NORSEMAN GOLD PROJECT

Supporting Document

Native Vegetation Clearing Permit (Purpose Permit) Application - Assessment of Clearing Principles

Desirables: M63/156

Prepared by:

Pantoro South Pty Ltd

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Revision Summary

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20 February 2024	Version 1.0	Norseman Gold Project Supporting Document – Native Vegetation Clearing Permit (Purpose Permit) Application - Assessment of Clearing Principles Desirables: M63/156

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1. INTRODUCTION

1.1 Project Background

This document has been prepared in support of a Native Vegetation Clearing Permit (NVCP) (Purpose Permit) application for the development of the Desirables Project (Desirables M63/156). Desirables is located approximately 2 km northwest of Slippers and 1.5 km southwest of Harlequin. There is no existing mine or infrastructure at Desirables, only mine access roads. Access to Desirables is via the Eyre Highway, Slippers M63/156) and along mine access roads. The Desirables Project (M63/156) form part of the larger Norseman Gold Project (NGP) which is operated and managed by Pantoro South Pty Ltd (Pantoro) with tenements held by Central Norseman Gold Corporation Pty Ltd (CNGC).

The location, key mine infrastructure and associated Mining Proposal details regarding Desirables is provided in Table 1. This NVCP application requests approval to clear a combined total of 18.1 ha of native vegetation within a PPA of 918.7 ha.

Table 1: NVCP Application - Project Areas

Project Area	Tenement(s)	Location Description	Figure(s)	Key Mine Infrastructure	Mining Proposal, Registration ID (status as of February 2022)
Desirables	M63/156	Located approximately 6 km north-north-east of the town of Norseman, east of Lake Cowan.	Figure 1	Proposed: • Mining of open pit. • Construction of waste rock dump. • Construction of ROM. • Construction of supporting infrastructure.	• Reg ID: 50013 Version 6.0 submitted to DMIRS for assessment on 24 January 2025 (approval pending).

1.2 Proponent

The NGP is solely operated and managed by Pantoro South Pty Ltd (Pantoro), a wholly owned subsidiary of Pantoro Limited. Pantoro Limited listed on the Australian Stock Exchange (ASX: PNR). Tenements are held by Central Norseman Gold Corporation Pty Ltd (CNGC) under a 50/50 unincorporated Joint Venture (JV) agreement (Appendix 1).

All compliance and regulatory requirements regarding this assessment should be forwarded by email, post or courier to the following address:

Proponent: Pantoro South Pty Ltd
Level 2, 46 Ventnor Avenue
West Perth WA 6005

Contact: Karen de Roer
Title: Environment and Approvals Manager
Company: Pantoro South Pty Ltd
Phone: (08) 6263 1110
E-mail: admin@pantoro.com.au

1.3 Location, Access and Tenure

The NGP is located approximately 725 km east of Perth, 200 km south of Kalgoorlie-Boulder, and 200 km north of Esperance within the Shire of Dundas and Goldfields-Esperance region of Western Australia (Figure 1). It is situated adjacent to the historic mining town of Norseman within the Eastern Goldfields of Western Australia.

The NGP is accessed via the main public route of Coolgardie-Esperance highway. Access to various NGP tenements is via existing well defined bitumised highways/roads and gravel roads.

Desirables is situated on M63/156 approximately 8 km north-north-east of the town of Norseman and about 1.5 km west of the eastern shore of Lake Cowan. Desirables shares a tenement (M63/156) with Slippers, located about 1.5 km south-east, and North Royal, located about 1.5 km north-east. Access to the site is via the Eyre Highway, Slippers M63/156) and along mine access roads.

Figure 1: Location Plan

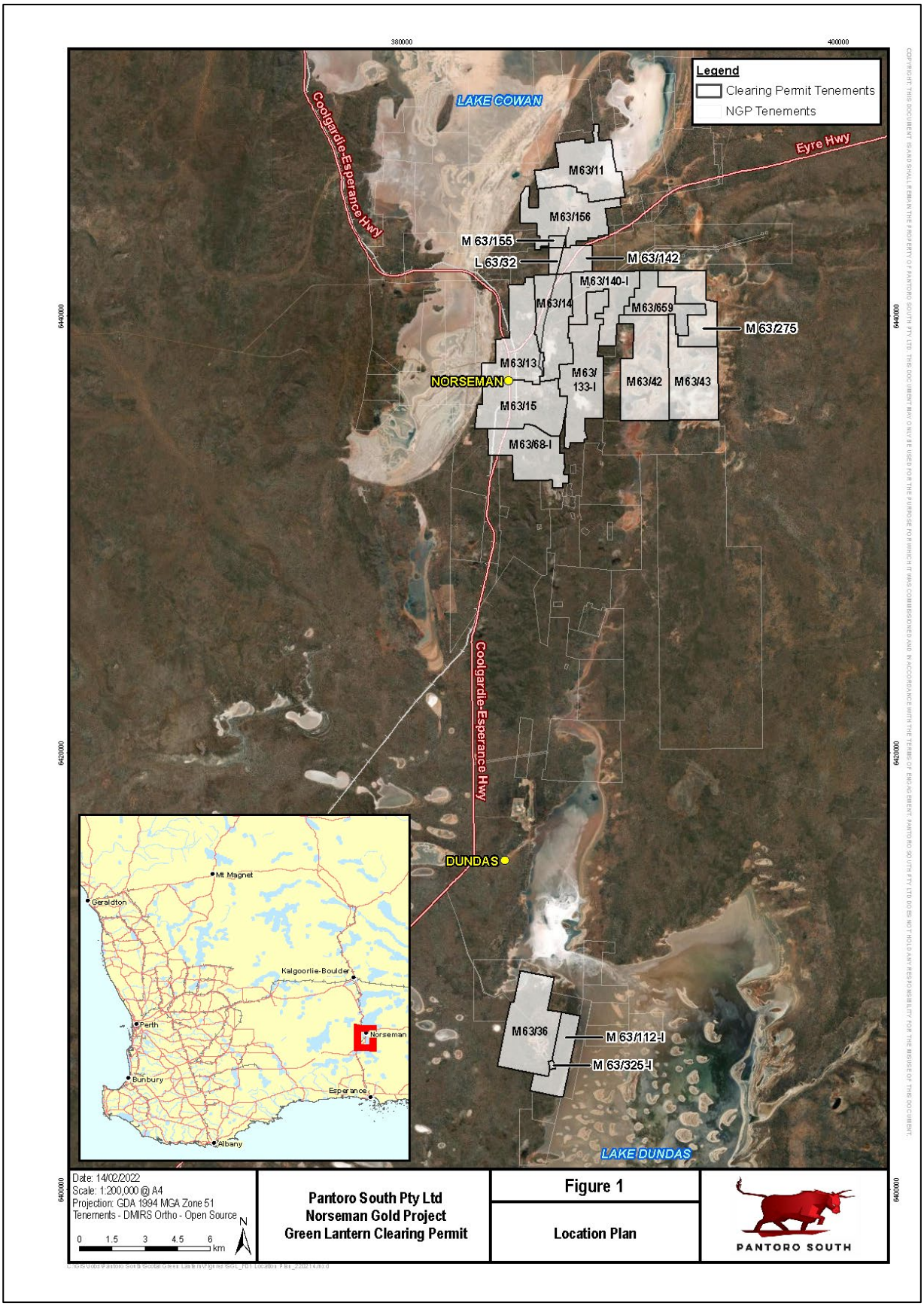

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Figure 2: Site Layout – Desirables

