survey areas and on Blackwood Plateau
Levenhookia preissii	Stylidiaceae	P1	-	Habit: Annual (ephemeral), herb, 0.03-0.17 m high. Flower colour: pink-red Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Grey or black, peaty sand. Swamps. IBRA Distribution: SWA Florabase records: 14	**Very Low** Occurs on Coastal Plain from north of Perth to Augusta and then localised patch in southern forests
Netrostylis sp. Nannup (P.A. Jurjevich 1133)	Cyperaceae	P1	-	Habit: Perennial. Caespitose sedge 90 cm high. Flower colour: - Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Creek, valley floors. IBRA Distribution: JAF Florabase records: 6	**Moderate** Locally abundant to the NW and within 5 km of survey area (WA Herb). Findings associated with clay loam and dark grey soils in lowland areas.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Paracaleana gracilicordata	Orchidaceae	P1	-	Habit: Perennial, herb, to 0.07 m high. Flower colour: green-yellow-purple Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: Growing on moss mats, granite. Outcrops. IBRA Distribution: JAF Florabase records: 8	**Moderate** Recorded north and north-east of survey areas
Paracaleana granitica	Orchidaceae	P1	-	Habit: Perennial, herb, to 0.07 m high. Flower colour: green-purple Flowering period (indicated in green): J F M A M J J A S **O** **N** **D** Soils: Growing on moss mats, granite. Outcrops. IBRA Distribution: JAF Florabase records: 7	**High** **R**ecorded near Huntly North survey areas, mainly on granites
Senecio gilbertii	Asteraceae	P1	-	Habit: Erect, slender perennial, herb, to 1.5 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S** **O** **N** D Soils: Peaty sand. Swamps, slopes IBRA Distribution: AVW, JAF Florabase records: 10	**Very Low** Recorded north of Brookton Highway and in Wheatbelt
Synaphea odocoileops	Proteaceae	P1	-	Habit: Tufted, compact shrub, 0.2-0.5 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils: Brown-orange loam & sandy clay, granite. Swamps, winter-wet areas. IBRA Distribution: SWA Florabase records: 22	**Very Low** Recorded on Swan Coastal Plain

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

Note: Refer to Appendix A for State (SCC; WA Herb 1998-) and Federal (FCC; EPBC Act, DCCEEW 2024a, 2024b) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Banksia recurvistylis	Proteaceae	P2	-	Habit: Non-lignotuberous shrub to c. 2 m high and 3 m wide. Flower colour: pale yellow Flowering period (indicated in green): J F M A M J J A S O **N D** Soils: Shallow, lateritic soils associated with granite outcrops. IBRA Distribution: JAF Florabase records: 7	**Moderate** Recorded north and northeast of survey area
Bossiaea modesta	Fabaceae	P2	-	Habit: Slender, trailing & twining shrub. Flower colour: yellow & red Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: Soils derived from granite. Damp areas close to stream. IBRA Distribution: JAF, SWA Florabase records: 22	**Moderate** Recorded mainly north of survey areas and outlier north of Dwellingup
Calectasia grandiflora	Dasypogonaceae	P2		Habit: Rhizomatous, perennial, herb (or undershrub), to 0.65 m high, without stilt roots. Flower colour: blue/purple Flowering period (indicated in green): J F M A M **J J A S O N** D Soils: White, grey or yellow sand, sandy clay, gravel, laterite, granite. Swampy areas, rock outcrops, flats, slopes, ridges. IBRA Distribution: JAF, SWA Florabase records: 12	**Very Low** Mainly on Darling Scarp and Swan Coastal Plain

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Cardamine paucijuga	Brassicaceae	P2	-	Habit: Slender erect annual herb to 0.4m high. Flower colour: White Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: In moist to dry habitats IBRA Distribution: SWA, WAR, JAF Florabase records: 10	**Very Low** Occurs on Swan Coastal Plain and in Southern Wheatbelt
Grevillea crowleyae	Proteaceae	P2	-	Habit: Dense & spreading shrub, 0.5-1.5 m high. Flower colour: - Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils: Loam. IBRA Distribution: JAF Florabase records: 9	**Very Low** Occurs East on fringes of Wheatbelt and in Wheatbelt
Grevillea ornithopoda	Proteaceae	P2	-	Habit: Spreading, virgate shrub, 1-3 (-5) m high, up to 3 m wide. Flower colour: cream-white Flowering period (indicated in green): J F M A **M** **J** **J** **A** **S** **O** **N** D Soils: Loam, loam over clay, sand, clay. Edge of river bank and creek, dunes IBRA Distribution: JAF, SWA Florabase records: 20	**Low Moderate** Within species range, recorded south, west and north of survey area.
Johnsonia pubescens subsp. *cygnorum*	Hemerocallidaceae	P2	-	Habit: Tufted, perennial, herb, 0.15-0.25 m high. Flower colour: white-green Flowering period (indicated in green): J F M A M J J A **S** O N D Soils: Grey-white-yellow sand. Flats, seasonally-wet sites. IBRA Distribution: SWA Florabase records: 12	**Very Low** Occurs on the Swan Coastal Plain

