Mundijong Road Spring Flora Survey

Main Roads Western Australia

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Abbreviations

Abbreviation	Description
ANOSIM	Analysis of Similarities
BC Act	State *Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
CLUSTER	Hierarchical Clustering
CR	Critically Endangered
DAFWA	Department of Agriculture and Food Western Australia
DBCA	Department of Biodiversity, Conservation and Attractions
DEWHA	Department of the Environment, Water, Heritage and the Arts (now the Department of the Environment and Energy)
DotEE	Department of the Environment and Energy
DPIRD	Department of Primary Industries and Regional Development
DRF	Declared Rare Flora
ELA	Eco Logical Australia
EN	Endangered
EP Act	State *Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
FCT	Floristic Community Type
ha	hectare

Abbreviation	Description
IBRA	Interim Biogeographical Regionalisation for Australia
km	kilometre
m	metre
Main Roads	Main Roads Western Australia
MDS	Multi-Dimensional Scaling
mm	millimetre
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
SIMPER	Similarity Percentages
SIMPROF	Similarity Profile
T	Threatened
TEC	Threatened Ecological Community
VU	Vulnerable
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WoNS	Weed of National Significance

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Executive Summary

Eco Logical Australia was engaged by Main Roads Western Australia to undertake a Detailed and Targeted flora and vegetation survey at a nominated section of Mundijong Road in Mundijong, Western Australia. The survey area is located approximately 45 kilometres south of Perth, Western Australia, and comprises a section of road reserve approximately 8.9 hectares in size.

The survey area and surrounds are currently known to support or provide potential habitat for a number of conservation listed flora species and communities, with the focus of the current survey being to determine the presence and extent of these. Specifically, there are records of three conservation listed flora species within the survey area, two of which are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the State *Biodiversity Conservation Act 2016* (BC Act) and one which is listed as Priority (P) by Department of Biodiversity Conservation and Attractions (DBCA). In addition, sections of the survey area occur within the buffer of three Threatened Ecological Communities (TECs), two of which are listed under the EPBC Act and BC Act and one that is listed under the BC Act only.

The field survey was conducted over a single day on 15th November 2018.

A total of 97 flora taxa from 34 families and 78 genera were recorded from both established quadrats and opportunistic collections. Introduced species represented almost one third of the total species recorded within the survey area; with three species,**Asparagus asparagoides*, **Gomphocarpus fruticosus* and **Moraea flaccida* listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007*. **Asparagus asparagoides* is also listed by the Australian Government as a Weed of National Significance.

Two Threatened flora species listed under section 178 of the EPBC Act and Part 2 of the BC Act were recorded within the survey area: S*ynaphea* sp. Serpentine (G.R. Brand 103; EPBC Act CR, BC Act CR) and *Synaphea* sp. Pinjarra Plain (A.S. George 17182; EPBC Act EN, BC Act EN) with 180 and two individuals recorded, respectively. Despite an exhaustive search, historic records of two species within the survey area, *Tetraria australiensis* (EPBC Act VU, BC Act T rank VU) and *Babingtonia urbana* (DBCA listed Priority 3), could not be located. *Babingtonia urbana* is considered unlikely to occur as it would have been easily detectable, and the location of the previous record is in a cleared area. *Tetraria australiensis* however, was still considered likely to occur as due to dry conditions, there was insufficient material to enable positive identification; the absence of fertile inflorescences was indicative of most species within the Cyperaceae family during the survey.

Four vegetation communities were delineated and mapped within the survey area. Statistical analyses were inconclusive about the relationship of vegetation within the survey area to TECs and Priority Ecological Communities mapped within and in proximity to the survey area. This was due to the degraded condition of the vegetation and high weed prevalence, leading to erroneous statistical outcomes. A qualitative assessment of landform and structural characteristics suggested some similarities to conservation significant vegetation. Specifically, Shrubland Community 1: MsspHvXpTS and Shrubland Community 2 (JsHvXpTSS) indicated a degree of affiliation with FCT8 – Herb rich shrublands in clay pans (component of broader Clay Pans of the Swan Coastal Plain TEC), as they both comprised several typical/key flora species in each stratum and occur on comparable soil/landform

types. Approximately 1.57 ha of the fore mentioned shrubland communities were recorded in 'Good' condition, satisfying the minimum patch condition requirement to be considered part of the TEC. The remaining requirement of a patch to be considered part of the TEC is presence of a functioning hydrological regime; this however, could not be determined as conditions were dry at the time of survey.

Woodland Community 1 (CcTW) indicated a degree of affiliation with FCT3a and the *Corymbia calophylla – Kingia australis* woodlands and shrublands TEC. CcTW comprised several typical/key species in each stratum and occurred on landform contiguous with a confirmed mapped occurrence of the TEC near the survey area. Floristic diversity recorded in Woodland Community 1: CcTW was, however, much lower than that expected for FCT3a, containing approximately one third of the species typically recorded in this Floristic Community Type.

Despite inconclusive results comparing the floristic values of vegetation within the survey area to individual FCTs, this vegetation may be important for maintenance of surrounding occurrences of TECs and the two threatened flora species recorded within the survey area.

1. Introduction

1.1 Project background

Eco Logical Australia (ELA) was engaged by Main Roads Western Australia (Main Roads) to undertake a Detailed and Targeted flora and vegetation survey at a nominated section of Mundijong Road in Mundijong, Western Australia.

The survey area is located approximately 45 kilometres (km) south of Perth, Western Australia, and comprises an approximately 1.3 km and 60 metre (m) wide section of road reserve to the south of Mundijong Road, located between Pure Steel Lane and Adonis Street (**Figure 1-1**). The survey area is approximately 8.9 hectares (ha) in size.

The objectives of this survey included:

- Undertake a Detailed flora and vegetation survey in accordance with the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016); and
- Undertake a Targeted flora survey for conservation significant flora species listed as Threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the State *Biodiversity Conservation Act 2016* (BC Act), or as Priority (P) by the Department of Biodiversity, Conservation and Attractions (DBCA).

The survey area and surrounds are currently known to support or provide potential habitat for a number of conservation listed flora species and communities. In particular, the focus of the survey was to determine the presence and extent of the following:

- *Tetraria australiensis* (EPBC Act Vulnerable [VU], BC Act Threatened [T] rank VU[1])
- *Synaphea* sp. Serpentine (G.R. Brand 103) (EPBC Act Critically Endangered [CR], BC Act T rank CR)
- *Babingtonia urbana* (DBCA listed P3)
- *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, SCP3c Threatened Ecological Community (TEC, EPBC Act Endangered [EN], BC Act CR[2])
- *Corymbia calophylla – Kingia australis* woodlands on heavy soils, SCP3a TEC (EPBC Act EN, BC Act CR)
- Herb rich shrublands in clay pans TEC (EPBC Act CR, BC Act VU)
- *Casuarina obesa* Association Priority Ecological Community (PEC, DBCA listed as P1)
- Banksia Woodlands of the Swan Coastal Plain TEC/PEC (EPBC Act EN, DBCA listed as P3)

[1] 1 Under the BC Act, native plants (flora) can be Specially Protected, listed as Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in Western Australia, however as the Wildlife Conservation (Rare Flora) Notice 2018 was issued prior to the full BC Act coming into effect the conservation codes listed under the repealed Wildlife Conservation Act have been referred to in this document.

[2] The BC Act provides for the statutory listing of threatened ecological communities (TECs) by the Minister, however the most current List of Threatened Ecological Communities Endorsed by the Western Australian Minister for Environment was issued prior to the full BC Act coming into effect and therefore conservation codes in this document refer to those applied during the non-statutory listing process.

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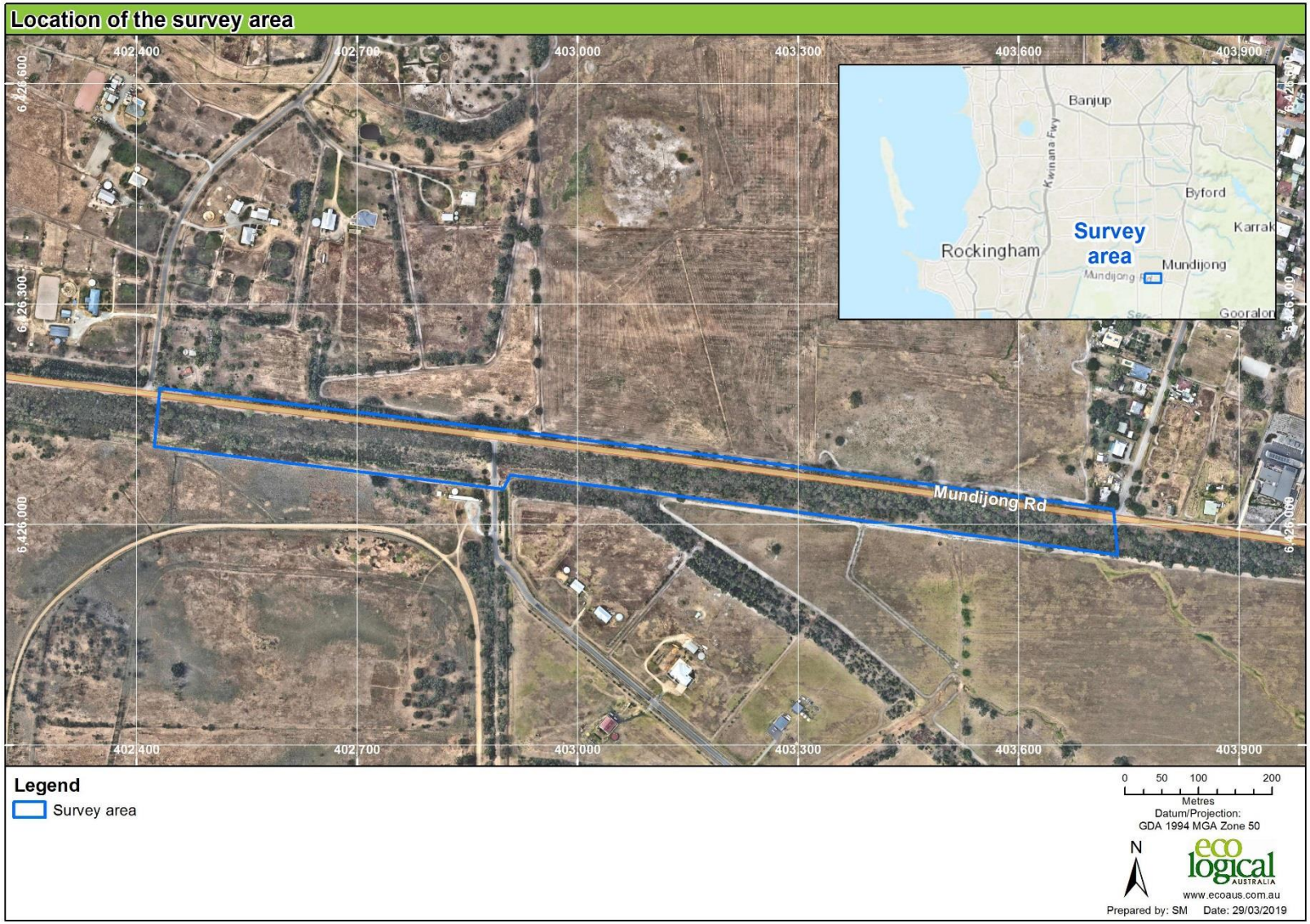

Figure 1-1: Location of the survey area

2. Environmental setting

2.1 Climate

The Swan Coastal Plain experiences a warm, Mediterranean climate with hot dry summers and mild wet winters (Mitchell *et al*. 2002). Based on climate data from the nearby Bureau of Meteorology (BoM) Serpentine weather station (station number 9039; climate data 1905 – current; located approximately 20 km southeast of the survey area) the region receives an annual average rainfall of 924.2 millimetres (mm), with most rainfall occurring during the winter months of June, July and August (185.3 mm, 180.5 mm and 140.6 mm respectively; BoM 2019; **Table 1**). In the 12 months preceding the field survey, the area received a total of 886.2 mm of rainfall, which is slightly below the long-term average (**Table 1**). A total of 111.6 mm of rainfall was recorded in the three months prior to the field survey in October, which is below the long-term average for the same time period (169.8 mm; BoM 2019).

Based on temperature data from the nearby Serpentine weather station (station number 9039; climate data 1963 – current; located approximately 20 km southeast of the survey area), mean maximum air temperature in the area ranges from 6.3 °C in July/August to 15.7 °C in February, while mean monthly maximum temperatures range from 15.5 °C in July to 30.6 °C in January (BoM 2019).

Table 1: Rainfall data recorded at the Serpentine weather station (9039) 12 months prior to the field survey, compared to the long-term average

Month	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Total monthly rainfall 2017-18 (mm)	40.8	116.2	12.4	8.2	9.2	66.6	174.6	162	184.6	47.2	55.8	8.6	886.2
Average monthly rainfall 1905-current (mm)	13.9	10.8	12.9	17.2	47.8	127.2	185.3	180.5	140.6	89.5	56.2	24.1	906.0

2.2 Geology, landform and soils

Geology within the Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, and coastal limestone (Mitchell *et al*. 2002). The survey area is situated on the Pinjarra Plain and Bassendean Dunes systems. The Pinjarra Plain landform is a low-lying and flat area found to the east of the Swan Coastal Plain. This landform is primarily of alluvial origin, with primarily clay soils with sand (Government of Western Australia 2000). This landform lies over the top of the eastern most Bassendean dunes. Bassendean dunes tend to be gently undulating, made up of well-bleached white-grey sands (Government of Western Australia 2000).

Three soil units occur within the survey area (Department of Primary Industries and Regional Development [DPIRD] 2019, previously Department of Agriculture and Food Western Australia [DAFWA]):

- **Pinjarra P1d Phase:** consists of flat to gently undulating plain with deep acidic mottled yellow duplex soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and moderately susceptible to salinity;
- **Bassendean B6 Phase:** consists of sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands; and
- **Pinjarra P1b Phase:** consists of flat to very gently undulating plain with deep acidic mottled to yellow duplex soils. Moderately deep pale sand to loamy sand over clay; imperfectly drained and moderately susceptible to salinity in limited areas.

The eastern section consists of Pinjarra P1b Phase soil which grades to Bassendean B6 and then Pinjarra P1b Phase soils toward the west.

2.3 Interim-Biogeographic Regionalisation for Australia

IBRA divides Western Australia into 26 biogeographic regions and 53 subregions based on dominant landscape characteristics of climate, lithology, geology, landform and vegetation (DotEE 2018a). The survey area is located in the Swan Coastal Plain bioregion (SWA), which is further divided into two subregions: Dandaragan Plateau (SWA01) and Perth (SWA02). The survey area occurs within the Perth (SWA02) subregion, which is described as a low-lying coastal plain, mainly covered with woodlands and dominated by Banksia or Tuart on sandy soils (Mitchell *et al.* 2002).

2.4 Broad-scale vegetation mapping

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

One vegetation association occurs within the survey area, namely Pinjarra 968. This vegetation association has less than 10% of its total pre-European extent remaining within the Perth bioregion (Government of Western Australia 2018; **Table 3**). Due to the large regional extent of this vegetation association, of which the survey area is well within its bounds, no overview figure has been provided in this report.

Table 2: Beard (1979) / Shepherd *et al.* (2002) vegetation associations of the survey area

Vegetation association	Description	Pre-European extent (ha) within the Northern SWA2 subregion	Current extent (ha) within the SWA2 subregion	Remaining (%)
Pinjarra 968	Medium woodland; jarrah, marri & wandoo	136,188.20	8,938.45	6.56

2.5 System 6 Vegetation Complexes

Vegetation within the Perth metropolitan area has been described by Heddle *et al.* (1980) as vegetation complexes. The survey area is situated in the fluviatile deposits landform and is within one vegetation complex: Guildford Complex. This complex is described as "a mixture of open forest to tall open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) - *Eucalyptus marginata* (Jarrah) and woodland of *Eucalyptus wandoo* (Wandoo) (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum). Minor components include *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) (Heddle *et al.* 1980). The current remaining extent of this vegetation complex, as

assessed in 2017 is 5 % (Government of Western Australia 2018; Table 3). Due to the large regional extent of this vegetation complex, of which the survey area is well within its bounds, no overview figure has been provided in this report.

Table 3: System 6 vegetation complexes within the survey area and extent (Government of Western Australia 2018).

Vegetation complex	System 6 code	Pre-European extent (ha)	Current extent (ha)	Remaining (%)
Guildford Complex	32	90,513.13	4,522.01	5.00

2.6 Hydrology

The survey area is located in the Peel Estuary/Serpentine River Catchment and is situated within a broad Palusplain, which is defined as a flat or plain with seasonal waterlogging (Semeniuk and Semeniuk 2011).

The Perth Groundwater Atlas (DoE 2014) shows a snapshot of groundwater levels, as measured in May 2003. The water table beneath the survey area occurs between 4.3 to 3 m east to west, with the base of the aquifer estimated to occur at 14.5 m (DoE 2014). Groundwater flows generally from the east to west under the site.

Surface water was not present within the survey area, however, an artificial drainage line running along the southern bounds did contain stagnant water.

2.7 Areas of conservation significance

Environmentally Sensitive Areas (ESAs) are defined in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005 under section 51B of the State *Environmental Protection Act 1986* (EP Act). ESAs include areas declared as World Heritage, included on the Register of the National Estate, defined wetlands, and vegetation containing rare (Threatened) flora and TECs.

Priority Ecological Communities (PECs) are biological flora or fauna communities that are recognised by the Western Australian Minister for Environment to be of significance, but which do not meet the criteria for a TEC. There are five categories of PECs, none of which are currently protected under State or Federal legislation.

2.7.1 Bush Forever

The Bush Forever project developed and implemented a plan to protect 51,000 ha of regionally significant vegetation within the Swan Coastal Plain portion of the Perth metropolitan area. This occurred through the identification of 287 Bush Forever sites representing a minimum (where possible) of 10% of each of the 26 vegetation complexes identified in the Bush Forever survey area (Government of Western Australia 2000). The survey area is recognised as being part of Bush Forever site number 360 – Mundijong and Watkins Road Bushland, Mundijong/Peel Estate (Figure 2-1, Government of Western Australia 2000).

Bush Forever site 360 covers an approximate area of 73.8 ha of which approximately 7 ha is within the survey area. The following Floristic Community Types (FCTs) as defined by Gibson *et al.* (1994) have been sampled or inferred to occur (*) within this site (Government of Western Australia 2000):

- **Supergroup 1: Foothills/Pinjarra Plain**
  - 3a: *Corymbia calophylla – Kingia australis* woodlands on heavy soils (EPBC Act EN, BC Act CR)
  - 3c: *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands (EPBC Act EN, BC Act CR)
  - S8*: *Eucalyptus wandoo* woodlands
- **Supergroup 2: Seasonal Wetlands**
  - 2*: Southern wet shrublands
  - 8: Herb-rich shrublands in claypans (EPBC Act CR, BC Act VU)
  - 9: Dense shrublands on clay flats (EPBC Act CR, BC Act VU)
  - 10a: Shrublands on dry clay flats (EPBC Act CR, BC Act EN)
- **Supergroups 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau**
  - 20b*: Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands (EPBC Act EN, BC Act EN)

2.7.2 Floristic Community Types (FCTs; Gibson et al. 1994)

Vegetation of the southern Swan Coastal Plain was systematically surveyed and defined into Floristic Community Types by Gibson *et al*. (FCT; 1994). Floristic analysis defined 30 FCTs with some groups further subdivided and, in all, a total of 43 types and sub-types have been recognised (Gibson *et al.* 1994). Three flora plots, MUD-4, MUD-5 and MUD-9 were established 90 m – 340 m to the southwest of the survey area by Gibson *et al.* (1994) and were assigned to FCT3a – '*Corymbia calophylla – Kingia australis* woodlands on heavy soils' and FCT8 – 'Herb Rich shrublands in clay pans' through statistical analysis of floristic data. FCT3a forms part of the '*Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain' ecological community (listed as EN under the EPBC Act and CR under the BC Act) and FCT8 forms part of the 'Herb rich shrublands in clay pans' (listed as CR under the EPBC Act and VU under the BC Act).

