Detailed Flora and Vegetation Survey

Lot 107 Godel Road,

Nowergup

September 2024

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Note: original data supplied by PGV Environmental not Ecoedge					

Executive Summary

Ecoedge Environmental Services (Ecoedge) was engaged by Coterra Environment (Coterra) in May 2024, to provide a report for Lot 107 Godel Road, Nowergup, Western Australia (the survey area).

The survey area is approximately 19 hectares in size and is currently undeveloped, containing native vegetation in varying condition.

The report was compiled from the findings of two surveys conducted by PGV Environmental in 2014 and 2023 which were supplied by Coterra.

The 2023 survey determined that some areas of vegetation within the survey area met the definition of a Threatened Ecological Community (TEC). The vegetation type containing Tuart trees was considered to be representative of the Tuart Woodlands and Forests of the Swan Coastal Plain ecological community which is a TEC at both Commonwealth and State levels. The total area of Tuart Woodland TEC within the survey area is 9.77 hectares.

The 2014 and 2023 surveys were both undertaken by Dr Paul van der Moezel of PGV Environmental, who has extensive botanical survey experience on the Swan Coastal Plain. In 2014 the flora and vegetation survey was conducted on the 7 October and in 2023, Lot 107 Godel Road was surveyed on the 25 September. The 2023 survey has been conducted in accordance with the Environmental Protection Authority (EPA) (2016) Technical Guidance, Flora and Vegetation Surveys for Environmental Impact Assessment.

No Threatened flora listed under either the State *Biodiversity Conservation Act 2016* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were found nor were there any State listed Priority flora, or flora of otherwise significance were found in the survey area.

The Cottesloe Complex – Central and South is above the 30% retention of pre-European extent vegetation target across the SCP and at a local government level it is well represented with 41.65% pre-European extent vegetation remaining.

In the City of Wanneroo the amount of extent vegetation remaining is 41.65%, which exceeds the 30% national retention target.

There are no mapped watercourses or wetlands within the survey area. The closest wetland is the conservation category Nowergup Lake (UFI 8021) which is approximately 280 m to the south west of the survey area.

The survey area is not identified as a Bush Forever site. Similar vegetation from the Cottesloe – Central and South vegetation complex occurs in two nearby Bush Forever sites to the east and south-west.

The survey area does not occur within an Environmentally Sensitive Area (ESA) buffer. There are ESAs that are associated with Bush Forever sites to the east and southwest of the survey area and an ESA associated with the indicative location of TEC 'Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain' located approximately 1.4 kilometres to the northeast of the survey area.

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Statement of limitations

Reliance on data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

Original data was supplied by PGV Environmental and site survey was not conducted by Ecoedge's botanists.

Report for the benefit of the Client

The report has been prepared for the benefit of the Client and no other party. Ecoedge assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of Ecoedge or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

1 Introduction

Ecoedge Environmental Services (Ecoedge) was engaged by Coterra Environment (Coterra) in May 2024, to provide a report for Lot 107 Godel Road, Nowergup, Western Australia (the survey area). The survey area is shown in **Figure 1**.

The survey area is approximately 19 hectares (ha) in size and is currently undeveloped, containing native vegetation in Degraded and Completely Degraded condition.

The survey area is located in the City of Wanneroo, approximately 38 kilometres (km) north-north-west of the Perth Central Business District.

The report is compiled from the findings of two surveys conducted by PGV Environmental in 2014 and 2023, the details of which are described below.

1.1 2014 survey

Urban Resources Pty Ltd engaged PGV Environmental in 2014 to undertake a Level 2 spring flora and vegetation survey for Lots 105 McLennan Drive and 107 Godel Road, Nowergup, Western Australia.

A preliminary flora and vegetation survey had also been previously conducted by EnviroWorks Consulting (2014) in February, a time of the year when most ephemeral plant species are not able to be identified.

1.2 2023 survey

In 2023, a detailed flora and vegetation survey was conducted by PGV Environmental over a larger area which included Lot 105 McLennan Drive for Carabooda Landowners Pty Ltd.

The 2023 survey area was approximately 660 ha in size and is used for a variety of purposes including market gardens, turf farms, sand and limestone mining (past, present and possible future), rural retreats and undeveloped bushland.

2 Scope and objectives

The scope of the PGV surveys required a desktop assessment to be conducted prior to the field survey to identify relevant key features and constraints which were in or nearby the survey area, such as Threatened and Priority Flora, Threatened and Priority Ecological Communities (TEC and PECs), riparian vegetation, unusual soil/landscape systems, conservation estates, poorly represented vegetation associations and or vegetation complexes and environmentally sensitive areas (ESAs). The desktop assessment area (study area) encompassed a 10 km buffer to the survey area.

The field component of the PGV survey was required to ground truth the desktop assessment findings and delineate all significant flora and vegetation components within the survey area, including TECs and PECs and Threatened and Priority flora. In particular, a targeted assessment was required of the condition of Tuart woodland within the survey area to assist in the determination of *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) TEC status.

The 2014 survey was undertaken in accordance with now superseded Guidance Statement 51: *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) which was at the time the requirement for assessment of environmental factors in accordance with the Environmental Protection Act 1986.

The 2023 survey and report were required to be undertaken in accordance with the Environmental Protection Authority's (EPA) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) and meet requirements of other relevant State and Commonwealth guidelines for threatened species and communities, such as approved conservation advice for threatened species and communities under the EPBC Act 1999.

The 2023 survey included the following

- Desktop search and review of the Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority flora database.
- A search of Atlas of Living Australia for records of Threatened or Priority species.
- A search of the Commonwealth Government's Protected Matters Search Tool to identify species potentially occurring within the area that are protected under the EPBC Act.
- Field survey using quadrats to record native and introduced species as well as a thorough survey area walkover of any areas of native vegetation.
- Analysis of quadrat data to ascertain the conservation significance of the vegetation.
- Recording of any significant plant species using a hand-held GPS.
- Description and mapping of vegetation types and vegetation condition.
- Compilation of a flora list.

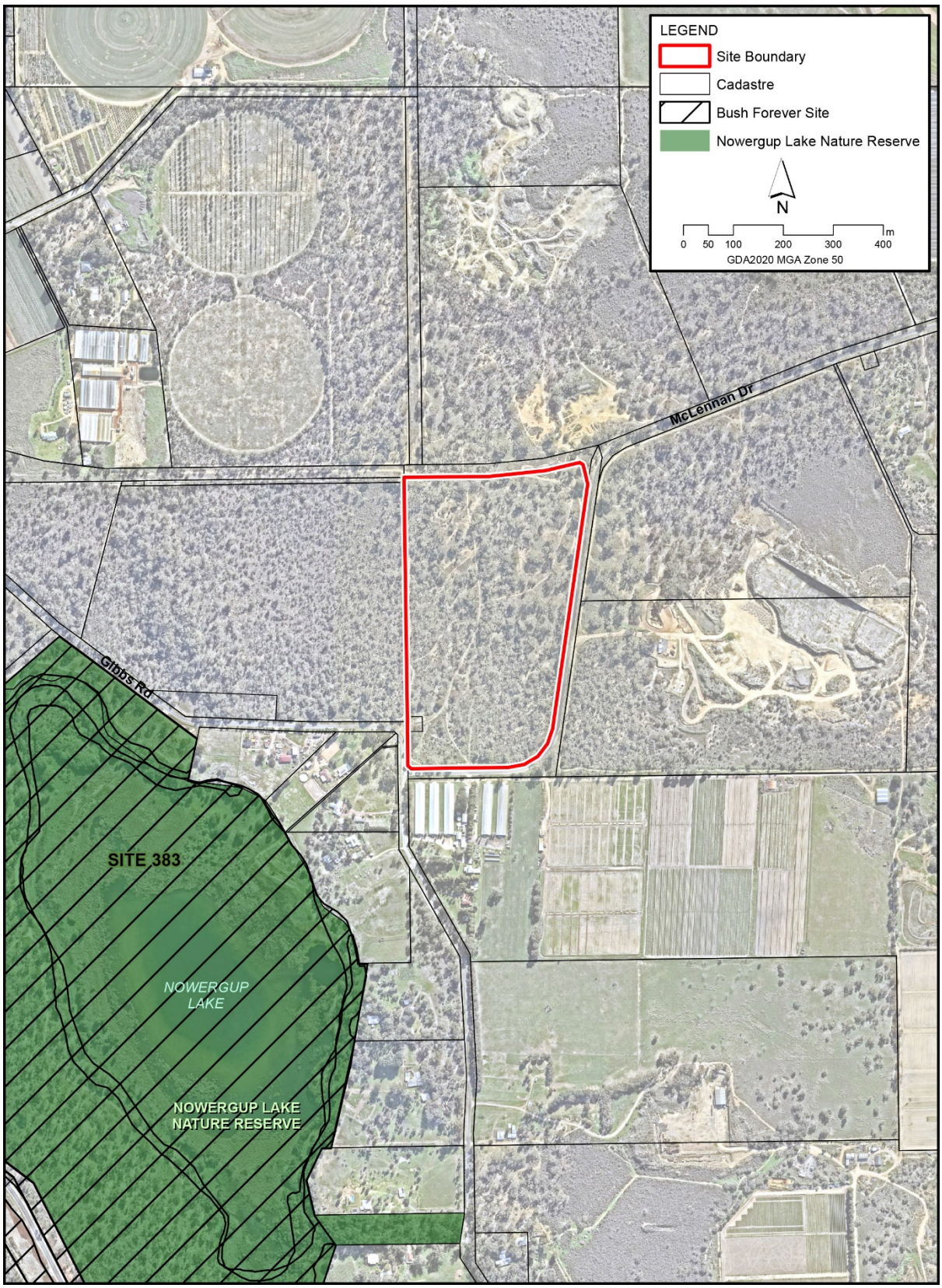

Figure 1. Aerial photograph showing the location of the survey area and surrounding area.

3 Methods

3.1 Desktop assessment

Prior to the 2023 PGV field survey, a desktop assessment was undertaken to provide contextual information on the flora and vegetation within the survey area. The desktop studies included a review of the following information.

- Regional geology and soil mapping (Schoknecht et al. 2004; van Gool 1990).
- Vegetation complex mapping of the South West Forest Region of Western Australia (Mattiske and Havel 1998) and the System 6 area (Heddle et al. 1980) as updated by Webb et al. (2016).
- Beard's pre-European vegetation association mapping dataset (DPIRD-006) (Beard et al. 2013).
- WA Threatened and Priority Ecological Communities DBCA database extracts from the Department of Biodiversity, Conservation and Attractions (DBCA 2023a) and TEC and PEC listings (DBCA 2023b, DBCA 2023c).
- Federal Protected Matters Search Tool results (DCCEEW 2023a).
- Extract from the Department's Threatened Flora database and the Western Australian Herbarium database (DBCA 2023d).
- Geomorphic Wetlands, Swan Coastal Plain (SCP) dataset DBCA-019 (DBCA 2022a).
- Tuart Woodlands dataset (DBCA-048) (DBCA 2018).
- Environmentally sensitive areas distribution maps and dataset (DWER 2021).
- Surface Hydrology Lines (National) (Crossman & Li 2015).
- State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region dataset (DPLH-054) (DPLH 2019).

The assessment also included a review of the following surveys:

- EnviroWorks Consulting (2014). Preliminary Flora and Vegetation Assessment Lots 105 and 107 McLennan Dr., Nowergup 2014.
- PGV Environmental (2014) Flora and Vegetation Survey - Lot 105 & 107 McLennan Drive, Nowergup, 21 November 2014.

3.2 Field survey

3.2.1 2014 survey

A flora and vegetation survey of Lot 107 was conducted by Dr Paul van der Moezel of PGV Environmental on 7 October 2014. The survey included sampling from four non-permanent 10 m x 10 m quadrats on Lot 107 as well as a thorough walk through the survey area. Survey area coverage was high due to the ease of access on foot through the understorey.

3.2.2 2023 survey

The 2023 detailed flora and vegetation survey was conducted by Dr Paul van der Moezel of PGV Environmental in September and 17 October 2023 over 8 separate field days for the overall area (660 ha), with Lot 107 Godel Road being surveyed on 25 September 2023. The survey across the 660 ha site included sampling from 39 permanently marked 10 m x 10 m quadrats as well as sampling from outside of the quadrats within the different vegetation types on the survey area. Four quadrats were sampled on Lot 107.

Information on flora composition and vegetation structure was recorded in the quadrats.

Most plant species were identified in the field. Some specimens were photographed or taken for identification at the Perth Reference Herbarium or office using standard reference guides.

Vegetation condition was assessed using the method provided by Government of Western Australia (GoWA 2000). **Appendix 1** shows the quadrat location, and track logs relevant to Lot 107.

3.3 Floristic Community Type Analysis

Floristic Community Types (FCT) are based on the whole floristic composition of the vegetation (trees, shrubs, herbs, sedges etc) rather than being determined by soil type and geomorphology (Vegetation Complex) or the nature of the dominant species (Vegetation Types). Many of the Threatened and Priority Ecological Communities on the Swan Coastal Plain are based on the FCT level of vegetation description.

The FCTs of the southern Swan Coastal Plain were initially identified in a study undertaken by the (then) Department of Conservation and Land Management and the Conservation Council of Western Australia (Gibson et al. 1994). The study analysed the floristic composition of 509 10m x 10m quadrats by computer programmes. The analysis resulted in the definition of 43 community types and sub- types.

The database searches undertaken in 2023 identified three FCTs that could potentially occur within the overall survey area:

- SCP20a *Banksia attenuata* woodlands over species rich dense shrublands
- SCP23b Swan Coastal Plain *Banksia attenuata* - *Banksia menziesii* woodlands
- SCP26a *Melaleuca huegelii* - *Melaleuca systena* shrublands on limestone ridges

To determine whether any of these FCTs occur within the survey area, quadrat data can be analysed using the PATN computer programme. This computer analysis of FCTs requires high quality quadrat data to achieve meaningful results. Based on the degraded vegetation condition onsite (see Section 6.5), PATN analysis was not able to be undertaken for Lot 107.

4 Survey limitations

Rainfall for Perth (Measured at Wanneroo, Site Number 009105) was above average in June and below average in July being 199.4mm and 66.4mm respectively, compared to an average of 160.9mm and 160.6mm (BOM, 2023). Rainfall in August and September was below average with 98.3mm and 73.5mm respectively, compared to 123.5 and 82.6mm (BoM, 2023). The below average rainfall in for most of the year was not sufficient to be considered a constraint on the survey.

Limitations with regards to the assessment are addressed in **Table 1.**

Table 1. Limitations of the 2014 and 2023 field surveys with regard to assessment adequacy and accuracy.

Aspect	Constraint *	Comment
Competency/experience of the consultant conducting the survey	Not a constraint	2014 & 2023 surveys- Dr Paul van der Moezel has extensive botanical survey experience on the Swan Coastal Plain, including the Wanneroo area.
Proportion of the flora identified^	Not a constraint	2014 survey– The timing of the survey in early October should have identified most of the native species on the survey area. 2023 survey- The timing of the survey in September-October was optimal to identify most flora species in the survey area including all potential Threatened and Priority Flora.
Sources of information (historic/recent or new data)	Not a constraint	2014 & 2023 surveys- The flora of the Swan Coastal Plain is well documented.
Timing/weather/ season/cycle	Not a constraint	2014 survey– Generally, slightly below average rainfall in winter 2014. Early October survey ideal for identifying rare orchids and maximising flowering of most species. 2023 survey– The spring survey was optimal for most flora species. 2023 was a good year for ephemeral species, although the season finished early due to the small amount of rainfall in September.
Disturbances (Fire)	Not a constraint	2014 survey– n/a 2023 survey– the survey area has not been recently burnt.

Aspect	Constraint *	Comment
Intensity of survey (e.g. In retrospect was the intensity adequate)	Not a constraint	2014 survey- The open understorey made access and coverage easy. Tracklogs show approximately 8 hours spent on the Lot 105 and Lot 107 survey areas. 2023 survey- The time spent on the overall site, 8 person days, was considered adequate to sample a high proportion of the flora.
Completeness (e.g. was relevant area fully surveyed)	Not a constraint	
Resources (e.g. degree of expertise available for plant identification)	Not a constraint	2014 & 2023 surveys – An experienced botanist undertook plant identifications mostly on site with some identification off-site using standard reference material.
Remoteness and/or access problems	Not a constraint	2014 & 2023 surveys- Easily accessible site in the Perth Metropolitan Region, traversed entirely on foot.
Availability of contextual (e.g. bioregional) information for the study area.	Not a constraint	2014 survey- Heddle et al. (1980), Government of Western Australia (2000), Gibson et al. (1994). 2023 survey– WALA statistics on remnant bushland.

*Constraints have been rated as Significant, Moderate or Not a constraint

^Fungi and nonvascular flora (e.g. algae, mosses and liverworts) were not specifically surveyed for during the survey.

5 Results desktop assessment

5.1 Biogeographic region and location

The survey area is situated within the Perth (SWA02) sub-region of the Swan Coastal Plain (SCP) biogeographic region as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia 2016).

5.2 Landform and soils

The survey area occurs on the SCP, which is bounded by the Darling Scarp to the east, Indian Ocean to the west, Moore River to the north and Dunsborough to the south. The SCP is built up of two belts of sediments that differ in origin: aeolian sediments in the west and alluvial sediments in the east. The aeolian sediments comprise three major dune systems: The Bassendean Dune System is the most easterly and oldest system; the Quindalup System is the most westerly and youngest system, with the Spearwood system located in between. These wind-deposited dunes press up against the Pinjarra plain, which is built up of alluvium deposited by streams from the Darling Plateau. Its alluvial soils are predominantly clays and silts; in places, low dunes of aeolian sands from the west may overlay the alluvial soils (Seddon 1972).

The survey area occurs across the Spearwood land system (211Sp) which is comprised predominantly of sand dunes and plains of aeolian deposited yellow deep sands, pale deep sands and yellow/brown sands over limestone (van Gool 1990). The Spearwood land system is commonly associated with Tuart-Marri forest and woodland in the south and heath and open woodland in the north of the SCP. The systems of the SCP have been divided into soil phases based on local soil conditions, with the soil phases found in the survey area described in **Table 2** and shown in **Figure 2**.

Table 2. Soil Mapping Units occurring within the survey area (Schoknecht et al. 2004).

System	Subsystem	Description
Spearwood (211Sp)	211Sp_Ky	Karrakatta sand yellow phase consisting of low hilly to gently undulating terrain, yellow sand over limestone at 1-2 m.
	211Sp_Sp	Spearwood sand phase consisting of irregular banks of karst depressions, some limestone outcrop and shallow brown sands.