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Lepyrodia curvescens	Restionaceae	P2		Habit: Dioecious, shortly creeping, tufted rhizomatous, herb, 0.24-0.4 m high, rhizomes on surface or to 1 cm deep Flower colour: light-brown to mauve Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Sand, laterite. Seasonally inundated swampland. IBRA Distribution: SWA Florabase records: 20	**Very Low** Mainly on Swan Coastal Plain, northern sandplains and near Brookton Highway
Millotia tenuifolia var. *laevis*	Asteraceae	P2	-	Habit: Ascending to erect annual, herb, 0.02-0.1 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Granite or laterite soils. IBRA Distribution: AVW, JAF, SWA Florabase records: 13	**Very Low** Mainly on Sawan Coastal Plain and in Wheatbelt
Schizaea rupestris	Schizaeaceae	P2	-	Habit: Rhizomatous, perennial, herb or grass-like or (fern), 0.1-0.2m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N D Soils: Sand. Gullies, creek banks, shaded moist rock faces. IBRA Distribution: ESP, JAF, WAR Florabase records: 13	**Moderate** Two records identified by WA herb and one record contained in the TFPL database. All occurring within 5 km N and S of the survey area. Findings are associated with clay loam and dark gravelly soils.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Tetratheca phoenix	Elaeocarpaceae	P2	-	Habit: Few-branched shrub (subshrub), to 0.25 m high. Flower colour: dark pink-magenta Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Brown gravelly loam over granite. Mid to Upper slopes, near granite outcrops. IBRA Distribution: JAF Florabase records: 10	**Moderate** Near granite outcrops and mainly near Monadnocks
Acacia drummondii subsp. *affinis*	Fabaceae	P3	-	Habit: Erect shrub, 0.3-1 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J **J** **A** S O N D Soils: Lateritic gravelly soils. IBRA Distribution: AVW, JAF, SWA Florabase records: 37	**Low** Mainly on Coastal Plain and in Wheatbelt north-east of Perth
Acacia horridula	Fabaceae	P3	-	Habit: Harsh, slender, single-stemmed shrub, 0.3-0.6 (-1) m high. Flower colour: yellow Flowering period (indicated in green): J F M A **M** **J** **J** **A** S O N D Soils: Gravelly soils over granite, sand. Rocky hillslopes. IBRA Distribution: JAF, SWA Florabase records: 33	**Low** Mainly on Swan Coastal Plain and western edges of Darling Ranges with patch on eastern fringes of northern Jarrah forest

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia oncinophylla subsp. *oncinophylla*	Fabaceae	P3	-	Habit: Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Flower colour: yellow Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: Granitic soils IBRA Distribution: AVW, JAF, SWA Florabase records: 42	**Low** Mainly on the western fringes of the Darling Ranges on granites
Actinotus repens	Apiaceae	P3	-	Habit: Prostrate perennial to 5 cm high, c. 20cm wide. Flower colour: white Flowering period (indicated in green): **J F M** A M J J A S O N D Soils: Coarse black peaty sand over clay. Creeklines, edges of water channels. IBRA Distribution: JAF, WAR Florabase records: 36	**Moderate** Mainly on southern forested areas. Located on the banks of a creekline containing *E. patens*, *E. megacarpa*, *T. linearifolia*, and *M. dilatata.* Near Willowdale
Adenanthos cygnorum subsp. chamaephyton	Proteaceae	P3	-	Habit: Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Flower colour: white-cream-pink-green/green Flowering period (indicated in green): **J** F M A M **J J A S O N D** Soils: Grey sand, lateritic gravel. IBRA Distribution: AVW, JAF, SWA Florabase records: 21	**Low** Recorded mainly north of Brookton Highway, localised areas south of survey areas

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	Ericaceae	P3	-	Habit: Shrub, to 1.1 m high and 1.1 m wide. Flower colour: white-cream/mauve-pink Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils: Loam, clay, sand, gravel. Granite, slopes and drainage lines. IBRA Distribution: JAF Florabase records: 22	**Moderate** Mainly north of Huntly North area and Albany Highway
Byblis gigantea	Byblidaceae	P3	-	Habit: Small, branched perennial, herb (or sub shrub), to 0.45 m high. Flower colour: pink-purple/white Flowering period (indicated in green): **J** F M A M J J A **S** **O** **N** **D** Soils: Sandy-peat swamps. Seasonally wet areas. IBRA Distribution: JAF, SWA Florabase records: 40	**Low** Mainly north of Albany Highway but patch southeast if Dwellingup
Conospermum scaposum	Proteaceae	P3		Habit: Erect shrub, 0.2-0.45(-0.75) m high. Flower colour: blue Flowering period (indicated in green): **J** **F** M A M J J A S **O** **N** **D** Soils: White-grey sand, sandy clay. Low swampy areas, road verges. IBRA Distribution: AVW, GES, JAF, SWA Florabase records: 46	**Low** Mainly north-east of survey areas, from northern sandplains to Wheatbelt