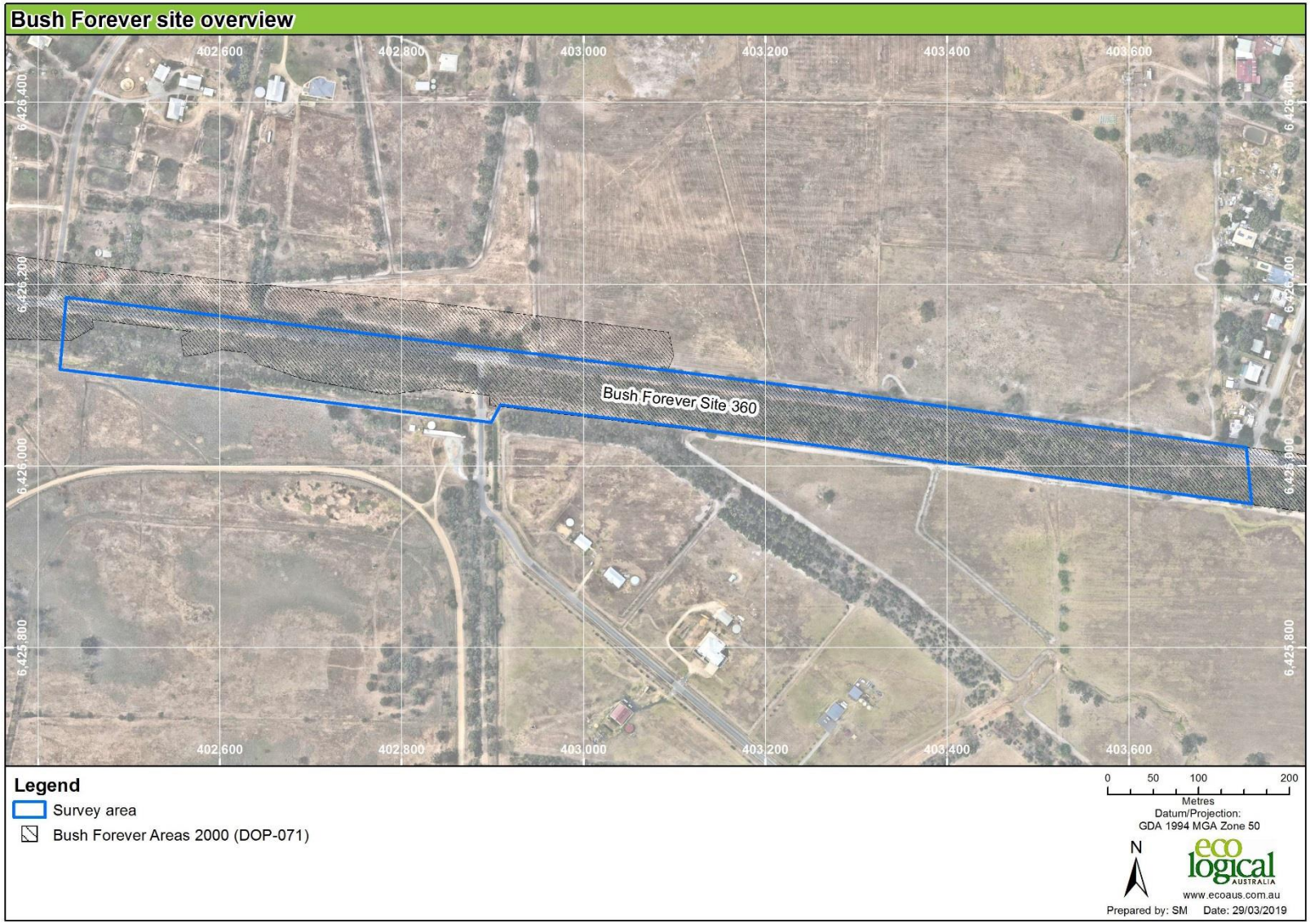

Figure 2-1: Bush Forever Site overview

3. Methodology

3.1 Desktop review

3.1.1 Database searches and literature review

The following Commonwealth and State databases were searched for information relating to conservation listed flora and ecological communities in order to compile and summarise existing data to inform the field survey. Database searches undertaken around the central coordinate 403037 mE, 6426075 mN are provided in **Table 4** below. Applied buffers below are considered suitable based on flora expected to occur within the survey area. It should be noted that the buffers for the DBCA database searches are selected by DBCA on a case-by-case basis and are therefore not always consistent with other searches undertaken in the area.

Table 4: Database searches undertaken for the survey area

Database	Reference	Buffer (km)
EPBC Act Protected Matters Search Tool (PMST) for Threatened species and communities listed under the EPBC Act.	DotEE 2018b	10
Department of Biodiversity, Conservation and Attractions (DBCA) and Western Australian Museum (WAM) NatureMap online database (DBCA 2007-2019)	DBCA 2007-2019	10
DBCA Threatened and Priority flora database searches for Declared Rare Flora (DRF) listed under the latest WA Wildlife Conservation (Rare Flora) Notice and Priority Flora.	DBCA 2018a	5
DBCA Threatened and Priority Ecological Communities' database search	DBCA 2018b	5

3.1.2 Likelihood of occurrence assessment

A likelihood of occurrence assessment was undertaken to identify conservation listed flora species that possibly occur within the survey area, identified from a review of key datasets and literature, as specified above.

The following criteria was used:

- Likelihood: Recorded.
    - The species has previously been recorded within survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
- Likelihood: Likely.
    - The species has not previously been recorded from within the survey area. However, (to qualify requires one or more criteria to be met):
        - the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area
        - core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. It may be there are seasonal wetlands present.
- Likelihood: Potential.

  - The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met):
    - targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area
    - the survey area has been assessed as having potentially suitable habitat through habitat modelling
    - the species is known to be cryptic and may not have been detected despite extensive surveys
  - The species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met)
    - doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution)
    - coordinates are doubtful
- Likelihood: Unlikely (one or more criteria requires to be met).
  - The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and
    - it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded
    - it is unlikely to occur due to few historic record/s and no other current collections in the local area.
  - The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches.
  - The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.
- Likelihood: Does not occur (one or more criteria requires to be met).
  - The species is not known to occur within the IBRA bioregion based on current literature and distribution.
  - The conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat.
  - The survey area lacks important habitat for a species that has highly selective habitat requirements.
  - The species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing.

4. Field survey

4.1.1 Survey team and timing

A Detailed and Targeted flora and vegetation survey was conducted by Dr. Jeff Cargill (Senior Ecologist) and Jeni Morris (Ecologist) on 15th November 2018. The survey team's relevant qualifications, experience and licences are provided in **Table 5** below. There was no rainfall recorded from the Serpentine weather station during the field survey (BoM 2019).

Table 5: Survey personnel

Name	Qualification	Field licence	Relevant experience
Dr. Jeff Cargill	BSc. Hons. PhD Environmental Science	Flora collection licence: SL012435 DRF: 23-1819	Jeff has extensive experience undertaking flora and vegetation surveys on the Swan Coastal Plain
Jeni Morris	BSc Conservation and Wildlife Biology	Flora collection licence: SL012347 DRF:196-1718	Jeni has over three years' experience undertaking flora and vegetation surveys on the Swan Coastal Plain.

4.1.2 Flora and vegetation survey

A Detailed and Targeted flora and vegetation survey was conducted in accordance with the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). The number of quadrats established to describe vegetation communities were informed using aerial imagery as well as being assessed in the field. The survey involved the use of 10 x 10 m quadrats as recommended for the Swan Coastal Plain bioregion (EPA 2016). Dominant vegetation communities were described and mapped in accordance with the National Vegetation Information System Level V (NVIS Technical Working Group 2017). A total of eight quadrats were surveyed across the survey area (Figure 4-1). Photos were taken from the north western corner of each quadrat. The following data was recorded within each quadrat:

- Site details (site name, number, observers, date and location);
- Environmental information including landform, soil type and colour, bare ground and leaf litter cover, rock outcropping and time since last fire event; and
- Biological information including vegetation structure, vegetation condition in accordance with EPA (2016), degree of disturbance, species present and species percentage cover.

A targeted survey was completed within the survey area to identify any conservation significant flora or communities potentially occurring, including:

- Threatened flora or TECs listed under the EPBC Act;
- Threatened (Declared Rare) Flora listed under the latest WA Wildlife Conservation (Rare Flora) Notice under the State BC Act;
- TECs listed under the BC Act;
- PEC's endorsed by the Western Australian Minister for the Environment; and
- Priority flora recognised by DBCA.

The survey methodology involved personnel walking transects across the survey area, with transects spaced (on average) 5-20 m apart. Locations of survey transects is shown in Figure 4-1 below. Flora species able to be identified in the field were recorded, and voucher specimens of unfamiliar species were collected for later identification. All collections were assigned a unique collecting number. For conservation significant flora species identified in the field, the following was recorded:

- A colour photograph;
- GPS location using a differential GPS;
- Population size estimate;
- Location of population boundaries;
- Associated habitat/landscape element;
- Time and date observed;
- Observer details; and
- A voucher specimen suitable for use as a reference specimen (if appropriate to do so for conservation significant flora).

The location of any Weeds of National Significance (WoNS) or Declared Pests listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act 2007) were also recorded during the survey.

4.2 Data analysis

4.2.1 Flora species accumulation curve

A flora species accumulation curve was undertaken to indicate adequacy of the survey effort (Clarke and Gorley 2006). As the number of quadrats increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provided an incidence-based coverage estimator of species richness. When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered adequate.

4.2.2 Vegetation communities

Plymouth Routines in Multivariate Ecological Research v6 (PRIMER) statistical analysis software was used to analyse species-by-site data and discriminate quadrats based on their species composition (Clarke and Gorley 2006). To down weight the relative contributions of quantitatively dominant species a 4th root transformation was applied to the dataset. Introduced species (weeds), specimens not identified to species level and singletons (species recorded at a single quadrat and not forming a dominant structural component) were excluded from the data set prior to analysis. In addition, annuals were also removed from the dataset prior to analysis due to the likelihood of substantial differences between years based on seasonality of local rainfall events. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Data were analysed using a series of multivariate analysis routines including Similarity Profile (SIMPROF), Hierarchical Clustering (CLUSTER) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and delineation of individual plant communities.

FCT analysis

Species within the Gibson *et al*. (1994) data set were updated to align with current names as specified by FloraBase (DBCA and WAH 2018). Using current records, a number of species in the Gibson *et al*. (1994) data set were shown to be significant range extensions from the Swan Coastal Plain. Where appropriate, such cases were removed. In addition, excluded and misapplied names were removed from the data set and infra-specific names were reduced. The merged dataset was analysed using a combination of pre-treatments such as the inclusion and/or removal of introduced species and singletons. The removal of both singletons and introduced species from the merged dataset, an accepted pre-treatment for such analysis, produced the best results (e.g. stronger correlations; Clarke and Gorley, 2006). Inclusion of such data merely served to confound the dataset by introducing stochastic and 'site' artefact data. Transformed data were analysed using a combination of multivariate analysis routines including Bray-Curtis Similarity Matrices, Multi-Dimensional Scaling (MDS) and Analysis of Similarities (ANOSIM).

To identify potential TECs and PECs in the project area, ELA quadrats and vegetation communities were compared to FCTs defined by Gibson *et al*. (1994). Analysis was undertaken at two varying scales, firstly using the complete Gibson *et al*. (1994) dataset, and lastly using only FCTs affiliated with the Pinjarra landform. To identify the presence of FCT's, appropriate multivariate analyses comparing current data to that of Gibson *et al*. (1994) species by quadrat data, and inferences based on dominant species and geomorphology were used. Given the nature of the data, results and subsequent extrapolations, assigned FCT's within the project area were inferred and not absolute, i.e. a vegetation code assigned to an FCT was inferred to comprise, to varying degrees, floristic aspects of that FCT as defined by Gibson *et al*. (1994).

4.2.3 Flora identification and nomenclature

Flora specimen identification was undertaken by Senior Ecologist Dr Jeff Cargill. Species identification utilised taxonomic literature and keys and where required specimens were confirmed using the Western Australian Herbarium (WAH) reference collection. Suitable material that meets WAH specimen lodgement requirements, such as flowering material and range extensions, will be submitted along with Threatened and Priority Report forms to DBCA, as required by conditions of collection licences issued under the BC Act.

Nomenclature used for the flora species within this report follows the WA Plant Census as available on FloraBase (DBCA and WAH 2018).

4.2.4 Survey limitations

The EPA *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) recommends including discussion of the constraints and limitations of the survey methods used. Constraints and limitations for the Detailed and Targeted flora and vegetation survey for the survey area are summarised in **Table 6** below.

Table 6: Survey limitations

Constraint	Limitations
Sources of information	**Not a constraint:** The Swan Coastal Plain has been relatively well surveyed, with increasing survey work occurring due to the ongoing urban development of the Perth

Constraint	Limitations
	metropolitan area. Gibson *et al.* 1994 was a primary source for determination of methods, analysis and results for assessing FCTs. Broad-scale vegetation mapping at a scale of 1:250,000 was available (Beard 1979, Shepherd et al 2002). Geology, landform and soils mapping at a scale of 1:250,000 was also available (Geological Survey of WA and Geoscience Australia 2008). The information which was available was sufficient and as such sources of information were not considered a major limitation.
Scope of work	**Not a constraint:** The survey requirement of a Detailed and Targeted flora and vegetation survey in accordance with the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) was adequately met.
Completeness of survey	**Not a constraint:** The survey area was surveyed to the satisfaction of the scope and a Detailed and Targeted flora and vegetation survey as per relevant guidelines. Two taxa were not identified to genus level and nine taxa were not identified to species level. It is unlikely that any of the taxa are conservation significant.
Intensity of survey	**Not a constraint:** The survey effort was adequately met. The area was surveyed for conservation significant flora species and vegetation communities by field staff undertaking transects across the survey area spaced 5-20 m apart on average. This method provided an accurate assessment of habitat characteristics and likelihood of conservation significant species. The number of quadrats established was sufficient to determine the vegetation communities present and to identify any vegetation of conservation significance. Adequacy of sampling effort was tested via a species accumulation curve; approximately 69% of the flora potentially present within the survey area was recorded.
Timing, weather, season, cycle	**Minor constraint:** The survey area is located in the Swan Coastal Plain bioregion of Western Australia. Recommended survey timing for this region is in spring (September – November; EPA 2016). The field survey was undertaken in mid-November. Many flora species were flowering at the time of the field survey or had sufficient material (fruit) available to identify majority of the dominant and target species. The timing was appropriate for conducting this level of survey. For two conservation significant species however, conditions were not suitable to enable detection. *Tetraria australiensis* (EPBC Act VU, BC Act T rank VU) and *Diuris purdiei* (EPBC Act EN, BC Act T rank EN) both require fire to initiate flowering and as no fire had occurred recently within the survey area, these species may not have been detectable. Additionally, many taxa in the Cyperaceae family had dried off at the time of the survey which limited the availability of sufficient material to enable positive identification.
Disturbances	**Not a constraint:** Disturbances within the survey area included the presence of weeds, minor rubbish dumping and decline of vegetation condition due to edge effects. These disturbances did not negatively impact the ability to meet objectives outlined in the scope of works.
Resources	**Not a constraint:** The personnel that conducted the field survey are both suitably qualified to identify specimens having previously undertaken numerous flora and vegetation surveys on the Swan Coastal Plain.
Accessibility	**Not a constraint:** All relevant areas of the survey area were easily accessed and able to be surveyed.

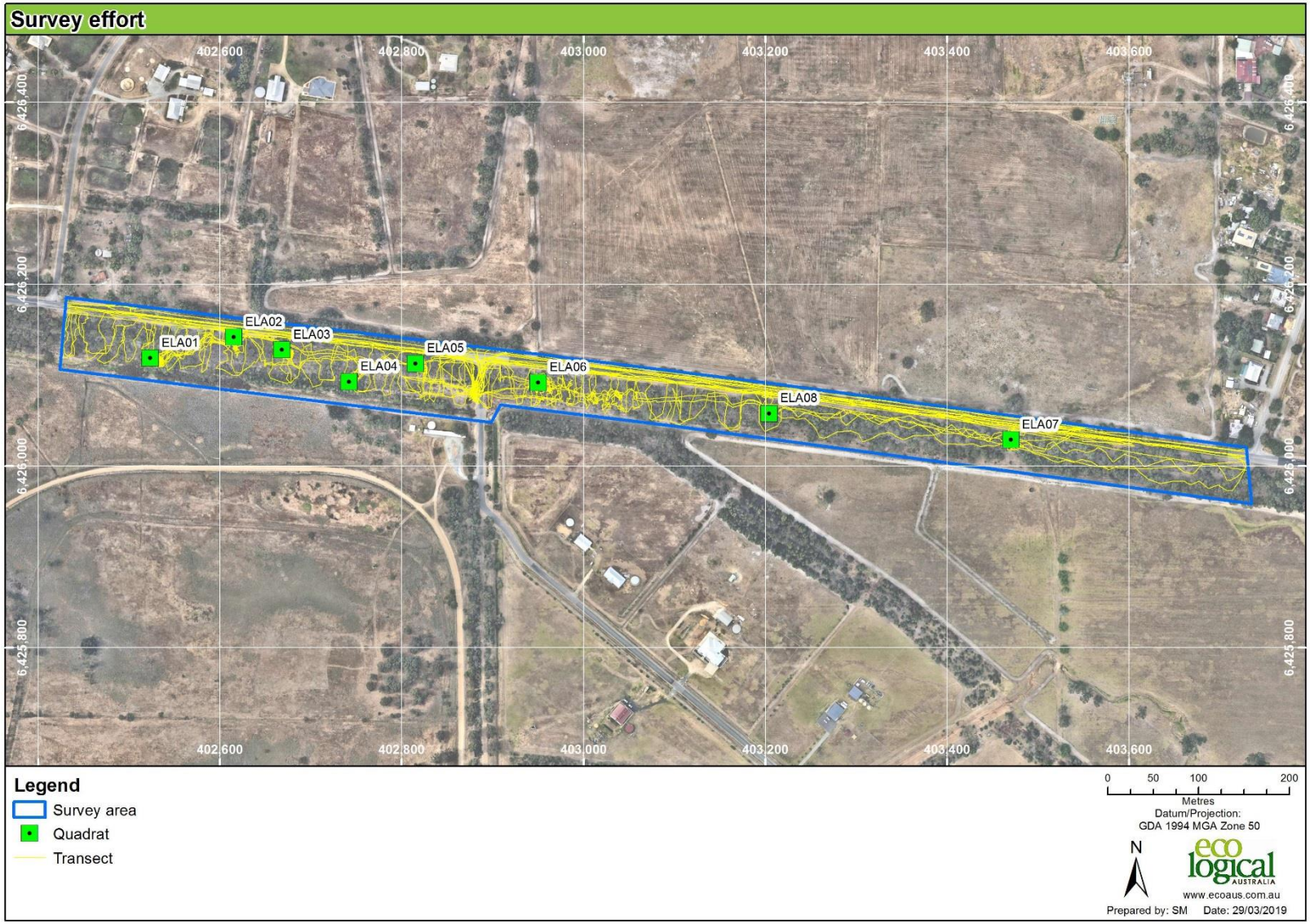

Figure 4-1: Survey effort

5. Results

5.1 Desktop review

5.1.1 Conservation listed flora species and ecological communities

A DBCA Threatened and Priority Flora and Communities database search (DBCA 2018a and DBCA 2018b) was undertaken to identify conservation significant species and communities recorded within, or nearby to, the survey area.

An initial 46 conservation listed flora species were identified as possibly occurring within the survey area based on the database searches outlined in **Section 3.1.1** and using the criteria outlined in **Section 3.1.2**. A likelihood of occurrence assessment table is presented in **Appendix D**.

The DBCA Threatened and Priority Flora search identified known occurrences of three conservation significant flora species within the survey area (DBCA 2018a):

- *Synaphea* sp. Serpentine (G. R. Brand 103) – listed as CR under the EPBC Act and as CR under the BC Act;
- *Tetraria australiensis* – listed as VU under the EPBC Act and as VU under the BC Act; and
- *Babingtonia urbana* – listed as Priority 3 by DBCA.

The DBCA Threatened and Priority communities search identified occurrences of three conservation significant ecological communities within the survey area (**Table 7**; **Figure 5-1**; DBCA 2018b). Buffers are included by DBCA around each occurrence of a TEC or PEC to help ensure that nearby developments with potential for impact are taken into account, to ensure essential ecological functions are maintained and to account for mapping inaccuracies (DBCA 2018b). Four Threatened Ecological Communities listed under the EPBC Act were also identified in the federal EPBC Act Protected Matters Report as likely or known to occur within the search area (**Table 7**).