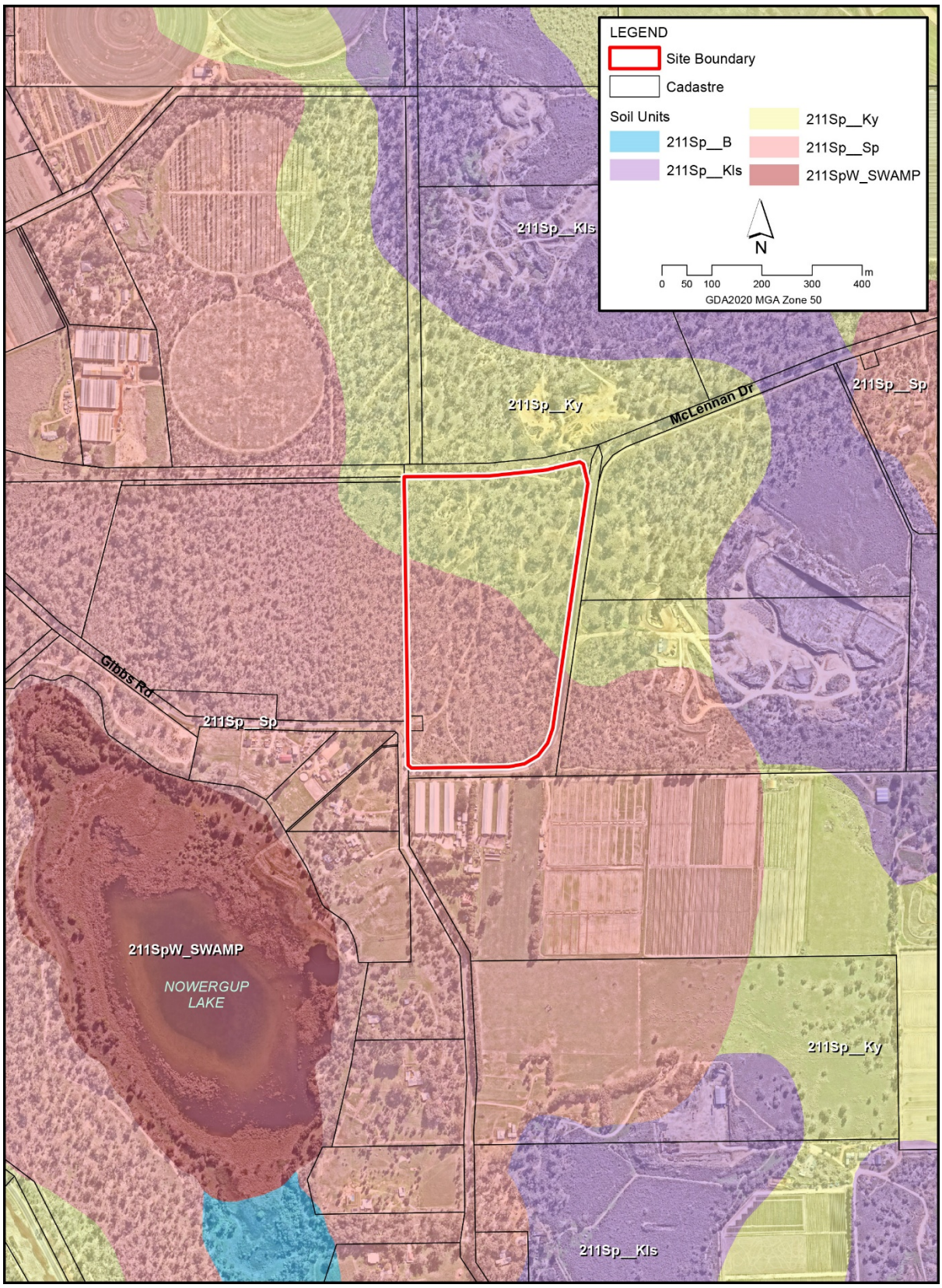

Figure 2. Land units mapped in and nearby the survey area (DPIRD 2017).

5.3 Vegetation description according to pre-European mapping datasets

5.3.1 Vegetation complexes

The comprehensive pre-1750 distribution of vegetation complexes[1] across the southwest of Western Australia is based on two main data sets. Heddle et al.'s 1980 1:250,000 scale vegetation complex mapping of the 'System 6' area comprising of the greater Perth and Darling Range Region and Mattiske and Havel's 1998 1:50,000 scale mapping of forest vegetation covered by the Regional Forest Agreement 1999[2] (Webb et al. 2016). Both data sets were prepared in order to inform the adequacy of biodiversity conservation through state managed reserves (EPA 1993, South-West Regional Forest Agreement 1999). In 2016, these data sets were revised by the Department of Parks and Wildlife (DPaW) (Webb et al. 2016) in order to fill data gaps and improve alignment and correlation between the data sets.

According to the vegetation complex mapping as updated by Webb et al. in 2016, there is one vegetation complex – the Cottesloe Complex - Central and South – mapped across the survey area. This vegetation complex is described in **Table 3** and shown in **Figure 3**.

Table 3. Vegetation complexes mapped for the survey area (Webb et al. 2016).

Vegetation Complex	Description
Cottesloe Complex – Central and South (52)	Mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri); closed heath on the Limestone outcrops.

5.3.2 Vegetation associations

A systematic survey of native vegetation in Western Australia was undertaken by J. S. Beard (along with others) during the 1970s, which described vegetation systems in the southwest of Western Australia at a scale of 1:250,000. Beard's vegetation maps attempted to depict the vegetation as it might have been prior to European settlement in terms of type and extent (Beeston et al. 2001). The Beard Vegetation Association dataset, also referred to as the pre-European native vegetation extent dataset, was digitised by Shepherd et al. (2002).

[1] Vegetation complex mapping is based on broadscale assessment of rregional patterns of vegetation in relation to underlying landforms, soils and climatic trends.

[2] Mattiske and Havel's (1998) mapping also included an assessment of an area of the very southern portion of the Swan Coastal Plain landform (Webb et al. 2016).

Beard vegetation associations have been described to a minimum standard of Level 3 “Broad Floristic Formation” for the National Vegetation Inventory System (NVIS) (state-wide to regional scale) [3] (NVIS 2017)

The survey area is comprised of one Beard vegetation association, being 998 ‘Medium woodland; tuart’ (**Figure 4**).

[3] Beard’s vegetation mapping units are referred to as ‘associations’ however these do not correspond to the NVIS Level 5 ‘Associations’. The NVIS system was developed long after Beard’s work was completed, and while both classification systems use the same term, NVIS ‘Associations’ describe vegetation in more detail than do Beard’s.

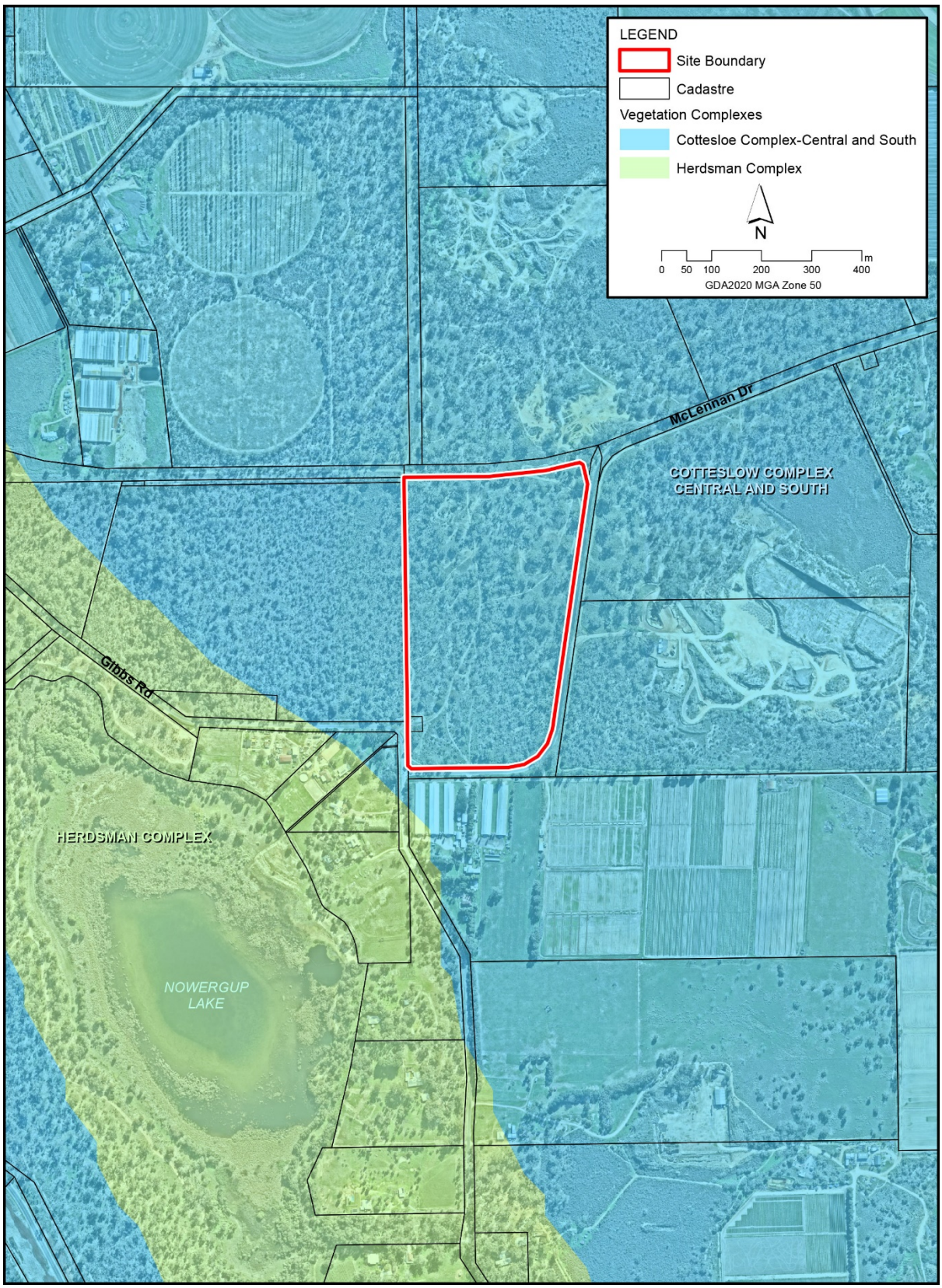

Figure 3. Vegetation complexes mapped in and nearby the survey area (Webb et al. 2016).

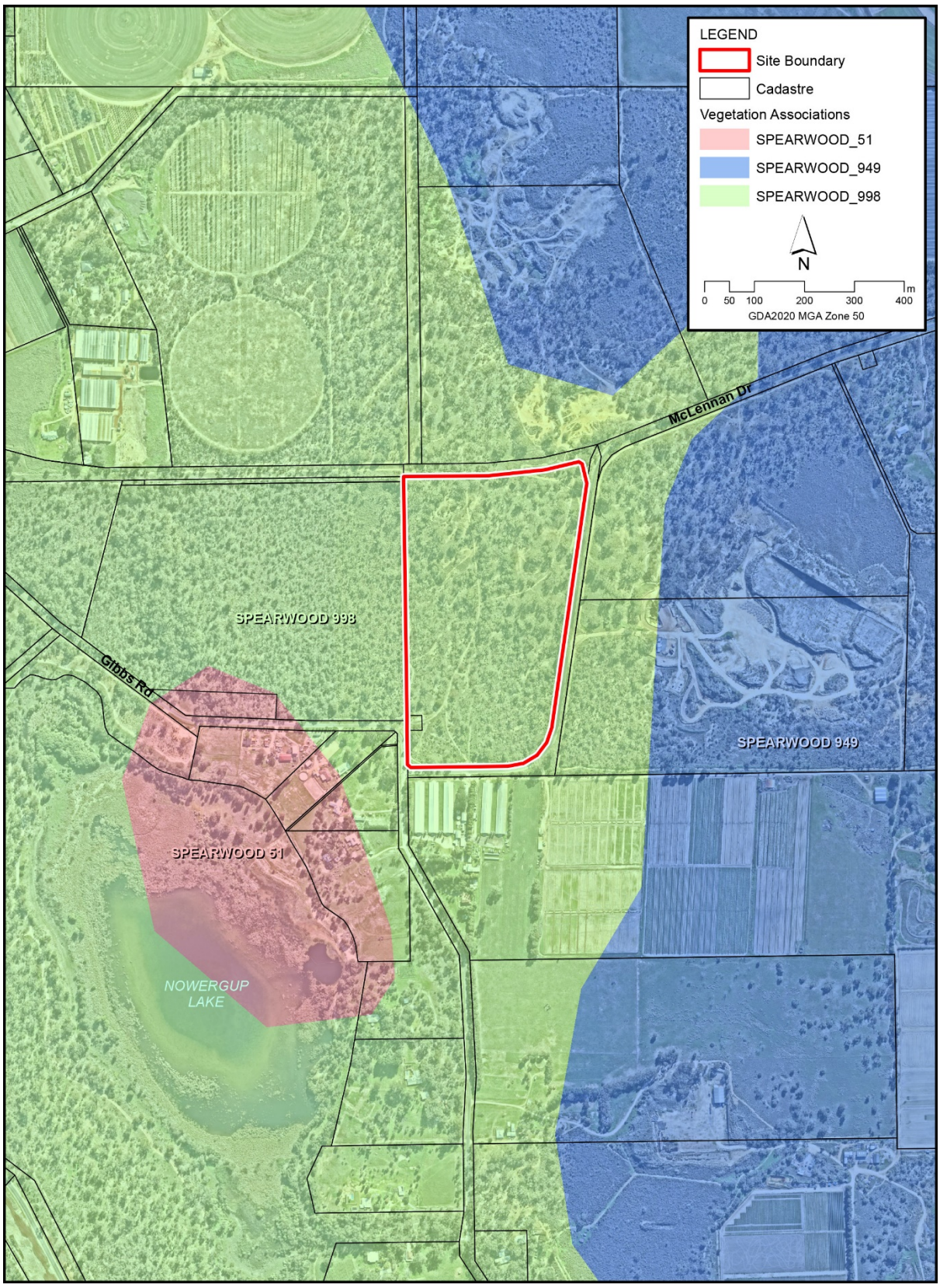

Figure 4. Vegetation associations mapped in and nearby the survey area (Beard et al. 2013).

5.3.3 Assessment of remaining extent against pre-European extent

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia 2001).

In its report on the Statewide Vegetation Statistics incorporating the Comprehensive, Adequate and Representative (CAR) Reserve Analysis, the Government of Western Australia (GoWA) provides information on the pre-European and current extent of the ecological communities of Western Australia and reports on the status of the CAR reserve system for WA (GoWA 2019a). This system is also based on the National retention targets of 30% overall. Only reserves managed by DBCA under the *Conservation and Land Management Act 1984* are considered for inclusion in the "CAR Reserve Analysis". In Western Australia, these statistics have been based on Beard's vegetation associations and Webb et al.'s (2016) updated vegetation complexes.

The percentage remaining of the pre-European extent vegetation and the percentage of current extent in DBCA managed land for the vegetation complex and association described for the survey area are presented in **Table 4** and **Table 5** respectively.

The Cottesloe Complex – Central and South is above the 30% retention of pre-European extent vegetation target across the SCP and at a local government level it is well represented with 41.65% pre-European extent vegetation remaining.

Association 998 is well represented across all boundaries, exceeding the 30% of pre-European extent vegetation remaining and meeting national retention targets.

The red, orange and yellow shading in the tables indicates the status of the Commonwealth 30% retention target.

Status of the Commonwealth retention target	>30%	<30%	<10%

Table 4. The vegetation complex (Cottesloe Complex – Central and South) mapped within the survey area with regards to the Commonwealth retention targets (GoWA 2019b).

Region	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA reserves[4]
Cottesloe Complex – Central and South (52)				
Swan Coastal Plain	45,299.61	14,567.87	32.16	10.01
City of Wanneroo	13,313.58	5,545.39	41.65	n/a

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

Table 5. The vegetation association within the survey area with regards to the Commonwealth retention targets (GoWA 2019a).

Region	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA Managed Land*
Association 998				
State-wide	51,015.33	18,492.63	36.25	17.65
IBRA region: Swan Coastal Plain (SWA)	50,867.50	18,492.32	36.35	17.70
IBRA sub-region Perth (SWA02)	50,867.50	18,492.32	36.35	17.70
City of Wanneroo	4,635.30	2,787.40	60.13	31.72

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

[4] The % remaining in DBCA land is not calculated for the vegetation complex mapping data set.

5.4 Threatened and Priority ecological communities.

Ecological communities are defined by Western Australia's DBCA as "...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services." (DEC 2013).

Under Section 27 of the *Biodiversity Conservation Act 2016* (BC Act), the Western Australian Minister for Environment may list communities considered under significant threat as a TEC. These TECs can be listed under one of three conservation categories. These categories are Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). The BC Act also provides for listing communities as collapsed ecological communities.

Possible TECs that do not meet survey criteria are added to the DBCA's Priority ecological community lists under Priorities 1, 2 or 3 (referred to as P1, P2, P3). Ecological communities that are adequately known, are rare but not threatened, that meet criteria for near Threatened, or that have been recently removed from the Threatened list, are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC 2013).

The current listing of Threatened and Priority ecological communities is specified in DBCA (2023b, 2023c). The conservation categories for these Threatened and Priority ecological communities are defined in **Appendix 2**.

TECs can also be listed under the Commonwealth EPBC Act, 1999. There are three categories of TEC under the EPBC Act: Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) (DCCEEW 2022). These are defined in **Appendix 3.**

In 2023, a search of DBCA's TEC and PEC database was conducted within a radius of 10 km around the survey area (10-0822EC) (**Appendix 4**).

These searches identified five TECs and seven PECs within the 10 km area, listed at a State level. Six TECs listed at a Commonwealth level were also identified.

The communities identified in the database searches are outlined in **Table 6.**

Outcomes of these searches are presented in **Table 6.** The results of the DBCA records are shown in **Figure 5**.

Of the TECs and PECs identified in the database search one community 'Tuart *(Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' was mapped as potentially occurring across the survey area (**Figure 5**).

Based on the preliminary assessment of vegetation types, the following additional communities are considered to potentially occur on the survey area (PGV 2023):

- SCP20a *Banksia attenuata* woodlands over species rich dense shrublands

- SCP23b Swan Coastal Plain *Banksia attenuata - Banksia menziesii* woodlands
- SCP26a *Melaleuca huegelii - Melaleuca systena* shrublands on limestone ridges
- Banksia Woodlands of the Swan Coastal Plain ecological community

Table 6. Threatened and Priority ecological communities occurring within 10 km study area (DBCA 2023a).