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Cyathochaeta teretifolia	Cyperaceae	P3	-	Habit: Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2.0 m high, to 1.0 m wide. Flower colour: brown Flowering period (indicated in green): **J** F M A M J **J** A **S** **O** **N** D Soils: Grey sand, sandy clay. Swamps, creek edges. IBRA Distribution: JAF, SWA, WAR Florabase records: 39	**Low to Moderate** Mainly on Coastal Plains, with few in creekline areas of forests
Grevillea dissectifolia (formerly known as *Grevillea manglesii* subsp. *dissectifolia)*	Proteaceae	P3	-	Habit: Spreading, virgate shrub, 1.5-3 (-5) m high, up to 33 m wide. Flower colour: white & red & brown Flowering period (indicated in green): J F M A M **J** J A **S** **O** **N** D Soils: Gravelly loam, moist. Roadsides. IBRA Distribution: JAF Florabase records: 27	**Moderate** Mainly north of the Albany Highway with some occurrences in valleys near survey areas
Grevillea prominens	Proteaceae	P3	-	Habit: Spreading shrub, 0.5-1.7m high, 0.3-1m wide. Flower colour: cream-white Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: Gravelly loam, along creeklines. IBRA Distribution: JAF Florabase records: 9	**Moderate** Recorded previously by MCPL (2022). Three records with WAHerb and near survey areas
Hakea oldfieldii	Proteaceae	P3	-	Habit: Open straggling shrub up to 2.5m. Flower colour: white-cream to yellow Flowering period (indicated in green): J F M A M J J **A** **S** **O** N D Soils: Red clay or sand over laterite, seasonally wet flats IBRA Distribution: GES, SWA, AVW, JAF. MAL, ESP Florabase records: 66	**Low** Soil conditions less likely in survey area and occurs mainly south, southeast and east of survey area

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Halgania corymbosa	Boraginaceae	P3	-	Habit: Erect shrub, 0.35-1 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J **A S O N** D Soils: Gravelly soils, soils over granite. IBRA Distribution: JAF, SWA Florabase records: 18	**Very Low** Mainly on fringes of northern Jarrah forest to north-west and north of survey areas with outliers near Bannister
Hemigenia microphylla	Lamiaceae	P3	-	Habit: Slender shrub, 0.4-1.8 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Sandy clay, peaty clay, granite. Winter-wet depressions. IBRA Distribution: JAF, SWA, WAR Florabase records: 25	**Low** Mostly on Swan Coastal Plain and in southern forest and coastal areas
Isopogon autumnalis	Proteaceae	P3	-	Habit: Shrub 0.3-1 m high, commonly 0.5-1 m wide. Flower colour: pale yellow Flowering period (indicated in green): **J F M A M** J J A S O N D Soils: Sandy soils. IBRA Distribution: GES, JAF, SWA Florabase records: 59	**Very Low** Mostly on Swan Coastal Plain and northern sandplains
Lasiopetalum glutinosum subsp. *glutinosum*	Malvaceae	P3	-	Habit: Shrub to 0.8 m high. Flower colour: pink-purple Flowering period (indicated in green): J F M A M J J A **S O** N D Soils: Lateritic gravel and clay, clay loam, sandy clay over granite. Slopes, granite outcrops. IBRA Distribution: AVW, JAF, SWA Florabase records: 48	**Very Low** Mainly on Darling Scarp and areas north of survey areas

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Lepyrodia heleocharoides	Restionaceae	P3	-	Habit: Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S O N **D** Soils: Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps. IBRA Distribution: JAF, SWA Florabase records: 20	**Very Low** Mainly on Darling Scarp or in southern areas of southwest forests
Meionectes tenuifolia	Haloragaceae	P3	-	Habit: Annual semi-aquatic herb, to 0.35 m high. Flower colour: orange-red-brown, green Flowering period (indicated in green): J F M A M J J A **S O N D** Soils: Grey sand or grey-brown clay, shallow soils. Seasonally inundated flat, edge of swamp. IBRA Distribution: JAF, SWA Florabase records: 24	**Very Low** Mainly on Darling Scarp, Swan Coastal Plain, north of Brookton Highway ad eastern fringes of forest
Netrostylis sp. Blackwood River (A.R. Annels 3043)	Cyperaceae	P3	-	Habit: Erect or spreading sedge to 1 m high. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D Soils: Shallow grey sandy soil, clay loam. Along edges of creeklines and inundated swamp. IBRA Distribution: ESP, JAF, SWA, WAR Florabase records: 16	**Moderate** WAHerb lists one record within 1 km of central survey point and found within creekline. Mostly in southern forest and coastal areas