Table 7: Conservation significant ecological communities recorded within the vicinity of the survey area

Community ID	Community description	Within the survey area	Conservation code	
			EPBC Act	BC Act / listed by DBCA
SCP1a	*Eucalyptus haematoxylon - E. marginata* woodlands on Whicher foothills			P3
SCP02	Southern wet shrublands, Swan Coastal Plain			EN
SCP3a	*Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain	x	EN	CR
SCP3b	Corymbia calophylla - Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain			VU
SCP3c	*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	x	EN	CR
SCP08	Herb rich shrublands in clay pans	x	CR	VU
SCP20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain		EN	EN

Community ID	Community description	Within the survey area	Conservation code	
			EPBC Act	BC Act / listed by DBCA
SCP21c	Low lying *Banksia attenuata* woodlands or shrublands		EN	P3
	Casuarina obesa Association			P1
	Banksia Woodlands of the Swan Coastal Plain		EN	P3

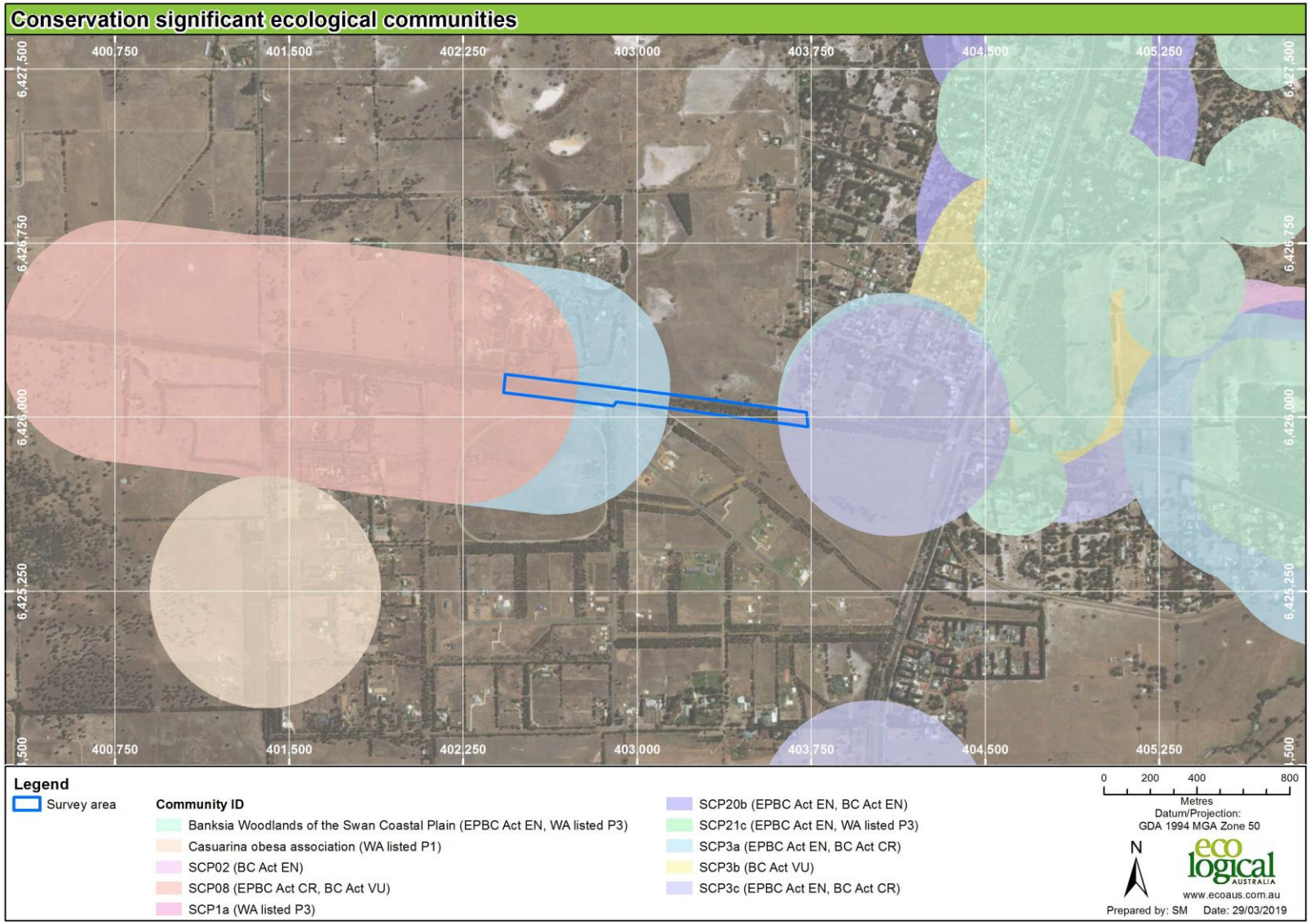

Figure 5-1: Conservation significant communities

5.2 Flora and vegetation survey

5.2.1 Flora overview

A total of 97 flora taxa were identified within the survey area from 34 families and 78 genera, with this total including all species recorded in quadrats and additional conservation significant flora species and dominant flora not present in quadrats (three additional taxa) (**Appendix E**). This total included 70 (72% of the total) native and 27 (28% of the total) introduced taxa. Average native species richness per quadrat was 20, ranging from a low of 13 at ELA02 to a high of 33 at ELA03. Families with the highest number of species included Myrtaceae (15 species), Poaceae (11 species) and Proteaceae (11 species). *Hakea* (four taxa), *Melaleuca* (four taxa), *Lepidosperma* (three taxa) and *Verticordia* (three taxa) were the best represented genera throughout the survey area. Quadrat data is presented in **Appendix G** and a flora species matrix is provided in **Appendix F**.

5.2.2 Accumulated species – site surveyed (species area curve)

A species accumulation curve (**Figure 5-2**) was used to evaluate the adequacy of sampling (Clarke and Gorley 2006). Only species data recorded from defined quadrats were used; no opportunistic flora collections were included. Using this analysis, the incidence-based coverage estimator of species richness was calculated to be 135.75. Based on this value, and the total of 94 species recorded within quadrats, approximately 69% of the flora species potentially present within the survey area were recorded. Environments within this region are innately floristically variable, with stochastic occurrences of individual species within a given area being common (particularly weeds). As a result, a figure of 69% was considered adequate to accurately delineate vegetation communities present and provide a detailed account of the flora species present.

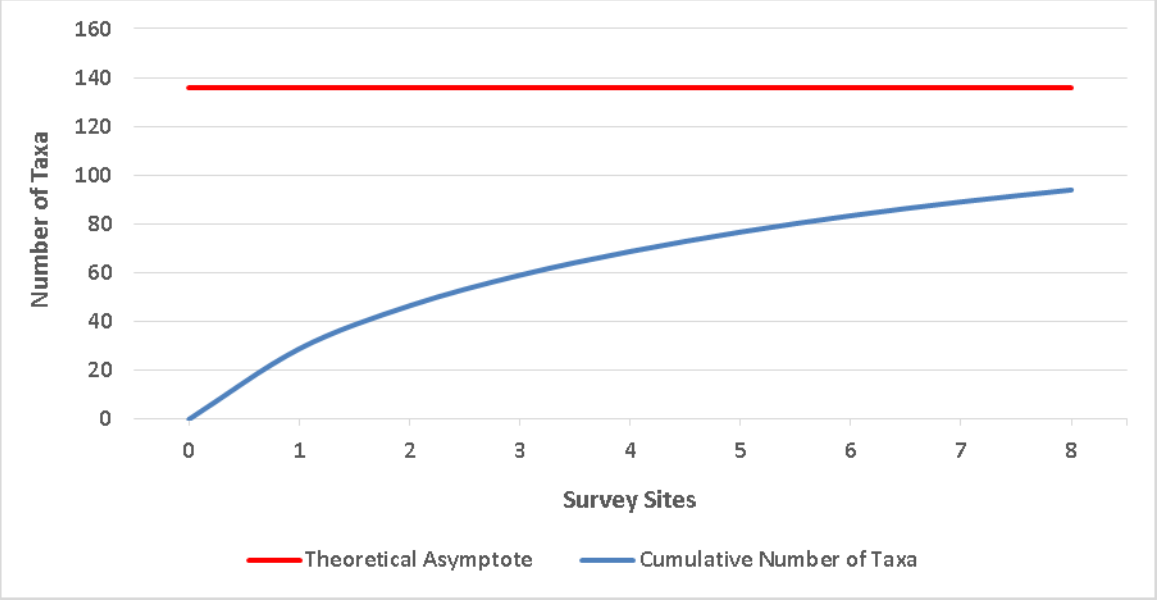

Figure 5-2: Averaged randomised species accumulation curve.

5.2.3 Conservation significant flora

Two Threatened flora species listed under section 178 of the EPBC Act and Part 2 of the BC Act were recorded within the survey area:

- *Synaphea* sp. Serpentine (G.R. Brand 103) (EPBC Act CR, BC Act T rank CR); and
- *Synaphea* sp. Pinjarra Plain (A.S. George 17182) (EPBC Act EN, BC Act T rank EN).

Synaphea sp. Serpentine (G.R. Brand 103) was recorded at 109 separate locations within the survey area with a total population of 180 individuals (**Figure 5-3**). This species was restricted to a small area to the east of the Lampiter Road and Mundijong Road intersection. The largest clusters of individuals within this population occurred in areas of open sand, particularly along the access track to the south and along a low linear sand mound running east to west through the survey area.

Figure 5-3: *Synaphea* sp. Serpentine (G.R. Brand 103) (EPBC Act CR, BC Act T rank CR). Photo J. Cargill

Synaphea sp. Pinjarra Plain (A.S. George 17182) was recorded at two separate locations along the south-western edge of the survey area with one individual present at each location (**Figure 5-4**). Both records occurred along the interzone between the *Corymbia calophylla* woodland community (CcTW) and the shrubland community (JsHvXpTSS).

Figure 5-4: *Synaphea* sp. Pinjarra Plain (A.S. George 17182) (EPBC Act EN, BC Act T rank EN). Photo J. Cargill

Identification of *Synaphea* sp. Serpentine (G.R. Brand 103) and *Synaphea* sp. Pinjarra Plain (A.S. George 17182) were confirmed by the Western Australian Herbarium (M. Hislop ACC/7860/E). DGPS locations of individuals are provided in **Appendix I** and **Figure 5-5** and a DBCA Threatened and Priority Flora report form for each species is provided in **Appendix J.**

No priority flora species listed by DBCA were recorded within the survey area.

Of the 46 conservation listed flora species identified in the desktop assessment as possibly occurring within the survey area, two species were found to occur (as above). Following the survey, the likelihood of occurrence rating was reduced for two species that had previously been recorded within the survey area. *Tetraria australiensis* (EPBC Act VU, BC Act T rank VU) and *Babingtonia urbana* (DBCA listed Priority 3) were previously recorded within the survey area, however despite extensive searching at GPS locations and throughout the survey area, these species could not be located. The likelihood of occurrence rating for *Tetraria australiensis* was downgraded to likely as although it could not be located in the survey, it could not be ruled out due to sub-optimal growing conditions for this species. *Tetraria australiensis* is known to flower following fire and as there was no evidence of recent fire in the survey area, this inhibited the availability of flowering material to assist identification (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2008a). Additionally, at the time of the survey it was found that many taxa from the Cyperaceae family had dried off and there was insufficient material to enable positive identification in some cases. This species was the only species assessed as 'likely' to occur following the survey. The likelihood of occurrence rating for *Babingtonia urbana* was reduced to unlikely as this species would have been conspicuous if present within the survey area. It was noted that the previous *Babingtonia urbana* location was on a road verge and it is possible individuals at this location have been cleared.

For one species, *Diuris purdiei* (EPBC Act EN, BC Act T rank EN), the likelihood of occurrence was assessed as 'potential'. This species could not be determined as 'unlikely' as the survey area contained potentially suitable habitat, the species had low chance of detectability and the closest record is within 1 km. Suitable habitat for this species includes sandy clay soils subject to winter inundation (DEWHA 2008b). Shrubland Community 1: MsspHvXpTS and Shrubland Community 2: JsHvXpTSS within the survey area contains sandy clay soils that may be subject to winter inundation and could potentially support this species. This habitat within the survey area covers 2.7 ha, all in the western half of the survey area (**Figure 5-8**). Additionally, the current survey was outside of flowering time and appropriate conditions for this species as it flowers late September to mid-October but only after summer or early autumn fire (DEWHA 2008b). However, the prevalence of weeds that would likely outcompete this species, lack of any recent records nearby, highly fragmented habitat within the survey area and disturbance from rabbits meant this species was not considered to be 'likely' to occur.

The remaining 42 species were considered unlikely to occur due to lack of suitable habitat and/or the high detectability of these species during the survey due to their conspicuous nature or it being an optimal time of year to detect individuals.

The flora likelihood of assessment is presented in **Appendix D**.

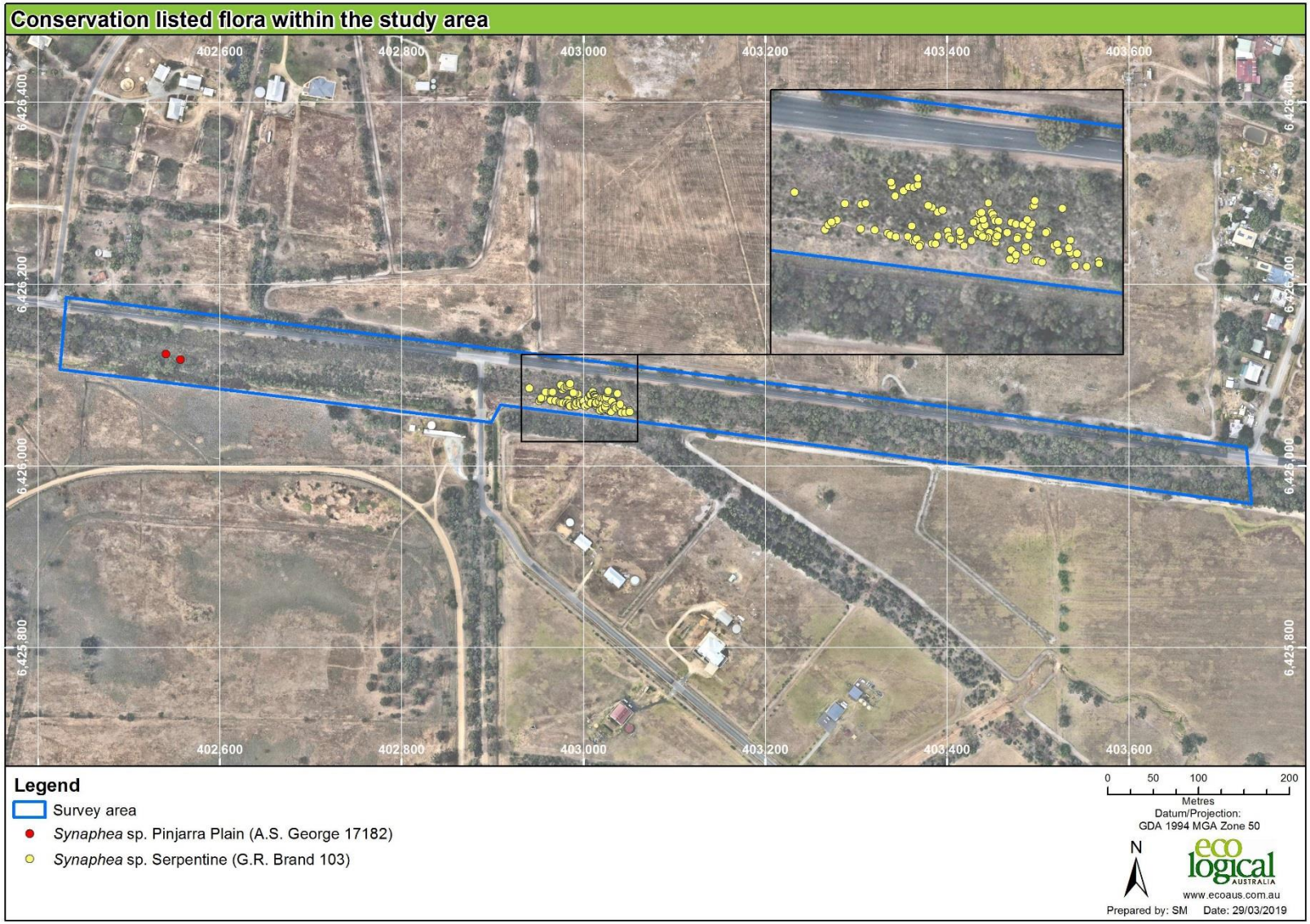

Figure 5-5: Conservation listed flora within the survey area.

5.2.4 Introduced flora

Introduced (weed) species represented almost one third of the total species recorded in the survey area with a total of 27 taxa recorded. Weed species cover ranged from 0.1% to 5.0%. Three species, including **Asparagus asparagoides*, **Gomphocarpus fruticosus and *Moraea flaccida* are Declared Pests listed under the BAM Act 2007. **Asparagus asparagoides* is also listed by the Australian Government as a WoNS.

The mean introduced species richness for quadrats sampled was 8.75 species per quadrat (range: 6-13 species per quadrat).

A full list of weed species recorded from the survey area is included in **Appendix E** and locations of Declared Pests and WoNS is provided in **Table 8**.

Table 8: Geographic locations and status of Declared Pests species recorded within the survey area

Species	Legal status	Geographic location (GDA94; 50H)		Population
		Easting (mE)	Northing (mN)	
**Asparagus asparagoides*	s22(2) (Exempt)	402523	6426119	1
**Gomphocarpus fruticosus*	s22(2) (C3)	402950	6426092	1
**Moraea flaccida*	s22(2) (Exempt)	402523	6426119	5
		402815	6426113	1
		402950	6426092	5
		403470	6426029	10
		403204	6426058	2

5.2.5 Vegetation communities

Similarity Profile Analysis (SIMPROF) separated the eight quadrats into three statistically dissimilar groupings (**Appendix H**). These three communities comprised two shrubland communities and a woodland community. An additional vegetation community was also identified within the survey area, comprising a narrow strip of roadside vegetation with planted or remnant trees of *Casuarina obesa* and *Eucalyptus* sp. (planted). This community was not included in the SIMPROF analysis as the remnant was too small to establish a sampling site. Based on this result, four vegetation communities were delineated and mapped within the survey area. Full descriptions of these and mapping boundaries are presented in **Table 10** and **Figure 5-8**, respectively.

5.2.6 FCT analysis

A tiered approach was undertaken for the MDS and ANOSIM analysis whereby data from the current survey was analysed against the full Gibson et al (1994; with treatments applied as per **section 4.2.2**) for the Swan Coastal Plain (**Appendix J**) and was also analysed against a partial Gibson (1994) dataset containing floristic sites from the Pinjarra Plain landform only (**Appendix L**). Analyses did not provide a definitive conclusion in determining degrees of 'relatedness' between vegetation communities (or sites), delineated in the survey area and FCTs as defined by Gibson *et al*. (1994). This outcome can be

attributed to the small size of the survey area and consequently prevalence of floristic admixtures and the very high number of weed species which have reduced native species diversity.

A qualitative assessment of landforms, vegetation structure and floristic values, showed that elements of vegetation within the survey area were inferred to represent FCT3a and FCT8. Specifically, vegetation community Woodland Community 1: CcTW has some of the typical species that comprise FCT3a, including *Corymbia calophylla* in the tree layer, *Kingia australis* and *Xanthorrhoea preissii* in the shrub layer and *Cyathochaeta avenacea*, *Dampiera linearis* and *Mesomelaena tetragona* in the herb layer. Vegetation Community 1: CcTW also occurs on a landform that is contiguous with a mapped occurrence of FCT3a. The mean species richness of Vegetation Community 1:CcTW is however very low with 16.67 native species and 8.0 weed species compared to 58.9 native and 3.9 weed species recorded for FCT3a respectively (Gibson et al 1994). Shrubland Community 1: MsspHvXpTS and Shrubland Community 2: JsHvXpTSS contain some typical flora species that comprise FCT8. These species included *Melaleuca viminea*, *Melaleuca osullivanii* and *Hypocalymma angustifolium* in the shrub layer and *Chorizandra enodis* in the herb layer (Department of Parks and Wildlife 2015). The substrate of both Shrubland Community 1: MsspHvXpTS and Shrubland Community 2: JsHvXpTSS contained clay elements and the landform resembled a flat within a broader clay pan however the hydrology in terms of seasonal inundation was unclear and the clay was dry and compact at the time of the survey.

Additionally, further analyses using the Bray-Curtis similarity measure found there were also some similarities between the floristic sites established in the current survey and the Gibson *et al*. (1994) MUD4, MUD5 and MUD9 sites. The MUD4, MUD5 and MUD9 Gibson *et al*. (1994) sites are located in a contiguous suite of vegetation alongside the Mundijong Road survey area, and have been assigned to FCT3a, FCT3a and FCT8, respectively.

5.2.7 Conservation significant vegetation communities

Three Gibson *et al*. (1994) flora plots, MUD-4, MUD-5 and MUD-9, which are in close proximity to the survey area were assigned to FCT3a and FCT8. FCT3a forms part of the '*Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain' ecological community (listed as EN under the EPBC Act, CR under BC Act) and FCT8 forms part of the 'Herb rich shrublands in clay pans' (listed as CR under the EPBC Act and VU under the BC Act; **Table 9**). As discussed in **section 5.2.6**, while statistical analyses were inconclusive about the relationship of vegetation within the survey area to FCT3a and FCT8, a qualitative assessment suggests there are some similarities. Specifically, structural and landform characteristics of Shrubland Community 1: MsspHvXpTS and Shrubland Community 2: JsHvXpTSS indicate there is a degree of affiliation with FCT8 and the Herb rich shrublands in clay pans TEC while Woodland Community 1: CcTW has elements of FCT3a and the *Corymbia calophylla – Kingia australis* woodlands and shrublands TEC (**Table 9, Figure 5-7, Figure 5-6**). Additionally, for a patch to be considered part of the Herb rich shrublands in clay pans TEC, it must have a functioning hydrologic regime and meet at least the good condition category (Threatened Species Scientific Committee 2012). Within the survey area, there was 1.57 ha of Shrubland Community 1: MsspHvXpTS and Shrubland Community 2: JsHvXpTSS that was in Good condition (**Table 9**), however the hydrologic regime could not be determined as conditions were dry at the time of the survey. It is likely that any standing water would dry out quickly in the area. Vegetation within the survey area has also been highly modified, specifically the understorey which had a high prevalence of weeds and low native species diversity, particularly native herbs/annual species. Due to the small size of the survey area and its current

condition, vegetation within the survey area cannot be conclusively determined to represent these TECs. The extent of vegetation recorded in the survey area that have elements of these TECs is provided in **Figure 5-10** and DBCA TEC/PEC report forms for these TECs are provided in **Appendix M**.