Number	Description	Conservation Status under the WA BC Act	Conservation Status under the Commonwealth EPBC Act
CAVES SCP01	Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain	Critically Endangered	Endangered
SCP19b	Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in Gibson et al. 1994)	Critically Endangered	Endangered
SCP10a	Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson *et al.* (1994))	Endangered	Critically Endangered
SCP26a	*Melaleuca huegelii - Melaleuca systena* shrublands on limestone ridges (floristic community type 26a as originally described in Gibson *et al*. (1994))	Endangered	Critically Endangered
SCP20a	*Banksia attenuata* woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. (1994))	Endangered	Endangered as part of the Banksia WL SCP
SCP22	*Banksia ilicifolia* woodlands	Priority 3	Endangered as part of the Banksia WL SCP
SCP23b	Swan Coastal Plain *Banksia attenuata - Banksia menziesii* woodlands	Priority 3	Endangered as part of the Banksia WL SCP
SCP24	Northern Spearwood shrublands and woodlands	Priority 3	-
SCP30b	Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands	Priority 3	Critically Endangered as part of the Tuart Woodlands
SCP29b	*Acacia* shrublands on taller dunes	Priority 3	-
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	Priority 3	Endangered
Tuart woodlands	Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	Priority 3	Critically Endangered

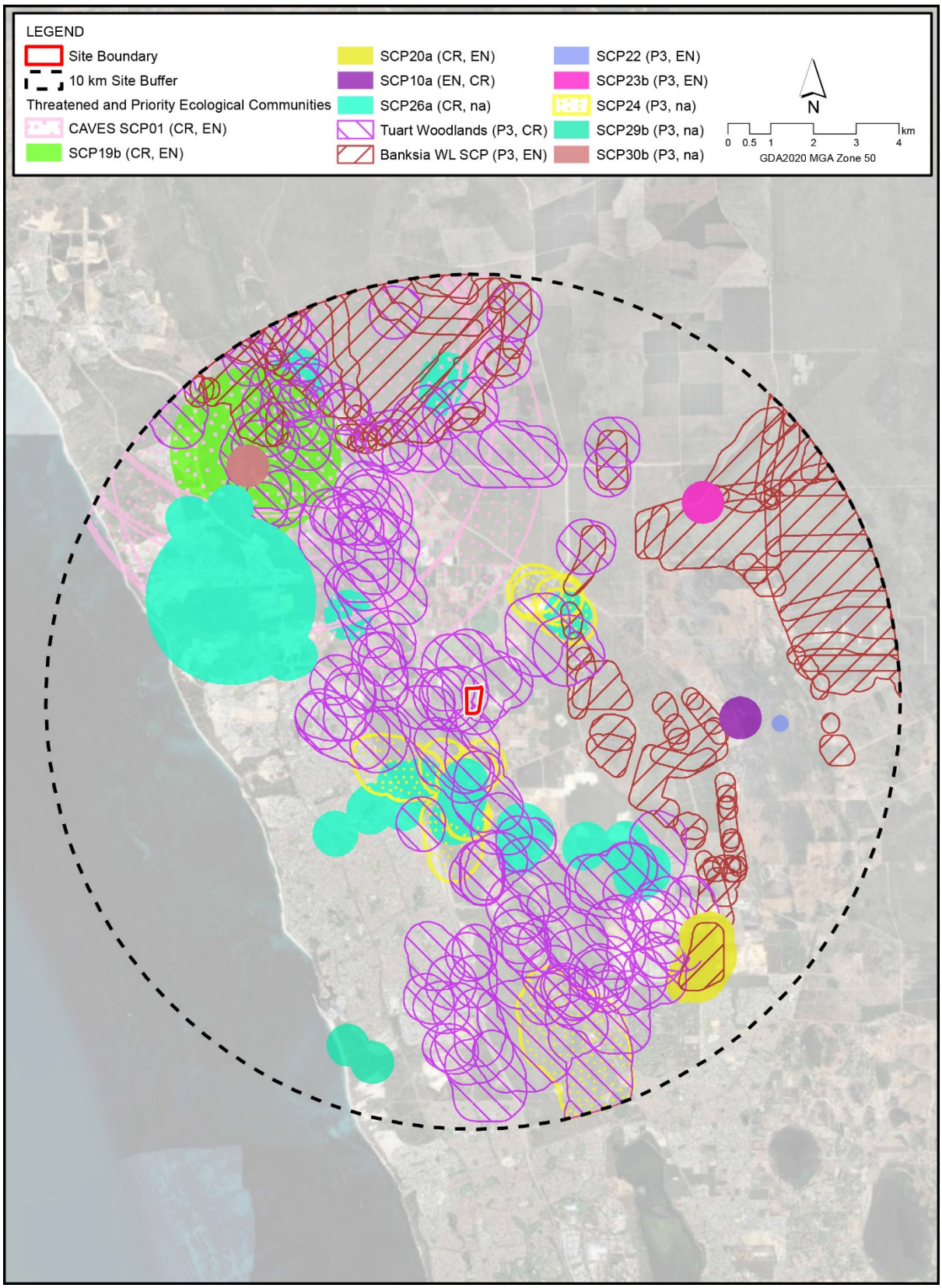

Figure 5. Threatened and Priority ecological communities within the desktop study area (DBCA 2018, DBCA 2023a).

5.5 Threatened and Priority flora

Species of flora and fauna are defined as having a Threatened or Priority conservation status where their extant populations are restricted geographically and/or under threat of possible extinction. The DBCA recognises these threats and consequently applies regulations towards population and species protection.

Threatened extant flora species are listed under Section 19 of the BC Act. They are ranked according to their level of threat using the International Union for Conservation of Nature (IUCN) Red List categories and criteria. The categories are Critically Endangered (CR), Endangered (EN), Vulnerable (VU). It is an offence to "take" or damage Threatened flora without Ministerial approval. Section 5 of the Act defines "to take" as "… to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means".

Priority flora is under consideration for future declaration as "Threatened flora", dependent on more information. Species classified as Priority One to Three (referred to as P1, P2 and P3) are in need of further survey to determine their status, while Priority Four (P4) species are adequately known rare or Threatened species that require regular monitoring.

Threatened flora lists are formally reviewed annually with the current listing updated on 1 May 2024 (DBCA 2024). The Priority flora list is subject to ongoing review with updates regularly published on the Western Australian Herbarium Florabase website.

Categories of Threatened and Priority flora as defined by the BC Act are presented in **Appendix 5** (DBCA 2019).

Threatened flora may also be protected under the Commonwealth EPBC Act and can be listed in one of six categories. Definitions of these categories are summarised in **Appendix 6** (DCCEEW 2020).

Threatened or Priority flora occurring within 10 km of the survey area were generated from a Protected Matters Search Tool query in 2023 (DCCEEW 2023a). DBCA and WA Herbarium Threatened and Priority flora data downloads generated in 2023 (DBCA 2023d) are shown in **Figure 6** and provided in **Appendix 4**.

The results from the database searches are shown in **Table 7.** A total of 37 species were identified in the database searches, including 13 Threatened and 24 Priority species. There was one Threatened species identified that appears to be an error within the databases as it does not grow in the Perth region.

A breakdown of the likelihood of occurrence (possible and likely) of all potential species according to conservation status is provided in **Table 7**.

5.5.1 Significant flora likelihood of occurrence

Prior to undertaking the survey, an assessment of the likelihood of occurrence of Threatened and Priority flora occurring within the survey area was undertaken. PGV Environmental (2023) categorise the pre-survey likelihood as Not Likely, Unlikely, Highly Unlikely, or Possible. **Table** 7 shows significant flora possible and likely to occur within the survey area.

Table 7. List of flora species identified from database searches within 10 km of the survey area and their likelihood of occurrence (DBCA 2023a).

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the survey area
Caladenia huegelii	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	Critically Endangered	Endangered	The Grand Spider-orchid prefers deep grey-white sand usually associated with the Bassendean sand-dune system, however, rare plants have been known to extend into the Spearwood system (in which calcareous yellow sands dominate) in some areas (DEC, 2009). This species generally does not survive in disturbed areas.	Unlikely – the location is further north of known populations
Drakaea elastica	Glossy-leafed Hammer Orchid	Critically Endangered	Endangered	The Glossy-leafed Hammer Orchid prefers low-lying situations adjoining winter-wet swamps and grows on bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps, typically in banksia (*Banksia menziesii*, *B. attenuata* and *B. ilicifolia*) woodland or spearwood (*Kunzea glabrescens*) thicket vegetation (DEC, 2009).	Highly Unlikely – not suitable habitat
Diuris purdiei	Purdie's Donkey-orchid	Endangered	Endangered	Purdie's Donkey Orchid occurs in grey-black sand in moist winter-wet swamps with winter inundation in dense heath with scattered trees and amongst native sedges and dense heath with scattered emergent *Melaleuca preissiana*, *Eucalyptus calophylla*, *E. marginata* and *Nuytsia floribunda*.	Highly Unlikely – not winter-wet habitat
Drakaea micrantha	Dwarf Hammer-orchid	Endangered	Vulnerable	Dwarf Hammer-orchid usually occurs on cleared fire breaks or open sandy patches in Banksia, Jarrah and Sheoak woodlands or forest and often found under Spearwood thickets.	Highly Unlikely – not suitable habitat and not recorded north of the Swan River
Macarthuria keigheryi	Keighery's Macarthuria	Endangered	Endangered	Keighery's Macarthuria prefers white or grey sand on low-lying winter-wet damp sands growing among heathland, Jarrah and Sheoak/Banksia woodland and Banksia/Eucalypt Woodland (DEC, 2008).	Highly Unlikely – not suitable habitat

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the survey area
Marianthus paralius		Endangered	Endangered	*Marianthus paralius* occurs in white sand and brown loam amongst heath on coastal limestone cliffs (DEC, 2009).	Highly Unlikely – not suitable habitat
Melaleuca sp. Wanneroo (G.J. Keighery 16705)		Endangered	Endangered	*Melaleuca* sp. Wanneroo occurs in very shallow soils over limestone 'caprock' on ridges.	Possible – potential habitat occurs on the survey area
Andersonia gracilis	Slender Andersonia	Vulnerable	Endangered	Slender Andersonia occurs in white/grey sand, sandy clay, gravelly loam in winter-wet areas, near swamps. Vegetation type is low open heath with shrubs over sedges (DEC, 2006).	No – outside of species range, record is in error
Anigozanthos viridis subsp. *terraspectans*	Dwarf Green Kangaroo Paw	Vulnerable	Vulnerable	The Dwarf Green Kangaroo Paw occurs on grey sand, clay loam in winter-wet depressions.	Highly Unlikely – not suitable habitat
Banksia mimica	Summer Honeypot	Vulnerable	Endangered	Summer Honeypot prefers white or grey sand over laterite, sandy loam.	Highly Unlikely – not suitable habitat and not recorded in the vicinity of the survey area
Diuris micrantha	Dwarf Bee-orchid	Vulnerable	Vulnerable	The Dwarf Bee-orchid is usually found on brown loamy clay in winter-wet swamps, in shallow water.	Highly Unlikely – not suitable habitat
Eleocharis keigheryi	Keighery's Eleocharis	Vulnerable	Vulnerable	Keighery's Eleocharis occurs in clay, sandy loam and is emergent in freshwater: creeks, claypans.	Highly Unlikely – not suitable habitat
Eucalyptus argutifolia	Yanchep Mallee, Wabling Hill Mallee	Vulnerable	Vulnerable	The Yanchep Mallee occurs in shallow soils over limestone on slopes or gullies of limestone ridges, outcrops.	Highly Likely – habitat occurs on the survey area and has been previously recorded
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)		Priority 1		*Baeckea* sp. Limestone is recorded from limestone outcrop/ridge in yellow sand derived from Tamala Limestone - Spearwood Dune System in bushland burnt 5+ years (Western Australian Herbarium, 2012).	Possible – habitat may occur on the survey area

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the survey area
Leucopogon maritimus		Priority 1		*Leucopogon maritimus* occurs in Quindalup deep, calcareous sands, on the mid to upper slopes of dunes or in shallow sand over limestone, but avoiding the thicker vegetation of the swale (Hislop, 2011)	Highly Unlikely – not Quindalup habitat
Acacia benthamii		Priority 2		*Acacia benthamii* grows on sand, typically on limestone breakaways	Highly Unlikely – not limestone breakaway habitat
Fabronia hampeana		Priority 2		*Fabronia hampeana* occurs on sheltered wet trunk of *Macrozamia dyeri* in shrub layer (Western Australian Herbarium, 2005).	Highly Unlikely – host plant not recorded from the survey area
Netrostylis sp. Chandala (G.J. Keighery 17055)		Priority 2		*Netrostylis* sp. Chandala occurs in peaty sand on swamp edges.	Highly Unlikely – not suitable habitat
Adenanthos cygnorum subsp. *chamaephyton*		Priority 3		*Adenanthos cygnorum* subsp. *chamaephyton* occurs in grey sand, lateritic gravel.	Highly Unlikely – not suitable habitat
Conostylis bracteata		Priority 3		*Conostylis bracteata* occurs in sand, limestone on consolidated sand dunes.	Unlikely – not typical Habitat
Hibbertia leptotheca		Priority 3		*Hibbertia leptotheca* grows near-coastal limestone ridges, outcrops and cliffs in coastal heaths and thickets usually dominated by species of *Melaleuca* and *Acacia* (Thiele, 2019).	Highly Unlikely – not suitable habitat
Jacksonia gracillima		Priority 3		*Jacksonia gracillima* occurs in grey and brown well-drained sand.	Unlikely – not typical habitat
Lasiopetalum membranaceum		Priority 3		*Lasiopetalum membranaceum* grows in sand over limestone.	Unlikely – not typical habitat

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the survey area
Leucopogon sp. Yanchep (M. Hislop 1986)		Priority 3		*Leucopogon* sp. Yanchep occurs in light grey-yellow sand, brown loam, limestone, laterite, granite on coastal plain, breakaways, valley slopes, low hills.	Unlikely – not typical habitat
Pimelea calcicola		Priority 3		*Pimelea calcicola* occurs in sand on coastal limestone ridges.	Possible – habitat likely to occur on the survey area
Pithocarpa corymbulosa		Priority 3		*Pithocarpa corymbulosa* occurs in gravelly or sandy loam amongst granite outcrops.	Highly Unlikely – not suitable habitat
Sarcozona bicarinata	Ridged Noon-flower	Priority 3		Ridged Noon-flower is found in white sand in coastal areas.	Highly Unlikely – not suitable habitat
Sphaerolobium calcicola		Priority 3		*Sphaerolobium calcicola* grows in white-grey-brown sand, sandy clay over limestone, black peaty sandy clay on tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Highly Unlikely – not suitable habitat
Stylidium maritimum		Priority 3		*Stylidium maritimum* occurs in sand over limestone on dune slopes and flats in coastal heath and shrubland, open Banksia woodland.	Highly Likely – habitat occurs on the survey area and has been previously recorded
Conostylis pauciflora subsp. *euryrhipis*		Priority 4		*Conostylis pauciflora* subsp. *euryrhipis* occurs in white, grey or yellow sand on consolidated dunes in coastal areas.	Highly Unlikely – not suitable habitat
Conostylis pauciflora subsp. *pauciflora*		Priority 4		*Conostylis pauciflora* subsp. *pauciflora* occurs in grey sand, limestone on hillslopes, consolidated dunes in coastal areas.	Unlikely – not typical habitat
Eucalyptus foecunda subsp. *foecunda*	Fremantle Mallee	Priority 4		Fremantle Mallee grows on yellowish coastal sands overlying limestone, often on limestony hills and dunes, in shrubland or very open woodland (Nicolle and French, 2021).	Unlikely – not typical habitat

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the survey area
Jacksonia sericea	Waldjumi	Priority 4		Waldjumi grows in calcareous and sandy soils.	Possible – habitat may occur on the survey area
Lepidium pseudotasmanicum		Priority 4		*Lepidium pseudotasmanicum* occurs in loam, sand associated with granite.	Highly Unlikely – not suitable habitat
Stylidium longitubum	Jumping Jacks	Priority 4		Jumping Jacks prefer sandy clay, clay in seasonal wetlands.	Highly Unlikely – not suitable habitat
Stylidium striatum	Fan-leaved Triggerplant	Priority 4		The Fan-leaved Triggerplant grows in brown clay loam over laterite on hillslopes in Jarrah/Marri forest, Wandoo woodland.	Highly Unlikely – not suitable habitat
Tripterococcus sp. *Brachylobus* (A.S. George 14234)		Priority 4		*Tripterococcus* sp. Brachylobus occurs in grey, black or peaty sand winter-wet flats.	Highly Unlikely – not suitable habitat

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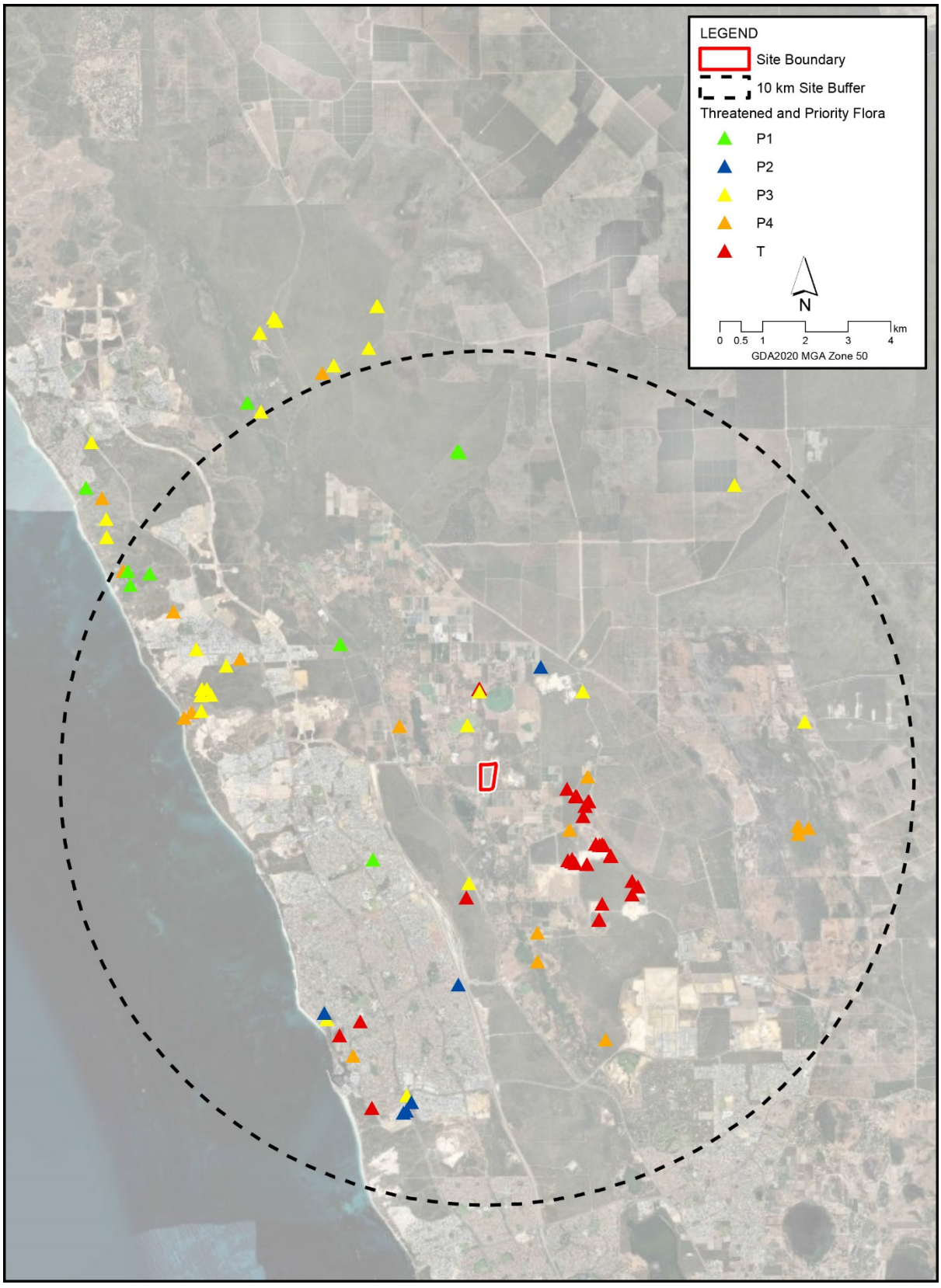

Figure 6. Threatened and Priority flora within the 10 km study area (DBCA 2023d).

5.6 Wetlands and water courses

5.6.1 Wetlands

Wetlands on the SCP have been classified into types using the geomorphic wetland classification system of Semeniuk & Semeniuk (1995), which is based on the characteristics of landform and water permanence, for example, lakes, palusplains and damplands. These are described in **Table 8.** The SCP wetlands have also been evaluated and assigned an appropriate management category and corresponding category objective, providing guidance on the nature of the management and protection the wetland should be afforded. These categories are described in **Table 9.**

Table 8. Wetland types (adapted from Semeniuk & Semeniuk 1995).

Management Category	Basin	Flat	Channel	Slope	Highland
Permanently inundated	Lake		River		
Seasonally inundated	Sumpland	Floodplain	Creek		
Intermittent inundation	Playa	Barlkarra	Wadi		
Seasonally waterlogged	Dampland	Palusplain	Trough	Paluslope	Palusmont

Table 9. Definitions of and objectives for the different wetland management categories (EPA 2008).

Management Category	Definition	Category Objective
Conservation	Wetlands with high conservation value for both natural or human use	To preserve wetland (natural) attributes and functions
Resource Enhancement (RE)	Wetlands with moderate natural and human use attributes that can be restored or enhanced	To restore wetlands through maintenance and enhancement of wetland functions and attributes
Multiple Use (MU)	Wetlands that score poorly on both natural and human use attributes	To use, develop and manage wetlands in the context of water, town and environmental planning

There are no wetlands mapped across the survey area according to the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2022a). The outer margins of the conservation category Nowergup Lake (UFI 8021) are approximately 275 m to the south west of Lot 107 (**Figure 7**).

5.6.2 Watercourses

There are no mapped watercourses within the survey area (Crossman & Li 2015) (**Figure 7**).