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Petrophile filifolia subsp. *laxa*	Proteaceae	P3	-	Habit: Erect, spreading shrub, to 0.75 m high. Flower colour: cream Flowering period (indicated in green): **J F** M A M J J A S O **N D** Soils: White gritty sand, brown, red, yellow, white or grey sand, brown-yellow sandy clay. Winter-wet sites, flats, slopes, swamps, drainage lines. IBRA Distribution: JAF Florabase records: 18	**Very Low** Mainly northeast of Albany Highway
Pithocarpa corymbulosa	Asteraceae	P3	-	Habit: Erect to scrambling perennial, herb, 00.5-1 m high. Flower colour: white Flowering period (indicated in green): **J F M A** M J J A S O N D Soils: Gravelly or sandy loam. Amongst granite outcrops. IBRA Distribution: GES, JAF, SWA Florabase records: 22	**Very Low** Mainly on granites on Darling Scarp with outliers on northern sandplains
Stackhousia sp. Red-blotched corolla (A. Markey 911)	Celastraceae	P3	-	Habit: Erect herb or shrub, approximately 0.2 m high. Flower colour: cream-yellow Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Brown loamy sand, clayey sand over laterite, white sandy clay over granite, grey clay. Slopes. IBRA Distribution: AVW, GES, JAF Florabase records: 9	**Very Low** Mainly on Darling Scarp or in southern areas of southwest forests

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Synaphea pandurata	Proteaceae	P3	-	Habit: Clumped shrub (subshrub), 0.2-0.55 m high. Flower colour: yellow Flowering period (indicated in green): J F M **A** M **J** J A **S** **O** N **D** Soils: Yellow-grey, yellow-brown, yellow-red sands and sandy loams, dark brown loam, laterite gravel, granite. In undulating areas. IBRA Distribution: JAF Florabase records: 23	**Very Low** Mainly northeast of Albany Highway
Tetratheca pilifera	Elaeocarpaceae	P3	-	Habit: Spreading shrub, 0.1-0.3 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J **A** **S** **O** N D Soils: Gravelly soils. IBRA Distribution: JAF, SWA Florabase records: 35	**Very Low** MCPL (2019) recorded at one location and within 5 km of survey areas, mainly norther of Great Eastern Highway
Thysanotus anceps	Asparagaceae	P3	-	Habit: Rhizomatous, leafless perennial, herb, to 0.4 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S **O** **N** **D** Soils: White or grey sand, lateritic gravel, laterite. IBRA Distribution: GES, JAF, SWA Florabase records: 17	**Moderate** Mainly in northwest areas and Darling Scarp with outliers on northern sandplains

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia cuneifolia	Fabaceae	P4	-	Habit: Erect or straggly shrub, 1-3 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J **J A S O** N D Soils: Sand, clay or loam over granite. Granite outcrops & hills, rocky watercourses. IBRA Distribution: AVW, JAF Florabase records: 41	**Very Low** Mainly northeast of Albany Highway and in Wheatbelt
Acacia oncinophylla subsp. *patulifolia*	Fabaceae	P4	-	Habit: Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Granitic soils, occasionally on laterite. IBRA Distribution: JAF, SWA Florabase records: 31	**Very** Recorded mainly to north and north-west on granites mainly.
Aponogeton hexatepalus	Aponogetonceae	P4	-	Habit: Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Flower colour: green-white Flowering period (indicated in green): J F M A M J **J A S O** N D Soils: Mud. Freshwater: ponds, rivers, claypans. IBRA Distribution: JAF, SWA Florabase records: 30	**Very Low** Mainly on Swan Coastal Plain and southern forests.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Caladenia speciosa	Orchidaceae	P4	-	Habit: Tuberous, perennial, herb, 0.35-0.6 m high. Flower colour: white-pink Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils: White, grey or black sand. IBRA Distribution: JAF, SWA Florabase records: 59	**Very Low** Mainly on Swan Coastal Plain with outlier north of Brookton Highway
Calothamnus graniticus subsp. *leptophyllus*	Myrtaceae	P4	-	Habit: Erect, multi-stemmed shrub, 1-2 m high. Flower colour: red Flowering period (indicated in green): J F M A M **J** **J** **A** S O N D Soils: Clay over granite, lateritic soils. Hillsides. IBRA Distribution: JAF, SWA Florabase records: 32	**Moderate** Nearby records within SWA and near survey areas
Chorizema ulotropis	Fabaceae	P4	-	Habit: Sprawling, open, semi-prostrate shrub, to 0.45 m high. Flower colour: orange-yellow Flowering period (indicated in green): J F M A M J **J** **A** **S** O N D Soils: Moist to dry soils, white sand with gravel, laterite, granite. Outcrops, winter damp to dry areas, flats. IBRA Distribution: ESP, JAF, MAL Florabase records: 24	**Low-Moderate** Mostly northeast of Albany Highway with several outliers in forest
Cyanothamnus tenuis	Rutaceae	P4	-	Habit: Procumbent or erect & slender shrub, 0.1-0.5 m high. Flower colour: white-pink Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils: Laterite, stony soils, granite. IBRA Distribution: JAF, SWA Florabase records: 44	**Moderate** Manly on western fringes of survey areas, with some outliers