Figure 5-7: Example of shrubland community within the survey area with similarities to 'Herb rich shrublands in clay pans' TEC. Photo J. Cargill.

Figure 5-6: Example of woodland community within the survey area with similarities to the *Corymbia calophylla – Kingia australis* woodlands and shrublands TEC. Photo J. Cargill.

Statistical analyses were also inconclusive about the relationship of vegetation within the survey area to the TEC FCT3c - *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain. While the vegetation did have some structural and landform elements of FCT3c, vegetation more

closely resembled FCT3a. Specifically, there were typical species of FCT3c, including *Corymbia calophylla* in the tree layer, *Xanthorrhoea preissii* in the shrub layer and *Burchardia congesta*, *Cyathochaeta avenacea* and *Neurachne alopecuroidea* in the herb layer. However, with the presence of *Kingia australis* and since the vegetation occurs on soils likely to be in proximity to seasonally wet areas (FCT3c occurs on the driest of the soils), vegetation more closely resembles FCT3a (Endangered Species Scientific Subcommittee 2000).

A narrow stand of *Casuarina obesa* trees were also recorded along the road verge in the survey area. This vegetation is not considered to represent the DBCA listed P1 community '*Casuarina obesa* association' as vegetation within the survey area was highly modified with no native understorey being present. This vegetation comprised a very narrow strip of vegetation that was either planted or a small remnant of vegetation.

No key *Banksia* species outlined in the diagnostic assessment for Banksia Woodland of the Swan Coastal Plain TEC were recorded within the survey area (DotEE 2016). As a result, floristic aspects of this TEC do not occur within the survey area.

Table 9: Inferred relationships of vegetation within the survey area to FCTs and TECs.

Vegetation community	Inferred FCT (Gibson et al. 1994)	Inferred BC Act/EPBC Act TEC	Current vegetation condition	Extent within the survey area of inferred BC Act/EPBC Act vegetation
Woodland Community 1: CcTW	FCT3a	*Corymbia calophylla – Kingia australis* woodlands on heavy soils, SCP3a TEC (EPBC Act EN, BC Act CR)	Good (3.06 ha) Degraded – Good (0.11 ha)	3.17 ha
Shrubland Community 1: MsspHvXpTS	FCT8	SCP08 - Herb rich shrublands in clay pans TEC (EPBC Act CR, BC Act VU)	Good (1.57 ha) Degraded – Good (1.08 ha)	2.65 ha
Shrubland Community 2: JsHvXpTSS				

5.2.8 Vegetation condition

Vegetation condition within the survey area ranged from Good to Degraded condition based on the vegetation condition scale provided in the *Environmental Protection Authority Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). Vegetation was observed mostly to be in Good condition (4.6 ha; 52.2%) while the remaining areas of vegetation were in Good – Degraded condition (1.2 ha; 13.4%) and Degraded condition (1.2 ha, 12.9%; Figure 5-9). Approximately 1.9 ha (21.5%) is cleared areas or infrastructure (e.g. roads).

The most significant disturbance in the survey area was the prevalence of weeds which have altered the natural structure of the remnant vegetation and displaced native species. The narrow linear band of native vegetation is subject to several weeds dispersal vectors, the most prevalent being the main road (Mundijong Rd), bordering grazing lands and the drainage channel along the southern boundary. Other disturbances include edge effects, dumped rubbish and grazing/diggings from rabbits.

Table 10: Vegetation communities within the survey area

Photo	Vegetation description	Quadrats	Landform/soil types	Extent within the survey area (ha)	Portion of the survey area (%)
	Woodland Community 1: CcTW *Corymbia calophylla* tall woodland over *Kingia australis* and *Melaleuca preissiana* mid open woodland over *Xanthorrhoea preissii* and *Jacksonia sternbergiana* mid sparse shrubland over *Mesomelaena tetragona*, *Cyathochaeta avenacea* and *Lepidosperma pubisquameum* low open sedgeland and **Ehrharta* spp., **Avena barbata*, **Briza* spp. low sparse grassland.	ELA01 ELA07 ELA08	Flat, dark brown sandy loam with clay elements and deep humus/leaf litter layer	3.2	35.8
	Shrubland Community 1: MsspHvXpTS *Melaleuca* spp., *Hakea varia* and *Xanthorrhoea preissii* tall shrubland over *Hypocalymma angustifolium* and *Calothamnus hirsutus* mid sparse shrubland and *Patersonia occidentalis* and **Watsonia meriana* var. *bulbillifera* low isolated forbs over *Chorizandra enodis* low isolated sedges and **Ehrharta calycina*, **Briza* spp. and **Lolium rigidum* low sparse grassland.	ELA02 ELA04	Flat, grey – white light clay with fine sand on surface and dark grey sandy loam with clay elements	1.1	12.2

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Photo	Vegetation description	Quadrats	Landform/soil types	Extent within the survey area (ha)	Portion of the survey area (%)
	Shrubland Community 2: JsHvXpTSS *Jacksonia sternbergiana*, *Hakea varia* and *Xanthorrhoea preissii* tall sparse shrubland over *Hypocalymma angustifolium*, *Verticordia* spp. and *Stirlingia latifolia* mid open shrubland over *Banksia dallanneyi, Acacia stenoptera* and *Allocasuarina ?microstachya* low sparse shrubland and *Mesomelaena tetragonophylla*, *Cyathochaeta avenacea* and *Desmocladus flexuosus* low sparse sedgeland.	ELA03 ELA05 ELA06	Flat, light brown to grey light clay	1.6	17.6
	Remnant or planted roadside trees: CoEspLICT *Casuarina obesa* and *Eucalyptus* sp. low isolated clumps of trees over mixed weeds.	n/a	Road verge, compact gravelly sand	1.2	12.9

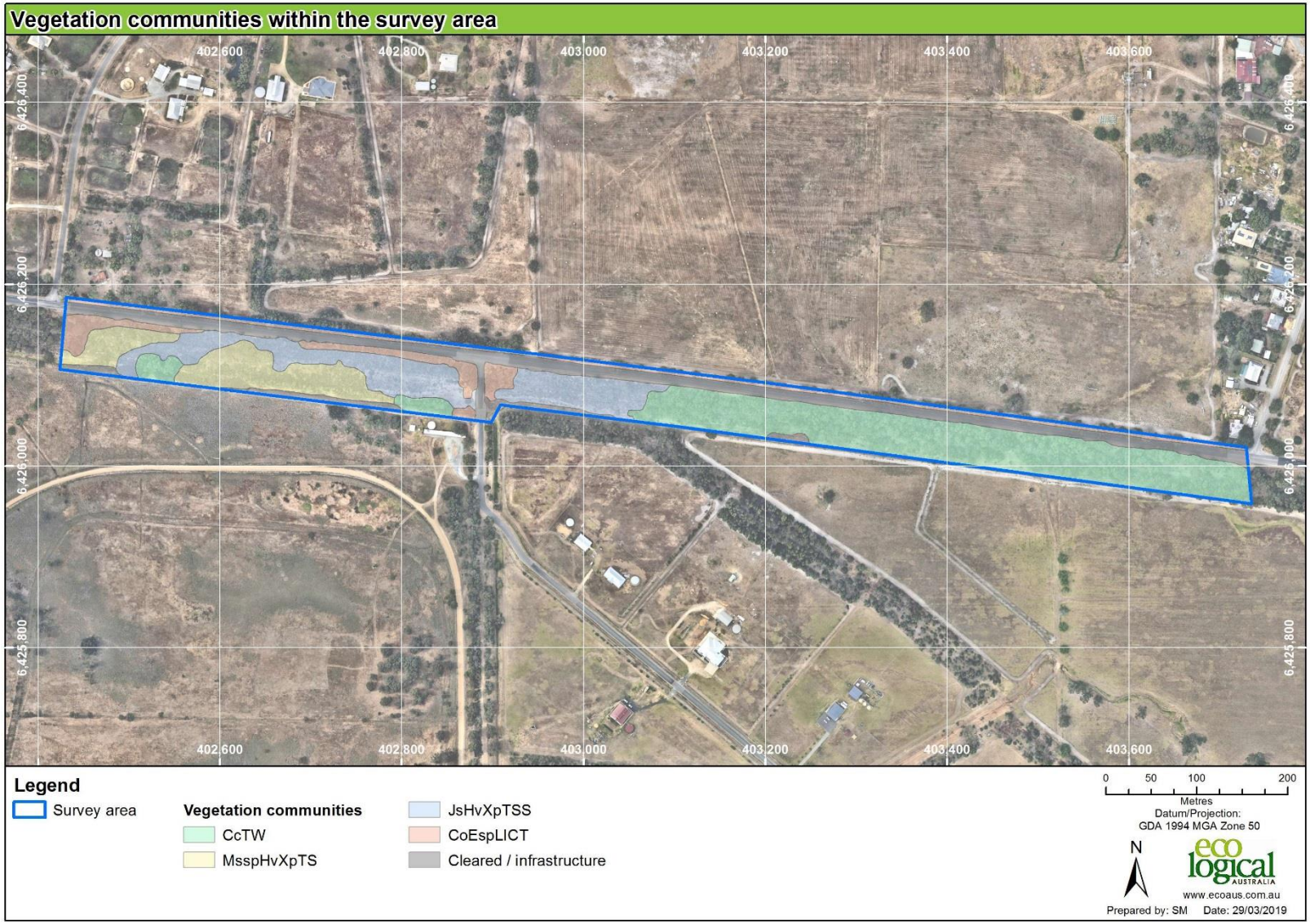

Figure 5-8: Vegetation communities within the survey area

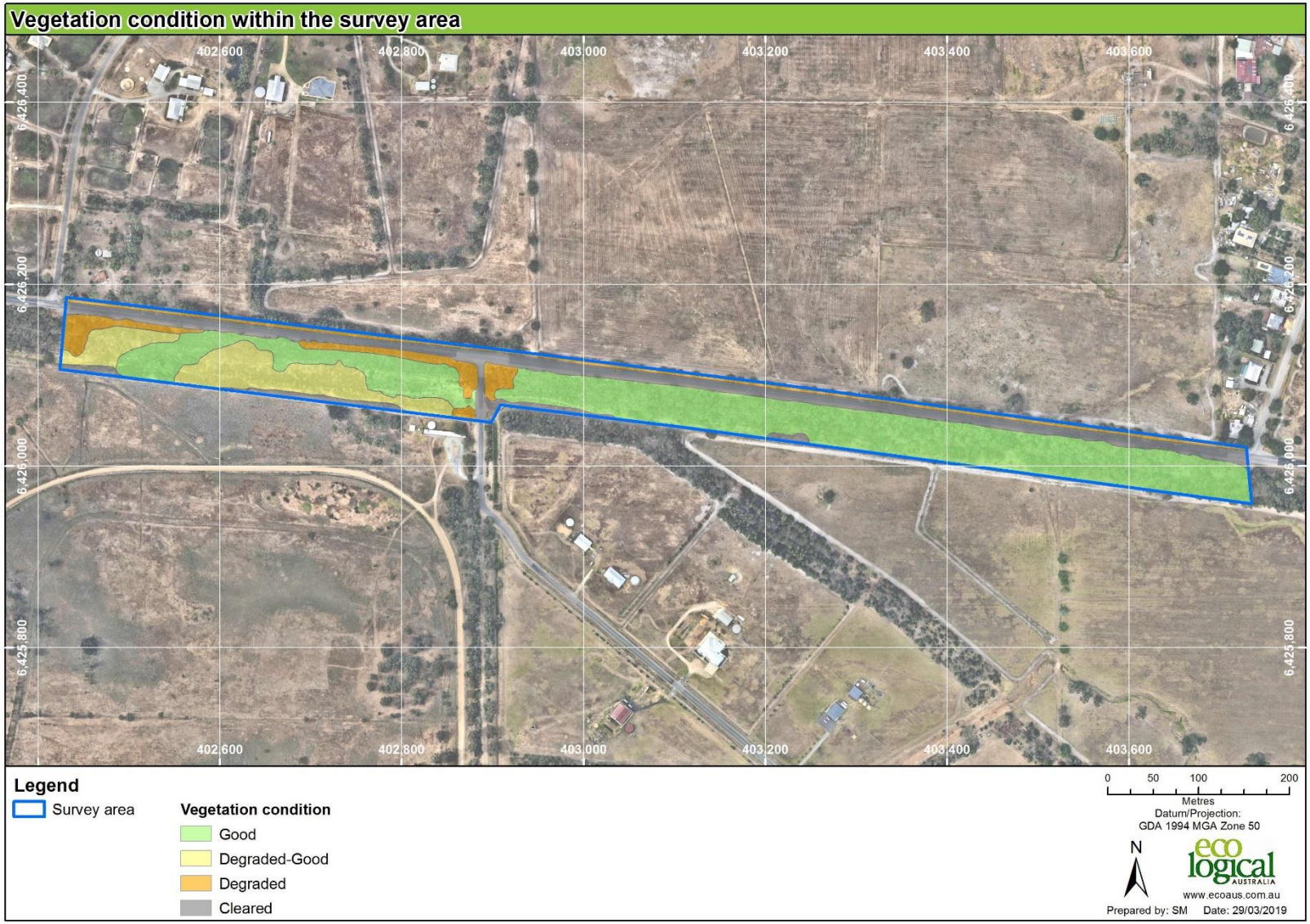

Figure 5-9: Vegetation condition within the survey area

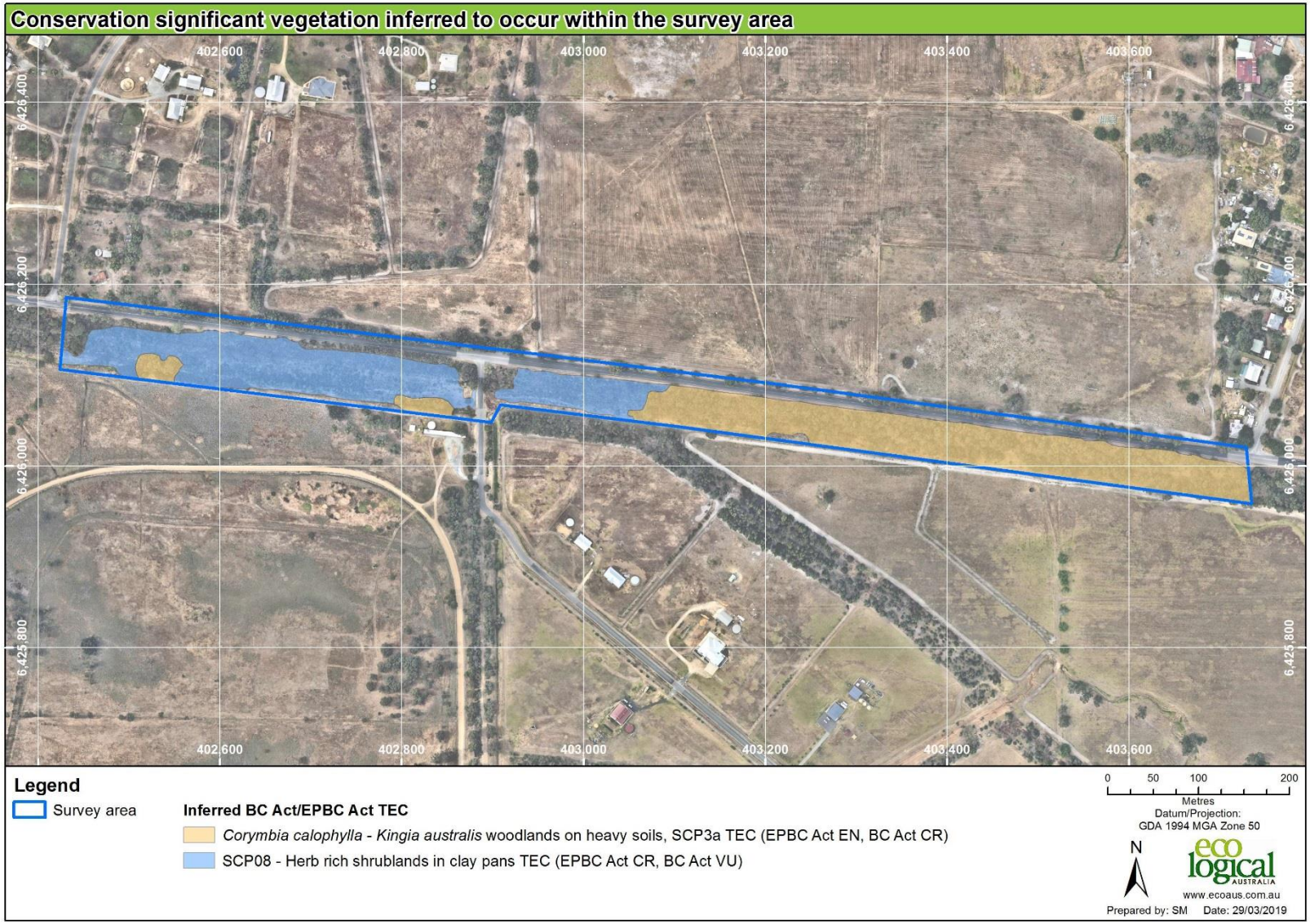

Figure 5-10: Conservation significant vegetation inferred to occur within the survey area.

6. Discussion

Prior to the assessment, the survey area was known to contain or potentially contain several conservation significant ecological values. Specifically, there are records of three conservation listed flora species within the survey area, two of which are listed under the EPBC Act and BC Act and one which is listed as Priority by DBCA. It is also within a Bush Forever site boundary and buffers of three TECs, two of which are listed under the EPBC Act and BC Act and one that is listed under the BC Act only. The broad regional vegetation associations Beard (1979) / Shepherd *et al.* (2002) and System 6 vegetation complexes (Government of Western Australia 2018) have also been largely cleared since European settlement of the area and have <10% of their pre-European extent remaining.

Threatened flora species previously recorded within the survey area included *Synaphea* sp. Serpentine (G. R. Brand 103; EPBC Act CR/BC Act CR), *Tetraria australiensis* (EPBC Act VU; BC Act VU) and *Babingtonia urbana* (DBCA P3). Despite exhaustive searches of the survey area, both *Tetraria australiensis* and *Babingtonia urbana* could not be located. Due to the conspicuous nature of *Babingtonia urbana* being a shrub, this species was considered to no longer be present within the survey area. The previous record of this species was also along a maintained road verge, so it is likely any individuals that were at this location have been cleared. *Tetraria australiensis* however, was still considered likely to occur as due to dry conditions at the time of the survey, there was an absence of sufficient material to enable correct identification of this species. Additionally, *Tetraria australiensis* is known to flower following fire and as there was no evidence of recent fire in the survey area, this also inhibited the availability of flowering material to assist identification (DEWHA 2008a).

Synaphea sp. Serpentine (G. R. Brand 103; EPBC Act CR/BC Act CR) was confirmed as presently occurring within the survey area and was recorded at the same location as previous records of this species. The previous record of this species is recognised by DBCA as population '5' which had a count of 48 mature plants and 53 juveniles (DBCA 2018a). This population has the second largest number of individuals currently known for this species (DotEE 2019a). In the current survey, 180 individuals of this species were recorded indicating the population is stable and successfully continuing to recruit. All individuals recorded in the current survey were found within 100 m of the previous record for this species.

A new record of the species *Synaphea* sp. Pinjarra Plain (A.S. George 17182; EPBC Act EN, BC Act EN) was also recorded during the current survey. This species is currently known from six locations with 12 sub-populations and a total of 751 mature individuals (DotEE 2019b). The closest previous record of this species is approximately 300 m to the west of the individuals recorded in the current survey, and approximately 190 m west of the survey area boundary. Two individuals were recorded during the current survey, approximately 20 m apart, in the western part of the survey area.

In the desktop assessment, three federally and state listed TEC's were identified as possibly occurring within the survey area, including: SCP08 – 'Herb Rich shrublands in clay pans' (EPBC CR, BC Act T/VU), SCP3a - '*Corymbia calophylla – Kingia australis* woodlands on heavy soils' (EPBC Act EN, BC Act T/CR) and SCP3c - '*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain' (EPBC Act EN, BC Act T/CR). Two of these TEC's (SCP08 and SCP3a) have been determined to occur in vegetation that is contiguous with the survey area, through flora plots established by Gibson *et al.* (1994). Statistical analysis comparing the floristic values of vegetation delineated within the survey area

to the Gibson *et al.* (1994) dataset were inconclusive. This was due to the degraded nature of remnant vegetation within the survey area which has reduced native species diversity and composition.