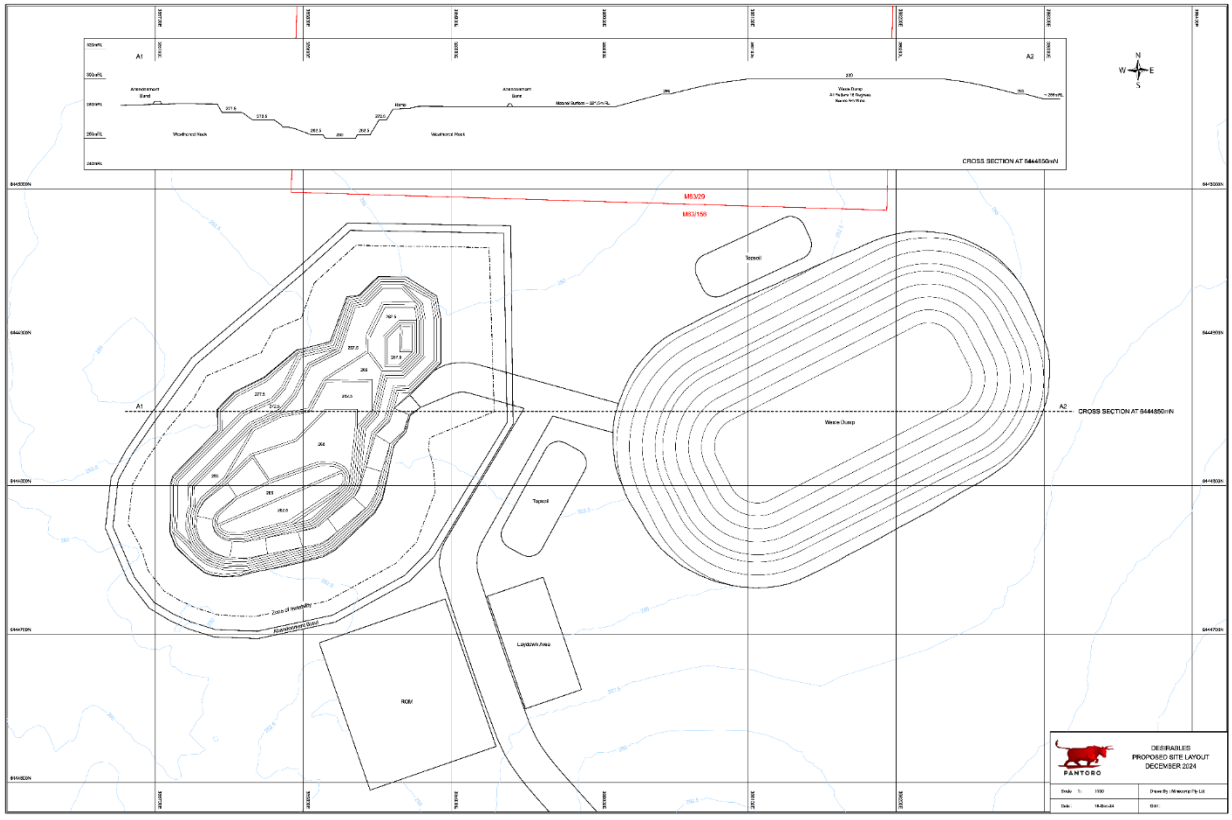
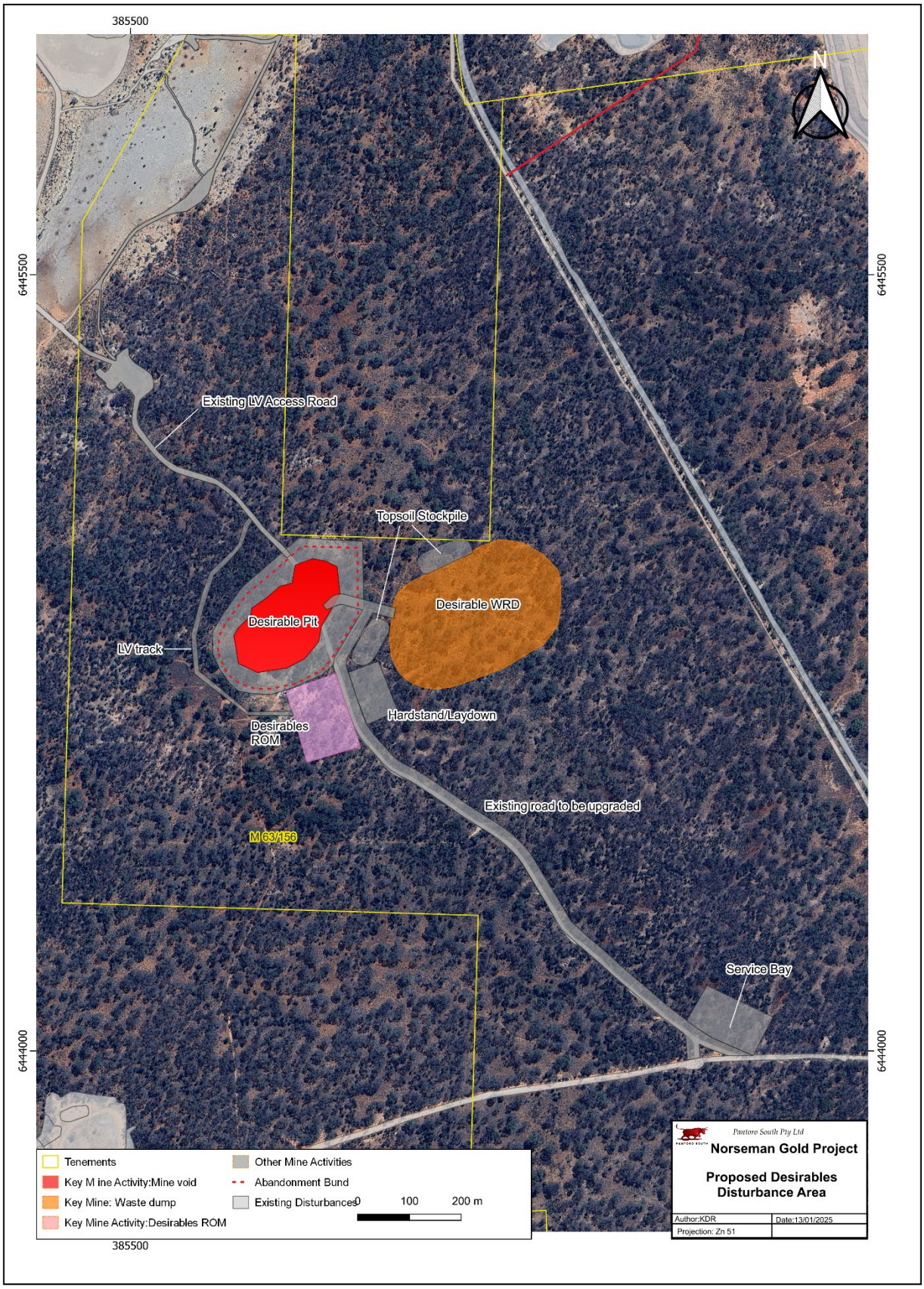


Figure 3: Proposed Disturbance Area – Desirables



2. EXISTING ENVIRONMENT

2.1 Landscape

The NGP area lies within the Coolgardie Botanical District of the Southwestern Interzone (Beard 1990). The vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area located within the 'Coolgardie 3 – Eastern Goldfields Subregion' of the Coolgardie Bioregion (Cowan 2001). The 'Coolgardie 3 Subregion' is rich in endemic *Acacia* spp. and the vegetation of the area is described as mallees, *Acacia* thickets and shrub heaths on sandplains. Diverse Eucalyptus woodlands occur on ranges, in valleys and around salt lakes. Salt lakes support dwarf shrublands of samphire (Cowan 2001).

Beard (1990) described the vegetation of the Coolgardie Botanical District as predominantly Eucalypt woodland, becoming open and with saltbush-bluebush understorey on calcareous soils. *Allocasuarina* thickets and scrub-heath occur on sandplains and there are patches of shrub steppe adjoining the Great Victoria Desert (Beard 1990).

The topography is of gently undulating plains, interrupted by occasional ranges of low hills and ridges of Archaean greenstones, playa lakes and sandplains in the west. A horst of Proterozoic basic granulite interrupts the undulating plains to the east (Beard 1990, Cowan 2001).

There is a regional slope from north-west to south-east and there are a chain of hills in the north west of the area near Norseman and altitudes in this area vary from 250 m to 350 m above sea level (Hall and McKenzie 1993). The area around Norseman town and the mine administration area is generally flat with slopes less than 5%.

The area directly east of the administration area and processing plant has slopes of around 20% in the vicinity of the Beacon Lookout. In the northern tenements around North Royal and Harlequin mines, slopes are around 2% to 6%. In the southern tenements (which includes Scotia and Green Lantern), slopes are up to 25% around Scotia/Green Lantern and around 18% at Maybell mine (Landgate 2017).

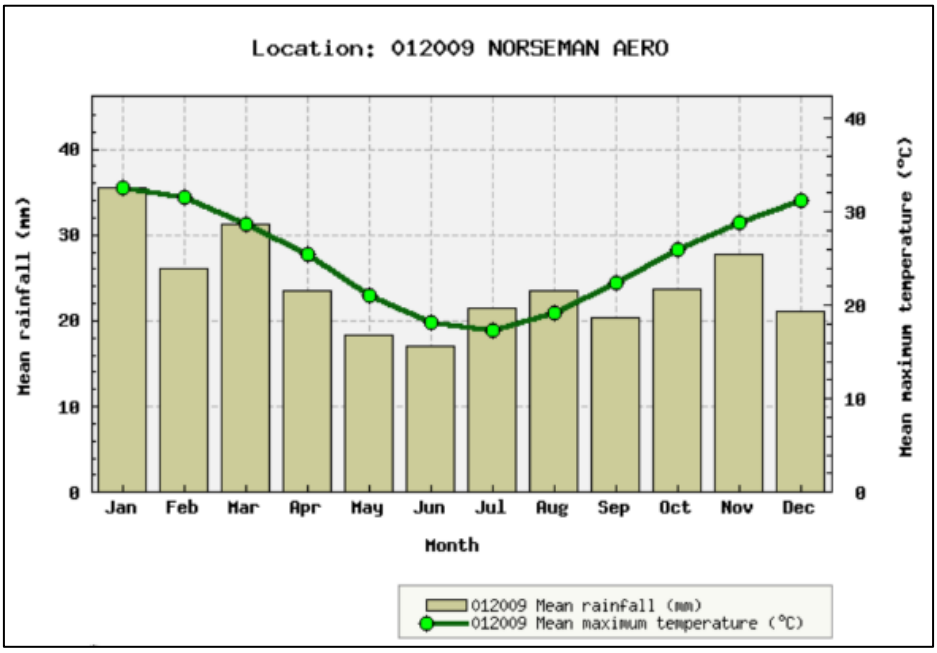
The dominant salt lakes in the Norseman area are Lake Dundas and Lake Cowan of which Lake Cowan is a wetland of sub regional significance. These endorheic salt lakes drain a combined catchment area of about of 15,225 km^2, with Lake Cowan having a surface area of some 970 km^2 with few islands and Lake Dundas having a surface area of about 280 km^2.