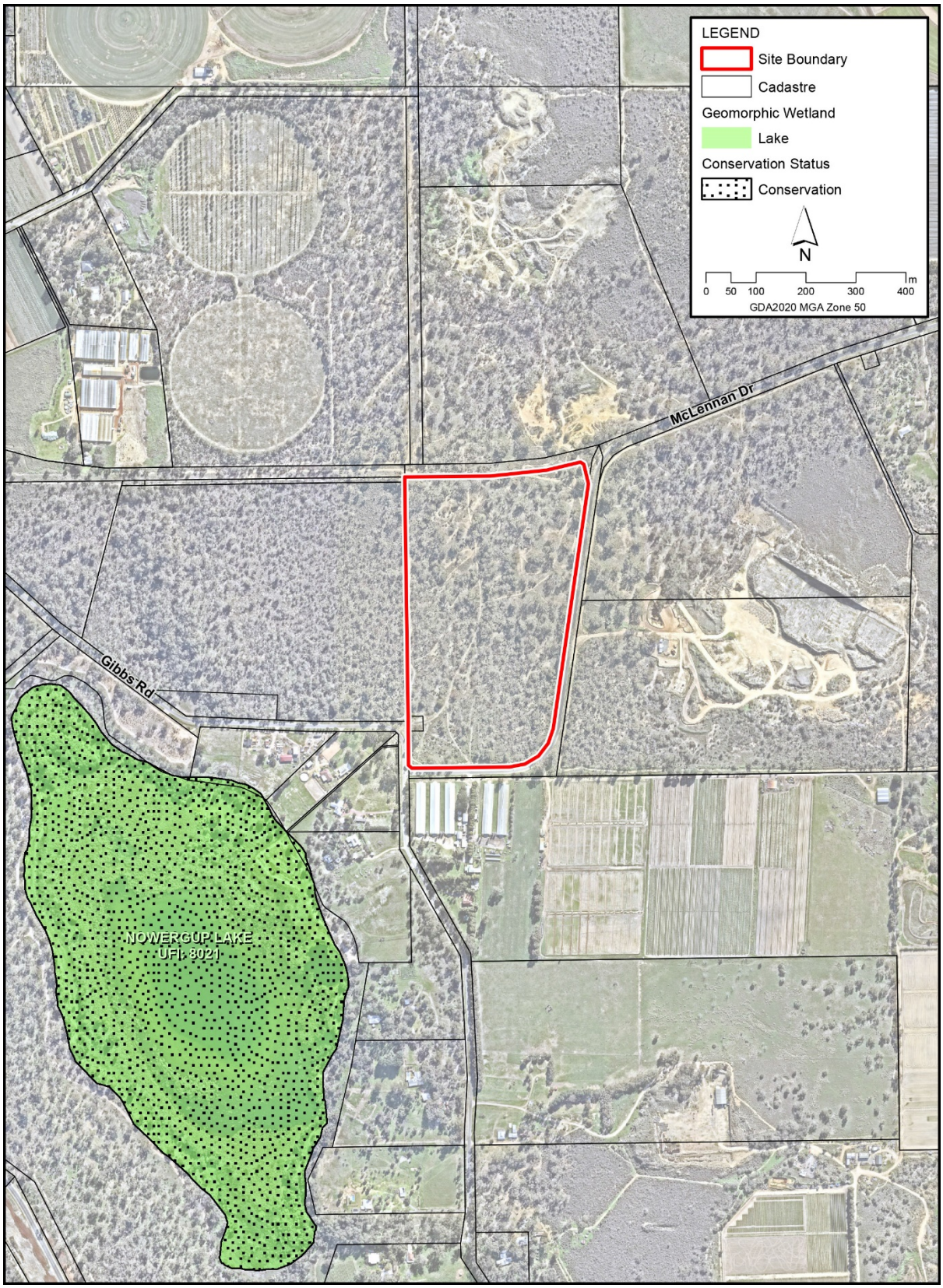

Figure 7. Geomorphic wetland types and their conservation management status in proximity to the survey area (DBCA 2022a).

5.7 Bush Forever sites

The State Government's Bush Forever process aimed to protect areas of regionally significant vegetation on the Swan Coastal Plain in the Perth Metropolitan Region. Bush Forever adopted one of the key commitments in the Urban Bushland Strategy (Government of Western Australia, 1995) which was to protect (rather than retain) at least 10% or 400 ha, whichever is the largest, of each vegetation complex in at least five separate areas.

There are two Bush Forever sites mapped in proximity to the survey area. Site 290 'Hopkins Road Bushland, Nowergup' contains 406.9 ha of bushland and is located approximately 1 km east of the survey area. Site 383 'Neerabup National Park, Lake Nowergup Nature Reserve and Adjacent Bushland, Neerabup' is comprised of 1736.1 ha of bushland and water and is located approximately 300 m southwest of the survey area (**Figure 8**).

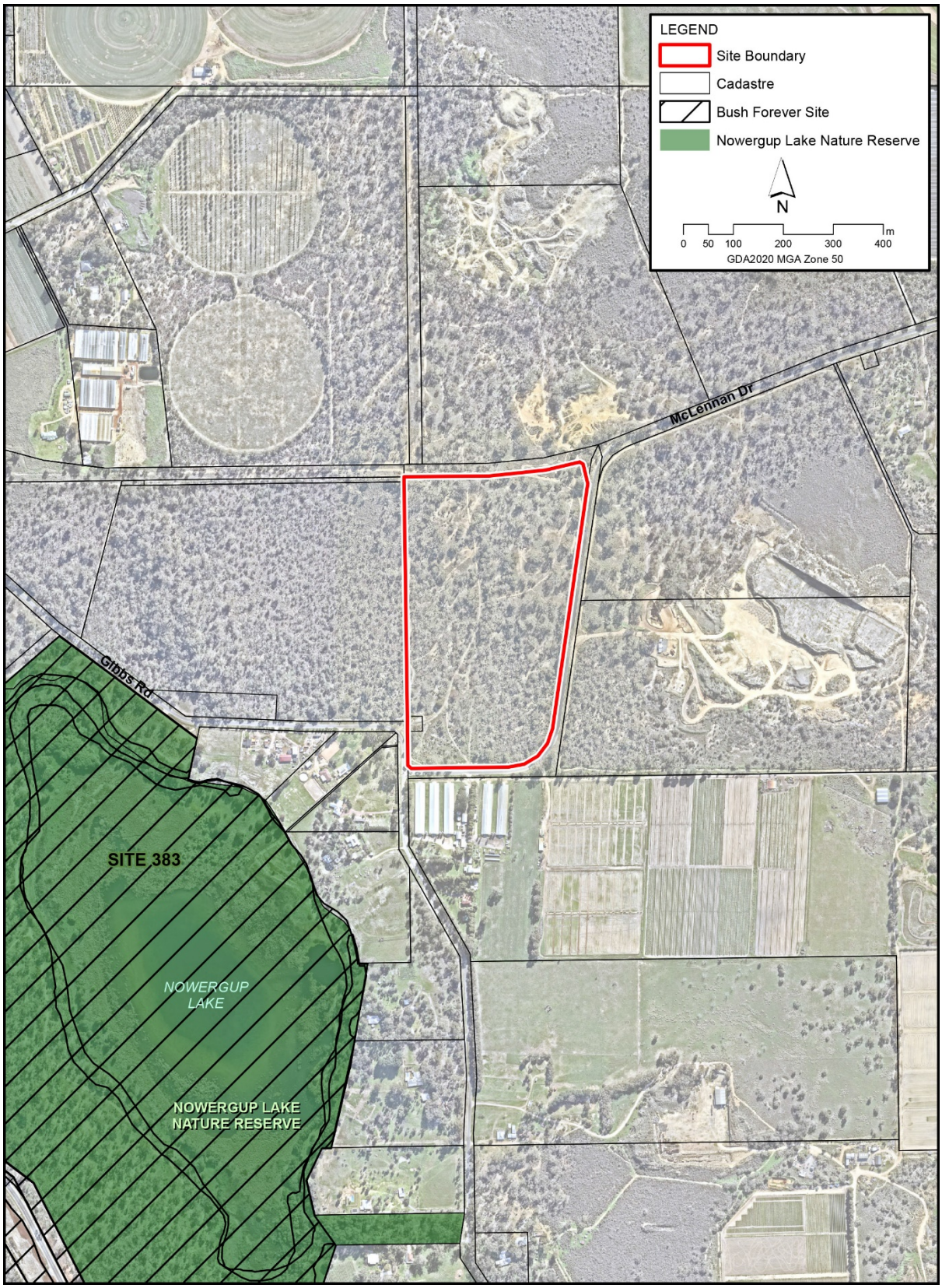

Figure 8. The survey area in relation to Bush Forever sites and DBCA managed land (DBCA 2017; DPLH 2019).

5.8 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. They are selected for their environmental values at State or National levels (Government of Western Australia 2005). They include:

- Defined wetlands and riparian vegetation within 50 m of the wetland
- Areas covered by Threatened ecological communities
- Area of vegetation within 50 m of Threatened flora
- Bush Forever sites
- Declared World Heritage property sites.

The survey area does not occur within a mapped ESA buffer. There are ESAs that are associated with the Bush Forever sites discussed in Section 5.7 to the east and south west of the survey area, as well as an ESA occurring in association with Nowergup Lake (Conservation Category Wetland, UFI 8,021) and an ESA associated with the TEC 'Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain' located approximately 1.4 km to the northwest of the survey area (**Figure 9**).

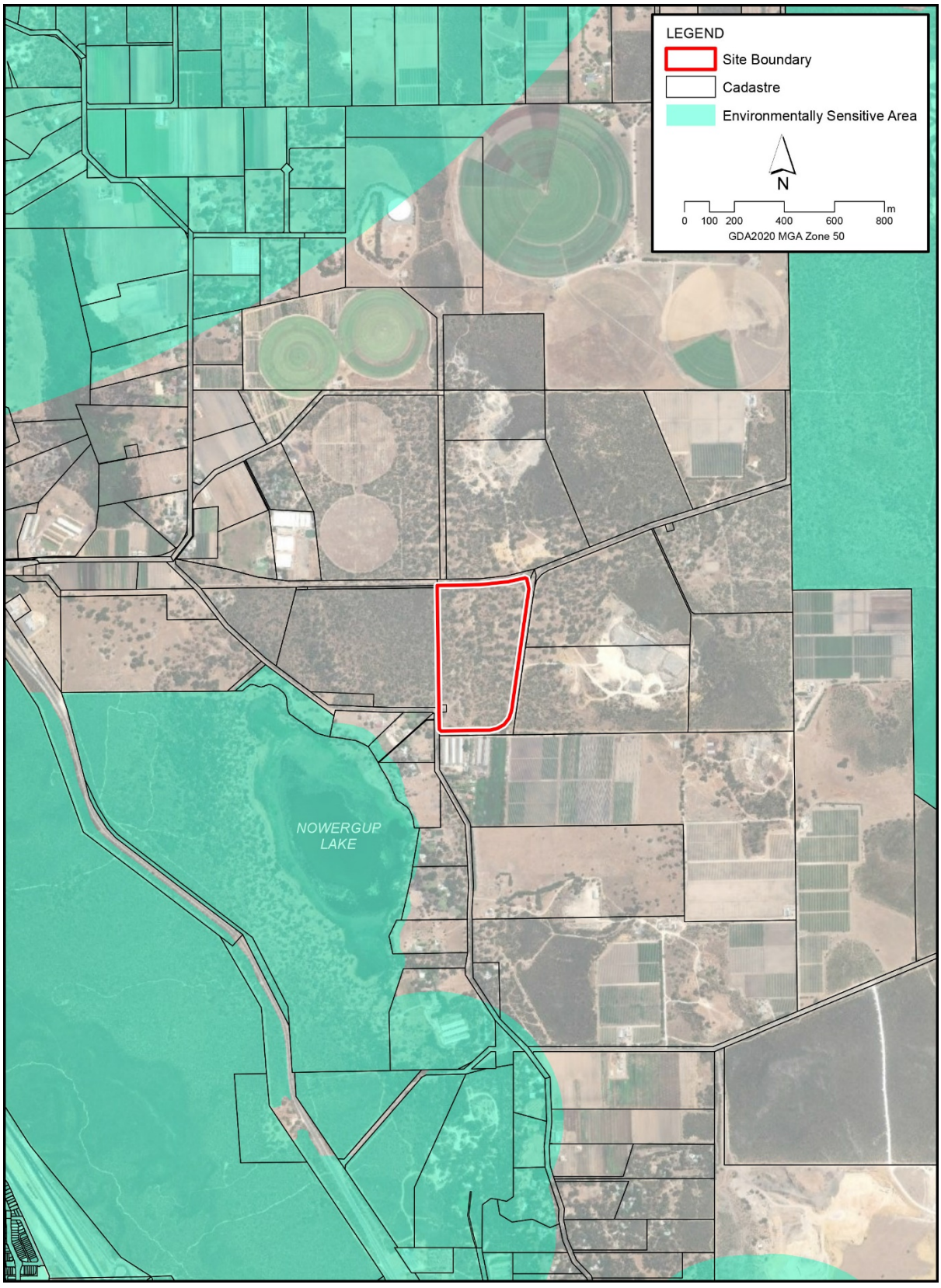

Figure 9. ESAs in proximity to survey area (DWER 2021).

5.9 Other reports

EnviroWorks Consulting (2014). Preliminary Flora and Vegetation Assessment Lots 105 and 107 McLennan Dr., Nowergup 2014.

A Preliminary Flora and Vegetation Assessment undertaken by EnviroWorks Consulting (2014) identified 46 native species on both lots from within three plant communities. The conservation significant Priority 4 species *Jacksonia sericea* was identified as occurring on Lot 107. This species was not recorded in the 2023 survey.

6 Survey results

6.1 Flora

6.1.1 2014 survey

No Threatened flora listed under either the State BC Act or Commonwealth EPBC Act were found within the survey area. Neither was there any State listed Priority flora or flora of other significance found within the survey area. PGV Environmental stated that the occurrences of Priority 4 species *Jacksonia sericea* recorded in near the north-west boundary of the survey area in the EnviroWorks Consulting (2014) report were more likely to be the more common *Jacksonia calcicola*.

6.1.2 2023 survey

The plant Families with the highest representation of species were the Fabaceae (Wattle and Pea family – 22 species, 19 native and 3 introduced), Asteraceae (Daisy family – 19 species, 11 native, 8 introduced), Proteaceae (Banksia family – 18 species, all native), Poaceae (Grass family – 17 species, 5 native, 12 introduced), Myrtaceae (Myrtle family – 16 species, 15 native and 1 introduced), Orchidaceae (Orchid family – 12 species, 11 native, 1 introduced) and Asparagaceae (Asparagus family - 10 species, 9 native and 1 introduced).

Species richness in the 4 quadrats within the Lot 107 survey area ranged from 9-23 with a range of 5-14 native species, averaging 8 native species. The average number of weed species was 7. Quadrat data for Lot 107 is provided in **Appendix 7** with quadrat locations shown in **Appendix 1**.

No Threatened flora listed under either the State BC Act or Commonwealth EPBC Act were found within the survey area, nor any State listed Priority flora or flora of other significance.

6.2 Declared pest plants and environmental weeds.

There were no declared pest plants or environmental weeds recorded in Lot 107.

6.3 Vegetation units

Vegetation types are a finer level of vegetation description and mapping used for small scale sites, such as the survey area. Vegetation types are described based on the structure of the vegetation (e.g. woodland, heath) and the dominant species in each structure.

6.3.1 2014 survey

A total of three separate vegetation types were mapped and described for the survey area based on the structure and composition of the dominant layers.

The vegetation mapping is similar to that prepared by EnviroWorks Consulting (2014) with Tuart-Jarrah woodland in the northern upper slopes, however EnviroWorks Consulting (2014) mapped the lower slopes of the site as containing a Banksia-Eucalyptus Low Woodland. The PGV Environmental survey recorded only scattered *Banksia attenuata* and *Banksia menziesii* in numbers too low to describe as a vegetation type.

A description of each of the units is provide in **Table 10**.

Table 10. Vegetation units identified and described in the 2014 survey.

Name	Description
EgEm	***Eucalyptus gomphocephala/E. marginata* Woodland over *Xanthorrhoea preissii/Hibbertia hypericoides* Open Low Heath** This vegetation type occurred on the northern upper slopes of the site. Tuart (*Eucalyptus gomphocephala*) and Jarrah (*E. marginata*) occur in mixed proportions. The understorey ranges from almost parkland cleared with few native species and dense Veldtgrass (*Ehrharta calycina*) to slightly better condition with common native shrubs including *Xanthorrhoea preissii, Acacia pulchella* and the climber *Hardenbergia comptoniana*. The soils are brown sands with occasional surface limestone in places. Quadrats MC1 and MC2 are representative of this vegetation type.
EmCc	***Eucalyptus marginata/ Corymbia calophylla Low Woodland over Xanthorrhoea preissii Shrubland*** Marri (*Corymbia calophylla*) become more common with the Jarrah in the lower part of the site. The understorey mostly consists of dense Veldtgrass and a few native shrubs such as *Xanthorrhoea preissii* and *Acacia pulchella.* The soils were dark brown sand. Quadrat MC3 is representative of this vegetation type.
Em	***Eucalyptus marginata* Low Woodland over *Xanthorrhoea preissii* Shrubland** Tuart trees drop out in the lower southern half of the site and Jarrah occurs by itself over an similar to the Tuart/Jarrah understorey containing *Xanthorrhoea preissii, Acacia pulchella*, *Hardenbergia comptoniana* as well as *Macrozamia fraseri* and *Hakea lissocarpha*. The soil type is dark brown sand. Quadrat MC4 is representative of this vegetation type.

6.3.2 2023 survey

Vegetation type analysis was further refined and updated in 2023 with three vegetation types in addition to cleared vegetation being described and mapped on the survey area (**Figure 10**) The vegetation types are described in **Table 11**. Quadrat data are in **Appendix 7.**

Table 11. Vegetation types recorded on 2023 survey area.