Although the relationship of vegetation within the survey area to the TEC's was quantitatively inconclusive, qualitative elements of these two TECs were still evident. Specifically, the landform and structure of Shrubland Community 1: MsspHvXpTS and Shrubland Community 2: JsHvXpTSS indicate there is a degree of affiliation with FCT8 and the Herb rich shrublands in clay pans TEC. These two shrubland communities had typical flora species in some strata that comprise FCT8 and the Herb rich shrublands in clay pans TEC, including *Melaleuca viminea*, *Melaleuca osullivanii* and *Hypocalymma angustifolium* in the shrub layer and *Chorizandra enodis* in the herb layer (Department of Parks and Wildlife 2015). The soil and landforms were also comparable as it contained clay elements and resembled a flat within a broader clay pan. The survey area also contains 1.57 ha of the shrubland communities (Shrubland Community 1: MsspHvXpTS and Shrubland Community 2: JsHvXpTSS) which is in 'Good' condition, the minimum condition requirement for a patch to be considered part of the TEC (Threatened Species Scientific Community 2012). An additional 1.08 ha of this vegetation within the survey area was in Degraded – Good condition. The remaining requirement of a patch to be considered the TEC however is for it to have a functioning hydrologic regime (Threatened Species Scientific Community 2012). This could not be determined during the survey as the conditions were dry.

Woodland Community 1: CcTW has elements of FCT3a the *Corymbia calophylla – Kingia australis* woodlands and shrublands TEC. These include some typical species in each structural layer including *Corymbia calophylla* in the tree layer, *Kingia australis* and *Xanthorrhoea preissii* in the shrub layer and *Cyathochaeta avenacea*, *Dampiera linearis* and *Mesomelaena tetragona* in the herb layer. The landform of this vegetation type was also contiguous with a mapped occurrence of the TEC nearby, however the floristic diversity recorded in Woodland Community 1: CcTW was much lower than what was recorded for FCT3a, with the woodland community containing approximately a third of the species recorded in FCT3a. The condition of Woodland Community 1: CcTW within the survey area is 3.06 ha in Good condition and 0.11 ha in Degraded – Good condition. It is likely that vegetation within the survey area was representative of these TEC's prior to disturbance.

Statistical analysis was also inconclusive about the relationship of vegetation in the survey area to the TEC FCT3c *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain. Woodland Community 1: CcTW occurred on similar soils and contained typical species found in this TEC such as *Corymbia calophylla* in the tree layer, *Xanthorrhoea preissii* in the shrub layer and *Burchardia congesta, Cyathochaeta avenacea* and *Neurachne alopecuroidea* in the herb layer. However, with the presence of *Kingia australis* and the vegetation occurring on soils likely to be in proximity to seasonally wet areas (FCT3c occurs on the driest of the soils), vegetation more closely resembles FCT3a (Endangered Species Scientific Subcommittee 2000).

No key *Banksia* species outlined in the diagnostic assessment for Banksia Woodland of the Swan Coastal Plain TEC were recorded within the survey area (DotEE 2016). As a result, floristic aspects of this TEC do not occur within the survey area. The vegetation community CoEspLICT which comprised *Casuarina obesa* and *Eucalyptus* sp. low isolated clumps of trees over mixed weeds was not considered to represent the nearby DBCA P1 PEC - *Casuarina obesa* association as this vegetation community was highly modified and consisted of a narrow band of remnant or planted roadside trees.

Overall, although the remnant vegetation within the survey area is affected by disturbance, this vegetation may be important for maintenance of surrounding occurrences of TECs and the two Threatened flora species that were recorded within the survey area, as they exist in a highly cleared landscape.

7. References

Beard, J. S. 1979. *The vegetation of the Perth Area Western Australia, Map and Explanatory Memoir 1:250,000 Series*. Vegmap Publications Perth

Bureau of Meteorology (BoM). 2018. Climate Data Online: Fitzroy Crossing Aero. Available: http://www.bom.gov.au/climate/data/

Clarke, K.R., and Gorley, R.N. 2006. PRIMER v6: User Manual/Tutorial. PRIMER-E, Plymouth.

Department of Biodiversity, Conservation and Attractions (DBCA). 2018a. Threatened and Priority Flora database search. Department of Biodiversity, Conservation and Attractions, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA). 2018b. Threatened and Priority Communities database search. Department of Biodiversity, Conservation and Attractions, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA). 2007 - 2018. NatureMap. Department of Parks and Wildlife and WA Museum. Accessed June 2018. Available from: https://naturemap.dpaw.wa.gov.au/

Department of Conservation, Biodiversity and Attractions and the Western Australian Herbarium (DBCA and WAH). 2018. FloraBase—the Western Australian Flora. Department of Biodiversity, Conservation and Attractions. Available from: https://florabase.dpaw.wa.gov.au/. Accessed July 2018.

Department of Environment (DoE). 2004. *Perth Groundwater* Atlas. Second Edition: Perth.

Department of the Environment and Energy (DotEE). 2016. Threatened Species Scientific Committee Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain Ecological Community. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/131-conservation-advice.pdf

Department of the Environment and Energy (DotEE). 2018b. Australia's bioregions (IBRA). Available from: https://www.environment.gov.au/land/nrs/science/ibra.

Department of the Environment and Energy (DotEE). 2018b. EPBC Act Protected Matters Search Tool (PMST). Available from: http://www.environment.gov.au/epbc/pmst/index.html. Accessed June 2018.

Department of the Environment and Energy (DotEE). 2019a. *Synaphea sp. Serpentine (G.R. Brand 103) in Species Profile and Threats Database.* Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat

Department of the Environment. 2019b. *Synaphea sp. Pinjarra Plain (A.S. George 17182) in Species Profile and Threats Database*. Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.

Department of the Environment, Water, Heritage and the Arts (DEWHA). 2008a. *Approved Conservation Advice for* Diuris purdiei *(Purdie's Donkey-orchid)*. Available

from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/12950-conservation-advice.pdf.

Department of the Environment, Water, Heritage and the Arts (DEWHA). 2008b. *Approved Conservation Advice for* Tetraria australiensis *(Southern Tetraria)*. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/10137-conservation-advice.pdf.

Department of Parks and Wildlife. 2015. *Interim Recovery Plan No. 354 Clay Pans of the Swan Coastal Plain (Community types 7, 8, 9 and 10a – Gibson et al. 1994 and Clay pans with mid dense shrublands of Melaleuca lateritia over herbs) 2015 – 2020*. Available from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/recovery_plans/Approved_interim_recovery_plans_/communities/claypans_of_the_swan_coastal_plain.pdf

Department of Primary Industries and Regional Development (DPIRD). 2019. *NR Info Soil Landscape Mapping*. Available from: https://maps.agric.wa.gov.au/nrm-info/

Endangered Species Scientific Subcommittee. 2000. *Commonwealth Listing Advice on* Corymbia calophylla - Xanthorrhoea preissii *woodlands and shrublands of the Swan Coastal Plain.* Available from: http://www.environment.gov.au/biodiversity/threatened/communities/calophylla-x-preissii.html.

Environmental Protection Authority (EPA). 2016. Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment. Perth, Western Australia.

Geological Survey of WA and Geoscience Australia. 2008. 1:250 000 Scale Topographic Maps. Australian Government, Canberra.

Gibson, N., Keighery, B. J., Keighery, G. J., Burbidge, A. H. and Lyons, M. N. 1994. A Floristic Survey of the Southern Swan Coastal Plain. Report prepared for the Australian Heritage Commission. Western Australian Department of Conservation and Land Management, and Western Australia Conservation Council.

Government of Western Australia. 2000. Bush Forever Volume 2: Directory of Bush Forever Sites. Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia. 2018. 2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of December 2017. WA Department of Biodiversity, Conservation and Attractions.

Heddle E.M., Loneragan O.W. and Havel J.J. (1980) Vegetation of the Darling System. IN: DCE 1980 Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Perth, Western Australia.

Mitchell, D., Williams, K. and Desmond, A. 2002. Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion). In: (CALM (Ed) A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, pp. 606 – 623. Department of Conservation and Land Management, Perth, Western Australia.

NVIS Technical Working Group. 2017. *Australian Vegetation Attribute Manual: National Vegetation Information System, Version 7.0*. Department of the Environment and Energy, Canberra. Prep by Bolton, M.P., deLacey, C. and Bossard, K.B. (Eds)

Semeniuk, C. A. and Semeniuk, V. 2011. A comprehensive classification of inland wetlands of Western Australia using the geomorphic-hydrologic approach. Journal of the Royal Society of Western Australia, 94: 449-464.

Shepherd, D.P., Beeston, G.R., and Hopkins, A.J.M. 2002. *Native Vegetation in Western Australia – Extent, Type and Status. Resource Management Technical Report 249*, Department of Agriculture, Western Australia.

Threatened Species Scientific Committee. 2012. *Commonwealth Listing Advice on Claypans of the Swan Coastal Plain*. Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/121-listing-advice.pdf.

Appendix A Framework for conservation significant flora and fauna ranking

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

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

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

CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA

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

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

Threatened species (T)
Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

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

Category	Code	Description
Critically Endangered species	CR	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
Endangered species	EN	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

Category	Code	Description
Vulnerable species	VU	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Extinct species

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

Category	Code	Description
Extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
Extinct in the wild species	EW	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

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

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

Categories are detailed below.

Category	Code	Description
Migratory species	MI	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Species of special conservation interest (conservation dependent fauna)	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Other specially protected species	OS	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

Priority species (P)

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

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

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

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

DEFINITIONS, CATEGORIES AND CRITERIA FOR THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

An Ecological Community is described as "a naturally occurring biological assemblage that occurs in a particular type of habitat".

A threatened ecological community (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable".

Possible TECs that do not meet survey criteria are added to DPaW's Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Definitions and Criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

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

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats,

B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

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.

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

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);

ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the c

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Endangered (EN)

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.

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

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community 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.

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

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definitions and Criteria for Priority Ecological Communities

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities

Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 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.

Priority Two: Poorly-known ecological 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 of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

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

(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix B PMST database search results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

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

Report created: 10/01/19 11:12:23

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

Coordinates
Buffer: 10.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	30
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	9
Regional Forest Agreements:	1
Invasive Species:	40
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar
Peel-yalgorup system	20 - 30km upstream

Listed Threatened Ecological Communities		[Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Anthocercis gracilis Slender Tailflower [11103]	Vulnerable	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lasiopetalum pterocarpum Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat known to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur

Name	Status	Type of Presence within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area
Verticordia plumosa var. araneotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Banksia	WA
Cardup	WA
Gooralong	WA
Lambkin	WA
Serpentine	WA
Unnamed WA46587	WA
Unnamed WA46818	WA
Unnamed WA51784	WA
Watkins Road	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-32.29778 116.97

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

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

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Appendix C NatureMap database search results

NatureMap

NatureMap Species Report

Created By Guest user on 10/01/2019

Kingdom	Plantae
Origin	Native
Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Data Source	Threatened and Priority Flora Database or WA Herbarium Specimen Database
Method	'By Circle'
Centre	115° 58' 12" E,32° 17' 53" S
Buffer	10km
Group By	Conservation Status

Conservation Status	Species	Records
Priority 1	3	6
Priority 2	2	13
Priority 3	15	51
Priority 4	8	27
Rare or likely to become extinct	10	156
TOTAL	**38**	**253**

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct					
1.	1596	*Caladenia huegelii* (Grand Spider Orchid)		T	
2.	1627	*Diuris purdiei* (Purdie's Donkey Orchid)		T	
3.	1639	*Drakaea elastica* (Glossy-leafed Hammer Orchid)		T	
4.	17000	*Lasiopetalum pterocarpum*		T	
5.	942	*Lepidosperma rostratum*		T	
6.	18560	*Synaphea* sp. *Fairbridge Farm (D. Papenfus 696)*		T	
7.	33751	*Synaphea* sp. *Pinjarra Plain (A.S. George 17182)*		T	
8.	33354	*Synaphea* sp. *Serpentine (G.R. Brand 103)*		T	
9.	1003	*Tetraria australiensis*		T	
10.	12448	*Verticordia plumosa* var. *ananeotes*		T	
Priority 1					
11.	14892	*Acacia lasiocarpa* var. *bracteolata long peduncle variant (G.J. Keighery 5026)*		P1	
12.	15633	*Boronia juncea* subsp. *juncea*		P1	
13.	16665	*Synaphea odocoileops*		P1	
Priority 2					
14.	19272	*Johnsonia pubescens* subsp. *cygnorum*		P2	
15.	14531	*Millotia tenuifolia* var. *laevis*		P2	
Priority 3					
16.	3273	*Acacia horridula*		P3	
17.	14129	*Acacia oncinophylla* subsp. *oncinophylla*		P3	
18.	7828	*Angianthus drummondii*		P3	
19.	45402	*Babingtonia urbana (Coastal Plain Babingtonia)*		P3	
20.	759	*Carex tereticaulis*		P3	
21.	16246	*Cyathochaeta teretifolia*		P3	
22.	3883	*Dillwynia dillwynioides*		P3	
23.	41661	*Eryngium pinnatifidum* subsp. *Palustre (G.J. Keighery 13459)*		P3	
24.	20775	*Isopogon drummondii*		P3	
25.	33462	*Jacksonia gracillima*		P3	
26.	8163	*Pithocarpa corymbulosa* (Corymbose Pithocarpa)		P3	
27.	900	*Schoenus capillifolius*		P3	
28.	1008	*Schoenus pennisetis*		P3	
29.	17731	*Schoenus* sp. *Waroona (G.J. Keighery 12235)*		P3	
30.	18564	*Stylidium aceratum*		P3	
Priority 4					
31.	141	*Aponogeton hexatepalus* (Stalked Water Ribbons)		P4	

NatureMap is a collaborative project of the Department of Parks and Wildlife and the Western Australian Museum.

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NatureMap
Mapping Western Australia's Biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
32.	1123	*Centrolepis caespitosa*		P4	
33.	13191	*Drosera occidentalis subsp. occidentalis*		P4	
34.	13512	*Eucalyptus rudis subsp. cratyantha*		P4	
35.	5573	[illegible]		P4	
36.	8212	*Senecio leucoglossus*		P4	
37.	7756	*Stylidium longitubum* (Jumping Jacks)		P4	
38.	11717	*Verticordia lindleyi subsp. lindleyi*		P4	

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

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

NatureMap is a collaborative project of the Department of Parks and Wildlife and the Western Australian Museum.

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Appendix D Flora likelihood of occurrence assessment

Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	T (CR)	PMST, NatureMap	Unlikely	Potentially suitable habitat with some associated species present however this species would have been detectable during the extensive targeted search of the survey area.
Synaphea sp. Serpentine (G.R. Brand 103)	CR	T (CR)	PMST, NatureMap, DBCA	Recorded	This species has been recorded previously within the survey area and was recorded at 109 locations within the survey area during the current survey.
Caladenia huegelii	EN	T (CR)	PMST, NatureMap	Unlikely	Potentially suitable soil, however few associated species present in the survey area and no nearby records (closest record approx. 9 km away). Additionally high weed cover in the understorey likely to compete with this species.
Drakaea elastica	EN	T (CR)	PMST, NatureMap, DBCA	Unlikely	No suitable habitat within the survey area as there were no sandy areas in dense vegetation, specifically no Banksia or Spearwood vegetation in proximity to winter-wet swamps. The closest record is 5.0 km away. Weeds are also prevalent in the understorey and have altered the natural structure of vegetation and have therefore increased competition and reduced the habitat potential for this species.
Eucalyptus x balanites	EN	T (CR)	PMST	Unlikely	Habitat not suitable and the closest record is approx. 17 km away. This species would have also been visible during the survey if present within the survey area.
Grevillea curviloba subsp. *incurva*	EN	T (CR)	PMST	Unlikely	Habitat not suitable and the closest record is approx. 38 km away. This species would have also been visible during the survey if present within the survey area.

Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Lasiopetalum pterocarpum	EN	T (CR)	PMST, NatureMap	Unlikely	Habitat not suitable and the closest record is approx. 7 km away. This species would have also been visible during the survey if present within the survey area.
Thelymitra dedmaniarum	EN	T (CR)	PMST	Unlikely	Habitat not suitable and few associated species present within the survey area. The closest record is approx. 50 km away. This species would have also been flowering and visible during the survey if present within the survey area.
Verticordia plumosa var. *ananeotes*	EN	T (CR)	PMST, NatureMap	Unlikely	Habitat potentially suitable. However the closest record is approx. 7 km away and this species would have been flowering and visible during the survey if present within the survey area.
Diuris purdiei	EN	T (EN)	PMST, NatureMap, DBCA	Potential	Habitat marginally suitable as there is sandy clay soil that may be subject to winter inundation. There is also a historic record nearby within 1 km. The current survey was outside of flowering time and appropriate conditions for this species as it flowers late September to mid-October but only after summer or early autumn fire. High weed cover in the understory however is also likely to compete with this species and reduce its habitat potential within the survey area.
Lepidosperma rostratum	EN	T (EN)	PMST, NatureMap, DBCA	Unlikely	The closest record is within 1 km of the survey area however habitat is marginally suitable within the survey area. This species also would have also been detectable during the survey if present.
Synaphea sp. Pinjarra Plain (A.S. George 17182)	EN	T (EN)	NatureMap, DBCA	Recorded	This species was recorded at two locations within the survey area during the survey.

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Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Thelymitra stellata	EN	T (EN)	PMST	Unlikely	Habitat is not suitable and the closest record is approx. 12 km from the survey area. This species also would have been flowering and detectable during the survey if present. High weed cover in the understorey also limits habitat potential for this species.
Andersonia gracilis	EN	T (VU)	PMST	Unlikely	Habitat marginally suitable and the closest record is approx. 30 km away. This species would have also been flowering and visible at the time of the survey if present.
Drakaea micrantha	VU	T (EN)	PMST	Unlikely	Habitat potentially suitable, however high weed cover in the understorey is likely to limit habitat availability for this species. The closest record of this species is 14 km away.
Anthocercis gracilis	VU	T (VU)	PMST	Unlikely	No suitable habitat, species is a shrub to 0.6 m and would have been detectable during the survey if present.
Diuris micrantha	VU	T (VU)	PMST	Unlikely	Habitat within the survey area unlikely to be suitable to support this species due to lack of standing water. Also high weed cover in the understorey is likely to displace this species. The closest record of this species is also 15 km away.
Eleocharis keigheryi	VU	T (VU)	PMST	Unlikely	Habitat within the survey area unlikely to be suitable to support this species due to lack of standing water. This species would have also been detectable at the time of the survey if it was present. The closest record of this species is also 22 km away.

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Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Tetraria australiensis	VU	T (VU)	PMST, NatureMap, DBCA	Likely	Although this species has been recorded previously in the survey area in 2009, it could not be located during the current survey despite exhaustive search effort being undertaken.
Acacia lasiocarpa var. *bracteolata* long peduncle variant (G.J. Keighery 5026)	-	P1	NatureMap, DBCA	Unlikely	Potentially suitable habitat, however the closest record is 4.5 km away and this species is a shrub 0.4 - 1.4 m high and would have been detectable during the survey if present.
Boronia juncea subsp. *juncea*	-	P1	NatureMap	Unlikely	Potentially suitable habitat, however the closest record is 12 km away and this species is a shrub and would have been detectable during the survey if present.
Synaphea odocoileops	-	P1	NatureMap	Unlikely	Habitat marginally suitable. The closest record is approximately 8 km away. This species would have been visible during the survey if present.
Johnsonia pubescens subsp. *cygnorum*	-	P2	NatureMap, DBCA	Unlikely	No suitable habitat. While there is a record within 1 km however this record is historic from the 1920s and species hasn't been recorded in close proximity since.
Millotia tenuifolia var. *laevis*	-	P2	NatureMap	Unlikely	Habitat marginally suitable. The closest record is approximately 8 km away. This species would have been visible during the survey if present.
Acacia horridula	-	P3	NatureMap	Unlikely	Habitat marginally suitable. The closest record is approximately 8 km away. High weed cover in the understorey is likely to displace this species.

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Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Acacia oncinophylla subsp. *oncinophylla*	-	P3	NatureMap	Unlikely	Habitat unlikely to be suitable. The closest record is approximately 3 km away. High weed cover in the understorey is likely to displace this species. This species would have also been flowering and visible during the survey if present.
Angianthus drummondii	-	P3	NatureMap, DBCA	Unlikely	Habitat unlikely to be suitable. The closest record is approximately 1.3 km away. This species is also a shrub 0.9 - 2.5 m high and would have been visible during the survey if present.
Babingtonia urbana	-	P3	NatureMap, DBCA	Unlikely	This species has been recorded previously at one location in the survey area in 1992 however was not detected again during the survey despite extensive searches. The record within the survey area was noted to be on a road verge and it is possible this species has been cleared in the past.
Carex tereticaulis	-	P3	NatureMap	Unlikely	Habitat unlikely to be suitable. The closest record is approximately 8 km away. This species would have also been visible during the survey if present.
Cyathochaeta teretifolia	-	P3	NatureMap	Unlikely	Habitat potentially suitable however the closest record is approximately 11 km away and this species would have also been visible during the survey if present.
Dillwynia dillwynioides	-	P3	NatureMap, DBCA	Unlikely	Potentially suitable habitat, however the closest record is 5.0 km away and this species is a shrub 0.3 - 1.2 m high and would have been detectable during the survey if present.