2.2 Climate

The climate of the NGP is characterised as an arid non-seasonal to semi-arid Mediterranean climate with hot dry summers and mild winters. The closest active Bureau of Meteorology (BoM) weather station is Norseman Aero (site number 012009, commencing data collection in 1999 at an elevation of 262 m). This station reports an annual average rainfall of 293.7 mm (BoM 2020). The highest rainfall typically occurs during January (35.5 mm) with summer thunderstorms and the lowest rainfall occurs in June (17.0 mm) with winter rains resulting from low pressure cells moving in an easterly direction. Mean monthly rainfall is shown in Plate 1. Rainfall is low and unreliable and the mean number days of rain is 46.1 (BoM 2020).

Temperatures show a range with a summer maximum in January of 32.6°C (Plate 1) and a winter minimum in July of 4.0°C. Frosts may be expected in any of the winter months but are not severe and are within the tolerance of native vegetation. It is common for heavy fog to envelop lower lying areas in the winter months e.g., the processing plant area which is surrounded by old tailings dams and waste rock dumps. The annual mean relative humidity varies considerably, ranging from 37 % (at 3pm) to 63 % (at 9am) (BoM 2020). The average wind speeds vary throughout the year from 17.4 km/h in the morning to 19.8 km/h in the afternoon (BoM 2020).

Plate 1: Climate Statistics for Norseman Aero Weather Station



Source: BOM 2025

2.3 Soils and Landforms

Soil-landscapes zones of Western Australia's rangelands and arid interior were defined by Tille (2006). The NGP predominantly falls within the Kambalda Zone (265) of the Kalgoorlie Province. The Desirables Project lies entirely within the Kambalda Zone (265).

The area is characterised by flat to undulating plains, hills, ranges, stony plains and salt lakes on greenstone and granite of the Yilgarn Craton (Tille 2006). Soils of the area include:

- Salt lake soils.
- Red loamy earths.
- Hardpan shallow loams.
- Sandy duplexes.
- Calcareous loamy earths.

Calcareous earths are the predominant soil in the area, covering most of the plains and greenstone areas (Beard 1990, Cowan 2001 and Tille 2006). Tille (2006) notes that the Stirling and Kalgoorlie Provinces grade into each other and that the boundary between the two reflects the change in terrain from Tertiary marine sediments supporting predominantly mallee vegetation with *Melaleuca* spp. understorey, to terrain formed by aeolian deposits in the north that supports predominantly eucalypt woodland with halophytic understorey.

2.4 Flora and Vegetation

2.4.1 Pre-2020 Surveys

The following surveys were undertaken pre-2020 for the NGP and the results are summarised below:

- A baseline vegetation survey (Phase I) was undertaken by Landcare Services Pty Ltd for Western Mining Corporation (WMC) in March 1995 titled *'Baseline Vegetation Survey, Central Norseman Gold Corporation Ltd, Norseman Western Australia'* (Landcare Services 1995):

  - The survey covered 'a range of WMC's tenements' (none specified) and of the 266 taxa recorded in this baseline survey, 12 were regarded as Priority taxa and one was classed as Declared Rare Flora (DRF) taxon. The DRF taxon *Eucalyptus platydisca* (as of 2021, it is a Threatened species) and three of the Priority taxa *Eriostemon apiculatus* (as of 2021 this species name has changed to *Philotheca apiculata (Paul G.Wilson*) and it is a Priority 1 species), *Grevillea phillipsiana* (as of 2021 it is a Priority 1 species) and *Melaleuca cliffortioides* (as of 2021, this species is Not Threatened) were recorded in general collections around the Norseman area and not within CNGC leases.
  - The range of vegetation associations studied reflected the wide range of landforms encountered and ranged from low chenopod shrublands fringing Lake Cowan to several distinct types of eucalypt woodland and diverse woodland/shrublands encountered on the Dundas Hills (Landcare Services 1995).

- A baseline vegetation survey (Phase II) was undertaken by Landcare Services Pty Ltd for CNGC in June 1996 titled *'Baseline Flora and Vegetation Survey, Phase II, Norseman WA'* (Landcare Services 1996):
  - The survey covered 'several operational sites near Norseman' and revealed 369 endemic taxa for the Norseman region. Species recorded in these surveys included nine as yet undescribed varieties, 17 priority taxa, two DRF taxa and significant range extensions for 6 species. In addition, several new combinations of flora were noted (Landcare Services 1996). The report does not detail the names of the species found.
- A baseline vegetation survey (Phase III) was undertaken by Landcare Services Pty Ltd for CNGC in July 1997 titled *'Baseline Flora Survey, Phase III, Norseman WA'* (Landcare Services 1997):
  - Albion, Bromus - Goodia, East Polar Bear and Lady Miller – Penneshaw lease areas were surveyed over a total area of approximately 218 sq km. The survey resulted in a large population of *Eremophila lucida (Chinnock)* (as of 2021 this species is a Priority 1) being found and mapped in the western Polar Bear Peninsula. A cumulative total of 467 endemic taxa was recorded in the Norseman area.
- A baseline survey was undertaken by Mattiske Consulting Pty Ltd (Mattiske) for CNGC in August 2001 titled *'Flora and Vegetation Survey, Gladstone and Daisy Project Areas, Norseman'* (Mattiske 2001):
  - The surveyed covered 10 square km and is located to the north and east of the Norseman townsite. A total of 144 plant taxa and 139 species from 83 genera and 44 families were recorded in the Gladstone and Daisy project area. Species representation was greatest amongst families Chenopodiaceae. Mynaceae, Asteraceae. Mimosaceae and Myoporaceae, a flora composition typical of the Coolgardie Botanical District (Mattiske 2001).
  - Two DRF species *Daviesia microcarpa* and *Eucalyptus platydiscus* (as of 2021, both are Threatened species) and *Styphelia pulchella* Priority 1 (as of 2021, name changed to *Styphelia exserta* and not a Priority species), *Eremophila purpurascens* Priority 3 (correct status of as 2021) and *Darwinia polycephala* Priority 4 (correct status as of 2021) were located within the survey area (Mattiske 2001).
  - A total of seven vegetation communities were recorded in the area and no threatened ecological communities (TEC) were present (Mattiske 2001).
- A flora and vegetation survey were undertaken by Mattiske in August 2002 of the North Cobbler area (Mattiske 2002). The key findings comprised of (Mattiske 2002):
  - A total of 34 plant families, 53 genera and 89 plant taxa (including subspecies and varieties) were recorded within the survey area. Dominant families included Chenopodiaceae, Myrtaceae and Myoporaceae. There was one introduced (weed) species located within community NC2 (Chenopod shrublands), **Carthamus lanatus* (Saffron Thistle), which, as of 2020, is listed on DPIRD 2020 as Permitted s11.
  - The species *Lepidosperma pruinosum* was reported as a Priority 3 and was found to be outside of its normal range of occurrence within communities NE1 and NE5 (*Eucalyptus* woodlands) however as of 2020, *Lepidosperma pruinosum* is listed as 'not threatened' (Florabase 2020). Few annual or *Asteraceae* (daisy) and *Poaceae* (grass) species were recorded due to the paucity of annual species as a result of the timing of the survey.

  - No threatened flora species were located during the survey. One Priority One species (*Eucalyptus websteriana subsp. norsemanica*) and one Priority Three species (*Eremophila purpurascens*) were located within vegetation communities NE1, NE2, NE3 and NE5 (*Eucalyptus* woodlands).
  - A total of eight plant communities were recorded in the survey area. Five of the vegetation communities were *Eucalyptus* Woodlands, one a Mixed Shrubland and two Chenopod Shrublands. None of the vegetation communities described in the survey area are classified as Threatened Ecological Communities. Communities NE1, NE2, NE3 and NE5 (*Eucalyptus* woodlands) are considered to be Locally Significant due to the presence of the Priority species, *Eucalyptus websteriana subsp. norsemanica* and *Eremophila purpurascens*.
  - The condition of the vegetation within the study area was good to very good based on the presence of one introduced (weed) species and low disturbance.

- A flora and vegetation survey were undertaken by Mattiske in April 2005 of the proposed Tailings Dam area (Mattiske 2005). The key findings comprised of (Mattiske 2005):
  - A total of 32 plant families, 63 genera and 134 plant taxa (including subspecies and varieties) were recorded within the survey area. Dominant families included Chenopodiaceae, Mimosaceae, Myrtaceae and Myoporaceae. There were two introduced (weed) species present and few annual or Asteraceae (daisy) and Poaceae (grass) species were recorded due to the paucity of annual species as a result of the timing of the survey (Mattiske 2005).
  - No Threatened species were found. One Priority One *Acacia dorsenna* and two Priority Three *Eremophila purpurascens* and *Eucalyptus brockwayi* were found (these species have the same status as of 2021) (Mattiske 2005).
  - A total of seventeen plant communities were recorded within the survey area. Eleven of the communities were Eucalyptus Woodlands, three Shrublands, one Casuarina Woodland and two are Chenopod Shrublands. Although several of these communities were restricted in area, none of the communities were restricted to the survey area and no TEC were present (Mattiske 2005).