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

Note: Refer to Appendix A for State (SCC; WA Herb 1998-) and Federal (FCC; EPBC Act, DCCEEW 2024a, 2024b) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; ESP – Esperance Plains; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; SWA – Swan Coastal Plain; WAR – Warren. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Drosera occidentalis	Droseraceae	P4	-	Habit: Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Flower colour: pink/white Flowering period (indicated in green): **J F M A M J J A S O N D** Soils: White/black sand over yellow clay, yellow sand, moist brown/grey clay/sand, peaty sand, sandy clay. Damp flats, flood plain. IBRA Distribution: JAF, SWA Florabase records: 18	**Low** Swan Coastal Plain and northeast mainly of survey areas
Eucalyptus x graniticola	Myrtaceae	P4	-	Habit: Mallee to 4 m, smooth bark. Flower colour: Stamens cream Flowering period (indicated in green): **S O** Soils: Granite soils. IBRA Distribution: JAF Florabase records: 6	**Low** WA Herb lists two records, both north of survey area and associated with granite.
Goodenia verreauxii	Goodeniaceae	P4	-	Habit: Perennial, herb, to 0.5 m high. Flower colour: yellow Flowering period (indicated in green): **J F M A M J J A N D** Soils: White/grey or yellow sand. Flats. IBRA Distribution: AVW, JAF Florabase records: 44	**Very Low** Occurs northeast of Brookton Highway and into Wheatbelt

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Grevillea pimeleoides	Proteaceae	P4	-	Habit: Non-lignotuberous shrub, 0.4-2.4 m high. Flower colour: yellow-orange Flowering period (indicated in green): J F M A **M J J A S O N** D Soils: Gravelly soils over granite. Rocky hillsides. IBRA Distribution: JAF Florabase records: 36	**Low** Mainly north of survey area and associated with granite.
Hemigenia platyphylla	Lamiaceae	P4	-	Habit: Spreading shrub, 0.2-1.5 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J A **S O N** D Soils: Sandy & loamy soils. Granite rocks, slopes. IBRA Distribution: AVW, ESP, JAF, MAL Florabase records: 21	**Very Low** Mainly north of survey areas, in the Wheatbelt and southern coastal areas
Lasiopetalum cardiophyllum	Malvaceae	P4	-	Habit: Erect, multi-stemmed shrub, 0.2-0.5 m high. Flower colour: pink Flowering period (indicated in green): **J** F M A M J J **A S O N D** Soils: Lateritic gravelly soils, sandy clay. Flats, hillslopes. IBRA Distribution: AVW, JAF Florabase records: 34	**Low** Mainly on eastern fringes of Jarrah forest and in the Wheatbelt
Parsonsia diaphanophleba	Apocynaceae	P4	-	Habit: Woody climber, to 10 m high. Flower colour: white/cream & pink Flowering period (indicated in green): **J F** M **A M J** J A **S** O N D Soils: Alluvial soils. Along rivers. IBRA Distribution: JAF, SWA Florabase records: 28	**Low** Mainly Swan Coastal Plain with a few outliers in forest

APPENDIX B: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Pimelea rara	Thymelaeaceae	P4	-	Habit: Shrub, 0.2-0.35 m high. Flower colour: white Flowering period (indicated in green): **J** F M A M J **J** A S O N **D** Soils: Lateritic soils. IBRA Distribution: JAF Florabase records: 52	**High** Occurs near survey areas and norther of Brookton Highway
Senecio leucoglossus	Asteraceae	P4	-	Habit: Erect annual, herb, to 1.3 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A S O N D** Soils: Gravelly lateritic or granitic soils. Granite outcrops, slopes. IBRA Distribution: JAF, SWA, WAR Florabase records: 44	**High** Occurs in local patches within survey areas
Stylidium ireneae	Stylidiaceae	P4	-	Habit: Lax perennial, herb, (0.06-) 0.1-0.28 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: Sandy loam. Valleys near creek lines. IBRA Distribution: JAF, SWA, WAR Florabase records: 25	**Moderate-High** Extends from forest area to coastal plains and southern forests
Stylidium longitubum	Stylidiaceae	P4	-	Habit: Erect annual (ephemeral), herb, 0.05-0.12 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S **O N D** Soils: Sandy clay, clay. Seasonal wetlands. IBRA Distribution: GES, JAF, SWA Florabase records: 46	**Very Low** Mainly on coastal plains north and south of Perth