Type	Photo	Description	Area (ha)
EgEm		***Eucalyptus gomphocephala* Woodland over *Xanthorrhoea preissii* Shrubland over *Mesomelaena pseudostygia/Phyllanthus calycinus* Open Low Heath** Occurs on the lower slopes of limestone hills, mostly in the central part of the survey area. *Eucalyptus gomphocephala* (Tuart) is up to 25m high and moderately dense (15-25% cover). Typical understorey species include *Xanthorrhoea preissii, Mesomelaena pseudostygia, Phyllanthus calycinus, Hakea lissocarpha* and *Desmocladus flexuosus*. The soils are orange-brown sand with some surface limestone. Quadrat C22 is a representative of this vegetation type.	9.77 ha
CcEm		***Corymbia calophylla/Eucalyptus marginata* Low Woodland over Xanthorrhoea preissii Shrubland** Only one area containing Marri (*Corymbia calophylla*) mixed with Jarrah was recorded on the site, at the southern end of Lot 107 Godel Road. The vegetation is in Degraded to Completely Degraded condition with Perennial Veldtgrass dominating the understorey. *Xanthorrhoea preissii* is the only common native species. The soils are dark brown sand. Quadrat C18 is representative of this vegetation type.	4.79 ha

Type	Photo	Description	Area (ha)
Em		***Eucalyptus marginata* Low Woodland over *Xanthorrhoea preissii* Tall Shrubland** Occurs on lower areas in the central part of the survey area. All of the areas mapped have a very weedy understorey. The *Eucalyptus marginata* (Jarrah) trees have mostly been coppiced with few to no old, mature single stem trees. *Xanthorrhoea preissii* is the most common native understorey species while the most common weed species is Perennial Veldtgrass (*Ehrharta calycina*). The soils are dark brown sand.	3.83 ha
Cleared			0.53 ha
Total			**18.92 ha**

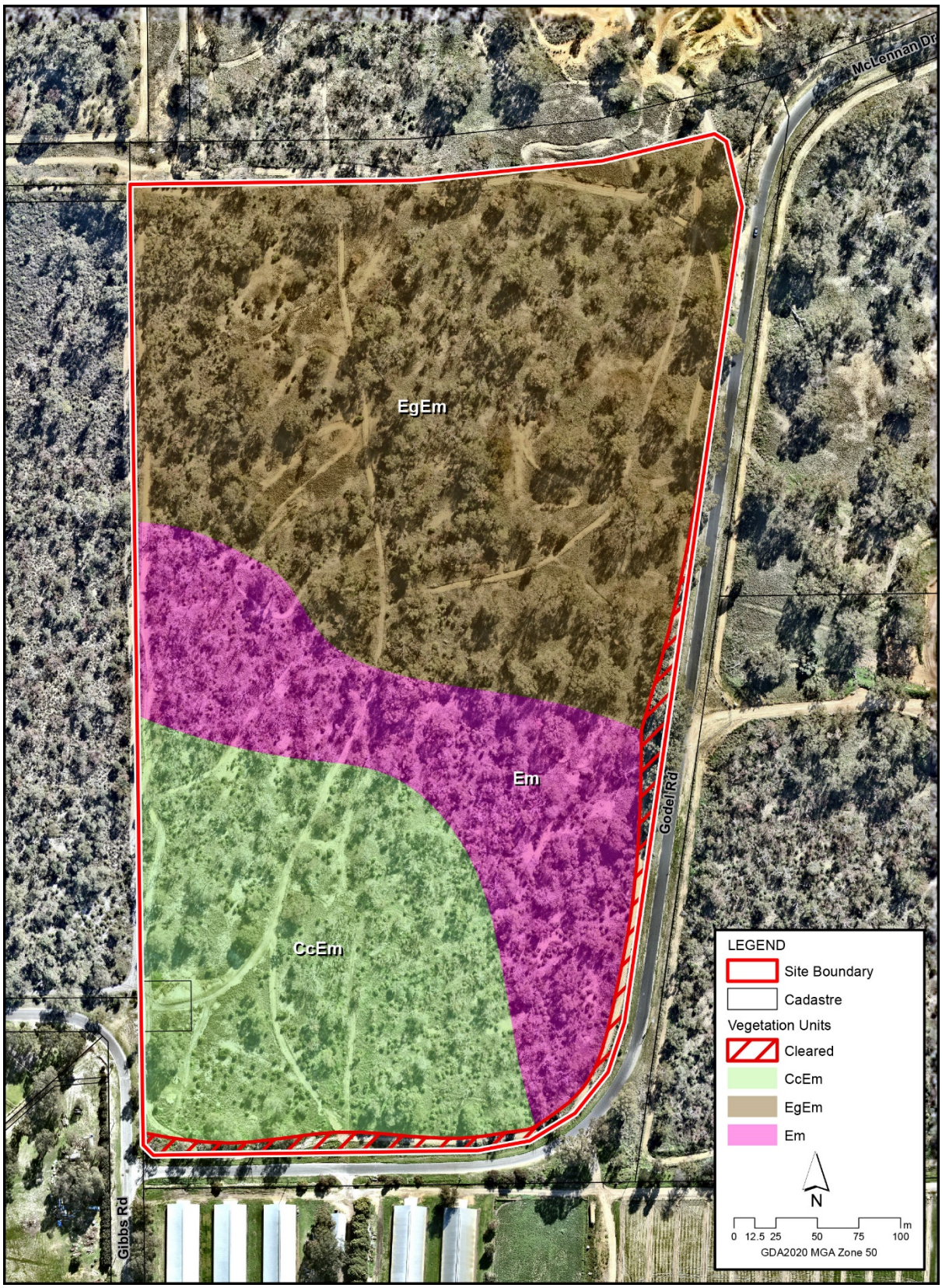

Figure 10. Location of vegetation units described and mapped by the 2023 survey within the survey area.

6.4 Floristic community types

No FCT analysis was undertaken as vegetation present within the site was considered too degraded to allow an accurate statistical analysis to be performed.

Based on PATN analysis outcomes for Eucalyptus dominated vegetation units on Very Good and Excellent condition in the surrounding survey area (PGV Environmental, 2023), it appears likely that the vegetation onsite would have originally represented FCT 24 and/or FCT 28.

6.5 Vegetation condition

6.5.1 2014 survey

The vegetation condition over the survey area was assessed using the condition scale adopted in Bush Forever (**Table 12**).

The 2014 survey found the vegetation condition on the survey area ranged from Completely Degraded to Degraded. The vegetation condition on Lot 107 was assessed as Completely Degraded in the northern and southwestern corner due to limited presence of native shrubs and abundance of introduced species, particularly grasses such as Veldtgrass. Where the understorey contained a higher density of native species the vegetation was rated as Degraded. The poor condition of the vegetation is consistent with the historic aerial photographs that show the lot was parkland cleared prior to 1965.

6.5.2 2023 survey

The condition of the vegetation was assessed according to the system devised by Keighery and described in Bush Forever (Government of Western Australia, 2000) (**Table 12**).

Table 12. Vegetation condition rating scale (Government of Western Australia, 2000).

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Condition	Description
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

The vegetation condition ranged from Completely Degraded to Degraded (**Figure 11**). Generally, the areas with the best quality vegetation were the areas of outcropping and shallow limestone. The areas of deeper sand over limestone contained more weeds, with Perennial Veldtgrass the most common weed species.

A breakdown of the condition of the survey area vegetation is shown in **Table 13**. The distribution of vegetation condition in the survey area is provided in **Figure 11**.

Table 13. Area and percentage of the survey area in vegetation condition classes.

Condition	Area (ha)	%
Degraded	16.73	88%
Completely Degraded	2.19	12.%
Total	**18.92 ha**	100.00%

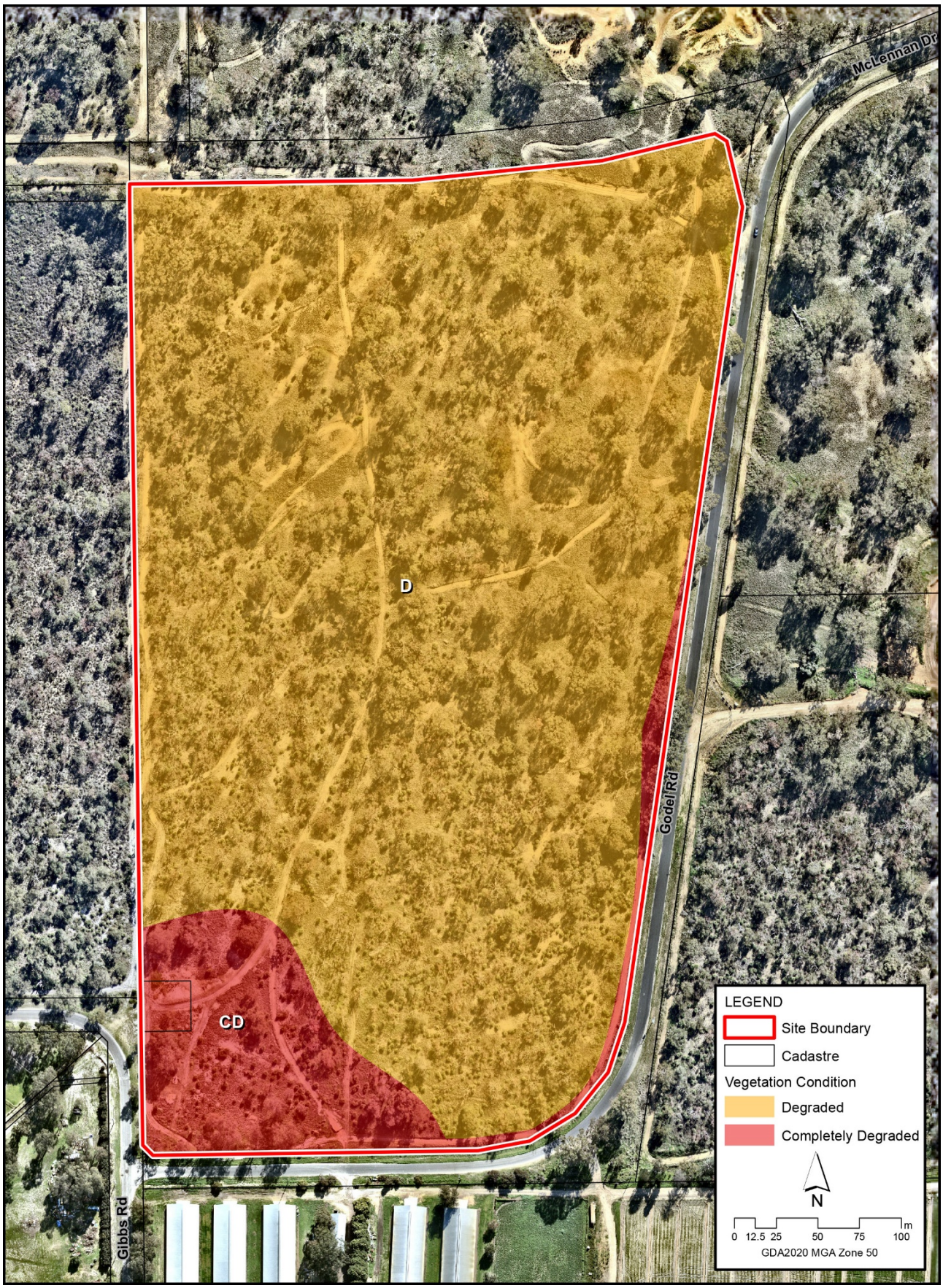

Figure 11. 2023 Vegetation condition for survey area

6.6 Threatened and Priority Ecological Communities

6.6.1 Banksia Woodlands of the SCP TEC and PEC Assessment

The Banksia Woodlands of the Swan Coastal Plain ecological community was listed as an Endangered community under the Commonwealth EPBC Act on 16 September 2016. The Banksia Woodland ecological community is listed as a Priority Ecological Community at State level.

The Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (Commonwealth of Australia, 2016) (Conservation Advice) describes the Banksia Woodland TEC as:

> *The ecological community is a woodland associated with the Swan Coastal Plain of southwest Western Australia. A key diagnostic feature is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range* (Commonwealth of Australia, 2016).

The Banksia Woodland TEC is most commonly dominated by *Banksia attenuata* and/or *B. menziesii* and in some examples *B. prionotes* or *B. ilicifolia*. For an area of Banksia woodland to meet the criteria of the Banksia Woodland TEC it needs to be in at least Good condition and meet a minimum patch size depending on the condition of the vegetation.

The vegetation onsite is not dominated or co-dominated by Banksia, but there were scattered Banksia present onsite as noted in the quadrat data presented in **Appendix 7**.

Based on the scattered nature of the Banksia present, as well as the condition being Degraded and Completely Degraded, the vegetation does not meet the definition of the Banksia Woodlands TEC.

6.6.2 Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the SCP TEC and PEC assessment

The Tuart Woodlands and Forests of the Swan Coastal Plain was listed as a Threatened Ecological Community (TEC) with a rating of Critically Endangered under the Commonwealth EPBC Act on 4 July 2019 (for brevity the community will be called the Tuart Woodland TEC in this report). The Tuart Woodland ecological community is listed as a Priority Ecological Community at State level.

A description of the Tuart Woodland TEC is contained in the Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community (Commonwealth of Australia, 2019). Key diagnostic characteristics according to the Conservation Advice are outlined below.

6.6.2.1 Key diagnosis characteristics

The Tuart Woodlands ecological community is limited to patches of vegetation (with their associated biota) that meet all of the following key diagnostic characteristics:

- Occurs in the Swan Coastal Plain Bioregion, Western Australia (IBRA v7. Department of the Environment 2012).
- Primarily occurs on the Spearwood and Quindalup dune systems but can also occur on the Bassendean dunes and Pinjarra Plain. It can occur on the banks of rivers and wetlands.
- The primary defining feature is the presence of at least two living established *Eucalyptus gomphocephala* (Tuart) trees in the uppermost canopy layer, although they may co-occur with trees of other species. There is a gap of no more than 60 m between the outer edges of the canopies of adjacent Tuart trees. These trees may occur either as single stemmed trees or as a mallee growth form.
- Most often occurs as a woodland but can occur in other structural forms, For example, forest, open forest, woodland, open woodland, and various mallee forms.
- Other tree species may be present in the canopy or sub-canopy. They commonly include: *Agonis flexuosa* (Peppermint) and *Banksia grandis* (Bull Banksia) (both in the southern part of the range), *Banksia attenuata* (Candlestick Banksia), *Eucalyptus marginata* (Jarrah); and less commonly, *Corymbia calophylla* (Marri), *Banksia menziesii* (Firewood Banksia) and *Banksia prionotes* (Acorn Banksia).
- An understorey of native plants is typically present, which may include grasses, herbs and shrubs, although this is often modified by disturbance. Some understorey plant species that are most commonly present are listed in Section 2.3.3 of the Conservation Advice.
- Native fauna species that are most commonly present are noted in Section 2.4 of the Conservation Advice (Commonwealth of Australia, 2019).

6.6.2.2 Defining a patch of the Tuart Woodlands ecological community

- A patch of the ecological community is a discrete and mostly continuous area of vegetation that meets the key diagnostic characteristics.
- Boundaries for a patch can extend beyond a site or property boundary, or potential area of impact for a proposed action.
- The patch boundary is 30 m beyond the outer canopy of the established Tuart trees (≥15 cm diameter at breast height (DBH)), including dead Tuart trees (stags) (**Figure 12**).
- Where a dead Tuart tree (stag) is being considered for inclusion in a patch of the ecological community, the vertical projection of its outermost remaining branches is used to define the edge of its canopy. If the species of a stag tree is unclear, if the edge of its canopy is within 60 m of an identified Tuart tree the stag is presumed to be a Tuart.
- Patches of Tuart woodlands and forests may contain areas that vary in structural or biological complexity. One part of a patch may have a larger number of mature trees and more ecological diversity, whereas another part of the same patch may demonstrate fewer mature trees and less groundcover. Areas with soil exposed and/or plant litter can also be expected within this ecological community.
- Variation in quality or condition of vegetation across a patch should not necessarily be considered to be evidence of multiple patches. Patches of the ecological community can be spatially variable and are often characterised by one or more areas within a patch that meet higher condition thresholds amongst areas of lower condition.
- If an area meets the key diagnostic characteristics but the average condition across that

area falls below the minimum condition thresholds, the largest area or areas of at least 0.5 ha that meet minimum condition thresholds on average, should be specified as the patch or patches of the nationally listed ecological community. This may result in multiple patches of the ecological community being identified within the overall area first identified as meeting the key diagnostics.

- A patch may include small areas without understorey vegetation, such as bare ground, as well as waterbodies or hardscape (e.g. roads, paths, car parks, or buildings) that do not significantly alter the overall function of the ecological community. These small areas do not break up a patch, or divide a patch into multiple patches, as long as there are some parts of the canopy within 60 m of the outer edges of the canopies of adjacent Tuart trees (as **Figure 12**). However, existing buildings and other human-made structures and gardens are not part of the nationally protected ecological community and should be excluded from the calculation of patch size and condition. See **Figure 13** (Commonwealth of Australia, 2019).

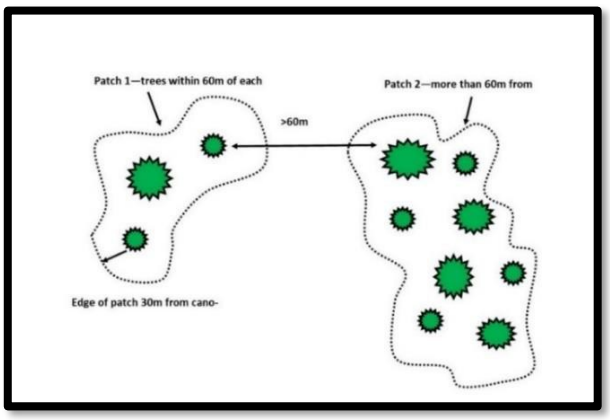

Figure 12. Tuart Patch Boundaries. Source: Commonwealth of Australia, 2019.

Plate 9: Variation Within a Patch*

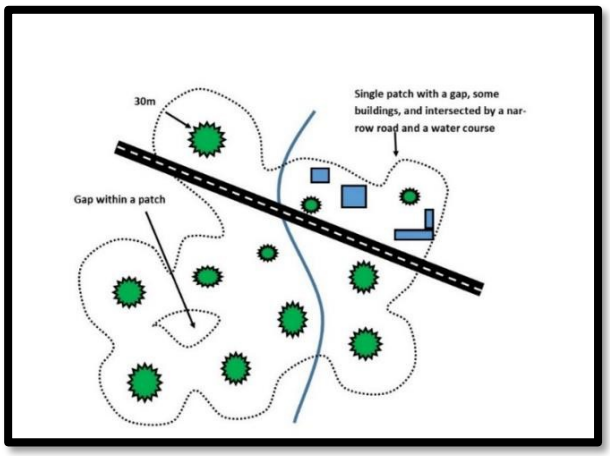

Figure 13. Variation within a Tuart patch[5].

[5] * including small areas without understorey vegetation, and a small gap within a patch due to part of the Tuart canopy being >60 m apart
Source: Commonwealth of Australia, 2019

6.6.2.3 Condition thresholds and categories

For confirmed patches of the ecological community, following the key diagnostic characteristics and patch definition above (Step 1), determine the following requirements for information on condition to indicate if they are part of the nationally protected ecological community:

- If the patch is smaller than 0.5 ha it is **not** part of the nationally protected ecological community.
- If **the patch is at least 0.5 ha and up to 5 ha** in size, conduct on ground surveys. Patches in this size range are presumed to be part of the nationally protected ecological community unless surveys indicate they do not meet the minimum condition required for national protection. For patches in this size range inclusion in the nationally protected ecological community is determined by surveyed characteristics such as native plant species richness and contribution to cover, habitat values, evidence of regeneration and landscape characteristics.
- **All patches of 5 ha or greater** that meet the key diagnostic characteristics **are part of the nationally protected ecological community**. It is not necessary to conduct additional surveys to confirm that they meet biotic condition thresholds (**Table 14**) and that they are protected.

Table 14. Tuart TEC condition categories and thresholds.

All patches ≥5 ha are part of the nationally protected ecological community, regardless of their understorey condition. That is, thresholds in this table do not apply to patches ≥5 ha, but the key diagnostic characteristics and patch definition must be met.

Biotic thresholds		
Patch size	**≥2 ha <5 ha**	**≥0.5 ha <2 ha**
Very high condition		
≥80 % of all understorey^ vegetation cover is native# Or At least 12 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit	Medium sized patches with very high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	Smaller patches with very high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY
High condition		
≥60 % of all understorey^ vegetation cover is native# Or At least 8 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)	Medium sized patches with high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	Smaller patches with high condition understorey. **AND** That either: have an important landscape role (≤100 m to native vegetation)* OR have a habitat role (≥2 very large trees per 0.5 ha)* OR show regeneration (≥15 seedlings and/or saplings per 0.5 ha)*

Biotic thresholds		
Patch size	**≥2 ha <5 ha**	**≥0.5 ha <2 ha**
		PART OF THE PROTECTED ECOLOGICAL COMMUNITY
Moderate condition		
≥50 % of all understorey^ vegetation cover is native# Or At least 4 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)	Medium sized patches with moderate condition understorey. **AND** That either: have an important landscape role (≤100 m to native vegetation)* OR have a habitat role (≥2 very large trees per 0.5 ha)* OR show regeneration (≥15 seedlings and/or saplings per 0.5 ha)* PART OF THE PROTECTED ECOLOGICAL COMMUNITY	NOT PART OF THE PROTECTED ECOLOGICAL COMMUNITY (but may be a focus for local protection or restoration)
Poor condition		
Has minimal or no native cover and species richness. That is: <50 % of all understorey^ vegetation cover is native# And Less than 4 native understorey^ species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)	NOT PART OF THE PROTECTED ECOLOGICAL COMMUNITY (but may be a focus for local protection or restoration)	NOT PART OF THE PROTECTED ECOLOGICAL COMMUNITY (but may be a focus for local protection or restoration)

6.6.2.4 Tuart Woodland TEC Assessment

One vegetation type within the survey area (Unit EgEm) contains Tuart trees as the dominant component of the tree canopy. The presence of Tuart trees does not automatically mean that the Tuart Woodland TEC occurs in the survey area. The Conservation Advice contains the following step-wise approach in determining if the TEC occurs on a site:

- Step 1: Is the Tuart Woodlands and Forests ecological community in your proposed project site? Is it in other adjacent or off-site areas that may be impacted (for example, by introducing weeds)?
- Step 2: What is the patch size and condition category of the Tuart Woodlands and Forests in the proposed project site and in the surrounding area?