The above mentioned pre-2020 surveys provide regional background flora and vegetation information for the Desirables Project area.

2.4.2 Detailed Surveys 2020-2024

2.4.2.1 Overview

An overview of the detailed surveys undertaken for the NGP is provided in Table 2 with a summary of the results in Table 3.

Flora and vegetation surveys were completed in accordance with:

- Environmental Factor Guideline: Flora and vegetation (Environmental Protection Authority (EPA) 2016a).
- Technical Guidance: Flora and vegetation surveys for environmental impact assessment (EPA 2016b).

Overall, Mattiske (2020a) found vegetation at the NGP to be common at statewide and regional levels and the presence of Priority listed flora species is of local importance.

Table 2: Overview of Flora and Vegetation Studies for the NGP

Proposed Project Area	Year	Consultant	Study Title
Desktop - all NGP areas. Field survey - Gladstone, North Royal, Gladstone-North Royal Haul Roads, Jimberlana Pipeline and Scotia (NB: Scotia included the Green Lantern area).	Autumn 2020	Mattiske Consulting Pty Ltd (Mattiske)	Flora and Vegetation Assessment, Norseman Gold Project, Norseman, WA, July 2020 (Mattiske 2020a).
Field survey - Camp, Cobbler, Gladstone extensions, North Royal extension, OK, Scotia extensions (NB: Scotia Extensions included the Green Lantern area), Slippers and TSF.	Spring 2020	Mattiske Consulting Pty Ltd (Mattiske)	Flora and Vegetation Assessment – Spring 2020, Norseman Gold Project, Norseman, WA, December 2020 (Mattiske 2020b).
Desktop - Scotia area. Field survey - 248 ha area, consisting of salt flats and littoral vegetation.	Spring 2020	Biota Environmental Sciences (Biota)	Norseman Gold (Scotia) Reconnaissance Flora and Vegetation Survey (Biota 2020).
Field Survey - Desirables and TSF	Spring 2024	Mattiske Consulting Pty Ltd (Mattiske)	Flora and Vegetation Assessment, TSF5 and Desirables Areas Norseman Gold Project, Norseman, WA, December 2024 (Mattiske 2024) (Attachment 3).

Table 3: Results Summary of Flora and Vegetation Studies for the NGP

Survey	No. Quadrats	Dominant Genera and Families	Vegetation Communities and Condition	Conservation Significant Taxa and Communities	Introduced Species
Autumn 2020 (Mattiske 2020a): • Northern area: – Gladstone – North Royal – Gladstone-North Royal – Haul Roads – Jimberlana Pipeline • Southern area: – Scotia (NB: Scotia included the Green Lantern area). • Opportunistic records.	• 61 quadrats in the northern survey areas. • 40 quadrats in the southern survey area.	• A total of 804 vascular plant taxa, representative of 260 genera and 115 families, with the most common families being Myrtaceae, Fabaceae and Asteraceae, and the most common genera being *Eucalyptus*, *Acacia* and *Eremophila*. • Species accumulation analysis shows that approximately 73% of taxa potentially present in the survey areas were recorded during the field survey.	• Eighteen vegetation communities were defined and mapped: twelve Eucalypt woodland communities, two other woodland communities and four shrubland communities. Two of the shrubland communities, dominated by salt-tolerant species, formed almost 25% of the Northern survey areas, reflecting the significant areas of salt lake in these areas. • Approximately 93 % of the sites with a recorded condition ranking were assessed as being in Pristine or Excellent condition. The vegetation condition in the Scotia survey area is generally better than that in the Northern areas, although both areas have very little disturbance within the areas of native vegetation.	**Threatened Species** • One Threatened species, *Davesia microcarpa* (T), was previously recorded within the survey areas, with the most recent record from 2001. • Three sites, two along Jimberlana pipeline and one where the North Royal pipeline meets the Eyre Highway, where *Davesia microcarpa* (T) was previously found were traversed, with one dead plant recorded at two of the locations. • No live Threatened species were recorded. **Priority Species** • *Calandrinia lefroyensis* (P1) and *Acacia kerryana* (P2), were recorded in the GEV and Jimberlana Pipeline survey areas, respectively. • *Eremophila parvifolia ?subsp. parvifolia* (P4), which was recorded throughout the four Northern survey areas, was unable to be confidently identified to a sub-species level. This species was treated with a precautionary approach as the P4 subspecies. **Threatened and Priority Ecological Communities** • No Threatened Ecological Communities (TEC) were recorded.	Two introduced species, **Asphodelus fistulosus* (Onion Weed) and **Gazania linearis*, were recorded in very small numbers at one site each. Under the Department of Parks and Wildlife Weed Prioritisation Process, **Gazania linearis* is considered to be one of the 17 Goldfields Region priority alert weeds.

Survey	No. Quadrats	Dominant Genera and Families	Vegetation Communities and Condition	Conservation Significant Taxa and Communities	Introduced Species
				• No Priority Ecological Communities (PEC) were recorded in the study area. One PEC (*'Allocasuarina globosa* assemblages on greenstone rock'), supporting the Threatened flora species *Allocasuarina globosa* (T) is known to occur south of Norseman and is located 12 km north of the Scotia survey area (note that Scotia is approximately 30 km southeast of the Norseman township). • **Note there are no Threatened or priority flora species or TEC/PECs located within the Green Lantern Project Purpose Permit boundary.**	
Spring 2020 (Mattiske 2020b): • Hills Area: – Cobbler – Scotia extensions (NB: Scotia Extensions included the Green Lantern area). • Flats Area: – Camp – North Royal extension – OK	• 48 quadrats in the 'Hills' area. • 31 Quadrats in the 'Flats' area.	• A total of 168 vascular plant taxa, representative of 85 genera and 40 families, were recorded. In the Hills area, 145 taxa were recorded and in the Flats area, 100 taxa. The most common families overall, and within each of the Hills and Flats areas, were Myrtaceae, Chenopodiaceae, and Scrophulariaceae, and the most common genera were Eucalyptus, Eremophila and Acacia. Species accumulation analysis shows that approximately 70% in the Hills area and 65% in the Flats area of taxa potentially present in the survey areas were recorded during the field survey.	• Nine vegetation communities were mapped across the Hills survey areas: five Eucalyptus woodland communities, four shrubland communities as well as cleared land and salt lakes. Two Eucalyptus woodland communities made up most of the vegetation of the Hills survey area. • Approximately 57% of the survey sites were assessed as being in Pristine condition and 43% in Excellent condition. The vegetation condition in the Hills area is generally better than that in the Flats areas, although both areas have very little disturbance within the areas of native vegetation. The east-facing hillslope at Cobbler had been burnt within the previous year;	**Threatened Species** • No threatened flora species were recorded. **Priority Species** • Eight priority flora species were recorded. i.e., – *Allocasuarina eriochlamys subsp. grossa (P3), Eremophila purpurascens (P3), Eucalyptus brockwayi (P3), Eucalyptus websteriana subsp. norsemanica (P1), Goodenia laevis subsp. laevis (P3), Melaleuca coccinea (P3), Micromyrtus papillosa (P1) and Philotheca apiculata (P1).*	Five introduced species, **Asphodelus fistulosus* (Onion Weed), **Carrichtera annua* (Ward's weed), **Gazania linearis*, **Salvia verbenaca* (Wild sage) and **Sonchus oleraceus* (Common sowthistle) were recorded.

Survey	No. Quadrats	Dominant Genera and Families	Vegetation Communities and Condition	Conservation Significant Taxa and Communities	Introduced Species
– Gladstone extensions – Slippers – TSF			quadrats were moved slightly to avoid burnt vegetation.	– All of these taxa were found within the Hills survey areas; one taxon was also recorded in the TSF and Camp areas. • The shrub *Eremophila parvifolia?subsp. parvifolia* (P4), collected in Autumn as a potential priority species, was re-collected in spring and re-identified as the non-priority listed subspecies *Eremophila parvifolia ?subsp. auricampi*. **Threatened and Priority Ecological Communities** • No TECs or PECs were recorded.	
Spring 2020 (Scotia) (Biota 2020)	10 quadrats.	• 136 native vascular flora taxa, 68 genera and 41 families.	• Seven vegetation types were identified within the study area comprising: – A mosaic of five different Eucalyptus open forest vegetation types was recorded on plains surrounding the lake. – The Melaleuca shrubland vegetation type occurred along the salt lake margins, with three small depressions of samphire shrubland scattered through the site. • Two other units not assessed as vegetation types were also identified and mapped; these were the non-vegetation bed of the salt lake and cleared ravel roads and tracks.	**Threatened Species** • No Threatened species. **Priority Species** • One P3 i.e., *Eremophila purpurascens* was recorded at two separate locations in the E5 vegetation type. • One potential P1 species i.e., *Lepidosperma ? lyonsii was n*ot able to be confirmed through the formal identification process as the taxonomic revision for the genus is not yet complete. A small population of this species was found within the MS vegetation type along the central western edge of the study area. **Threatened and Priority Ecological Communities**	One introduced flora species (**Pentameris airoides*).