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Stylidium scabridum	Stylidiaceae	P4	-	Habit: Perennial herb, 0.05-0.24 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S **O** **N** **D** Soils: Sands. IBRA Distribution: AVW, JAF Florabase records: 53	**Very Low** Mainly north of Albany Highway
Verticordia lindleyi subsp. *lindleyi*	Myrtaceae	P4	-	Habit: Erect shrub, 0.2-0.75 m high. Flower colour: pink Flowering period (indicated in green): **J** F M A **M** J J A S O **N** **D** Soils: Sand, sandy clay. Winter-wet depressions. IBRA Distribution: GES, JAF, SWA Florabase records: 83	**Very Low** Nearby records within Swan Coastal Plain. Grows on sand, sandy clay

APPENDIX C: SUMMARY OF INTRODUCED PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE HUNTLY AND WILLOWDALE SURVEY AREAS

NOTE: The ecological impact and invasiveness rating of each taxon was assessed based on the South West Region database (DPaW, 2013; DBCA, 2024). The ecological impact of an introduced species is rated from low (L), medium (M), to high (H) disturbance. Invasiveness is an assessment of the rate of spread by that species throughout a system; from rapid (R) to slow (S). If species have deficiencies in knowledge, an unknown (U) is assigned. Desktop surveys were conducted by Biologic (2024) and Ecologia (2024) in 2023.

Family	Introduced species (*)	BAM act status	Ecological Impact	Invassivness	Biologic 2024	Ecologia 2024	Eco Logical 2024
Alismataceae	* *Sagittaria platyphylla*	Declared Pest - s22(2), WoNs	U	U		X	
Alliaceae	* *Allium neapolitanum*	Permitted - s11	U	U	X		
Apocynaceae	* *Calotropis procera*	Declared Pest - s22(2)	U	U		X	
Apocynaceae	* *Cryptostegia madagascariensis*	Declared Pest - s22(2)	U	U		X	
Apocynaceae	* *Gomphocarpus fruticosus*	Declared Pest - s22(2)	U	R	X	X	
Apocynaceae	* *Gomphocarpus physocarpus*	Permitted - s11	U	R	X		
Apocynaceae	* *Vinca major*	Permitted - s11	H	S	X		
Araceae	* *Pistia stratiotes*	Declared Pest - s22(2)	U	U		X	
Araceae	* *Zantedeschia aethiopica*	Declared Pest - s22(2)	H	M		X	X
Araliaceae	* *Hedera helix*	Permitted - s11	L	S	X		
Araliaceae	* *Hydrocotyle ranunculoides*	Declared Pest - s22(2)	U	U		X	
Asparagaceae	* *Asparagus asparagoides*	Declared Pest - s22(2), WoNs	H	R		X	
Asteraceae	* *Arctotheca calendula*	Permitted - s11	M	M	X		
Asteraceae	* *Chondrilla juncea*	Declared Pest - s22(2)	U	U		X	
Asteraceae	* *Cotula coronopifolia*	Permitted - s11	U	R	X		
Asteraceae	* *Cotula turbinata*	Permitted - s11	U	R	X		
Asteraceae	* *Erigeron sumatrensis*	Permitted - s11	U	U	X		
Asteraceae	* *Hypochaeris glabra*	Permitted - s11	M	R	X		
Asteraceae	* *Onopordum acaulon*	Declared Pest - s22(2)	L	S		X	
Asteraceae	* *Senecio diaschides*	Permitted - s11	U	U	X		
Asteraceae	* *Silybum marianum*	Declared Pest - s22(2)	U	M		X	
Asteraceae	* *Sonchus oleraceus*	Permitted - s11	M	R	X		
Asteraceae	* *Symphyotrichum squamatum*	Permitted - s11	U	R	X		
Asteraceae	* *Tolpis barbata*	Permitted - s11	U	R	X		
Asteraceae	* *Ursinia anthemoides*	Permitted - s11	U	R	X		
Asteraceae	* *Vellereophyton dealbatum*	Permitted - s11	M	R	X		
Asteraceae	* *Xanthium spinosum*	Declared Pest - s22(2)	U	U		X	
Asteraceae	* *Xanthium strumarium*	Declared Pest - s22(2)	U	U		X	
Bignoniaceae	* *Jacaranda mimosifolia*	Permitted - s11	U	U	X		
Boraginaceae	* *Echium plantagineum*	Declared Pest - s22(2)	L	M		X	
Cactaceae	* *Austrocylindropuntia cylindrica*	Declared Pest - s22(2), WoNs	U	U		X	
Cactaceae	* *Austrocylindropuntia subulata*	Declared Pest - s22(2), WoNs	U	U		X	
Cactaceae	* *Cylindropuntia fulgida*	Declared Pest - s22(2), WoNs	U	U		X	
Cactaceae	* *Cylindropuntia imbricata*	Declared Pest - s22(2), WoNs	U	U		X	
Cactaceae	* *Cylindropuntia kleiniae*	Declared Pest - s22(2), WoNs	U	U		X	
Cactaceae	* *Cylindropuntia pallida*	Declared Pest - s22(2), WoNs	U	U		X	