The assessment of the Tuart Woodland TEC within the survey area is outlined in **Table 15** and **Table 16**.

In summary, all vegetation types within the survey area containing Tuart trees are large enough (i.e. greater than 5ha, irrespective of vegetation condition) to be considered patches of the Tuart Woodland TEC. The location of the Tuart Woodland TEC is shown on **Figure 14**.

The total area of Tuart Woodland TEC onsite is 9.77 ha. The Tuart Woodland TEC on Lot 107 being in Degraded condition.

Step 1: Is the Tuart Woodlands and Forests ecological community in your proposed project site? Is it in other adjacent or off-site areas that may be impacted (for example, by introducing weeds)?

Table 15: Tuart Woodland TEC Step 1 diagnostics (DoEE 2019)

Key diagnostic characteristics♦	**Information**	**Key diagnostic questions*** (Refer to Section 3.2 of the Approved Conservation Advice for a complete explanation of these diagnostic features – other sections of the Approved Conservation Advice are referenced where relevant)	**Response (yes/no/possibly) and detailed comments. Use as much space as you need to fully answer the question**#
Location and physical environment	Bioregion	Is the proposal site within the Swan Coastal Plain IBRA bioregion?	Yes
Soils and Landform	Soil type	Is the soil type consistent with where the Tuart Woodlands and Forests may occur? (see Section 2.2.1♦)	Yes, Spearwood Dune soil type
	Location in the landscape, topography	Is the topography/physical environment consistent with where the Tuart Woodlands and Forests may occur? Is the site associated with any hydrology (groundwater/surface water)?	Yes, Tuarts commonly found in the Wanneroo area. Not associated with any wetlands
Structure	Presence of Tuart trees	How many Tuart trees are present and are they consistent with the characteristics set out in the Approved Conservation Advice? **Note:** Please present this information in terms of total number of trees (dead, established, seedlings etc.) and trees per hectare of the footprint. Diagrams/maps should also be provided.	The fauna assessment identified that 75 tuart trees with a DBH>50cm were present onsite (Terrestrial Ecosystems, 2024). Additional tuart trees with a smaller DBH were also present but not counted.
	Structural form	What structural form is the vegetation?	Low Open Woodland to Woodland
Composition	Dominant tree species, emergent tree layer, understory	Is the composition of the community consistent with the characteristics set out in the Approved Conservation Advice? What other tree species are present? How many native understorey species are present and what is the number of weedy species/proportion of weeds?	Tuarts occur in many areas as the sole tree species and in other areas co-dominant with Jarrah trees. Native understorey species from onsite Tuart Woodland quadrats (C17 and C18) ranges from7-13 in 2 quadrats. Number of weed species ranges from 7-9. Refer to quadrat data in **Appendix 7.**

Key diagnostic characteristics♦	Information	Key diagnostic questions* (Refer to Section 3.2 of the Approved Conservation Advice for a complete explanation of these diagnostic features – other sections of the Approved Conservation Advice are referenced where relevant)	Response (yes/no/possibly) and detailed comments. Use as much space as you need to fully answer the question#
Defining a patch of Tuart Woodlands and Forests	Patch definition	What is the extent of the patch? Note: Descriptions of patch extent must include analysis of canopy extent and associated understorey vegetation (see Section 3.2.2•). Patches may extend beyond the project area or include areas of infrastructure (i.e. road, powerline). The referral should make clear how, and how much of the patch will be directly or indirectly impacted.	Given the large number of tuart trees present onsite (i.e. 75 trees with a DBH>50cm, plus smaller trees) the location of all trees has not been mapped. However, based on site investigations the density of Tuarts on the survey area is highly likely that the 30 m perimeter overlaps in all areas mapped with Tuart trees.
Relationship with other ecological communities	Other vegetation communities	Are other vegetation communities present? What are they and how do they intergrade and/or interact with the Tuart Woodlands and Forests TEC? (see Section 3.2.3•)	The survey area contains other dryland woodland vegetation that does not contain Tuart trees as well as wetland vegetation in the south-east corner.

The complete key diagnostic characteristics are provided in the Approved Conservation Advice.

* The Tuart Woodlands and Forests may include restored, planted or revegetated flora. Do not exclude vegetation from being classed as the Tuart Woodlands and Forests because it is a planted, restoration or revegetation site (unless it is a garden).

Comments should include references to appropriate supporting information and data.

Step 2: What is the patch size and condition category of the Tuart Woodlands and Forests in the proposed project site and in the surrounding area?

Table 16: Tuart Woodland Step 2 diagnostics (DoEE 2019)

Size and condition♦	Information	Relevant content to be discussed in the referral (Refer to Section 3.3 of the Approved Conservation Advice for a complete explanation of these diagnostic features)	Detailed comments. Use as much space as you need to fully answer the question#
Patch Size	Patch size in hectares	Is the patch size large enough to meet the minimum patch size in this section? (Section 3.3♦) **Note:** Patch boundaries are not limited to the proposal site. You must make clear that the patch boundary is consistent with Section 3.2.2♦.	The areas mapped with Tuart trees are above the minimum 5ha to meet the criteria for the TEC regardless of understorey condition.
Patch condition	Condition thresholds	Using the condition categories in this section, what is the patch condition? (Section 3.3.1♦) What is the quality and size (hectares) of the vegetation community in and around the site where the proposed action will occur? Is the patch expected to improve in condition (e.g. after appropriate fire management) or is there a threatening process underway that will reduce the current size and/or condition? **Note:** Refer to Section 3.4 – Step 3 – Further information to assist in identifying patches of the protected ecological community and avoiding significant adverse impacts. If patch quality varies over the site; characterisation of the variation should be provided. Patch condition includes consideration of thresholds for characteristics such as plant species richness, landscape features, Tuart tree age and size and other habitat roles of the vegetation. Other vegetation condition measures (e.g. Keighery scale) do not necessary reflect the condition thresholds and both should be provided, where relevant. Where threats are identified (i.e. those listed in Appendix C of the Approved Conservation Advice) please provide further information on what these are and how they have impacted the condition.	The 2 Tuart Woodland quadrats assessed have 8 and 14 native understorey species per 0.1ha. Quadrats that have more than 12 species are considered to have a Very High rating.

♦ Further information on the key diagnostic characteristics is provided in the Approved Conservation Advice.

Comments should include references to appropriate supporting information and data. The response which includes the information does not need to be presented in table form.

6.7 Bush Forever sites

The survey area was not identified as a Bush Forever site. Similar vegetation from the Cottesloe – Central and South vegetation complex and FCT 28 occurs in two nearby Bush Forever sites to the east and south-west.

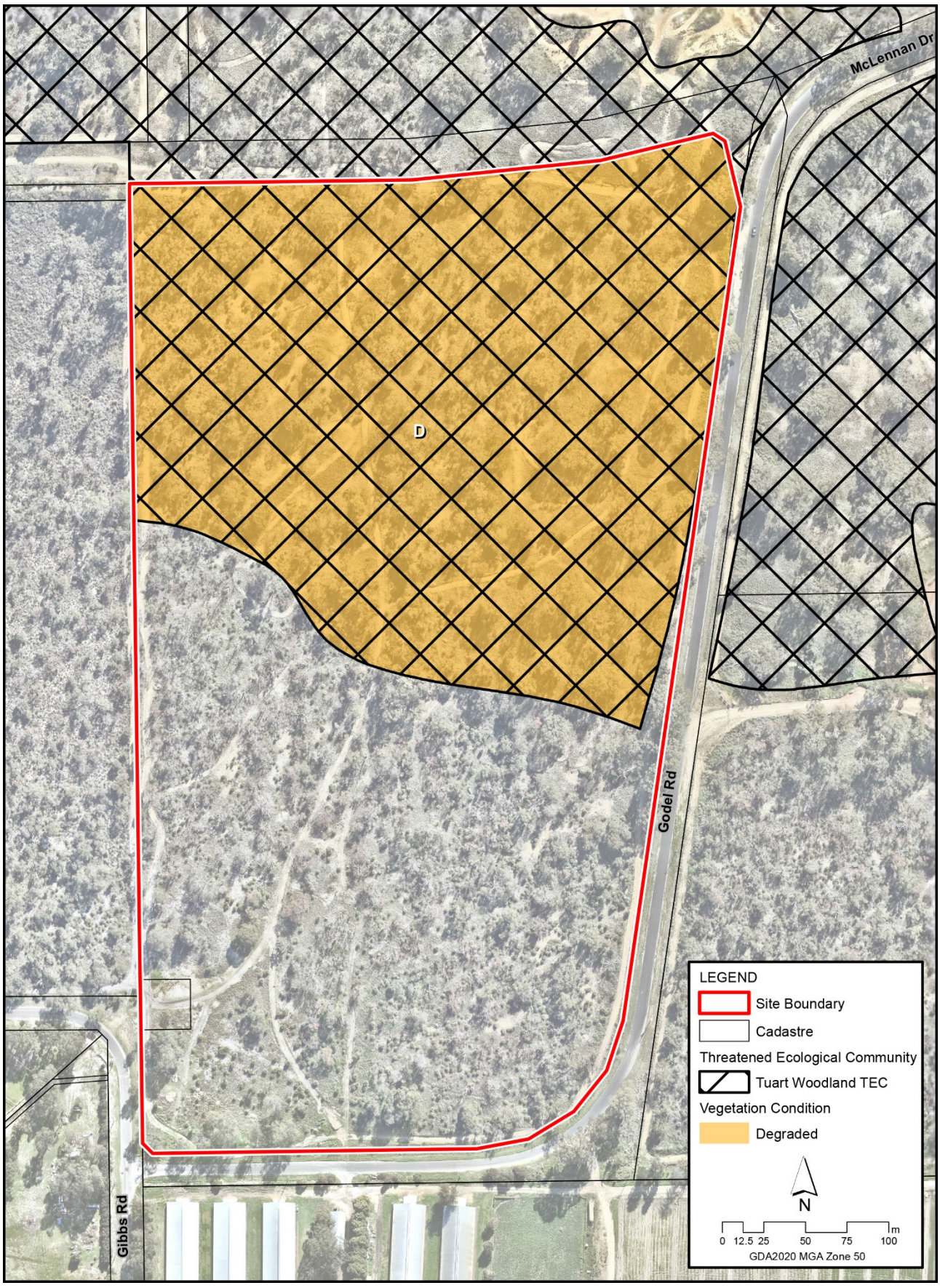

Figure 14. Location and condition of TECs within the survey area.

7 Discussion and conclusions

7.1 Significance of flora

Species richness in the 4 quadrats surveyed within Lot 107 in 2023 ranged from 9-23 with a range of 5-14 native species, averaging 8 native species. The average number of weed species was 7.

There were no Threatened or Priority-listed flora, or other flora of conservation significance recorded within the survey area in the 2014 or 2023 surveys.

Declared pest plants

There were no declared pest plants or environmental weeds recorded during the survey of Lot 107.

7.2 Significance of vegetation

Three vegetation types were recorded and mapped on the survey area, with soils consisting of dark brown to orange brown sand. The condition of the vegetation ranged from Completely Degraded to Degraded.

The vegetation at the site was too degraded to undertake FCT analysis, but based on PATN analysis outcomes for Eucalyptus dominated vegetation units on Very Good and Excellent condition in the surrounding survey area (PGV Environmental, 2023), it appears likely that the vegetation onsite would have originally represented FCT 24 and/or FCT 28.

The vegetation type containing Tuart trees (Unit EgEm) was considered to be representative of the Tuart Woodlands and Forests of the Swan Coastal Plain ecological community which is a TEC at Commonwealth level and State level. The total area of Tuart Woodland TEC within the survey area is 9.77 ha.

7.3 Vegetation complexes and associations

Vegetation onsite was found to align with the Cottesloe – Central and South vegetation complex as mapped by Heddle et al. (1980). 2018 Statewide vegetation statistics (GoWA 2019) show approximately 26.87% of the original 87,476.26 ha of the vegetation complex remains on the SCP, below the 30% required to meet the national retention target, with 5% remaining in DBCA reserves. In the City of Wanneroo the amount of extent vegetation remaining is 41.65%, which exceeds the 30% national retention target.

These figures show a decline in extent of the vegetation complex remaining when compared to the 2002 data used in the 2014 survey, where approximately 18,474 ha (41%) of the original 44,995 ha of the complex's vegetation remained on the Southern Swan Coastal Plain (EPA, 2006). Of this, 3,951 ha, or 8.8% of the original extent, was contained in secure tenure nature reserves (EPA, 2006).

7.4 Bush Forever sites

The survey area was not identified as a Bush Forever site. Similar vegetation from the Cottesloe – Central and South vegetation complex and FCT 28 occurs in two nearby Bush Forever sites to the east and south-west which ensures its long-term retention within the local area.

7.5 Watercourses and wetlands

There are no mapped watercourses or wetlands within the survey area. The closest wetland is the conservation category Nowergup Lake (UFI 8021) which is approximately 275 m to the southwest.

7.6 Environmentally sensitive areas

The survey area does not occur within a mapped ESA buffer. There are ESAs that are associated with the Bush Forever sites discussed in Section 5.7 to the east and southwest of the survey area, as well as an ESA occurring in association with Nowergup Lake (Conservation Category Wetland, UFI 8021) and an ESA associated with the TEC 'Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain' located approximately 1.4 km to the northwest of the survey area.

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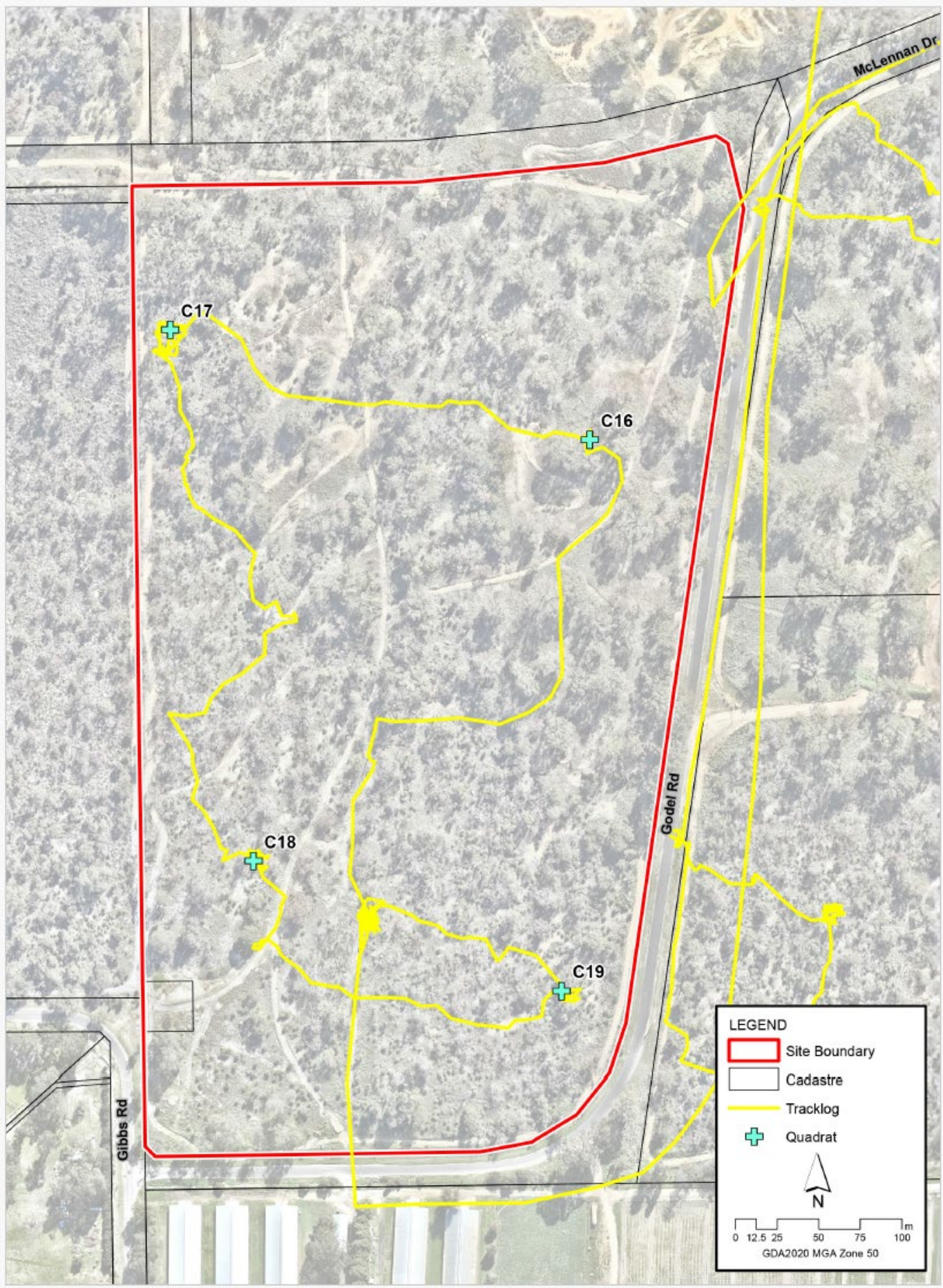
Appendix 1. Quadrat location and track log.



Appendix 2. Categories of Threatened ecological communities under the EPBC Act.

Category	Definition
Critically endangered (CR)	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered (EN)	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable (VU)	If, at that time, an ecological, community is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

Appendix 3. Categories of threatened and priority ecological communities under the BC Act.

Conservation code	Category
(T) Threatened ecological community pursuant to Sect 27 of the *Biodiversity Conservation Act 2016.*	
T	(T) CR – Critically endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
	(T) EN - Endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
	(T) VU - Vulnerable An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
(P) Priority species – possible threatened communities.	
P1	Poorly known communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Conservation code	Category
P2	Poorly known communities Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Poorly known communities a) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: b) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; c) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	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. 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.
P5	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 4. Protected Matters Search Tool and data searches.