Survey	No. Quadrats	Dominant Genera and Families	Vegetation Communities and Condition	Conservation Significant Taxa and Communities	Introduced Species
			• Approximately 150 ha, or 60.73% of the study area was comprised of 'Pristine' vegetation. • Less than 5% of the study area was rated as 'Excellent' (the E5 vegetation type) due to the presence of the weed species *Pentameris airoides.* • Less than 1% was rated as 'Completely Degraded' and comprised cleared roads and tracks. • The non-vegetated salt lake bed, covering just over a third of the study area, was not assigned a condition rating due to it being naturally devoid of vegetation.	• No TECs or PECs were recorded.	
Spring 2024 (TSF5 and Desirables) (Mattiske 2024)	• 21 quadrats in the Desirables area • 16 quadrats in the TSF5 area	• 136 native vascular flora taxa, 68 genera and 41 families.	TSF5: Eight vegetation communities were mapped: seven Eucalypt woodland/mallee shrubland communities (NW, S, and W) and a disturbed community (CL). One community, S7, was newly defined and only occurs within the TSF5 Survey Area. Desirables: Eight eucalypt woodland/mallee shrublands (NW, NS and W), one Casuarina woodland (NW11), and one disturbed community (CL). There are three newly defined communities that only occur in the Desirables Survey Area (NS5, NW16, NW17). Vegetation condition within the survey areas ranged from excellent to degraded. Overall, the Desirables	**Threatened Species** • No Threatened species. **Priority Species** Two priority flora species were recorded in the survey areas. Three records of *Eucalyptus brockwayi* (P3) and three records of *Eremophila purpurascens* (P3) were found in the TSF5 survey area, and one record of *Eremophila purpurascens* (P3) was found in the Desirables survey area. **Threatened and Priority Ecological Communities** No TECs or PECs were recorded.	Nine introduced weed taxon permitted under section 11 of the BAM Act were recorded in the Survey Areas, **Asphodelus fistulosus, *Carrichtera annua, *Centaurea melitensis, *Lysimachia arvensis, *Medicago minima, *Mesembryanthemum nodiflorum, *Oligocarpus calendulaceus, *Sonchus asper and *Sonchus oleraceus*

Survey	No. Quadrats	Dominant Genera and Families	Vegetation Communities and Condition	Conservation Significant Taxa and Communities	Introduced Species
			survey area was in better condition, with the majority (47.6%) of sites being in excellent condition, than the TSF5 survey area, with the majority (43.8%) of sites in very good condition. Vegetation in the TSF5 and Desirables survey areas was found to be predominantly Eucalypt woodlands, with minor shrublands on rocky upper slopes and ridges, and narrow strips of Casuarina woodland and chenopod shrubland along salt lake margins. The survey concluded: *Survey areas exhibited moderate signs of disturbance in terms of tracks, litter, weeds and historical mining infrastructure. Vegetation condition within the survey areas therefore ranged from excellent to degraded.* *There are no factors, from a flora and vegetation perspective, which would either be a cause for concern or warrant additional survey work within the Desirables survey area.*		

2.4.2.2 Impact Assessment

Conservation Significant Flora Species

A records of *Eremophila purpurascens* (P3) was found during the Desirables survey (Mattiske 2024), however, this record is not located within the proposed Desirables site layout and will not be impacted.

One Priority Ecological Community (PEC) '*Allocasuarina globosa* assemblages on greenstone rock', supporting the Threatened flora species *Allocasuarina globosa* (T) is located south of Norseman and will not be impacted by Desirables located 8km north-north-east of Norseman.

Vegetation Communities

The NGP area lies within the Coolgardie 3 – Eastern Goldfields Subregion of the Coolgardie Bioregion within the Southwestern Interzone botanical district (Cowan 2001). Most of the vegetation in the area comprises *Eucalyptus* woodlands, often over *Eremophila* species and/or chenopod shrublands, and *Triodia* species grasslands with mallees.

Vegetation communities of the Desirables survey area shown in Table 4 (Mattiske, 2024).

Figure 4: Desirables Vegetation Mapping and Threatened and Priority Flora Locations (Mattiske, 2024)

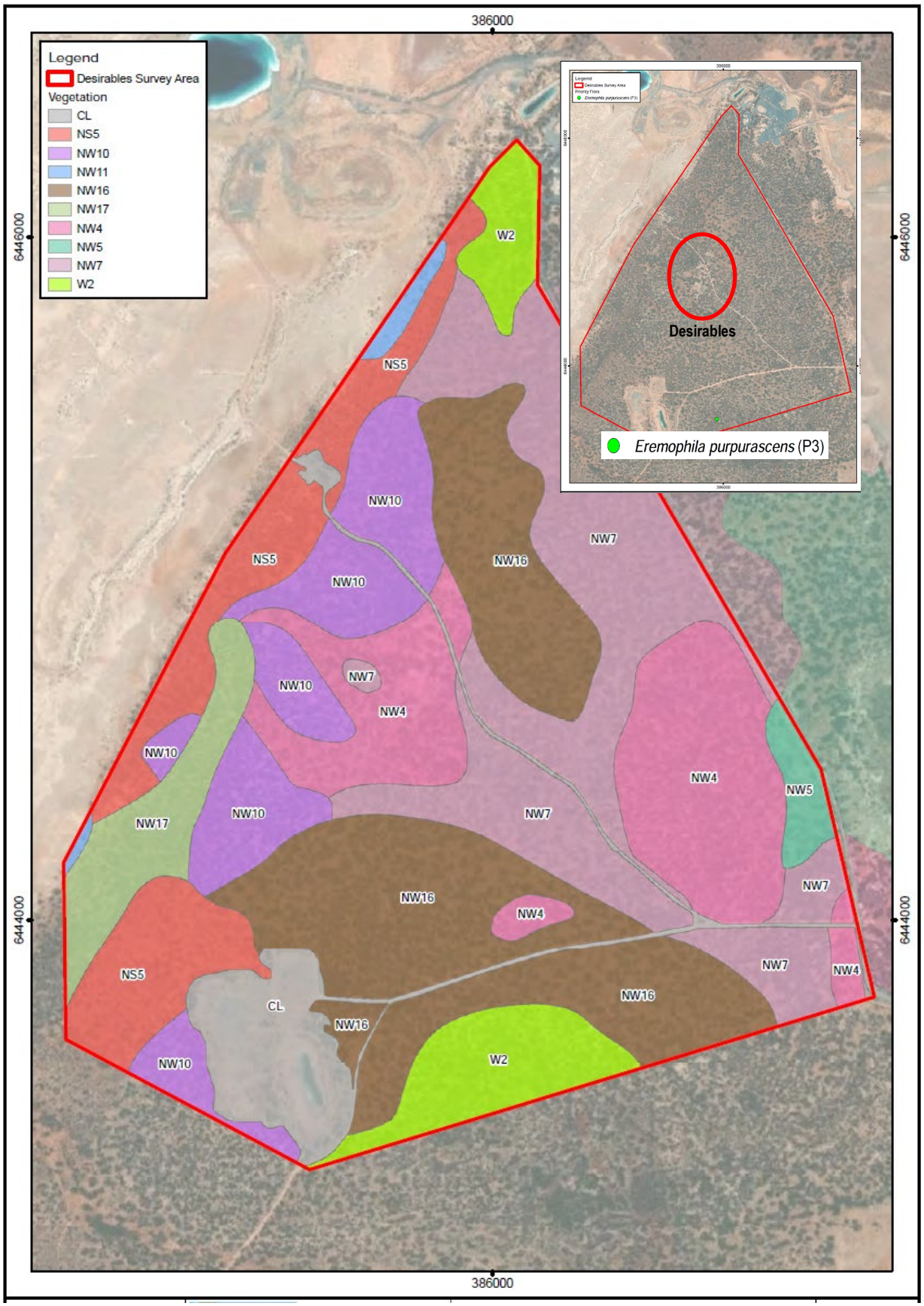

386000
6446000
6444000
Legend
Desirables Survey Area
Vegetation
CL
NS5
NW10
NW11
NW16
NW17
NW4
NW5
NW7
W2
Desirables
Eremophila purpurascens (P3)

Table 4: Vegetation Communities of the Desirables Survey Area (Mattiske 2024)