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Family	Introduced species (*)	BAM act status	Ecological Impact	Invassivness	Biologic 2024	Ecologia 2024	Eco Logical 2024
Cactaceae	* *Cylindropuntia tunicata*	Declared Pest - s22(2), WoNs	U	U		X	
Cactaceae	* *Opuntia elata*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia elatior*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia engelmannii*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia microdasys*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia monacantha*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia polyacantha*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia puberula*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia stricta*	Declared Pest - s22(2), WoNs	L	S		X	
Cactaceae	* *Opuntia tomentosa*	Declared Pest - s22(2), WoNs	U	U		X	
Cannabaceae	* *Cannabis sativa*	Permitted, Requires Permit - r73	U	U	X		
Caprifoliaceae	* *Centranthus macrosiphon*	Permitted - s11	H	R	X		
Caprifoliaceae	* *Lonicera japonica*	Permitted - s11	U	S	X		
Caryophyllaceae	* *Moenchia erecta*	Permitted - s11	U	U	X		
Cyatheaceae	* *Sphaeropteris cooperi*	Permitted - s11	M	R	X		
Cyperaceae	* *Cyperus brevifolius*	Permitted - s11	H	M	X		
Cyperaceae	* *Cyperus tenellus*	Permitted - s11	U	R	X		
Euphorbiaceae	* *Jatropha gossypifolia*	Declared Pest - s22(2), WoNs	U	U		X	
Fabaceae	* *Acacia baileyana*	Permitted - s11	L	S	X		
Fabaceae	* *Acacia decurrens*	Permitted - s11	L	S	X		
Fabaceae	* *Acacia iteaphylla*	Permitted - s11	U	R	X		
Fabaceae	* *Acacia longifolia*	Permitted - s11	U	M	X		
Fabaceae	* *Acacia podalyriifolia*	Permitted - s11	L	S	X		
Fabaceae	* *Alhagi maurorum*	Declared Pest - s22(2)	U	U		X	
Fabaceae	* *Chamaecytisus palmensis*	Permitted - s11	H	R	X		
Fabaceae	* *Lathyrus tingitanus*	Permitted - s11	L	S	X		
Fabaceae	* *Lotus angustissimus*	Permitted - s11	U	R	X		
Fabaceae	* *Lotus subbiflorus*	Permitted - s11	U	R	X		
Fabaceae	* *Neltuma glandulosa × velutina*	Declared Pest - s22(2), WoNs	U	U		X	
Fabaceae	* *Parkinsonia aculeata*	Declared Pest - s22(2), WoNs	U	U		X	
Fabaceae	* *Senna alata*	Declared Pest - s22(2)	U	U		X	
Fabaceae	* *Senna obtusifolia*	Declared Pest - s22(2)	U	U		X	
Fabaceae	* *Trifolium campestre*	Permitted - s11	U	U	X		
Fabaceae	* *Trifolium dubium*	Permitted - s11	U	U	X		
Fabaceae	* *Trifolium hirtum*	Permitted - s11	U	U	X		
Fabaceae	* *Trifolium ligusticum*	Permitted - s11	U	U	X		