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Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	-	P3	NatureMap	Unlikely	Habitat unlikely to be suitable. The closest record is approximately 8 km away. This species would have also been visible during the survey if present.
Isopogon drummondii	-	P3	NatureMap	Unlikely	Habitat potentially suitable however the closest record is approximately 7 km away and this species would have also been visible during the survey if present.
Jacksonia gracillima	-	P3	NatureMap, DBCA	Unlikely	Habitat marginally suitable and the closest record is approximately 1 km away. However, this species would have been visible during the survey if present.
Pithocarpa corymbulosa	-	P3	NatureMap, DBCA	Unlikely	Habitat not suitable. Additionally high weed cover would likely displace this species and the closest record is 5 km away in a different topographical position to the survey area.
Schoenus capillifolius	-	P3	NatureMap, DBCA	Unlikely	Habitat unlikely to be suitable. High weed cover would likely displace this species. The closest record is 2 km away. This species would have also been visible during the survey if present.
Schoenus pennisetis	-	P3	NatureMap	Unlikely	Habitat unlikely to be suitable. High weed cover would likely displace this species and the closest record is 8 km away.
Schoenus sp. Waroona (G.J. Keighery 12235)	-	P3	NatureMap, DBCA	Unlikely	Habitat unlikely to be suitable. The closest record is approx. 1 km away. This species would have also been visible during the survey if present.

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Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Stylidium aceratum	-	P3	NatureMap, DBCA	Unlikely	Potentially suitable habitat present, however high weed cover would likely displace this species. The closest record is approx. 1 km and this species would have also been flowering and detectable at the time of the survey if present.
Aponogeton hexatepalus	-	P4	NatureMap	Unlikely	No suitable habitat within the survey area. The closest record of this species is 10 km away.
Drosera occidentalis	-	P4	NatureMap	Unlikely	Habitat marginally suitable and high weed cover would likely limit habitat opportunities for this species within the survey area. Additionally the closest record of this species is 7 km away.
Eucalyptus rudis subsp. *cratyantha*	-	P4	NatureMap	Unlikely	Habitat unlikely to be suitable. The closest record is approx. 8 km away. This species would have been visible if present within the survey area. No native Eucalyptus species were recorded within the survey area.
Parsonsia diaphanophleba	-	P4	NatureMap, DBCA	Unlikely	No suitable habitat. The closest record is approx. 3 km away. This species would have also been visible if present within the survey area.
Senecio leucoglossus	-	P4	NatureMap	Unlikely	No suitable habitat. The closest record is approx. 7 km away. This species would have also been visible if present within the survey area.
Stylidium longitubum	-	P4	NatureMap	Unlikely	Potentially suitable habitat. However the closest record is 11 km away and this species would have been visible at the time of the survey. Additionally, high weed cover in the understorey has likely limited habitat availability for this species.

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Species	EPBC Act	BC Act/DBCA	Source	Likelihood of occurrence	Justification
Verticordia lindleyi subsp. *lindleyi*	-	P4	NatureMap	Unlikely	Potentially suitable habitat. However the closest record is 8 km away and this species would have been visible at the time of the survey.

Appendix E Flora species list

Family	Confirmed Name
Anarthriaceae	*Lyginia barbata*
Apocynaceae	**Gomphocarpus fruticosus*
Asparagaceae	**Asparagus asparagoides*
Asteraceae	**Hypochaeris glabra*
	**Sonchus oleraceus*
	**Ursinia anthemoides*
	Pterochaeta paniculata
Campanulaceae	**Monopsis debilis*
	**Wahlenbergia capensis*
Casuarinaceae	*Allocasuarina* ?*microstachya*
	Casuarina obesa
Colchicaceae	*Burchardia congesta*
Cupressaceae	*Callitris pyramidalis*
Cyperaceae	*Chorizandra enodis*
	Cyathochaeta avenacea
	Isolepis marginata
	Lepidosperma pubisquameum
	Lepidosperma squamatum
	Lepidosperma sp.
	Mesomelaena tetragona
	Schoenus ?*bifidus*
	Tricostularia neesii
Dasypogonaceae	*Dasypogon bromeliifolius*
	Kingia australis
Droseraceae	*Drosera* ?*platystigma*
Ericaceae	*Leucopogon* sp.
	Lysinema pentapetalum
Fabaceae	**Lotus angustissimus*
	Acacia saligna
	Acacia stenoptera
	Daviesia incrassata
	Gompholobium marginatum
	Jacksonia sternbergiana
Gentianaceae	**Cicendia filiformis*
Goodeniaceae	*Dampiera linearis*
Haemodoraceae	*Conostylis aculeata* subsp. *aculeata*
	Haemodorum spicatum
Hemerocallidaceae	*Caesia micrantha*
	Tricoryne elatior
Iridaceae	**Moraea flaccida*
	**Romulea rosea*
	**Watsonia meriana* var. *bulbillifera*
	Patersonia occidentalis
Lauraceae	*Cassytha* sp.

Family	Confirmed Name
Myrtaceae	*Calothamnus hirsutus*
	Corymbia calophylla
	Eucalyptus sp. (planted)
	Hypocalymma angustifolium
	Kunzea micrantha
	Melaleuca incana
	Melaleuca osullivanii
	Melaleuca preissiana
	Melaleuca viminea
	Myrtaceae sp.
	Pericalymma ellipticum
	Regelia ciliata
	Verticordia acerosa
	Verticordia densiflora
	Verticordia plumosa ?var. *brachyphylla*
Orchidaceae	*Microtis media*
Orobanchaceae	**Bellardia trixago*
	**Orobanche minor*
Oxalidaceae	**Oxalis pes-caprae*
Poaceae	**Aira caryophyllea*
	**Avena barbata*
	**Briza maxima*
	**Briza minor*
	**Ehrharta calycina*
	**Ehrharta longiflora*
	**Eragrostis curvula*
	**Lolium rigidum*
	**Vulpia myuros*
	Austrostipa compressa
	Neurachne alopecuroidea
Primulaceae	**Lysimachia arvensis*
Proteaceae	*Banksia bipinnatifida*
	Banksia dallanneyi
	Hakea ?marginata
	Hakea prostrata
	Hakea sulcata
	Hakea varia
	Petrophile brevifolia
	Stirlingia latifolia
	Synaphea petiolaris
	Synaphea sp. Serpentine (T)
	Synaphea sp. Pinjarra Plain (A.S. George 17182) (T)
Restionaceae	*Desmocladus fasciculatus*
	Desmocladus flexuosus

Family	Confirmed Name
	Leptocarpus sp.
Rhamnaceae	*Rhamnaceae* sp.
Rubiaceae	*Opercularia echinocephala*
	Opercularia vaginata
Solanaceae	**Solanum nigrum*
Stylidiaceae	*Stylidium calcaratum*
	Stylidium repens
Thymelaeaceae	*Pimelea imbricata*
Xanthorrhoeaceae	*Xanthorrhoea preissii*

Appendix F Flora species matrix

Species	Quadrat							
	ELA01	ELA02	ELA03	ELA04	ELA05	ELA06	ELA07	ELA08
**Aira caryophyllea*		x		x				
**Asparagus asparagoides*	x							
**Avena barbata*					x			x
**Bellardia trixago*		x						
**Briza maxima*	x	x	x	x	x	x		x
**Briza minor*		x	x	x	x	x	x	x
**Cicendia filiformis*			x					
**Ehrharta calycina*	x	x	x	x	x	x	x	x
**Ehrharta longiflora*				x				x
**Eragrostis curvula*							x	
**Gomphocarpus fruticosus*						x		
**Hypochaeris glabra*	x	x		x		x		x
**Lolium rigidum*		x						
**Lotus angustissimus*		x				x		
**Lysimachia arvensis*						x		
**Monopsis debilis*						x		
**Moraea flaccida*	x				x	x	x	x
**Orobanche minor*		x				x	x	
**Oxalis pes-caprae*	x							x
**Romulea rosea*						x		
**Solanum nigrum*								x
**Sonchus oleraceus*		x		x		x	x	
**Ursinia anthemoides*					x	x	x	
**Vulpia myuros*			x					
**Wahlenbergia capensis*					x			
**Watsonia meriana* var. *bulbillifera*	x	x	x	x	x		x	
Acacia saligna							x	
Acacia stenoptera	x		x		x	x		

Species	Quadrat							
	ELA01	ELA02	ELA03	ELA04	ELA05	ELA06	ELA07	ELA08
Allocasuarina ?microstachya			x		x			
Austrostipa compressa						x		
Banksia bipinnatifida					x			
Banksia dallanneyi	x		x	x	x	x		
Burchardia congesta							x	
Caesia micrantha	x						x	x
Callitris pyramidalis				x				
Calothamnus hirsutus				x				
Cassytha sp.	x		x	x	x			
Chorizandra enodis		x		x				
Conostylis aculeata subsp. *aculeata*		x			x	x	x	x
Corymbia calophylla	x			x			x	x
Cyathochaeta avenacea	x		x			x	x	x
Dampiera linearis			x		x	x	x	
Dasypogon bromeliifolius							x	
Daviesia incrassata					x			
Desmocladus fasciculatus	x		x					
Desmocladus flexuosus			x		x			
Drosera ?platystigma			x					
Gompholobium marginatum			x				x	
Haemodorum spicatum					x	x		
Hakea ?marginata			x		x			
Hakea prostrata					x			
Hakea sulcata			x					
Hakea varia	x	x	x	x	x			
Hypocalymma angustifolium	x	x	x	x	x			
Isolepis marginata			x					
Jacksonia sternbergiana	x		x		x	x		x

Species	Quadrat							
	ELA01	ELA02	ELA03	ELA04	ELA05	ELA06	ELA07	ELA08
Kingia australis						x	x	x
Kunzea micrantha			x		x			
Lepidosperma pubisquameum	x						x	x
Lepidosperma squamatum			x				x	x
Lepidosperma sp.			x		x		x	
Leptocarpus sp.		x	x					
Leucopogon sp.	x		x					
Lyginia barbata					x			
Lysinema pentapetalum					x			
Melaleuca incana		x		x				
Melaleuca osullivanii				x				
Melaleuca preissiana								x
Melaleuca viminea		x		x				
Mesomelaena tetragona	x		x	x	x	x	x	x
Microtis media	x	x		x			x	x
Myrtaceae sp.				x				
Neurachne alopecuroidea		x	x	x		x		x
Opercularia echinocephala							x	
Opercularia vaginata			x					
Patersonia occidentalis		x		x				
Pericalymma ellipticum	x		x					
Petrophile brevifolia					x			
Pimelea imbricata		x	x					
Pterochaeta paniculata						x		
Regelia ciliata	x							
Rhamnaceae sp.			x		x			
Schoenus ?bifidus			x					
Stirlingia latifolia					x	x		x

Species	Quadrat							
	ELA01	ELA02	ELA03	ELA04	ELA05	ELA06	ELA07	ELA08
Stylidium calcaratum						x		
Stylidium repens					x			
Synaphea petiolaris		x			x			
Synaphea sp. Serpentine (T)						x		
Tricoryne elatior		x	x		x	x	x	x
Tricostularia neesii								x
Verticordia acerosa			x	x	x			
Verticordia densiflora			x		x			
Verticordia plumosa ?var. *brachyphylla*			x		x	x		
Xanthorrhoea preissii	x		x	x		x	x	

Appendix G Quadrat data

Site name and number	Date	Site type	Observer
ELA01	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
G	Weeds	>20 years	CcTW
Habitat description	Landform unit	Aspect	Slope %
Marri woodland	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Dark brown	Coarse	Sandy loam	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	402523	6426119

North west

South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Corymbia calophylla	60	U	Tree/palm
Hypocalymma angustifolium	2.5	M	Shrub, cycad, grass-tree, tree-fern
Regelia ciliata	1	M	Shrub, cycad, grass-tree, tree-fern
Xanthorrhoea preissii	0.5	M	Shrub, cycad, grass-tree, tree-fern
Banksia dallanneyi	0.4	M	Shrub, cycad, grass-tree, tree-fern
Pericalymma ellipticum	0.25	M	Shrub, cycad, grass-tree, tree-fern
Jacksonia sternbergiana	0.2	M	Shrub, cycad, grass-tree, tree-fern
Hakea varia	0.05	M	Shrub, cycad, grass-tree, tree-fern
Leucopogon sp.	0.05	M	Shrub, cycad, grass-tree, tree-fern
Acacia stenoptera	0.01	M	Shrub, cycad, grass-tree, tree-fern
**Ehrharta calycina*	1.2	G	Other grass
**Briza maxima*	0.3	G	Other grass
Mesomelaena tetragona	6	G	Sedge
Lepidosperma pubisquameum	4	G	Sedge
Cyathochaeta avenacea	0.3	G	Sedge
Caesia micrantha	0.5	G	Forb
**Asparagus asparagoides*	0.2	G	Forb
**Watsonia meriana* var. *bulbillifera*	0.2	G	Forb
**Oxalis pes-caprae*	0.15	G	Forb
Desmocladus fasciculatus	0.1	G	Forb
**Moraea flaccida*	0.1	G	Forb
**Hypochaeris glabra*	0.05	G	Forb
Microtis media	0.01	G	Forb
Cassytha sp.	0.02	G	Vine

Site name and number	Date	Site type	Observer
ELA02	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
D-G	Weeds and refuse	>20 years	MsspHvXpTS
Habitat description	Landform unit	Aspect	Slope %
Melaleuca shrubland over weeds	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Grey to white	Fine	Light clay with fine sand on surface	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	402615	6426142

North west

South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Melaleuca viminea	75	M	Shrub, cycad, grass-tree, tree-fern
Melaleuca incana	2	M	Shrub, cycad, grass-tree, tree-fern
Hakea varia	0.5	M	Shrub, cycad, grass-tree, tree-fern
Hypocalymma angustifolium	0.5	M	Shrub, cycad, grass-tree, tree-fern
Synaphea petiolaris	0.08	M	Shrub, cycad, grass-tree, tree-fern
Pimelea imbricata	0.01	M	Shrub, cycad, grass-tree, tree-fern
**Ehrharta calycina*	5	G	Other grass
**Briza maxima*	0.6	G	Other grass
**Briza minor*	0.3	G	Other grass
**Lolium rigidum*	0.25	G	Other grass
Neurachne alopecuroidea	0.25	G	Other grass
Chorizandra enodis	3	G	Sedge
Leptocarpus sp.	10	G	Forb
**Lotus angustissimus*	0.35	G	Forb
**Aira caryophyllea*	0.3	G	Forb
Patersonia occidentalis	0.3	G	Forb
**Orobanche minor*	0.15	G	Forb
Conostylis aculeata subsp. *aculeata*	0.05	G	Forb
**Hypochaeris glabra*	0.05	G	Forb
**Watsonia meriana* var. *bulbillifera*	0.05	G	Forb
Tricoryne elatior	0.03	G	Forb
**Bellardia trixago*	0.02	G	Forb
**Sonchus oleraceus*	0.02	G	Forb
Microtis media	0.01	G	Forb

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Site name and number	Date	Site type	Observer
ELA03	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
G	Grazing (rabbits) and weeds	>20 years	JsHvXpTSS
Habitat description	Landform unit	Aspect	Slope %
Low Heath	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Light brown to grey	Fine	Light clay	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	402668	6426128

North west

South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Hypocalymma angustifolium	15	M	Shrub, cycad, grass-tree, tree-fern
Kunzea micrantha	4	M	Shrub, cycad, grass-tree, tree-fern
Jacksonia sternbergiana	2.5	M	Shrub, cycad, grass-tree, tree-fern
Verticordia plumosa ?var. *brachyphylla*	1.5	M	Shrub, cycad, grass-tree, tree-fern
Verticordia acerosa	1.4	M	Shrub, cycad, grass-tree, tree-fern
Xanthorrhoea preissii	1	M	Shrub, cycad, grass-tree, tree-fern
Allocasuarina ?microstachya	0.6	M	Shrub, cycad, grass-tree, tree-fern
Hakea ?marginata	0.5	M	Shrub, cycad, grass-tree, tree-fern
Hakea varia	0.5	M	Shrub, cycad, grass-tree, tree-fern
Pericalymma ellipticum	0.5	M	Shrub, cycad, grass-tree, tree-fern
Acacia stenoptera	0.25	M	Shrub, cycad, grass-tree, tree-fern
Banksia dallanneyi	0.25	M	Shrub, cycad, grass-tree, tree-fern
Hakea sulcata	0.25	M	Shrub, cycad, grass-tree, tree-fern
Verticordia densiflora	0.25	M	Shrub, cycad, grass-tree, tree-fern
Leucopogon sp.	0.1	M	Shrub, cycad, grass-tree, tree-fern
Gompholobium marginatum	0.05	M	Shrub, cycad, grass-tree, tree-fern
Rhamnaceae sp.	0.05	M	Shrub, cycad, grass-tree, tree-fern
Pimelea imbricata	0.02	M	Shrub, cycad, grass-tree, tree-fern
**Ehrharta calycina*	2.5	G	Other grass
**Briza maxima*	1.5	G	Other grass
**Briza minor*	0.5	G	Other grass
Neurachne alopecuroidea	0.3	G	Other grass
Lepidosperma sp.	0.6	G	Sedge

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Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Mesomelaena tetragona	0.5	G	Sedge
Lepidosperma squamatum	0.3	G	Sedge
Schoenus ?bifidus	0.2	G	Sedge
Cyathochaeta avenacea	0.1	G	Sedge
Isolepis marginata	0.01	G	Sedge
Desmocladus flexuosus	6	G	Forb
Dampiera linearis	0.5	G	Forb
**Watsonia meriana* var. *bulbillifera*	0.2	G	Forb
Opercularia vaginata	0.15	G	Forb
Desmocladus fasciculatus	0.1	G	Forb
Leptocarpus sp.	0.1	G	Forb
Tricoryne elatior	0.02	G	Forb
**Cicendia filiformis*	0.01	G	Forb
Drosera ?platystigma	0.01	G	Forb
**Vulpia myuros*	0.01	G	Forb
Cassytha sp.	0.1	G	Vine

Site name and number	Date	Site type	Observer
ELA04	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
G	Weeds and refuse	>20 years	MsspHvXpTS
Habitat description	Landform unit	Aspect	Slope %
Melaleuca shrubland over weeds	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Dark grey	Fine to Medium	Sandy Loam with clay elements	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	402742	6426093

North west

South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Corymbia calophylla	4	U	Tree, palm
Callitris pyramidalis	1	U	Tree, palm
Calothamnus hirsutus	25	M	Shrub, cycad, grass-tree, tree-fern
Melaleuca incana	15	M	Shrub, cycad, grass-tree, tree-fern
Melaleuca osullivanii	10	M	Shrub, cycad, grass-tree, tree-fern
Myrtaceae sp.	5	M	Shrub, cycad, grass-tree, tree-fern
Melaleuca viminea	4	M	Shrub, cycad, grass-tree, tree-fern
Hakea varia	2	M	Shrub, cycad, grass-tree, tree-fern
Xanthorrhoea preissii	2	M	Shrub, cycad, grass-tree, tree-fern
Verticordia acerosa	0.4	M	Shrub, cycad, grass-tree, tree-fern
Hypocalymma angustifolium	0.3	M	Shrub, cycad, grass-tree, tree-fern
Banksia dallanneyi	0.08	M	Shrub, cycad, grass-tree, tree-fern
**Ehrharta calycina*	1.2	G	Other grass
**Briza minor*	0.4	G	Other grass
**Briza maxima*	0.25	G	Other grass
**Ehrharta longiflora*	0.05	G	Other grass
Neurachne alopecuroidea	0.01	G	Other grass
Mesomelaena tetragona	0.25	G	Sedge
Chorizandra enodis	0.02	G	Sedge
**Aira caryophyllea*	0.15	G	Forb
**Watsonia meriana* var. *bulbillifera*	0.15	G	Forb
Patersonia occidentalis	0.1	G	Forb
**Hypochaeris glabra*	0.01	G	Forb
Microtis media	0.01	G	Forb
**Sonchus oleraceus*	0.01	G	Forb
Cassytha sp.	0.02	G	Vine

Site name and number	Date	Site type	Observer
ELA05	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
G	Weeds	>20 years	JsHvXpTSS
Habitat description	Landform unit	Aspect	Slope %
Low Heath	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Light brown to grey	Fine	Light clay	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	402815	6426113