Vegetation Community	Description	Representative Photo	Proposed Clearing of Native Vegetation (ha)	Total Mapped by Mattiske (2024) (ha)	% Impact
NS5	*Santalum acuminatum, Melaleuca* spp. *(M. ?lanceolata, M. sheathiana), Eucalyptus* spp. tall open shrubland over *Eremophila scoparia, Cratystylis conocephala, Scaevola spinescens* low sparse shrubland on brown-orange sandy clay on slopes and flats.		0	40.6	0%
NW4	Open low woodland of *Eucalyptus lesouefii* over tall isolated clumps of *Melaleuca ?sheathiana* and *Eremophila* spp. shrubs over low isolated clumps of *Cratystylis conocephala* shrubs.		4.2	61.3	7%
NW5	Mid woodland of *Eucalyptus lesouefii* and *Eucalyptus salubris* over mid isolated shrubs of *Eremophila scoparia* and occasional low *E. parvifolia* ?subsp. *auricampi* shrubs over open low chenopod shrubland of *Tecticornia* spp. and *Atriplex* spp. on orange to brown sandy clay with some surface gravel on flats and gentle slopes.		0	5.1	0%

Vegetation Community	Description	Representative Photo	Proposed Clearing of Native Vegetation (ha)	Total Mapped by Mattiske (2024) (ha)	% Impact
NW7	Low woodland of *Eucalyptus salubris* and *E. lesouefii* over tall sparse shrubland of *Melaleuca*?*sheathiana* or *M. lanceolata* over mid-low sparse shrubland of *Atriplex*?*nummularia* and *Atriplex* ?*vesicaria* on red to brown sandy clay with scattered surface rocks on flats and lower slopes.		3.1	83.9	4%
NW10	Mid woodland of mixed *Eucalyptus* spp. over tall sparse shrubland of *Melaleuca*?*sheathiana* over open mid-low shrubland of *Atriplex* spp. on brown clayey loam with some surface rocks on gentle mid to upper slopes.		0.5	44.9	1%
NW11	Open low woodland of *Casuarina obesa* over low isolated clumps of Chenopodiaceae sp. and Aizoaceae sp. shrubs and isolated tussock grassland on dry, powdery pale orange clay on low dune ridges and flats at the edge of salt lakes.		0	2.6	0%

Vegetation Community	Description	Representative Photo	Proposed Clearing of Native Vegetation (ha)	Total Mapped by Mattiske (2024) (ha)	% Impact
NW16	*Eucalyptus oleosa* mid sparse mallee shrubland over *Cratystylis conocephala, Melaleuca sheathiana* mid open shrubland over *Atriplex* sp. 2 low sparse shrubland on orange clay on flats.		10.3	94.2	11%
NW17	*Eucalyptus platycorys, Eucalyptus* spp. mid sparse mallee shrubland over *Lawrencia squamata, Lomandra effusa, Westringia rigida* low sparse shrubland over *Triodia scariosa* low isolated hummock grasses on brown-orange sandy clay on flats and slopes.		0	17.9	0%
W2	Woodland to open woodland of *Eucalyptus flocktoniae*, *E. urna*, *E. lesouefii* and *E. dundasii* over sparse shrubland of *Melaleuca sheathiana*, *Eremophila scoparia*, *Scaevola spinescens*, *Beyeria sulcata* and *Exocarpos aphyllus* over isolated shrubs of *Olearia muelleri* on orange-red to brown clayey loam on flats and slopes.		0	26.5	0%
CL	Cleared or disturbed.			25.6	
		Total	**18.1**	**2,245.2**	**-**

2.4.3 Weeds

The Mattiske (2020a) study recorded two introduced species within the entire NGP autumn survey area (the NGP includes Scotia and Green Lantern as well as other Project areas) i.e., **Asphodelus fistulosus* (Onion Weed) and **Gazania linearis*, in very small numbers at one site each.

The Mattiske (2020b) study recorded five introduced weed species within the entire NGP spring survey area (the NGP includes Scotia and Green Lantern as well as other Project areas) i.e., **Asphodelus fistulosus* (Onion Weed), **Carrichtera annua* (Ward's weed), **Gazania linearis*, **Salvia verbenaca* (Wild sage) and **Sonchus oleraceus* (Common sowthistle).

The Biota (2020) study recorded one introduced weed species (**Pentameris airoides*) within the Scotia area.

Under the Department of Parks and Wildlife Weed Prioritisation Process, **Gazania linearis* is considered to be one of the 17 Goldfields Region priority alert weeds (Mattiske 2020a). None of these species are Weeds of National Significance (DAWE 2020b).

The declared pest status and control/keeping category pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) for all of the above-mentioned weed species is (DPIRD 2020b):

- Permitted - s11 (Permitted organisms must satisfy any applicable import requirements when imported. They may be subject to an import permit if they are potential carriers of high-risk organisms). Not assigned to any control category for a local government area at this time.

Survey areas exhibited moderate signs of disturbance in terms of tracks, litter, weeds and historical mining infrastructure. Vegetation condition within the survey areas therefore ranged from excellent to degraded (Mattiske 2024).

2.4.4 Great Western Woodlands

The NGP falls within the Great Western Woodlands (GWW). The GWW are the largest remaining intact Mediterranean-climate woodland which covers almost 16 million hectares in size and extends between the edge of the Western Australian Wheatbelt in the west, to Kalgoorlie-Boulder in the north, the inland deserts to the northeast and the Nullarbor Plain to the east (DEC 2010). The GWW is an internationally significant area of biological richness. The vegetation of the area is predominantly woodland communities but also includes shrubland and mallee vegetation (DEC 2010). It supports approximately 20% of Australia's known flora and is a centre of Eucalyptus species diversity, with over 160 species of Eucalyptus found in the area (DEC 2010).

2.5 Terrestrial Vertebrate Fauna and Habitat

2.5.1 Basic Survey 2020

2.5.1.1 Overview

Western Wildlife was engaged to complete a basic vertebrate fauna survey and targeted Malleefowl survey (Western Wildlife 2021). A desktop and field survey were carried out in June 2020 for NGP areas totalling 4,180.2 ha (Table 5). After the basic survey was completed, the survey area was extended into adjacent areas of the NGP. These additional areas were subject to a desktop survey, including habitat mapping, in January 2021.The survey was undertaken in accordance with:

- Environmental Factor Guideline - Terrestrial Fauna (EPA 2016c).
- Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020).

Eight fauna habitats were identified across the NGP areas and the survey area extent for each habitat is shown in Table 5:

- Eucalypt woodland on rocky hills.
- Eucalypt woodland on plains.
- Mallee woodland over spinifex.
- Shrubland on rocky hills.
- Shrubland on sandy lake edges.
- Gypsum dunes.
- Chenopod shrubland.
- Salt lake.

In 2024, Western Wildlife undertook further Basic Vertebrate Fauna and Targeted Malleefowl surveys in the TSF5 and Desirables Project areas (Appendix 4).

The surveys to date concluded that habitats present are common in the region. Habitats that are less common in the region, such as granite outcrops or freshwater wetlands, were absent from the NGP area. Although all habitats have importance in supporting native fauna, the habitats of the NGP area are unlikely to be of particular significance as ecological linkages, refugia or supporting important populations of conservation significant vertebrate fauna (Western Wildlife 2021 and 2024).

Table 5: Survey Area Extent of Fauna Habitats (Western Wildlife, 2021)

Survey Area	Area of Each Habitat (ha)									
	Cleared	Chenopod shrubland	Eucalypt woodland on plains	Eucalypt woodland on rocky hills	Gypsum dunes	Mallee woodland over spinifex	Salt lake	Shrubland on rocky hills	Shrubland on sandy lake edge	Total
North Royal	195.27	13.96	151.51	34.87	-	-	1.97	-	8.87	406.45
Gladstone	110.64	316.44	194.43	64.53	132.52	31.75	424.04	-	156.41	1,430.76
North Royal –Gladstone Haul Road	20.69	-	-	5.99	-	2.43	-	-	-	29.11
Cobbler	8.71	14.89	28.20	46.48	-	-	363.44	14.53	-	476.25
TSF4	79.09	-	4.09	112.96	-	-	-	20.37	-	216.51
OK	38.51	-	-	81.82	-	-	-	-	-	120.34
Camp	10.24	-	-	4.60	-	-	-	-	-	14.84
Maybell	7.72	9.11	211.09	49.28	-	-	9.83	25.30	-	312.33
Scotia (includes Green Lantern)	70.62	8.41	917.22	128.88	-	-	11.41	36.92	0.17	1,173.62
Total (ha)	**541.50**	**362.81**	**1,506.53**	**529.39**	**132.52**	**34.18**	**810.70**	**97.12**	**165.45**	**4,180.20**

The faunal assemblage of the NGP area is likely to be largely intact, as the NGP area is situated within a larger tract of native vegetation. Many of the species that occur are widely distributed through semi-arid Australia. The predicted faunal assemblage includes up to 9 frogs, 66 reptiles, 159 birds, 24 native mammals and 8 introduced mammals noting that only a subset of these are likely to be present due to the small size of the Desirables area and the lack of some habitat elsewhere; the observed assemblage on this survey included no frogs, two reptiles, 34 birds, one native mammal and three introduced mammals (Western Wildlife 2024).