FID	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site	Vegetation	Frequency	Notes
749	1218697	3237	Acacia benthamii	2					
770	8982627	3237	Acacia benthamii	2	Shrub, 1.3 m high.	Flat. Yellow brown sand.	Low open forest of Allocasuarina fraseriana, Banksia attenuata and B. menziesii over tall open shrubland of Xanthorrhoea preissii over low open heath of Hibbertia hypericoides and Acacia humilis over very open grassland/sedgeland of Mesomelaena pseudosty		
5072	1014773	11336	Adenanthos cygnorum subsp. chamaephyton	3	Prostrate mat like shrub.	Lateritic sandy loam. Roadside.		common, ca 10 plants.	
8365	3416119	34161	Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	1	Shrub 1.8-2 m high, flowers white.	Limestone.			
8370	7404808	34161	Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	1		Limestone ridges SCP26a.			FCT26a Hadrell road. Transect road myhad 02, 10 m transect ID JP05, preburn plot.
8374	9139532	34161	Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	1	Upright shrub to 2.5 m. White flowers.	Moderate east-facing slope. Yellow grey sand.		120+ plants.	
16366	8755388	1425	Conostylis bracteata	3	Tufted herb to 20 cm tall. Flowers yellow. Plants flowering at the time of collection. Leaves arranged into flattened, broadly fan-like clusters. The leaf margins glabrescent.	Grey sand, on mid-slope.	Acacia rostellifera and Melaleuca systena mid shrubland. Lomandra maritima low open herbs.	1 mature plant.	Project: 3536.
16534	9208054	11388	Conostylis pauciflora subsp. euryrhipis	4	Stoloniferous herb, 20 cm high.	Interdunal flat or swale. White calcareous sand. > 7 years since fire.	Allocasuarina lehmanniana subsp. lehmanniana high open shrubland over Spyridium globulosum, Olearia axillaris, Acacia cyclops high shrubland over Melaleuca systena, Rhagodia baccata low open shrubland over Desmocladus asper, Lepidosperma pubisquameum ver		
16537	5982138	11388	Conostylis pauciflora subsp. euryrhipis	4		S slope, on sand dunes; dry white sand; long unburnt.	Low heath 0.3 m tall, 30-70% cover.	c. 20 mature plants in a 5 x 20 m area.	
16539	7836457	11388	Conostylis pauciflora subsp. euryrhipis	4		Yellow-brown sand over limestone, slope, private lease. NW aspect.	Acacia rosterllifera and Spyridium globulosum Tall Open Scrub over Melaleuca systena Low Open Shrubland over mixed Herbland-Grassland.		Healthy population with flowers. Potential threat from clearing.
16540	7858833	11388	Conostylis pauciflora subsp. euryrhipis	4	Tufted perennial.	Sand, secondary dunes.	Scaevola crassifolia, Lomandra maritima, Rhagodia baccata, Hardenbergia comptoniana, Threlkeldia diffusa, Hemiandra pungens, Acanthocarpus preissii.		
16545	9039023	11388	Conostylis pauciflora subsp. euryrhipis	4	Herb.	Dunes.	Acacia cochlearis and Melaleuca systena low open shrubland.		
16550	4059034	11388	Conostylis pauciflora subsp. euryrhipis	4	Tufted perennial herb, flowers yellow.	On grey calcareous sand.			
16567	7836449	11657	Conostylis pauciflora subsp. pauciflora	4		Grey sand over limestone, slope private lease, W aspect.	Melaleuca systena and Scaevola globulifera Open Low Heath over Austrostipa flavescens, Lolium perenne and Bromus diandrus Grassland.		Healthy population with flowers. Potential threat from clearing.

FID	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site	Vegetation	Frequency	Notes
22919	1123661	13091	Eucalyptus argutifolia	T		ESE aspect. Lower ridgetop slope. Sheet sand/brown boulder. Completely open to treeless site.	Melaleuca huegelii, Xanthorrhoea preissii, Dryandra sessilis/nivea, Hakea trifurcata, Hibbertia hypericoides, Native wisteria.		
22934	9139524	13091	Eucalyptus argutifolia	T	Mallee to 2 m high.	At the base of a limestone ridge. Grey sand.		ca. 6 plants.	
22936	2160765	13091	Eucalyptus argutifolia	T		Slight gully situation nestles between two limestone ridges. Sand/boulder/brown/ yellow/dry/limestone.	Completely open and treeless with dense scrubland. Dryandra's nivea/ sessilus, Hakea trifurcata, Melaleuca huegelii, Blackboys (Xanthorrhoea preissii), Templetonia retusa.	32 clumps.	
22937	2117223	13091	Eucalyptus argutifolia	T		Slight gully situation nestled between two limestone ridges. Limestone/boulder/ sand/brown/yellow/dry.	Completely open & treeless with dense scrubland. Dryandra's nivea/ sessilus, Hakea trifurcata, Melaleuca huegelii, Blackboys (Xanthorrhoea preissii), Templetonia retusa.	32 clumps, undisturbed.	
22946	8153302	13091	Eucalyptus argutifolia	T	Mallee to 2.5 m. Flowers white.	Slight slope/ridge. Grey/white sand over limestone.	With Acacia cyclops, Hakea prostrata, Lomandra maritima, rhagodia baccata, Spyridium globulosum.		
22947	8153310	13091	Eucalyptus argutifolia	T	Mallee to 2.5 m. Flowers white.	Slight slope/ridge. Grey/white sand over limestone.	With Acacia cyclops, Hakea prostrata, Lomandra maritima, rhagodia baccata, Spyridium globulosum.		
22953	9482083	13091	Eucalyptus argutifolia	T	Mallee, 1 - 2.5 m high by 1 - 3.5 m wide.	Hill top, with exposed limestone outcropping, moist brown sand. Site was burnt approx. 2002-2003.			Population 7B. Access is through the quarry.
22954	9487921	13091	Eucalyptus argutifolia	T	Mallee to 3 m high. Buds, white flowers and fruit present.	Mid-slope, brown sand over limestone.	Associated species: Banksia sessilis, Xanthorrhoea preissii, Melaleuca huegelii, Hibbertia hypericoides.	25 mature and 2 juvenile plants.	Plants are in two clumps. The southern clump is close to a limestone quarry.
24451	1176412	50737	Eucalyptus foecunda subsp. foecunda	4	Mallee to 5 m tall, bark rough, flowers white.	Slopes of hill high in the landscape.	Limestone heath with Eucalyptus falcata and E. decipiens at foot of N side of hill.		
24457	1153900	50737	Eucalyptus foecunda subsp. foecunda	4	Mallee to < 3 m, grey bark rough at base, smooth above. Buds and branchlets yellow-orange.	On limestone/sand,	Dryandra sessilis, Grevillea thelemanniana, Hakea trifurcata.		
24458	1153919	50737	Eucalyptus foecunda subsp. foecunda	4	Mallee to < 3 m, grey bark rough at base, smooth above. Buds and branchlets yellow-orange.	On limestone/sand,	Dryandra sessilis, Grevillea thelemanniana, Hakea trifurcata.		
24466	1192558	50737	Eucalyptus foecunda subsp. foecunda	4	Smooth barked mallee to 2 m x 2 m.	Grey sand over limestone, hilltop.	Low limestone heath.	rare.	
24472	1144987	50737	Eucalyptus foecunda subsp. foecunda	4		Limestone soil.			
24476	1155458	50737	Eucalyptus foecunda subsp. foecunda	4		In limestone soil.			
24503	1144235	50737	Eucalyptus foecunda subsp. foecunda	4		Sand over limestone.	In shrubland with E. petrensis.		
24511	6985165	50737	Eucalyptus foecunda subsp. foecunda	4	Mallee. 2 m high x 2 m wide. Flowers white; in flower and bud.	Limestone hill. White sand.	Eucalyptus foecunda mallee heath.	>100 plants over 0.25 ha.	
27340	8076626	20162	Fabronia hampeana	2		Private property in depression between limestone outcrops with yellow sand. Potential threat by urban development. Last burnt summer 2001.	Banksia low open woodland with occasional Eucalyptus decipiens, Macrozamia riedlei, Acacia rostellifera and Hypocalymma angustifolium.		Condition of population: Healthy.
27341	9248811	20162	Fabronia hampeana	2	Moss on Macrozamia riedlei trunks.	Lower dune. Dry pale grey sand.	Woodland of Banksia attenuata with Xanthorrhoea preissii, Mesomelaena pseudostygia, Hakea trifurcata and occasional Macrozamia.		The stems of Macrozamia needed to be well developed and the fronds large to provide shade.
34558	2625598	49637	Hibbertia leptotheca	3		Limestone.	Heath.		

FID	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site	Vegetation	Frequency	Notes
34572	7520859	49637	Hibbertia leptotheca	3		Outcrop, slope. Dry, red-brown-white, limestone.	Mixed low scrub. Melaleuca cardiophylla, Mel. huegelii, Diplopeltis huegelii, Grevillea preissii, Trymalium ledifolium.	> 100 plants.	
34582	9208046	49637	Hibbertia leptotheca	3	Low shrub, 30 cm high.	WSW-facing upper to mid slope of dune. White calcareous sand. 1.5 to 2.5 years since fire.	Allocasuarina lehmanniana subsp. lehmanniana, high open shrubland over Acacia rostellifera shrubland over Melaleuca systena, Phyllanthus calycinus, Olearia axillaris, Gastrolobium linearifolium low shrubland over Lepidosperma pubisquameum scattered sedge		
34583	9039058	49637	Hibbertia leptotheca	3	Low shrub.	Dunes.	Xanthorrhoea preissii mid open shrubland over Melaleuca systena low open shrubland.	5 plants.	
36574	8755396	20462	Jacksonia gracillima	3	Perennial tufted herb with narrow leaves 10-40 cm long, with rose pink flowers.	Grey sand, on mid-slope with exposed limestone. Fire > 5 years.	Low open forest of Eucalyptus rudis and Melaleuca preissiana. Banksia attenuata shrubs. Tall shrubland of Gastrolobium ebracteolatum and Kunzea glabrescens. Sedgeland of Baumea preisii subsp. laxa.	1 mature plant.	Project: 3516.
36729	6410731	4027	Jacksonia sericea	4		Slope/flat. Dry grey sand over limestone.	Eucalyptus marginata, Banksia attenuata, B. menziesii Woodland. Associated species: Banksia attenuata, B. grandis, Allocasuarina fraseriana, Dryandra sessilis, Calothamnus sp.		Condition of population: healthy.
36734	7400160	4027	Jacksonia sericea	4	Low shrub.				
36751	8982643	4027	Jacksonia sericea	4	Shrub, 0.5 m high.	Gentle slope, slight ridge. Yellow brown loamy sand.	Tall open shrubland of Acacia rostellifera to 3 m over closed tall scrub of Banksia sessilis to 2.4 m over open shrubland of Xanthorrhoea preissii, Melaleuca systena and Hakea trifurcata to 2 m over low shrubland of Jacksonia sericea and Hibbertia hyperi	> 700 plants.	
38359	1421468	3042	Lepidium pseudotasmanicum	4					
39370	5456169	40801	Leucopogon maritimus	1		On stable dune.	Coastal heath.		
39371	7835213	40801	Leucopogon maritimus	1		White sand, sand dune, slope, private property.	Melaleuca systena, Lomandria maritima Low Open Heath Melaleuca systena, Scaevola thesioides, Acacia rosterllifera and Herbland of Lomandra martima.		Healthy population with potential threat from clearing.
39378	5536359	40801	Leucopogon maritimus	1	Low spreading shrub, 20 cm high x 20 cm wide. Flowers white, single stemmed at ground level. Ovary 3 celled glabrous.	Near coastal dunes ca 600 m from beach. Bare yellow sand over limestone.	Low Heath D (Muir 1977) with Acacia truncata, Melaleuca systena and Acanthocarpus preissii.	locally common.	
39383	5127742	40801	Leucopogon maritimus	1	Erect to spreading shrub to 30 cm tall. Corolla white, flowers just beginning.	In sand among limestone rocks on small hill.	In low kwongan, Scaevola, Pimelea, Acacia.		
39384	9208038	40801	Leucopogon maritimus	1	Low shrub, 35 cm high.	Gentle, NW-facing lower slope of lower ridge. Grey calcareous sands. > 5 - 7 years since fire.	Melaleuca huegelii, M. cardiophylla, Acacia truncata closed low heath over Thomasia triphylla, Leucopogon insularis, Melaleuca systena, Lysinema ciliatum low shrubland over Desmocladus asper, Lepidosperma pubisquameum very open sedgeland with Lomandra ma		
39599	8262926	19460	Leucopogon sp. Yanchep (M. Hislop 1986)	3					
39600	8262934	19460	Leucopogon sp. Yanchep (M. Hislop 1986)	3					

FID	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site	Vegetation	Frequency	Notes
39603	3509311	19460	Leucopogon sp. Yanchep (M. Hislop 1986)	3	Dwarf shrub 40 cm high, flowers white, mucronate leaves.	Undulating, grey sand over limestone.	Woodland, Banksia.	frequent.	
39604	1147773	19460	Leucopogon sp. Yanchep (M. Hislop 1986)	3	Low twiggy woody shrub, 15-20 cm, flowers white, sweet honey scent.	Low hill, grey sand over limestone.	Limestone heath.	scattered in area.	
39617	7293178	19460	Leucopogon sp. Yanchep (M. Hislop 1986)	3	Erect shrub to 60 cm high x 60 cm wide. Flowers white, strictly pendulous.	Coastal plain. Dry, yellow sand over limestone.	Heath (mostly 1-2 m). Dryandra sessilis, Jacksonia calcicola, Conostephium stoechadis.	locally common.	
41047	9196951	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Slender erect open shrub, 2-3 m high x 1 m wide. In fruit, not in flower.	Limestone hill. Skeletal white loam over limestone.	Banksia sessilis / Melaleuca tall shrubland.	locally common.	Co-occurring with Melaleuca systena which is in full flower.
41048	8815224	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Erect to spreading shrub to 1.5 m with yellow flowers.	Limestone ridge remnant within a mine pit.	Remnant.	occasional.	
41049	8816476	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Erect shrub 1 - 2.5 m x 2 m.	On fine sand to sandy loam soils with 30-70% outcropping limestone.	Closed tall scrub of Melaleuca systena, M. sp. Wanneroo, M. sp. Wanneroo x systena and M. huegelii, over low shrubland of Calothamnus quadrifidus, Banksia sessilis var. cygnorum, Leucopogon parviflorus and Templetonia retusa.	locally common.	Co-occurs with Melaleuca systena and M. systena x M. sp. Wanneroo. Population 1.
41050	8816522	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Erect shrub 1-2.5 m x 2 m. Flowers yellow.	On well drained grey sand with 30-70% outcropping limestone.	Tall open scrub of Melaleuca huegelii, M. sp. Wanneroo with occasional Eucalyptus petrensis and Melaleuca systena, over open low heath of Acacia alata var. tetrantha, Thomasia triphylla over open sedgeland/herbland.	locally common.	
41051	9137459	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Tall shrub to 2 m tall. Yellow flowers.	Hilltop and upper slopes. Soil: shallow brown sand.	Shrubland. Associated species: Thomasia sp., sedges, Hakea trifurcata, Grevillea preissii, Melaleuca systena, Banksia sessilis.	>1000.	
41052	8997675	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T		Hill slope. Yellow/brown sand.	Melaleuca shrubland. Associated species: Acacia alata var. tetrantha, Banksia sessilis, Melaleuca huegelii and M. systena.	1000+.	
41053	9041443	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Shrub to 2 m tall. Yellow flowers.	NE face of limestone hill. Soil: shallow yellow/brown sand.	Dense shrubland to 2 m. Associated species: Calothamnus sp., Hakea trifurcata, Grevillea preissii and Banksia sessilis.	>1000.	
41054	6972942	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Slender erect single 2-3 m high and 1-2 m wide. Flowers pale yellow; in full flower.	Rugged limestone ridge. Mossy black sand.	Melaleuca cardiophylla, M. sp., M. systena tall closed shrubland.	dominant locally.	
41057	8982635	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Shrub, 2.5 m high. Flowers yellow.	Limestone ridge. Brown loamy sand.	Tall open scrub of Melaleuca huegelii and M. sp. Wanneroo (G.J. Keighery 16705) over open shrubland to 1.5 m of Melaleuca systena, Xanthorrhoea preissii and Acacia lasiocarpa over low open shrubland to 0.4 m of Grevillea preissii and Banksia nivea over v	40 plants.	

FID	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site	Vegetation	Frequency	Notes
41058	9446958	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Many branched shrub to 1.3 m tall x 0.8 m wide. Leaves are linear to 20 mm long x 3-5 mm wide, hairy and bright green on young plants. Early fruits present towards stem ends, with new growth of shorter recurved leaves continuing.	Grey fine sand on limestone outcropping up to 70%. Upper slopes to ridge.	Very Open Shrub Mallee of Eucalyptus argutifolia over Closed to Open Heath of Melaleuca sp. Wanneroo (G.J. Keighery 16705), Grevillea preissii, Templetonia retusa, Melaleuca huegelii, Acacia lasiocarpa, A. alata subsp. tetranthera, Opercularia vaginata,	6250 plants extrapolated within a mapped population boundary.	The majority of plants had recruited after a wildfire 6 years previously. The habitat is between a water corporation facility and a mine-pit.
41059	9446966	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	Many branched shrub to 1.3 m tall x 0.8 m wide. Leaves are linear to 20 mm long x 3-5 mm wide, hairy and bright green on young plants. Early fruits present towards stem ends, with new growth of shorter recurved leaves continuing.	Grey fine sand on limestone outcropping up to 70%. Upper slopes to ridge.	Very Open Shrub Mallee of Eucalyptus argutifolia over Closed to Open Heath of Melaleuca sp. Wanneroo (G.J. Keighery 16705), Grevillea preissii, Templetonia retusa, Melaleuca huegelii, Acacia lasiocarpa, A. alata subsp. tetranthera, Opercularia vaginata,	6250 plants extrapolated within a mapped population boundary.	The majority of plants had recruited after a wildfire 6 years previously. The habitat is between a water corporation facility and a mine-pit.
42409	8755442	50567	Netrostylis sp. Chandala (G.J. Keighery 17055)	2	Sedge c. 50 cm tall with very narrow leaves and culms. Inflorescence loose and branched, with dark brown florets.	Grey brown peaty soil in a swamp.	Low open forest of Eucalyptus rudis and Melaleuca preissiana. Tall open shrubland of Astartea fascicularis and Kunzea glabrescens. Pteridium esculentum mid ferns. Sedgeland of Lepidosperma.	100 mature plants.	Project: 3516.
44256	9136924	5237	Pimelea calcicola	3		Brown sandy loam soil on plain over limestone.	Isolated low Banksia attenuata trees over tall closed Banksia sessilis, Hakea trifurcata and Leptospermum laevigatum shrubland over low open Hibbertia hypericoides and Xanthorrhoea preissii shrubland.	1 mature plant.	
44267	3409368	5237	Pimelea calcicola	3	Shrub, erect 3 ft. Reddish pink flowers.				
44269	4948874	5237	Pimelea calcicola	3	Erect single stemmed shrub 1 m high x 1 m wide. Flowers grading from white through to pink.	Dry brown clayey sand over limestone.	Dense Low Forest A, Open Scrub, Heath A, Heath B, Low Heath C, Low Heath D, Very Open Herbs, Open Hummock Grass. Eucalyptus gomphocephala, Dryandra sessilis, Scaevola sp, purple Hemiandra and yellow flowered Melaleuca, Xanthorrhoea preissii.	frequent.	
44274	9220828	5237	Pimelea calcicola	3	1.5 m high.	Undulating plain. Brown sandy loam over limestone.	Isolated low Banksia attenuata trees over tall closed Banksia sessilis, Hakea trifurcata and Leptospermum laevigatum shrubland over low open Hibbertia hypericoides and Xanthorrhoea preissii shrubland.		
44419	6209874	8163	Pithocarpa corymbulosa	3					Field No. Y 64.
46763	8039364	17543	Sarcozona bicarinata	3		Private property; limestone outcrops with dry white sand. Potential threat by urban development. Last burnt summer 2001.	Open Banksia sessilis heathland. Banksia sessilis, Opercularia vaginata, Scaevola crassifolia and Desmocladus flexuosus.	5 mature plants over 5 m squared.	Condition of population: Healthy.
48266	6233090	20348	Sphaerolobium calcicola	3	Standard yellow, red around yellow eye. Red wings. Keel yellow with few red spots near apex. Ca 1 m tall.	Grey brown sand over limestone. Seasonally wet, fairly low lying area.	Shrubland with understorey of sedgeland. Associated species: Nuytsia and Acacia with Viminaria, Xanthorrhoea, Comesperma and Lepidospermum.	occasional.	
49717	6511546	7756	Stylidium longitubum	4	Flowers pink.	Seasonal Wetland, flat ground. Dark brown clay loam some peat, over ?clay. Poor drainage, wet during winter/spring.	Open Low Scrub A. Associated species: Astartea fascicularis.		