North west

South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Allocasuarina ?microstachya	5	M	Shrub, cycad, grass-tree, tree-fern
Hakea varia	5	M	Shrub, cycad, grass-tree, tree-fern
Hypocalymma angustifolium	3.5	M	Shrub, cycad, grass-tree, tree-fern
Banksia bipinnatifida	2	M	Shrub, cycad, grass-tree, tree-fern
Hakea ?marginata	2	M	Shrub, cycad, grass-tree, tree-fern
Petrophile brevifolia	2	M	Shrub, cycad, grass-tree, tree-fern
Hakea prostrata	1	M	Shrub, cycad, grass-tree, tree-fern
Daviesia incrassata	0.5	M	Shrub, cycad, grass-tree, tree-fern
Jacksonia sternbergiana	0.5	M	Shrub, cycad, grass-tree, tree-fern
Verticordia plumosa ?var. *brachyphylla*	0.5	M	Shrub, cycad, grass-tree, tree-fern
Banksia dallanneyi	0.4	M	Shrub, cycad, grass-tree, tree-fern
Stirlingia latifolia	0.4	M	Shrub, cycad, grass-tree, tree-fern
Acacia stenoptera	0.3	M	Shrub, cycad, grass-tree, tree-fern
Synaphea petiolaris	0.3	M	Shrub, cycad, grass-tree, tree-fern
Lysinema pentapetalum	0.25	M	Shrub, cycad, grass-tree, tree-fern
Rhamnaceae sp.	0.25	M	Shrub, cycad, grass-tree, tree-fern
Verticordia acerosa	0.25	M	Shrub, cycad, grass-tree, tree-fern
Kunzea micrantha	0.05	M	Shrub, cycad, grass-tree, tree-fern
Verticordia densiflora	0.05	M	Shrub, cycad, grass-tree, tree-fern
**Ehrharta calycina*	2	G	Other grass
**Briza maxima*	0.3	G	Other grass
**Briza minor*	0.15	G	Other grass
**Avena barbata*	0.02	G	Other grass

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Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Mesomelaena tetragona	0.4	G	Sedge
Lepidosperma sp.	0.2	G	Sedge
Desmocladus flexuosus	15	G	Forb
Lyginia barbata	2	G	Forb
**Watsonia meriana* var. *bulbillifera*	0.5	G	Forb
Conostylis aculeata subsp. *aculeata*	0.1	G	Forb
Dampiera linearis	0.08	G	Forb
Haemodorum spicatum	0.02	G	Forb
**Moraea flaccida*	0.02	G	Forb
Stylidium repens	0.01	G	Forb
Tricoryne elatior	0.01	G	Forb
**Ursinia anthemoides*	0.01	G	Forb
**Wahlenbergia capensis*	0.01	G	Forb
Cassytha sp.	0.03	G	Vine

Site name and number	Date	Site type	Observer
ELA06	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
G	Weeds	>20 years	JsHvXpTSS
Habitat description	Landform unit	Aspect	Slope %
Low Heath	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Light brown	Medium to coarse	Light clay	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	402950	6426092

North west

South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Xanthorrhoea preissii	5	M	Shrub, cycad, grass-tree, tree-fern
Verticordia plumosa ?var. *brachyphylla*	4	M	Shrub, cycad, grass-tree, tree-fern
Jacksonia sternbergiana	2	M	Shrub, cycad, grass-tree, tree-fern
Stirlingia latifolia	1.5	M	Shrub, cycad, grass-tree, tree-fern
Kingia australis	0.5	M	Shrub, cycad, grass-tree, tree-fern
Acacia stenoptera	0.4	M	Shrub, cycad, grass-tree, tree-fern
Banksia dallanneyi	0.35	M	Shrub, cycad, grass-tree, tree-fern
Synaphea sp. Serpentine (T)	0.1	M	Shrub, cycad, grass-tree, tree-fern
**Gomphocarpus fruticosus*	0.02	M	Shrub, cycad, grass-tree, tree-fern
**Ehrharta calycina*	2.5	G	Other grass
**Briza maxima*	1.5	G	Other grass
**Briza minor*	0.5	G	Other grass
Neurachne alopecuroidea	0.2	G	Other grass
Austrostipa compressa	0.1	G	Other grass
Mesomelaena tetragona	4	G	Sedge
Cyathochaeta avenacea	0.3	G	Sedge
Conostylis aculeata subsp. *aculeata*	0.25	G	Forb
**Ursinia anthemoides*	0.25	G	Forb
Dampiera linearis	0.1	G	Forb
**Moraea flaccida*	0.1	G	Forb
Stylidium calcaratum	0.1	G	Forb
**Hypochaeris glabra*	0.08	G	Forb
**Lotus angustissimus*	0.05	G	Forb
**Orobanche minor*	0.05	G	Forb
**Monopsis debilis*	0.03	G	Forb
Haemodorum spicatum	0.02	G	Forb
**Romulea rosea*	0.02	G	Forb
**Sonchus oleraceus*	0.02	G	Forb
**Lysimachia arvensis*	0.01	G	Forb

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Pterochaeta paniculata	0.01	G	Forb
Tricoryne elatior	0.01	G	Forb

Site name and number	Date	Site type	Observer
ELA07	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
G	Weeds and refuse	>20 years	CcTW
Habitat description	Landform unit	Aspect	Slope %
Marri woodland	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Grey	Fine to Medium	Sandy loam with clay elements & deep leaf litter layer	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	403470	6426029

North west

South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Corymbia calophylla	20	U	Tree, palm
Xanthorrhoea preissii	2.5	M	Shrub, cycad, grass-tree, tree-fern
Kingia australis	1	M	Shrub, cycad, grass-tree, tree-fern
Acacia saligna	0.5	M	Shrub, cycad, grass-tree, tree-fern
Gompholobium marginatum	0.15	M	Shrub, cycad, grass-tree, tree-fern
**Ehrharta calycina*	2.5	G	Other grass
**Briza minor*	0.25	G	Other grass
**Eragrostis curvula*	0.2	G	Other grass
Mesomelaena tetragona	10	G	Sedge
Cyathochaeta avenacea	2	G	Sedge
Lepidosperma pubisquameum	1.5	G	Sedge
Lepidosperma squamatum	0.25	G	Sedge
Lepidosperma sp.	0.2	G	Sedge
Dampiera linearis	0.4	G	Forb
Caesia micrantha	0.3	G	Forb
Dasypogon bromeliifolius	0.3	G	Forb
Microtis media	0.3	G	Forb
**Ursinia anthemoides*	0.3	G	Forb
**Moraea flaccida*	0.25	G	Forb
Tricoryne elatior	0.25	G	Forb
Conostylis aculeata subsp. *aculeata*	0.15	G	Forb
**Watsonia meriana* var. *bulbillifera*	0.15	G	Forb
Opercularia echinocephala	0.1	G	Forb
Burchardia congesta	0.05	G	Forb
**Orobanche minor*	0.05	G	Forb
**Sonchus oleraceus*	0.05	G	Forb

Site name and number	Date	Site type	Observer
ELA08	15/11/2018	Quadrat 10 x 10 m	JC/JM
Vegetation condition	Disturbance notes	Age since fire	Vegetation type
G	Weeds	>20 years	CcTW
Habitat description	Landform unit	Aspect	Slope %
Marri woodland	Flat	n/a	0
Soil colour	Soil texture	Soil type	Soil condition
Brown to dark grey	Medium	Sandy loam to loam with deep leaf litter layer	Dry
Rock type	Outcropping %	Easting	Northing
n/a	0	403204	6426058

North west

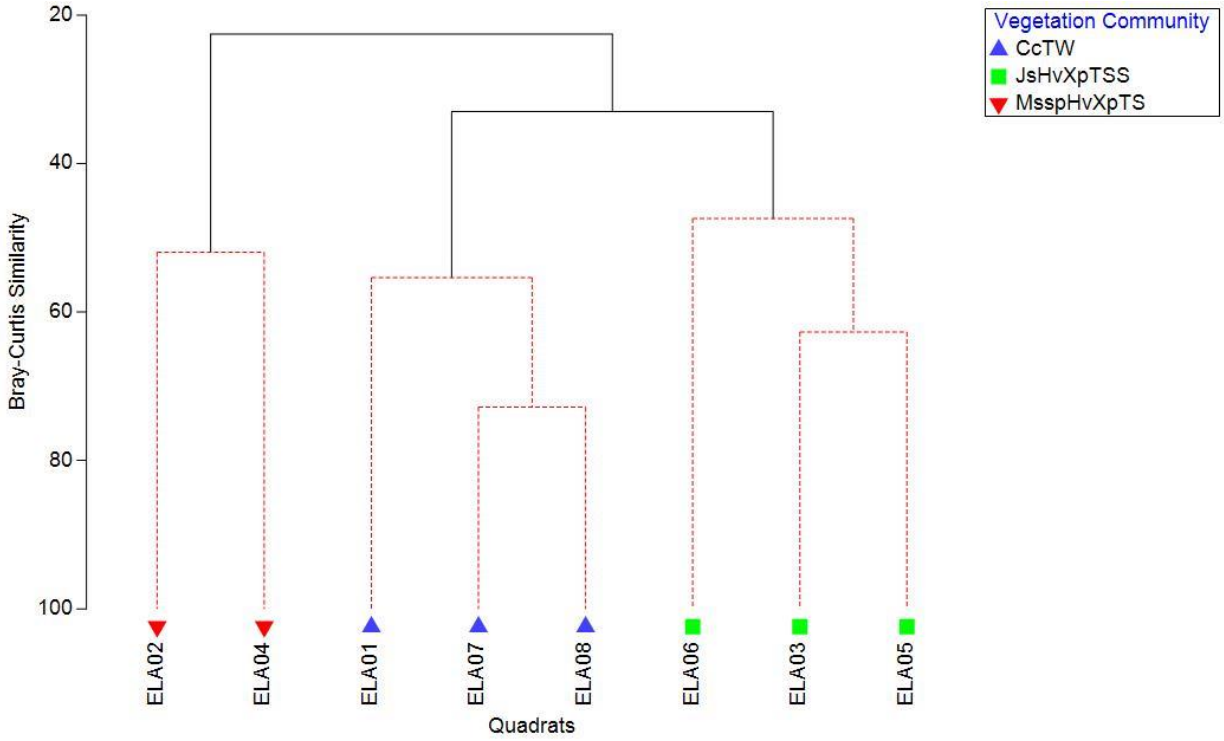
South west

South east

North east

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-Stratum
Corymbia calophylla	25	U	Tree, palm
Melaleuca preissiana	10	M	Shrub, cycad, grass-tree, tree-fern
Jacksonia sternbergiana	1	M	Shrub, cycad, grass-tree, tree-fern
Kingia australis	0.5	M	Shrub, cycad, grass-tree, tree-fern
Stirlingia latifolia	0.5	M	Shrub, cycad, grass-tree, tree-fern
**Solanum nigrum*	0.01	M	Shrub, cycad, grass-tree, tree-fern
**Briza maxima*	1.5	G	Other grass
**Ehrharta calycina*	1.2	G	Other grass
**Briza minor*	0.15	G	Other grass
**Ehrharta longiflora*	0.15	G	Other grass
**Avena barbata*	0.05	G	Other grass
Neurachne alopecuroidea	0.01	G	Other grass
Mesomelaena tetragona	5.5	G	Sedge
Cyathochaeta avenacea	1.4	G	Sedge
Lepidosperma pubisquameum	0.2	G	Sedge
Lepidosperma squamatum	0.1	G	Sedge
Tricostularia neesii	0.1	G	Sedge
Caesia micrantha	0.12	G	Forb
Conostylis aculeata subsp. *aculeata*	0.1	G	Forb
Microtis media	0.08	G	Forb
**Moraea flaccida*	0.05	G	Forb
Tricoryne elatior	0.05	G	Forb
**Oxalis pes-caprae*	0.02	G	Forb
**Hypochaeris glabra*	0.01	G	Forb

Appendix H Hierarchical clustering dendrogram


Vegetation Community
CcTW
JsHvXpTSS
MsspHvXpTS
Bray-Curtis Similarity
20
40
60
80
100
ELA02
ELA04
ELA01
ELA07
ELA08
ELA06
ELA03
ELA05
Quadrats

Appendix I Threatened Flora Locations

Species[1]	PCG 94[#]		MGA 50[#]		AHD[#]	Number of plants[2]
	mE	mN	mE	mN	RL	
Synaphea sp. Pinjarra Plain (A.S. George 17182) (T)	63957.823	225157.536	402540.137	6426123.321	23.041	1
	63973.789	225151.17	402556.168	6426117.133	23.141	1
	64357.454	225115.434	402940.095	6426085.643	25.406	1
	64368.475	225101.729	402951.264	6426072.064	25.587	8
	64369.658	225103.26	402952.429	6426073.608	25.555	2
	64371.349	225103.819	402954.114	6426074.185	25.599	1
	64372.812	225105.107	402955.562	6426075.489	25.613	7
	64370.731	225104.323	402953.49	6426074.682	25.664	1
	64375.649	225110.997	402958.333	6426081.408	25.741	2
	64381.62	225110.688	402964.305	6426081.165	25.775	1
	64383.288	225111.004	402965.969	6426081.499	25.764	1
	64381.371	225101.894	402964.153	6426072.371	25.679	1
	64386.437	225101.429	402969.223	6426071.962	25.687	1
	64391.243	225100.115	402974.042	6426070.702	25.754	2
	64392.154	225099.363	402974.961	6426069.96	25.714	1
	64394.145	225098.709	402976.958	6426069.328	25.753	3
	64394.079	225113.675	402976.727	6426084.288	25.686	1
Synaphea sp. Serpentine (G.R. Brand 103) (T)	64393.043	225117.216	402975.652	6426087.817	25.738	1
	64392.559	225118.604	402975.153	6426089.199	25.724	1
	64397.077	225115.424	402979.705	6426086.07	25.838	2
	64399.11	225116.809	402981.722	6426087.477	25.864	1
	64400.848	225116.668	402983.461	6426087.355	25.856	4
	64402.348	225117.505	402984.951	6426088.208	25.866	2
	64402.406	225120.023	402984.981	6426090.726	25.869	1
	64399.911	225102.548	402982.68	6426073.23	25.853	1
	64398.432	225098.804	402981.243	6426069.471	25.771	1
	64400.414	225097.069	402983.243	6426067.758	25.833	1
	64401.208	225096.938	402984.038	6426067.636	25.857	1
	64401.665	225097.931	402984.484	6426068.634	25.868	1
	64402.999	225095.887	402985.84	6426066.605	25.861	1
	64402.64	225095.287	402985.488	6426066.001	25.864	1
	64407.3	225096.117	402990.137	6426066.882	25.976	1
	64408.504	225095.949	402991.343	6426066.728	25.983	1

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Species[1]	PCG 94[#]		MGA 50[#]		AHD[#]	Number of plants[2]
	mE	mN	mE	mN	RL	
	64409.375	225098.884	402992.181	6426069.671	25.917	1
	64409.356	225107.553	402992.066	6426078.337	26.014	1
	64411.239	225108.291	402993.94	6426079.096	25.945	1
	64407.376	225109.222	402990.069	6426079.984	25.809	1
	64405.968	225109.942	402988.653	6426080.688	25.73	1
	64413.05	225100.736	402995.834	6426071.563	26.029	1
	64413.183	225098.767	402995.989	6426069.596	25.972	2
	64414.092	225097.499	402996.912	6426068.339	25.994	1
	64417.442	225097.088	403000.265	6426067.965	25.997	1
	64417.398	225098.822	403000.202	6426069.698	26.053	1
	64417.825	225099.191	403000.625	6426070.071	26.069	1
	64417.446	225100.42	403000.232	6426071.296	26.017	2
	64418.849	225095.225	403001.692	6426066.118	26.013	1
	64421.453	225097.012	403004.275	6426067.933	26.047	1
	64423.67	225099.673	403006.462	6426070.618	26.075	3
	64424.694	225100.094	403007.481	6426071.05	26.017	1
	64425.104	225102.033	403007.87	6426072.993	25.885	3
	64426.419	225102.75	403009.176	6426073.724	26.082	1
	64423.17	225104.357	403005.911	6426075.295	26.108	1
	64422.335	225103.629	403005.084	6426074.558	26.09	1
	64425.727	225104.662	403008.463	6426075.628	26.202	1
	64424.427	225106.923	403007.139	6426077.874	25.927	1
	64425.287	225107.268	403007.995	6426078.228	25.999	1
	64427.905	225110.695	403010.574	6426081.683	26.156	1
	64428.97	225107.336	403011.676	6426078.336	25.985	1
	64429.401	225106.407	403012.117	6426077.413	26.021	2
	64430.007	225104.876	403012.74	6426075.889	26.325	2
	64430.193	225104.171	403012.933	6426075.186	26.278	1
	64431.489	225103.995	403014.231	6426075.024	26.3	1
	64431.115	225100.65	403013.894	6426071.676	25.793	1
	64429.887	225099.433	403012.68	6426070.446	25.976	1
	64428.862	225099.714	403011.652	6426070.716	25.986	1
	64428.136	225099.965	403010.923	6426070.959	26.051	3
	64427.53	225098.114	403010.338	6426069.102	26.119	1
	64426.427	225098.224	403009.234	6426069.2	26.094	1

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Species[1]	PCG 94[#]		MGA 50[#]		AHD[#]	Number of plants[2]
	mE	mN	mE	mN	RL	
	64425.585	225098.529	403008.389	6426069.495	26.133	1
	64430.27	225096.269	403013.097	6426067.288	26.229	1
	64430.514	225097.849	403013.324	6426068.87	26.114	1
	64430.948	225098.678	403013.749	6426069.703	26.036	1
	64434.519	225099.901	403017.305	6426070.965	25.891	1
	64436.097	225103.547	403018.842	6426074.627	26.297	2
	64437.853	225102.9	403020.605	6426074	26.332	1
	64440.267	225102.361	403023.024	6426073.488	26.345	3
	64438.508	225098.303	403021.31	6426069.412	26.035	1
	64435.946	225093.511	403018.802	6426064.593	26.175	2
	64438.235	225097.594	403021.045	6426068.7	26.158	1
	64437.213	225089.773	403020.11	6426060.871	26.098	1
	64435.35	225090.106	403018.244	6426061.183	26.086	1
	64437.748	225091.743	403020.623	6426062.846	26.283	1
	64444.65	225089.533	403027.547	6426060.713	26.234	1
	64445.358	225089.428	403028.256	6426060.616	26.231	1
	64447.213	225088.854	403030.116	6426060.062	26.206	1
	64442.198	225094.045	403025.046	6426065.196	26.278	1
	64441.268	225093.028	403024.127	6426064.169	26.234	1
	64441.269	225094.683	403024.11	6426065.824	26.286	1
	64440.284	225102.532	403023.039	6426073.659	26.375	1
	64442.366	225098.692	403025.163	6426069.843	26.189	1
	64442.799	225101.303	403025.567	6426072.458	26.386	1
	64443.677	225102.915	403026.427	6426074.079	26.382	1
	64441.877	225104.438	403024.61	6426075.582	26.167	1
	64443.909	225109.106	403026.59	6426080.271	26.334	1
	64444.402	225109.598	403027.078	6426080.768	26.389	1
	64444.636	225111.27	403027.293	6426082.442	26.456	2
	64454.644	225108.437	403037.329	6426079.72	26.373	1
	64449.168	225100.235	403031.945	6426071.461	26.392	1
	64448.561	225099.764	403031.344	6426070.983	26.3	1
	64451.533	225094.844	403034.369	6426066.098	26.36	1
	64452.671	225095.451	403035.5	6426066.717	26.465	1
	64453.144	225092.946	403036	6426064.218	26.381	1
	64457.938	225091.946	403040.804	6426063.271	26.381	1

© ECO LOGICAL AUSTRALIA PTY LTD

Species[1]	PCG 94[#]		MGA 50[#]		AHD[#]	Number of plants[2]
	mE	mN	mE	mN	RL	
	64457.356	225092.461	403040.216	6426063.78	26.427	1
	64459.827	225091.989	403042.691	6426063.335	26.403	1
	64456.766	225094.103	403039.608	6426065.415	26.456	1
	64457.529	225096.821	403040.341	6426068.14	26.4	1
	64458.992	225087.508	403041.906	6426058.847	26.334	22
	64463.242	225087.246	403046.158	6426058.632	26.465	13
	64467.799	225089.226	403050.691	6426060.661	26.529	1
	64467.893	225088.176	403050.797	6426059.613	26.663	1

[1] Species identification confirmed by Western Australian Herbarium (M. Hislop ACC/7860/E).

[2] Multiple records occur within a 2m radius of central point.

[#] Data collected using a differential global positioning system (DGPS).

Appendix J DBCA Threatened and Priority Report Forms for conservation significant species recorded in the survey

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Synaphea sp. Pinjarra Plain (A.S. George 17182) **TPFL Pop. No:**

OBSERVATION DATE: 15/11/2018 **CONSERVATION STATUS:** EN New population ☐

OBSERVER/S: Dr. Jeffry Cargill and Jeni Morris **PHONE:** 08 6218 2200

ROLE: Senior Ecologist / Ecologist **ORGANISATION:** Eco Logical Australia

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Mundijog Road Reserve, located South of Mundijong Road between Pure Steel Lane and Adonis Street in Mundijog, WA.