A total of 18 conservation significant fauna may occur in the NGP area (however none occur within the Desirables survey area); these comprise of (Western Wildlife 2021):

- Seven Threatened species:
  - Curlew Sandpiper (*Calidris ferruginea*) – EPBC Act (Critically Endangered and Migratory), BC Act (Critically Endangered).
  - Night Parrot (*Pezoporus occidentalis*) – EPBC Act (Endangered), BC Act (Critically Endangered).
  - Common Greenshank (*Tringa nebularia*) – EPBC Act (Endangered and Migratory), BC Act (Migratory).
  - Sharp-tailed Sandpiper (*Calidris acuminata*) – EPBC Act (Vulnerable and Migratory), BC Act (Migratory).
  - Southern Whiteface (*Aphelocephala leucopsis*) – EPBC Act (Vulnerable).
  - Chuditch (*Dasyurus geoffroii*) – EPBC Act (Vulnerable), BC Act (Vulnerable).
  - Malleefowl (*Leipoa ocellata*) – EPBC Act (Vulnerable), BC Act (Vulnerable).
- Four Migratory species:
  - Common Sandpiper (Actitis hypoleucos) – EPBC Act (Migratory), BC Act (Migratory).
  - Red-necked Stint – (Calidris ruficollis) – EPBC Act (Migratory), BC Act (Migratory).
  - Pectoral Sandpiper (Calidris melanotos) – EPBC Act (Migratory), BC Act (Migratory).
  - Fork-tailed Swift (Apus pacificus) – EPBC Act (Migratory), BC Act (Migratory).

- One Specially Protected species:
  - Peregrine Falcon (*Falco peregrinus*) – BC Act (Other Specially Protected).
- Six Priority species:
  - Lake Cronin Snake (*Paroplocephalus atriceps*) – Priority 3.
  - Central Long-eared Bat (*Nyctophilus major tor*) – Priority 3.
  - Blue-billed Duck (*Oxyura australis*) - Priority 4.
  - Western Brush Wallaby (*Notamacropus irma*) – Priority 4.
  - Hooded Plover (*Thinornis cucullata*) – Priority 4.
  - Inland Western Rosella (*Platycercus icterotis xanthagenys*) – Priority 4.

With specific reference to Desirables, the Inland Western Rosella was recorded during this fauna survey and is likely to occur in eucalypt woodlands, potentially breeding in tree hollows. The Central Long-eared Bat is known to occur in the region and is likely to occur in eucalypt woodlands. The Western Brush Wallaby may occur in woodland habitats, but the study areas represent the extreme eastern edge of this species range. The Lake Cronin Snake possibly occurs, but it is rarely recorded. The study area lacks any habitat to support the Hooded Plover or Blue-billed Duck, although these species may occur nearby.

A summary of the listed conservation significant fauna is provided in Table 6 and is further described below (Western Wildlife 2021 and 2024):

- The Curlew Sandpiper may occur but is unlikely to be a regular visitor as it favours coastal environments.
- The Chuditch may occur in woodlands and shrublands in low densities, but there are very few records of this species in the region.
- The Malleefowl is known to occur in the region and may occur. However, no evidence of the Malleefowl was recorded in the NGP area despite 153 km of transects walked, and dense shrubby habitats suitable for nesting were uncommon in the NGP area (Western Wildlife 2021). During the 2024 Malleefowl targeted survey, despite an intensive effort, no mounds were detected, and no mounds have been detected (Western Wildlife 2024).
- Although Migratory shorebirds may occur on occasion, the Salt Lake habitat of the NGP area is unlikely to support nationally or internationally significant numbers of any species. The Fork-tailed Swift is a Migratory species that is thought to be almost entirely aerial when visiting Australia, so the NGP area is not likely to provide important habitat for this species (Western Wildlife 2021).
- The Peregrine Falcon is likely to occur as a foraging visitor and may breed in abandoned open pits (Western Wildlife 2021).

  With regard to Desirables (Western Wildlife, 2024): although likely to occur, the study area is unlikely to be important for the Peregrine Falcon, as this species is not considered to be in decline and its habitat is widespread.
- The Lake Cronin Snake has a low likelihood of occurrence despite suitable habitat being present, as there are few records in the region and the NGP area is north of its current known range.
- The Hooded Plover is known to occur on Lake Dundas, and is likely to occur in Salt Lake habitats, at least on occasion.
- The Inland Western Rosella (*Platycercus icterotis xanthagenys*) was recorded during the Desirables fauna survey. It is likely to occur in eucalypt woodlands and shrublands as a breeding resident, breeding in tree hollows (Table 6).
- The Central Long-eared Bat is known to occur in the region and is likely to occur in eucalypt woodlands.
- The Western Brush Wallaby may occur in woodland and shrubland habitats, but the NGP areas represent the extreme eastern edge of this species range (Western Wildlife 2021).

- The majority of species considered unlikely to occur are shorebirds. These species may occur on nearby salt lakes, but the study areas do not contain habitat to support these species. The Night Parrot (Pezoporus occidentalis: Endangered) requires mature spinifex for roosting and breeding. Although spinifex is present in the Desirables study area, it is too short and insufficiently dense to provide habitat for this extremely rare species (Western Wildlife, 2024).

Table 6: Summary of Conservation Significant Vertebrate Fauna (Western Wildlife 2021 and 2024)

Species	Status*				Likelihood of Occurrence	Habitat								Notes
	EPBC Act**	BC Act***	DBCA Priority	Locally Significant		Eucalypt Woodland on Rocky Hills	Eucalypt Woodland on Plains	Mallee Woodland over Spinifex	Shrubland on Rocky Hills	Shrubland on Salt Lake Edges	Gypsum Dunes	Chenopod Shrubland	Salt Lake	
REPTILES														
Paroplocephalus atriceps **Lake Cronin Snake**			P3		Very Low		X							Although the habitats present are potentially suitable, its distribution is not currently known to extend as far north as the study areas.
BIRDS														
Calidris ferruginea **Curlew Sandpiper**	Cr	Cr			Moderate								X	Although it may occur on occasion, this species is not likely to be present in significant numbers.
Leipoa ocellata **Malleefowl**	Vu	Vu			Moderate	X	X		X					This species is known to occur in the region, but no evidence of its presence was recorded during the field survey despite extensive searching.
Falco peregrinus **Peregrine Falcon**		OS			High	X	X	X		X	X	X		Although likely to occur, foraging in most open habitats, the study area is unlikely to be of particular significance to this species.
Actitis hypoleucos **Common Sandpiper**	Mi	Mi			High								X	Although likely to occur on occasion, this species is not likely to be present in significant numbers.
Calidris acuminata **Sharp-tailed Sandpiper**	Mi	Mi			High								X	Although likely to occur on occasion, this species is not likely to be present in significant numbers.

Species	Status*				Likelihood of Occurrence	Habitat								Notes
	EPBC Act**	BC Act***	DBCA Priority	Locally Significant		Eucalypt Woodland on Rocky Hills	Eucalypt Woodland on Plains	Mallee Woodland over Spinifex	Shrubland on Rocky Hills	Shrubland on Salt Lake Edges	Gypsum Dunes	Chenopod Shrubland	Salt Lake	
Tringa nebularia **Common Greenshank**	Mi	Mi			High								X	Although likely to occur on occasion, this species is not likely to be present in significant numbers.
Calidris ruficollis **Red-necked Stint**	Mi	Mi			High								X	Although likely to occur on occasion, this species is not likely to be present in significant numbers.
Calidris melanotos **Pectoral Sandpiper**	Mi	Mi			Low								X	This species may occur but prefers vegetated freshwater wetlands.
Apus pacificus **Fork-tailed Swift**	Mi	Mi			Moderate									This species is largely aerial in Australia, and although it may overfly the area the terrestrial habitats of the study area are not likely to be important for this species.
Thinornis cucullata **Hooded Plover**			P4		High								X	Known to occur on Lake Dundas, this species is likely to occur in the study area, at least on occasion.
Platycercus icterotis xanthagenys **Inland Western Rosella**			P4		Known to occur	X	X		X					This species was recorded in the OK study area during the 2020 field survey and is likely to be a breeding resident.
MAMMALS														
Dasyurus geoffroii **Chuditch**	Vu	Vu			Low	X	X		X					Although the habitats present are suitable, there are few records of this species in the region.

Species	Status*				Likelihood of Occurrence	Habitat								Notes
	EPBC Act**	BC Act***	DBCA Priority	Locally Significant		Eucalypt Woodland on Rocky Hills	Eucalypt Woodland on Plains	Mallee Woodland over Spinifex	Shrubland on Rocky Hills	Shrubland on Salt Lake Edges	Gypsum Dunes	Chenopod Shrubland	Salt Lake	
Nyctophilus major tor **Central Long-eared Bat**			P3		Moderate	X	X							This species is known to occur in the region and its favoured woodland habitats are present.
Notamacropus irma **Western Brush Wallaby**			P4		Low	X	X		X					This species may occur at low densities in the region, although it is likely to be at the very eastern limit of its distribution in the vicinity of the study areas.

*Key to Status: Mig = Migratory, En = Endangered, Vu = Vulnerable, OS = Other Specially Protected Fauna, P = Priority, LS = locally significant (Western Wildlife 2021).
** EPBC Act - *Environment Protection and Biodiversity Conservation Act 1999*.
*** BC Act - *Biodiversity Conservation Act 2016.*

2.5.1.2 Impact Assessment

Conservation Significant Fauna Species

No conservation significant fauna was identified within the vicinity of the Desirables survey area.