FID	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site	Vegetation	Frequency	Notes
49775	4430921	13127	Stylidium maritimum	3	Flowers pink-mauve, throat white, outer petal surface white to pale pink, upper winged throat appendages pink, lower throat appendages white-red tipped, leaves 3 per papery sheath.	On limestone outcrops in crater-like depressions filled with black sandy soil.	Area surrounded by low coastal heath and open Banksia menziesii woodland.		
49786	9139559	13127	Stylidium maritimum	3	Sedge-like herb to 0.4 m high. In fruit.	Limestone ridge with outcropping. Sandy soil.	Melaleuca huegelii and Melaleuca systena TEC.	ca. 35 plants.	
49790	7520840	13127	Stylidium maritimum	3		Side of dune. Dry, white-grey sand.	Low heath. Lomandra maritima, Leptorhynchos scabrus, Melaleuca huegelii.	> 200 plants.	
49791	5982103	13127	Stylidium maritimum	3		Slope; on stable sand dunes; dry white sand; long unburnt.	Low heath 0.5 m tall, 70-100 % cover.	c. 10 mature plants in a 5 x 5 m area.	
49796	7836384	13127	Stylidium maritimum	3		Grey sand-loam, slope, ridge, limestone, private property.	Closed Tall Scrub of Melaleuca huegelii, Dryandra sessilis with occasional Spyridium globulosum.		Healthy population, in flower. Potential threat from clearing and weeds.
49798	7836430	13127	Stylidium maritimum	3		Brown sand-loam over limestone, slope, private property.	Acacia rosteliifera Open Low Heath with Melaleuca huegelii, Acacia truncata and Melaleuca systena.		Healthy population with flowers. Potential threat from clearing and weeds.
49800	8755361	13127	Stylidium maritimum	3	Perennial tufted herb with narrow leaves 10-40 cm long, with rose pink flowers.	Grey sand, on mid-slope with exposed limestone.		1 mature plant.	Project: 3536.
49806	9039066	13127	Stylidium maritimum	3	Herb.	Dune swale.	Banksia sessilis low open shrubland.	10 plants.	
49808	8982600	13127	Stylidium maritimum	3	Herb, 0.8 m high.	Limestone ridge. Brown loamy sand over limestone.	Tall shrubland of Melaleuca systena over open shrubland of Melaleuca huegelii and Acacia lasiocarpa over very open herbland of Desmocladus flexuosus. Associated species: Grevillea preissii.	15 plants.	
49809	9207996	13127	Stylidium maritimum	3	Caespitose, perennial herb, 40 cm high. Flowers white/purple.	S-facing, midslope of low dune (ridge). Brown sand.	Olearia axillaris, Stylidium globulosum scattered shrubs over Melaleuca systena, Leucopogon parviflorus, Trymalium ledifolium var. ledifolium low shrubland over Austrostipa flavescens, Poa poiformis, Lomandra maritima herbland/grassland/sedgeland.		
49816	9556192	13127	Stylidium maritimum	3	Perrenial herb. Leaves smooth, 3 leaves sometimes 2 per scale leaf sheath. Flowers pink, calyx lobes bent at an angle away from the ovary centre line.	Grows in small pockets, filled with soil in very weathered and eroded limestone (cap-rock) outcrops.			
49818	9565078	13127	Stylidium maritimum	3	Flowers pink-mauve, throat white, outer petal surface white to pale pink, upper winged throat appendages pink, lower throat appendages white-red tipped, leaves 3 per papery-sheath.	On limestone outcrops in crater-like depressions filled with black sandy soil.	Area surrounded by low coastal heath and open Banksia menziesii woodland.		
49819	9565116	13127	Stylidium maritimum	3	Flowers pink-mauve, throat white, outer petal surface white to pale pink, upper winged throat appendages pink, lower throat appendages white-red tipped, leaves 3 per papery sheath.	On limestone outcrops in crater-like depressions filled with black sandy soil.	Area surrounded by low coastal heath and open Banksia menziesii woodland.		
50489	9573445	7803	Stylidium striatum	4	Corolla pink.	Grows in sand over limestone in Banksia woodlands.			
55374	6427405	44444	Tripterococcus sp. Brachylobus (A.S. George 14234)	4	Flowers yellow.	Seasonal Wetland, flat ground, black fine peaty clay loam sand, poor drainage, wet during winter/spring.	Open Herbs. Associated species: Lepyrodia muirii, Baumea articulata, Baumea vaginalis.		

FID	PopId	Nameid	Taxon	ConsStatus	WARank	PopNumber	SubPopCode	District	Vesting	Purpose1	Purpose2	CountDate	Method	HabNotes	SoilCondit	Landform	RockType	Gravel	SoilType	SoilColor	Drainage
352	86278	3237	Acacia benthamii	2		4		SWAN COASTAL	MRD	VER		5/06/2000	ESTMT	VegClas: Open B.menziessii woodland over shrubland	MOIST	FLAT	LIMESTN		SAND	YELLOW	
1684	89656	11336	Adenanthos cygnorum subsp. chamaephyton	3		16		SWAN COASTAL	LGA	VER	FOR	13/11/1981	UNKNOWN				LATERITE		LOAM_SND		
2856	118771	34161	Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	1		3		SWAN COASTAL	MRD	VER		9/11/2017	ESTMT	No sign of fire	DRY	SLOPE		GRVL_30	SAND	GREY	WLL_DRND
2857	118772	34161	Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	1		4		SWAN COASTAL	CC	FOR		14/09/2020	ACT_IND	Heath of Melaleuca huegelii, Banksia sessilis var. cygnorum, Xanthorrhoea preissii, Calothamnus quadrifidus, Baeckea sp. Limestone over Open Low Shrubland of Melaleuca systena, Hibbertia hypericoides, Banksia dallanneyi subsp. dallanneyi, Leucopogon parv	MOIST	SL_UP_ST	LIMESTN	GRVL_30	SAND	YEL_ORNG	WLL_DRND
6555	89775	11657	Conostylis pauciflora subsp. pauciflora	4		7		SWAN COASTAL	PRI			19/10/2007		Dom sp: Bromus diandrus. OPen low heath over grassland.		SLOPE	LIMESTN		SAND	GREY	
8894	101587	13091	Eucalyptus argutifolia	T	VU	7	A	SWAN COASTAL	CC	FOR		6/12/2013	ACT_CLMP	QUARRY Despite being surrounded by a limestone mine this elevated and isolated remnant of vegetation on the top of the ridge is in very good to excellent condition.	DRY	OUTCROP	LIMESTN	GRVL_30	SAND	BROWN	
8895	101588	13091	Eucalyptus argutifolia	T	VU	7	B	SWAN COASTAL	CC	FOR	MIN	6/12/2013	ACT_CLMP	Heath of Banksia sessilis var. cygnorum, Acacia lasiocarpa, Melaleuca huegelii, Melaleuca systena, Xanthorrhoea preissii, Acacia ?stenoptera, Hemiandra pungens, Trymalium ledifolium var. ledifolium with occasional Hakea prostrata, Cassytha ?racemosa, Tem	MOIST	SLOPE	LIMESTN		SAND	BROWN	
8898	90756	13091	Eucalyptus argutifolia	T	VU	10		SWAN COASTAL	WAT	WAT		15/05/2018	ACT_CLMP	Regenerating community: Very Open Shrub Mallee of Eucalyptus argutifolia over Tall Open Scrub of Banksia sessilis var. cygnorum, Xanthorrhoea preissii, Melaleuca systena, M. sp. Wanneroo (T), M. huegelii, Hakea prostrata, Acacia saligna over Open Low Hea	MOIST	SLOPE	LIMESTN		SAND	BROWN	WLL_DRND
8901	90759	13091	Eucalyptus argutifolia	T	VU	13		SWAN COASTAL	LGA	REC		5/12/2017	ACT_CLMP	HABITAT CONDITION: Good-degraded. Two bushland remnants still exist, but the degraded areas are reducing. 1. Low Open Woodland of Eucalyptus argutifolia over Tall Shrubland of Acacia rostellifera and Spyridium globulosum. 2. The second remnant is domina	MOIST	SL_MI_GE	LIMESTN		SAND	GREY	WLL_DRND
8902	101581	13091	Eucalyptus argutifolia	T	VU	14	A	SWAN COASTAL	NON	UCL		13/12/2013	ACT_IND		MOIST	SL_UP_ST	LIMESTN	GRVL_10	SAND	BROWN	
8903	101582	13091	Eucalyptus argutifolia	T	VU	14	B	SWAN COASTAL	NON	UCL		13/12/2013	ACT_IND		MOIST	RIDGE	LIMESTN		SAND	BROWN	
8904	90760	13091	Eucalyptus argutifolia	T	VU	15		SWAN COASTAL	LGA	REC		6/04/2021		A small amount of rubbish within population. Shrub Malle of Eucalyptus argutifolia over Shrubland Melaleuca huegelii, Melaleuca systena, Acacia rostellifera, Spyridium globulosum, Hakea trifurcata, over Hardenbergia comptoniana, Opercularia vaginata, Le	DRY	SL_UP_GE	LIMESTN		SAND	WHITE	
8906	101584	13091	Eucalyptus argutifolia	T	VU	17		SWAN COASTAL	PRI			3/08/2006	ACT_IND		MOIST	RIDGE	LIMESTN		SAND	BROWN	
8911	120029	13091	Eucalyptus argutifolia	T	VU	20		SWAN COASTAL	WAT	OTH		7/11/2017	ESTMT		DRY	SLOPE	LIMESTN	GRVL_10	SAND	GREY	WLL_DRND
10043	104267	20162	Fabronia hampeana	2		4	B	SWAN COASTAL	PRI			12/01/2009		Dom sp: Macrozamia sp. & Banksia sp. Woodland.					SAND	YELLOW	
10044	104268	20162	Fabronia hampeana	2		4	C	SWAN COASTAL	PRI			12/01/2009		Banksia low open woodland. Dom sp: Acacia cyclops, Hibbertai hypericoides, Desmocladus flexuosus			LIMESTN		SAND	YELLOW	
12418	100798	49637	Hibbertia leptotheca	3		9	A	SWAN COASTAL	PRI			14/10/2004	ESTMT		DRY	OUTCROP	LIMESTN		SAND	GREY	
12419	100799	49637	Hibbertia leptotheca	3		9	B	SWAN COASTAL	PRI			14/10/2005	UNKNOWN		DRY	OUTCROP	LIMESTN			WHITE	

FID	PopId	Nameid	Taxon	ConsStatus	WARank	PopNumber	SubPopCode	District	Vesting	Purpose1	Purpose2	CountDate	Method	HabNotes	SoilCondit	Landform	RockType	Gravel	SoilType	SoilColor	Drainage
13226	87329	5038	Lasiopetalum membranaceum	3		11		SWAN COASTAL	CC	NPK		4/11/1987		Growing under a jarrah tree in open woodland. On a flat - gently undulating slope. Occasional in area.		FLAT	LIMESTN		SAND	GREY	
14062	107424	25819	Marianthus paralius	T	EN	3		SWAN COASTAL	LGA	REC		18/09/2013	ACT_IND	1) Acacia xanthina, Templetonia retusa Open Heath over Spyridium globulosum, Grevillea preissii, Allocasuarina lehmanniana, Melaleuca cardiophylla, Phyllanthus calycinus, Hibbertia hypericoides, Scaevola crassifolia, Lomandra maritima Low Shrubland. *Ehr	MOIST	SL_UP_GE	LIMESTN	GRVL_10	SAND	GREY	WLL_DRND
14197	110769	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	1		SWAN COASTAL	LGA	GVT		8/07/2014	PART_CNT	Almost on the top of the ridge, slightly SW - W aspect.	MOIST	RIDGE	LIMESTN		FSA_LOAM		WLL_DRND
14198	110770	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	2		SWAN COASTAL	PRI	UNKNOWN		7/04/2008	ESTMT			OU_SLOPE	LIMESTN		SAND	BLACK	
14199	110789	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	3	A	SWAN COASTAL	PRI			10/05/2017	ESTMT	Hilltop and upper slopes. Soil: shallow brown sand.		CR_HILL	LIMESTN		SAND	BROWN	
14200	111492	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	3	B	SWAN COASTAL	RDL	MIN		27/11/2013	ACT_IND	NOTE - Fire information was taken from Corporate Mapping Data. Not confirmed in the field			LIMESTN				
14201	111509	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	3	C	SWAN COASTAL	RDL	MIN		30/09/2009	PART_CNT				LIMESTN				
14202	120789	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	3	D	SWAN COASTAL	WAT	GVT		15/05/2018	EXT_GRQD	Occasional Eucalyptus argutifolia and Eucalyptus petrensis to 1.5m over Closed Heath of Melaleuca sp. Wanneroo, Melaleuca huegelii, Grevillea preissii, Templetonia retusa, Scaevola crassifolia, Acacia lasiocarpa, Acacia alata var. tetrantha, Opercularia	MOIST	RIDGE	LIMESTN		SAND	GREY	WLL_DRND
14203	110790	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	4	A	SWAN COASTAL	CC	FOR		26/11/2013	PART_CNT	NOTE - Fire information was taken from Corporate Mapping Data. Not confirmed in the field			LIMESTN				
14204	111490	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	4	B	SWAN COASTAL	CC	FOR		6/12/2013	ESTMT		DRY	RIDGE	LIMESTN		SAND		WLL_DRND
14205	120790	33022	Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	4	C	SWAN COASTAL	CC	FOR		17/01/2019	PART_CNT	Tall Open Scrub of Melaleuca systena, M. sp. Wanneroo, Banksia sessilis ssp. cygnorum, M. huegelii over Open Heath of Grevillea preissii, Hibbertia hypericoides, Conostylis candicans, Cryptandra mutila, Acacia pulchella, Desmocladus flexuosa.	DRY	SL_MI_ST	LIMESTN		SAND	GREY	WLL_DRND
16741	89298	7756	Stylidium longitubum	4		16		SWAN COASTAL	SPC			10/11/1994				FL_PALU			CLA_LOAM	BROWN	SEASINUN
16766	90804	13127	Stylidium maritimum	3		13		SWAN COASTAL	PRI			9/10/2004	ESTMT	more illegible DomSp on RFRF	DRY	CREST	LIMESTN		SAND	GREY	
16767	90805	13127	Stylidium maritimum	3		14		SWAN COASTAL	PRI			12/10/2005	UNKNOWN		DRY	RI_DUNE			SAND	WHITE	
18032	93721	44444	Tripterococcus sp. Brachylobus (A.S. George 14234)	4		17		SWAN COASTAL	PRI			10/11/1994		VegClass:Open Herbs		FL_PALU			CLA_LOAM	BLACK	SEASINUN

Appendix 5. State Categories of Threatened and Priority list flora.

Conservation code	Category
(T) Threatened species pursuant to Sect 19 of the BC Act 2016.	
T	(T) CR – Critically endangered 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*".
	(T) EN - Endangered 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*".
	(T) VU - Vulnerable 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*".
(P) Priority species – possible Threatened species.	
P1	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.
P2	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.

Conservation code	Category
P3	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.
P4	(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 6. Categories of Threatened flora species under the EPBC Act.

Category	Definition
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 (ExW)	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 (CE)	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, 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.

Appendix 7. 2023 quadrat data – Lot 107 (C16-C19).

QUADRAT C16

50 380449 E 6500279 N

Vegetation: *Eucalyptus gomphocephala/E. marginata* Woodland over **Ehrharta calycina* Closed Grassland
Condition: Completely Degraded
Soil Type: Brown sand
Landform: Top of slope
Date: 25.9.23
Recorder: Paul van der Moezel

QUADRAT (10 x 10m)

SPECIES	HEIGHT (m)	COVER (%)
Eucalyptus gomphocephala	12	15
Eucalyptus marginata	6	10
Acacia pulchella	1.1	1
Xanthorrhoea preissii	1	<1
**Ehrharta calycina*	0.8	80
**Euphorbia terracina*	0.4	4
**Lolium perenne*	0.3	10
**Romulea rosea*	0.2	1
Hardenbergia comptoniana	Climber	1

* introduced species

QUADRAT C17

50 380197 E 6500345 N

Vegetation: *Eucalyptus gomphocephala* Woodland over *Xanthorrhoea preissii* Shrubland

Condition: Degraded

Soil Type: Orange-brown sand, some surface limestone

Landform: Upper slopes of low rise

Date: 25.9.23

Recorder: Paul van der Moezel

QUADRAT (10 x 10m)

SPECIES	HEIGHT (m)	COVER (%)
Eucalyptus gomphocephala	10	20
Xanthorrhoea preissii	1.5	10
**Ehrharta calycina*	1	50
Acacia pulchella	1	2
**Gladiolus caryophyllaceus*	0.6	1
Mesomelaena pseudostygia	0.5	<1
Hakea lissocarpha	0.4	1
**Ursinia anthemoides*	0.3	2
Acanthocarpus preissii	0.3	1
Jacksonia calcicola	0.3	1
Bossiaea eriocarpa	0.3	<1
Conostylis aculeata	0.3	<1
Banksia dallanneyi	0.2	1
Hakea prostrata	0.2	<1
**Briza maxima*	0.2	<1
**Romulea rosea*	0.2	<1
Ptilotus polystachyus	0.2	<1

SPECIES	HEIGHT (m)	COVER (%)
**Trifolium campestre*	0.1	<1
**Erodium botrys*	0.1	<1
**Urospermum picroides*	0.1	<1
Schoenus latitans	<0.1	<1
**Hypochaeris glabra*	Flat	<1
Hardenbergia comptoniana	Climber	<1

* introduced species

QUADRAT C18

50 380247 E 6500026 N

Vegetation: **Vegetation**: *Corymbia calophylla/Eucalyptus marginata* Low Woodland over *Xanthorrhoea preissii* Shrubland

Condition: Degraded

Soil Type: Dark brown sand

Landform: Mid-slope

Date: 25.9.23

Recorder: Paul van der Moezel

Quadrat (10 x 10m)

SPECIES	HEIGHT (m)	COVER (%)
Corymbia calophylla	8	10
Eucalyptus marginata	6	10
Xanthorrhoea preissii	1.2	10
**Ehrharta calycina*	1	80
Acacia pulchella	1.1	1
**Gladiolus caryophyllaceus*	0.5	<1
Burchardia congesta	0.4	<1
Dianella revoluta var. *divaricata*	0.4	<1
**Lolium perenne*	0.4	1
Hakea lissocarpha	0.4	<1
Morelotia octandra	0.3	<1
**Lupinus cosentinii*	0.3	<1
**Romulea rosea*	0.2	<1
**Disa bracteata*	0.2	<1
**Asparagus asparagoides*	Climber	<1

* introduced species

QUADRAT C19

50 380432 E 6499948 N

Vegetation: *Eucalyptus marginata* Low Woodland over *Xanthorrhoea preissii* Shrubland

Condition: Degraded

Soil Type: Dark brown sand

Landform: Mid slope

Date: 25.9.23

Recorder: Paul van der Moezel

QUADRAT (10 x 10m)

SPECIES	HEIGHT (m)	COVER (%)
Eucalyptus marginata	9	10
Xanthorrhoea preissii	1.5	10
Macrozamia fraseri	1	5
**Ehrharta calycina*	0.7	70
Acacia pulchella	0.6	4
Hakea lissocarpha	0.5	<1
**Gladiolus caryophyllaceus*	0.5	<1
**Avena fatua*	0.3	1
**Lupinus cosentinii*	0.3	<1
**Romulea rosea*	0.2	5
**Silene gallica*	0.2	<1
**Euphorbia terracina*	0.1	<1
Hardenbergia comptoniana	Climber	1
**Asparagus asparagoides*	Climber	<1

* introduced species

Lomandra maritima	0.3	1
Conostylis aculeata	0.3	1
Acanthocarpus preissii	0.3	<1
Mesomelaena pseudostygia	0.3	<1
**Lysimachia arvensis*	0.3	<1
**Lolium perenne*	0.3	<1
Desmocladus flexuosus	0.2	1
**Lactuca serriola*	0.2	<1
**Petrorhagia dubia*	0.2	<1
Tricoryne elatior	0.2	<1
**Ursinia anthemoides*	0.1	<1
**Sonchus oleraceus*	0.1	<1
Trachymene pilosa	0.1	<1
**Arctotheca calendula*	Flat	<1
Comesperma volubile	Climber	<1
Billardiera fraseri	Climber	<1
Drosera menziesii subsp. *penicillaris*	Climber	<1

* introduced species