Reserve No:

DBCA DISTRICT: SCP **LGA:** Shire of Serpentine Jarrahdale Land manager present: ☐

DATUM: GDA94 / MGA94 ☒ AGD84 / AMG84 ☐ WGS84 ☐ Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required) DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 402540

Long / Easting: 6426123

ZONE: 50

METHOD USED: GPS ☐ Differential GPS ☒ Map ☐

No. satellites: ___ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☒

National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐

Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☒ Area observed (m²): 89,000

EFFORT: Time spent surveying (minutes): 480 No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☒ Extrapolation ☐ Estimate ☐ Count method: _____ (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	2			
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. ___ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒

Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☐ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Edge effects Weeds	L	M	M
• Clearing			
•			

Please return completed form to **Species And Communities Branch** DBCA,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☒
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other:
Unclear

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☒
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☒
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other:

SOIL COLOUR:
Red ☐
Brown ☒
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other:
Dark brown

DRAINAGE:
Well drained ☐
Seasonally inundated ☒
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element:
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Jacksonia sternbergiana, Hakea varia and Xanthorrhoea preissii tall sparse shrubland over Hypocalymma angustifolium, Verticordia spp. and Stirlingia latifolia mid open shrubland over Banksia dallanneyi, Acacia stenoptera and Allocasuarina ?microstachya low sparse shrubland and Mesomelaena tetragonophylla, Cyathochaeta avenacea and Desmocladus flexuosus low sparse sedgeland
2.
3.
4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☒ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: Nil evident (>20 years) Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

2 records located at:
mE 402540, mN 6426123
mE 402556; mN6426117

DRF PERMIT/ LICENCE No: Jeff Cargill flora collection licence: SL012435; DRF: 23-1819; Jeni Morris flora collection licence: SL012347; DRF:196-1718 Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

Please return completed form to **Species And Communities Branch** DBCA,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Jeff Cargill Role: Senior Ecologist Signed: _____ Date: 28 / 03 / 19

Please return completed form to **Species And Communities Branch** DBCA,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Synaphea sp. Serpentine (G.R. Brand 103) **TPFL Pop. No:**

OBSERVATION DATE: 15/11/2018 **CONSERVATION STATUS:** EN New population ☐

OBSERVER/S: Dr. Jeffry Cargill and Jeni Morris **PHONE:** 08 6218 2200

ROLE: Senior Ecologist / Ecologist **ORGANISATION:** Eco Logical Australia

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Mundijog Road Reserve, located South of Mundijong Road between Pure Steel Lane and Adonis Street in Mundijog, WA.

Reserve No:

DBCA DISTRICT: SCP **LGA:** Shire of Serpentine Jarrahdale Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 402540
Long / Easting: 6426123
ZONE: 50

METHOD USED:
GPS ☐ Differential GPS ☒ Map ☐
No. satellites: ____ Map used: _____
Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☒
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☒ Area observed (m²): 89,000

EFFORT: Time spent surveying (minutes): 480 No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☒ Extrapolation ☐ Estimate ☐ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	180			180
Dead				

Area of pop (m²): _____
Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. ____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
• Edge effects Weeds	L	M	M
• Clearing			
•			

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☒
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: Unclear

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☒
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☒
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☒
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: Light brown

DRAINAGE:
Well drained ☐
Seasonally inundated ☒
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: Flat
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Jacksonia sternbergiana, Hakea varia and Xanthorrhoea preissii tall sparse shrubland over Hypocalymma angustifolium, Verticordia spp. and Stirlingia latifolia mid open shrubland over Banksia dallanneyi, Acacia stenoptera and Allocasuarina ?microstachya low sparse shrubland and Mesomelaena tetragonophylla, Cyathochaeta avenacea and Desmocladus flexuosus low sparse sedgeland.
2.
3.
4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☒ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: Nil evident (>20 years) Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Additional coordinate locations provided in Word document

DRF PERMIT/ LICENCE No: Jeff Cargill flora collection licence: SL012435; DRF: 23-1819; Jeni Morris flora collection licence: SL012347; DRF:196-1718 Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Jeff Cargill Role: Senior Ecologist Signed: _____ Date: 28 / 03 / 19

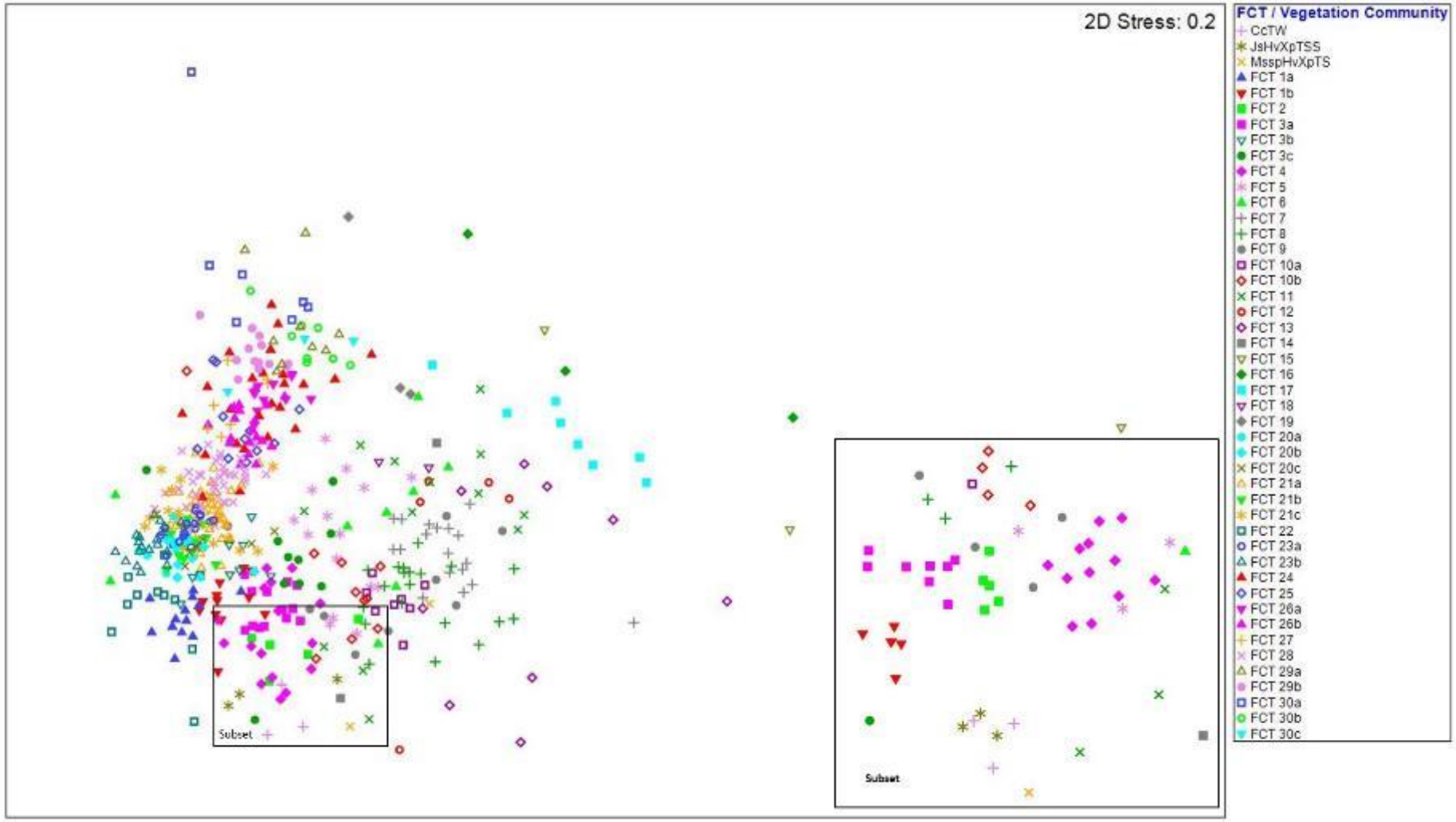
Please return completed form to **Species And Communities Branch** DBCA,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

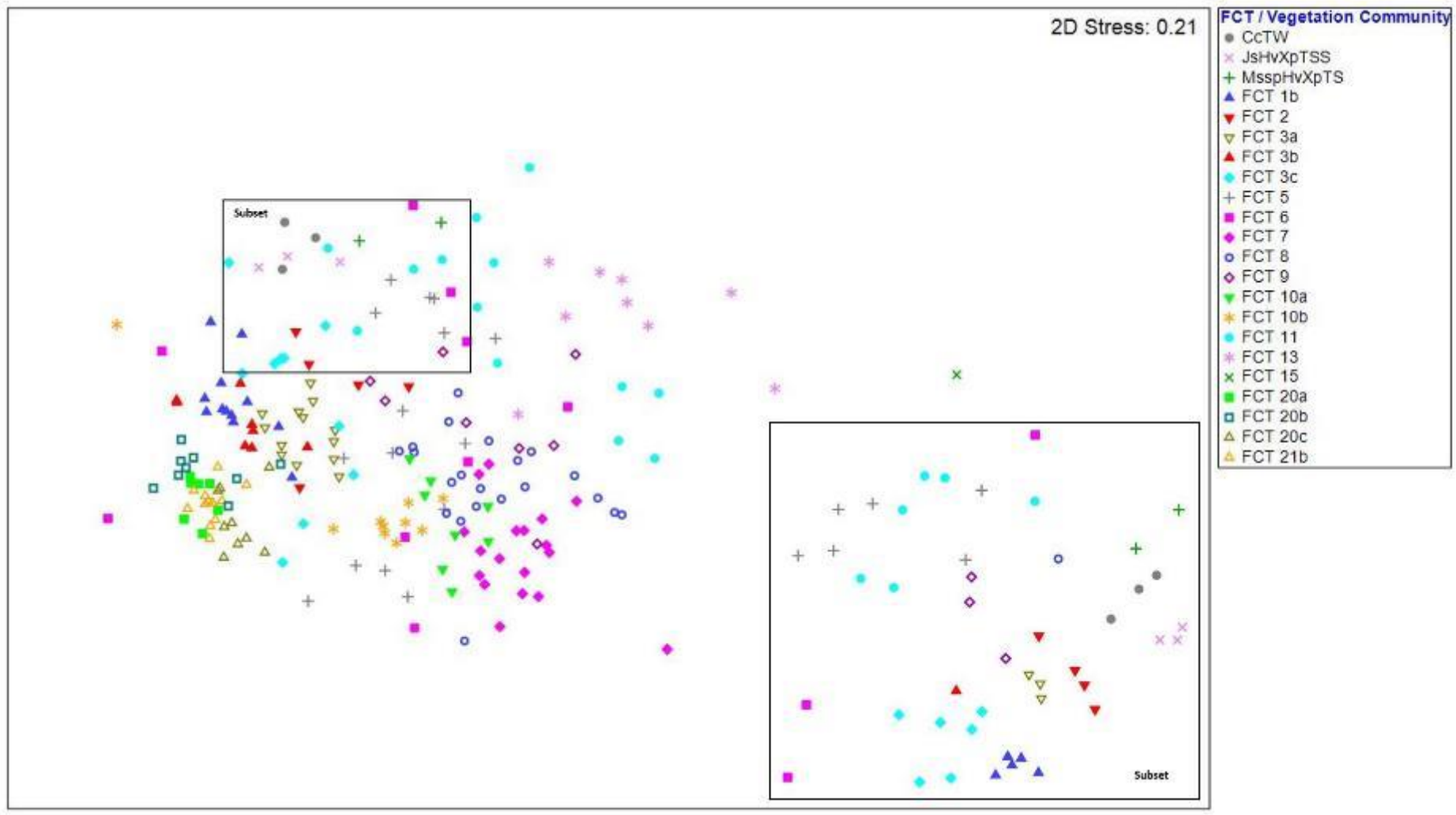
RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Appendix K MDS: Relationships between ELA vegetation communities and Floristic Community Types (FCTs) defined by Gibson et al. (1994)


2D Stress: 0.2
Subset
Subset
FCT / Vegetation Community
CcTW
JsHvXpTSS
MsspHvXpTS
FCT 1a
FCT 1b
FCT 2
FCT 3a
FCT 3b
FCT 3c
FCT 4
FCT 5
FCT 6
FCT 7
FCT 8
FCT 9
FCT 10a
FCT 10b
FCT 11
FCT 12
FCT 13
FCT 14
FCT 15
FCT 16
FCT 17
FCT 18
FCT 19
FCT 20a
FCT 20b
FCT 20c
FCT 21a
FCT 21b
FCT 21c
FCT 22
FCT 23a
FCT 23b
FCT 24
FCT 25
FCT 26a
FCT 26b
FCT 27
FCT 28
FCT 29a
FCT 29b
FCT 30a
FCT 30b
FCT 30c

Appendix L MDS: Relationships between ELA vegetation communities and Pinjarra Landform affiliated Floristic Community Types (FCTs) defined by Gibson et al. (1994)


2D Stress: 0.21
Subset
Subset
FCT / Vegetation Community
CcTW
JsHvXpTSS
MsspHvXpTS
FCT 1b
FCT 2
FCT 3a
FCT 3b
FCT 3c
FCT 5
FCT 6
FCT 7
FCT 8
FCT 9
FCT 10a
FCT 10b
FCT 11
FCT 13
FCT 15
FCT 20a
FCT 20b
FCT 20c
FCT 21b

Appendix M DBCA Threatened and Priority Report Forms for conservation significant communities recorded in the survey

Department of Parks and Wildlife

Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

Version 6.0 July 2013

COMMUNITY: Corymbia calophylla – Kingia australis woodlands on heavy soils, SCP3a TEC **OBSERVATION DATE:** 15 / 11 / 2019

New occurrence ☐ **Site ID:** **CONS STATUS:** EPBC Act EN, BC Act CR

OBSERVER/S: Jeffry Cargill and Jeni Morris **PHONE:** (08) 6218 2200

ROLE: Senior Ecologist and Ecologist **ORGANISATION:** Eco Logical Australia

EMAIL: Jeff.Cargill@ecoaus.com.au; JeniM@ecoaus.com.au

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Mundijong Road Reserve, located South of Mundijong Road between Pure Steel Lane and Adonis Street in Mundijong, WA.

Reserve No:

DISTRICT: SCP **LGA:** Shire of Serpentine Jarrahdale Land manager present: ☐

DATUM:

GDA94 / MGA94 ☑
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)

DecDegrees ☐ DegMinSec ☐ UTMs ☑

Lat / Northing: 403204

Long / Easting: 6426058

Zone: 50

METHOD USED:

GPS ☑ Differential GPS ☐ Map ☐

No. satellites: Map used:

Boundary polygon captured: ☐ Map used:

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☑
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☑ Area observed (m²): 31,700

EFFORT: Time spent surveying (minutes): 240 No. of minutes spent / 100 m²: _____

THREATS - type, and supporting information: e.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents.	**Cause/Agent:** e.g. weed type, grazing species, recreation type	Area affected	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
•Clearing, edge effects, risk of weed invasion	Nearby to tracks, roadside, weeds in adjacent areas	%	L	M	M
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			

*Rate current and potential threat impact: **N=Nil, L=Low, M=Medium, H=High, E=Extreme**

*Estimate time to potential impact: **S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)**

CONDITION OF OCCURRENCE: (Bush Forever Scale) (estimate % of area in each)

Pristine ☐ _____% Very Good ☐ _____% Degraded ☑ 3.5 %

Excellent ☐ _____% Good ☑ 96.5 % Completely Degraded ☐ _____%

Please return form to:

communities.data@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by:_____ *Date entered:*_____ *Database no:*_____

Department of Parks and Wildlife

Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

Version 6.0 July 2013

RECOMMENDED MANAGEMENT ACTIONS: e.g. roadside markers, weed control, etc.

ACTIONS IMPLEMENTED (include date):

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
Hill ☐	Dolerite ☐		Sandy loam ☑	Brown ☑	Seasonally inundated ☑
Ridge ☐	Laterite ☐		Loam ☐	Yellow ☐	
Outcrop ☐	Ironstone ☐	0-10% ☑	Clay loam ☐	White ☐	Permanently inundated ☐
Slope ☐	Limestone ☐	10-30% ☐	Light clay ☐	Grey ☐	Tidal ☐
Flat ☑	Quartz ☐	30-50% ☐	Peat ☐	Black ☐	
Open depression ☐		50-100% ☐			
Drainage line ☐	Specify other:		Specify other:	Specify other:	Specify other:
Closed depression ☐	Unknown			Light brown	
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

flat

CONDITION OF SOIL:

Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:	
	1. Corymbia calophylla tall woodland over Kingia australis and Melaleuca preissiana mid open woodland over Xanthorrhoea preissii and Jacksonia sternbergiana mid sparse shrubland over Mesomelaena tetragona, Cyathochaeta avenacea and Lepidosperma pubisquameum low open sedgeland and *Ehrharta spp., *Avena barbata, *Briza spp. low sparse grassland.
	2.
	3.
	4.

FIRE HISTORY:

Last Fire: Season/Month: Year: **Fire Intensity:** High ☐ Medium ☐ Low ☐ No evidence of fire ☑

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or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

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Department of Parks and Wildlife

Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

Version 6.0 July 2013

Actual Occurrence Landuse: Road reserve

Adjacent Landuse: Private farmland

Associated Flora Species:

Associated Fauna Species:

OTHER COMMENTS:

ATTACHED: Map ☑ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐

Other:

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: _____ **Role:** _____

Signature: **Date submitted:**

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Department of Parks and Wildlife

Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

Version 6.0 July 2013

COMMUNITY: SCP08 - Herb rich shrublands in clay pans TEC **OBSERVATION DATE:** 15 / 11 / 2019

New occurrence ☐ **Site ID:** **CONS STATUS:** EPBC Act CR, BC Act VU

OBSERVER/S: Jeffry Cargill and Jeni Morris **PHONE:** (08) 6218 2200

ROLE: Senior Ecologist and Ecologist **ORGANISATION:** Eco Logical Australia

EMAIL: Jeff.Cargill@ecoaus.com.au; JeniM@ecoaus.com.au

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Mundijong Road Reserve, located South of Mundijong Road between Pure Steel Lane and Adonis Street in Mundijong, WA.

Reserve No:

DISTRICT: SCP **LGA:** Shire of Serpentine Jarrahdale Land manager present: ☐

DATUM:

GDA94 / MGA94 ☑
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)

DecDegrees ☐ DegMinSec ☐ UTMs ☑

Lat / Northing: 402950

Long / Easting: 6426092

Zone: 50

METHOD USED:

GPS ☑ Differential GPS ☐ Map ☐

No. satellites: Map used:

Boundary polygon captured: ☐ Map used:

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☑
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☑ Area observed (m²): 26,500

EFFORT: Time spent surveying (minutes): 200 No. of minutes spent / 100 m²: _____

THREATS - type, and supporting information: e.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents.	**Cause/Agent:** e.g. weed type, grazing species, recreation type	Area affected	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
• Clearing, edge effects, risk of weed invasion	Nearby to tracks, roadside, weeds in adjacent areas	%	L	M	M
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			
•		%			

*Rate current and potential threat impact: **N=Nil, L=Low, M=Medium, H=High, E=Extreme**

*Estimate time to potential impact: **S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)**

CONDITION OF OCCURRENCE: (Bush Forever Scale) (estimate % of area in each)

Pristine ☐ _____% Very Good ☐ _____% Degraded ☑ 40.8 %

Excellent ☐ _____% Good ☑ 59.2 % Completely Degraded ☐ _____%

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Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

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RECOMMENDED MANAGEMENT ACTIONS: e.g. roadside markers, weed control, etc.

ACTIONS IMPLEMENTED (include date):

HABITAT INFORMATION: (Check more than one box for combinations or where necessary)

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest ☐	Granite ☐	(on soil surface; e.g. gravel, quartz fields)	Sand ☐	Red ☐	Well drained ☐
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Ridge ☐	Laterite ☐	0-10% ☑	Loam ☐	Yellow ☐	
Outcrop ☐	Ironstone ☐	10-30% ☐	Clay loam ☐	White ☐	Permanently inundated ☐
Slope ☐	Limestone ☐	30-50% ☐	Light clay ☑	Grey ☑	Tidal ☐
Flat ☑	Quartz ☐	50-100% ☐	Peat ☐	Black ☐	
Open depression ☐					
Drainage line ☐	Specify other:		Specify other:	Specify other:	Specify other:
Closed depression ☐	Unknown		Fine	Light-brown to grey	
Wetland ☐					

Specific Landform Element: (Refer to field manual for additional values)

Flat

CONDITION OF SOIL:

Dry ☑ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:

VEGETATION CLASSIFICATION:	1. Jacksonia sternbergiana, Hakea varia and Xanthorrhoea preissii tall sparse shrubland over Hypocalymma angustifolium, Verticordia spp. and Stirlingia latifolia mid open shrubland over Banksia dallanneyi, Acacia stenoptera and Allocasuarina ?microstachya low sparse shrubland and Mesomelaena tetragonophylla, Cyathochaeta avenacea and Desmocladus flexuosus low sparse sedgeland.
	2.
	3.
	4.

FIRE HISTORY:

Last Fire: Season/Month: Year: **Fire Intensity:** High ☐ Medium ☐ Low ☐ No evidence of fire ☑

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Signature: **Date submitted:**

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