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Family	Introduced species (*)	BAM act status	Ecological Impact	Invassivness	Biologic 2024	Ecologia 2024	Eco Logical 2024
Fabaceae	* *Ulex europaeus*	Declared Pest - s22(2), WoNs	H	M		X	
Gentianaceae	* *Centaurium erythraea*	Permitted - s11	U	R	X		
Gentianaceae	* *Cicendia filiformis*	Permitted - s11	L	R	X		
Iridaceae	* *Chasmanthe floribunda*	Permitted - s11	H	S	X		
Iridaceae	* *Gladiolus caryophyllaceus*	Permitted - s11	U	U	X		
Iridaceae	* *Ixia polystachya*	Permitted - s11	L	M	X		
Iridaceae	* *Moraea flaccida*	Declared Pest - s22(2)	H	M		X	
Iridaceae	* *Moraea miniata*	Declared Pest - s22(2)	U	U		X	
Iridaceae	* *Romulea rosea*	Permitted - s11	H	U	X		
Iridaceae	* *Tritonia gladiolaris*	Permitted - s11	U	U	X		
Juncaceae	* *Juncus articulatus*	Permitted - s11	U	U	X		
Juncaceae	* *Juncus bufonius*	Permitted - s11	L	R	X		
Juncaceae	* *Juncus capitatus*	Permitted - s11	L	R	X		
Juncaceae	* *Juncus microcephalus*	Permitted - s11	L	R	X		
Linaceae	* *Linum trigynum*	Permitted - s11	L	U	X		
Orchidaceae	* *Disa bracteata*	Permitted - s11	U	R	X		
Orobanchaceae	* *Bellardia trixago*	Permitted - s11	U	R	X		
Orobanchaceae	* *Bellardia viscosa*	Permitted - s11	U	U	X		
Orobanchaceae	* *Orobanche minor*	Permitted - s11	U	R	X		
Orobanchaceae	* *Parentucellia latifolia*	Permitted - s11	U	R	X		
Papaveraceae	* *Fumaria capreolata*	Permitted - s11	M	U	X		
Passifloraceae	* *Passiflora filamentosa*	Permitted - s11	L	S	X		
Pittosporaceae	* *Pittosporum undulatum*	Permitted - s11	H	R	X		
Poaceae	* *Aira caryophyllea*	Permitted - s11	U	R	X		
Poaceae	* *Aira cupaniana*	Permitted - s11	U	R	X		
Poaceae	* *Aristida ramosa*	Permitted - s11	U	U	X		
Poaceae	* *Avena barbata*	Permitted - s11	H	R	X		
Poaceae	* *Brachypodium distachyon*	Permitted - s11	U	U	X		
Poaceae	* *Briza maxima*	Permitted - s11	U	R	X		
Poaceae	* *Briza minor*	Permitted - s11	U	R	X		
Poaceae	* *Bromus diandrus*	Permitted - s11	H	R	X		
Poaceae	* *Bromus hordeaceus*	Permitted - s11	H	R	X		
Poaceae	* *Digitaria sanguinalis*	Permitted - s11	L	R	X		
Poaceae	* *Ehrharta longiflora*	Permitted - s11	U	R	X		
Poaceae	* *Glyceria declinata*	Permitted - s11	M	R	X		
Poaceae	* *Lagurus ovatus*	Permitted - s11	U	M	X		

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Family	Introduced species (*)	BAM act status	Ecological Impact	Invassivness	Biologic 2024	Ecologia 2024	Eco Logical 2024
Poaceae	* *Lolium perenne*	Permitted - s11	M	R	X		
Poaceae	* *Pentameris airoides*	Permitted - s11	U	U	X		
Poaceae	* *Vulpia bromoides*	Permitted - s11	U	R	X		
Poaceae	* *Vulpia myuros*	Permitted - s11	U	R	X		
Polygonaceae	* *Rumex acetosella*	Permitted - s11	U	U	X		
Primulaceae	* *Lysimachia arvensis*	Permitted - s11	U	R	X		
Rhamnaceae	* *Ziziphus mauritiana*	Declared Pest - s22(2)	U	U		X	
Rosaceae	* *Acaena echinata*	Permitted - s11	U	U	X		
Rosaceae	* *Prunus cerasifera*	Permitted - s11	L	S	X		
Rosaceae	* *Rubus anglocandicans*	Declared Pest - s22(2), WoNs	H	M	X	X	
Rosaceae	* *Rubus laudatus*	Declared Pest - s22(2), WoNs	H	M		X	
Rosaceae	* *Rubus rugosus*	Declared Pest - s22(2), WoNs	U	U		X	
Rosaceae	* *Rubus ulmifolius*	Declared Pest - s22(2), WoNs	H	M		X	
Rosaceae	* *Rubus x loganobaccus*	Permitted - s11	H	M	X		
Rosaceae	* *Rubus* sp.	Declared Pest - s22(2), WoNs	H	M			
Rubiaceae	* *Galium aparine*	Declared Pest - s22(2)	U	U		X	
Rubiaceae	* *Galium divaricatum*	Permitted - s11	L	U	X		
Rubiaceae	* *Galium spurium*	Declared Pest - s22(2)	U	U		X	
Salicaceae	* *Populus alba*	Permitted - s11	H	S	X		
Scrophulariaceae	* *Buddleja madagascariensis*	Permitted - s11	U	U	X		
Solanaceae	* *Solanum elaeagnifolium*	Declared Pest - s22(2), WoNs	U	U		X	
Solanaceae	* *Solanum linnaeanum*	Declared Pest - s22(2)	M	M		X	
Tamaricaceae	* *Tamarix aphylla*	Declared Pest - s22(2), WoNs	U	U		X	
Verbenaceae	* *Lantana camara*	Declared Pest - s22(2), WoNs	U	U		X	
Violaceae	* *Viola odorata*	Permitted - s11	L	S	X		
Zygophyllaceae	* *Tribulus terrestris*	Permitted - s11	U	U	X		