Fauna Habitats

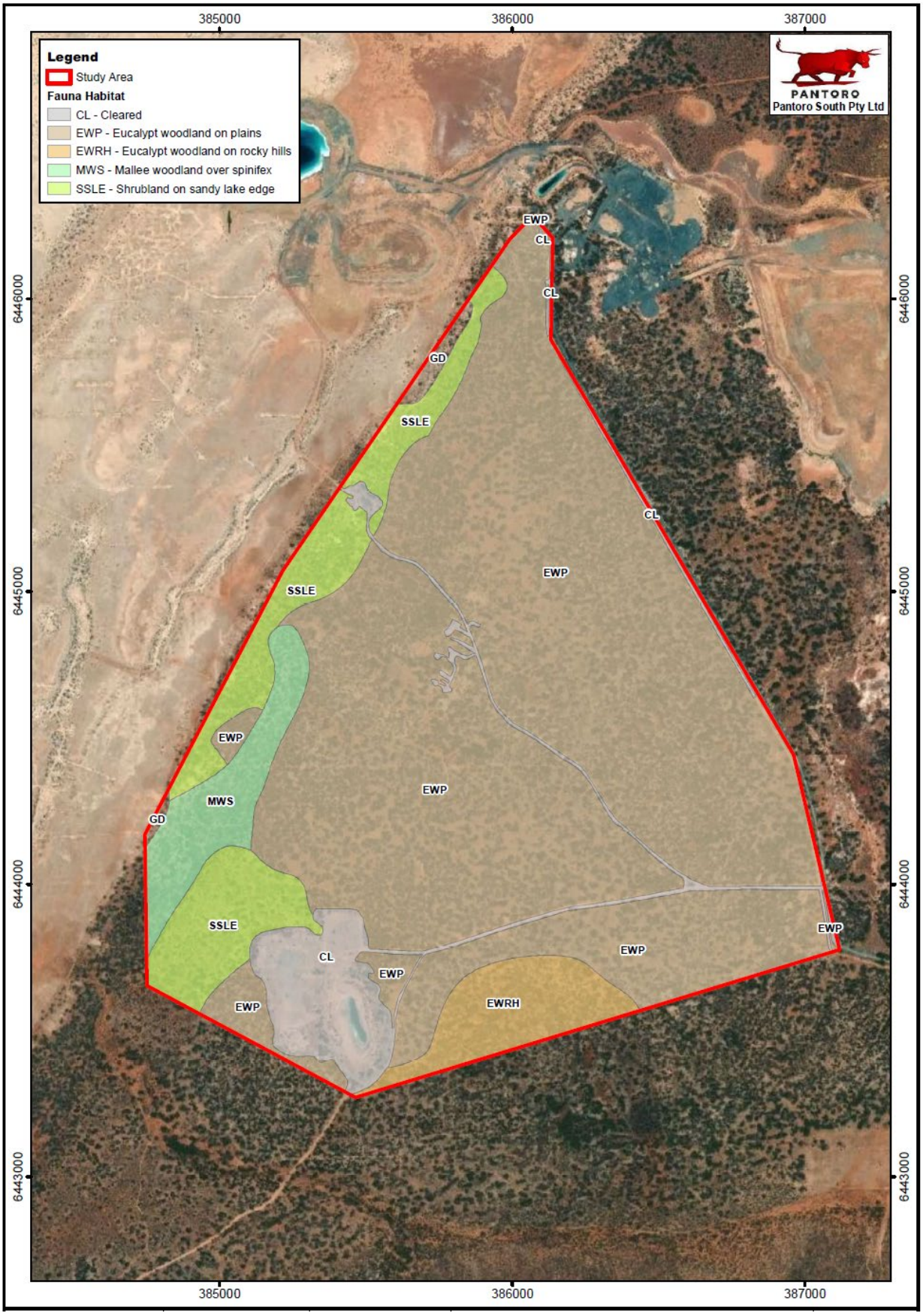
Fauna habitats of the survey areas are described in Table 7 and shown in Figure 7.

Table 7: Fauna Habitats of the Survey Area

Fauna Habitat	Fauna Habitat Type (Western Wildlife 2021 and 2024)	Photo (Western Wildlife 2021 and 2024)	Proposed Clearing of Fauna Habitat (ha)	Total Mapped by Western Wildlife (2021 and 2024) (ha)	% Fauna Habitat to be Impacted
Salt lake	The bare lakebeds of Lake Cowan and Lake Dundas lack vegetation.		0.0	812.1	0%
Shrubland on lake edges	Open shrubland of Sticky Hopbush (*Dodonaea viscosa*), Currant Bush (*Scaevola spinescens*), *Eremophila* sp. and mixed chenopods, sometimes with scattered Rottnest Island Pine (*Callitris preisii*).		0.0	169.0	0%
Eucalypt woodland on plains	Woodland of Merrit (*Eucalyptus flocktoniae*), Red Morrel (*Eucalyptus longicornis*), Gimlet (*Eucalyptus salubris*), Dundas Blackbutt (*Eucalyptus dundasii*), Mallett (*Eucalyptus prolixa*) and Goldfields Blackbutt (*Eucalyptus lesouefii*).		18.1	1,553.2	0.01%
Eucalypt woodland on rocky hills	Woodland of Coral Gum (*Eucalyptus torquata*) over shrubs such as Boree (*Melaleuca sheathiana*), Brilliant Hopbush (*Dodonaea microzyga*) and Sea Box (*Alyxia buxifolia*).		0.0	611.1	0%

Fauna Habitat	Fauna Habitat Type (Western Wildlife 2021 and 2024)	Photo (Western Wildlife 2021 and 2024)	Proposed Clearing of Fauna Habitat (ha)	Total Mapped by Western Wildlife (2021 and 2024) (ha)	% Fauna Habitat to be Impacted
Shrubland on rocky hills	Shrubland of sheoaks (*Allocasuarina acutivalvis* or *Allocasuarina campestris*), *Grevillea nematophylla* and/or *Acacia neurophylla*.		0.0	97.2	0.1%
		Total	**18.1**	**3,242.6**	**-**

Figure 5: Desirables Fauna Habitats (Western Wildlife, 2024)


Legend
Study Area
Fauna Habitat
CL - Cleared
EWP - Eucalypt woodland on plains
EWRH - Eucalypt woodland on rocky hills
MWS - Mallee woodland over spinifex
SSLE - Shrubland on sandy lake edge
PANTORO
Pantoro South Pty Ltd
385000
386000
387000
6446000
6445000
6444000
6443000
EWP
CL
GD
SSLE
MWS
EWRH

2.5.2 Introduced Species

Eight introduced species were identified as having the potential to occur in the Project area; these include the House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), Dog (*Canis familiaris familiaris*), Fox (*Vulpes vulpes*), Cat (*Felis catus*), Dromedary Camel (*Camelus dromedarius*), European Rabbit (*Oryctolagus cuniculus*) and Feral Goat (*Capra hircus*).

2.6 Short Range Endemic Fauna

Invertebrate Solutions undertook an assessment of Short Range Endemic (SRE) Fauna for the NGP (Appendix 5) which included the Desirables Project.

The study found that the area contains:

- Three Confirmed SRE species: *Paradoxosomatid* millipedes (*Antichiropus anconus, A. buchanorum and A. incomptus*)
- Four Likely SRE species:

  Two isopods (*Troglarmadillo sp*.'B35' and *Philosciidae sp*.'B28').

  Two Iulomorphid millipedes (*Atelomastix bamfordi?* and *Iulomorphidae [Atelomastix]* sp.'B03')
- Twelve Possible SRE species: trapdoor spiders, four land snails, two pseudoscorpions, two isopods, and one millipede.

The remaining species identified from desktop resources were found to be widespread. An additional five conservation significant invertebrates (widespread, non-SRE species) were identified in the desktop assessment:

- A fairy shrimp - Branchinella simplex – DBCA Priority 1
- A fairy shrimp - Branchinella denticulata– DBCA Priority 3
- A mygalomorph spider – Idiosoma intermedium - DBCA Priority 3
- A butterfly – The Inland Hairstreak (Jalmenus aridus) – DBCA Priority 1
- A butterfly – The Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – BC Act Critically Endangered / EPBC Act Critically Endangered

Of these five conservation significant species only the Arid Bronze Azure Butterfly is considered as possibly having potential habitat within the Project area.

A field habitat assessment for ABAB including both presence of suitable vegetation combined with the presence of the sugar ant *Camponotus sp. nr. terebrans* was undertaken. This assessed potential habitat presence in Desirables and TSF5 to determine the presence or absence of the ABAB host ant Camponotus sp. nr. terebrans. Whilst vegetated areas were dominated by smooth barked eucalyptus, no individuals, or nests of *Camponotus sp. nr. terebrans* were recorded in the Desirables survey area, hence the likelihood of ABAB being present is Very Low.

The SRE field surveys in 2020 and 2024 recorded seven potential SRE invertebrate species from within the nine SRE Survey Areas. These seven taxa included no Confirmed SRE species, one Likely SRE species and six Possible SRE species:

- One Likely SRE species: the millipede *Atelomastix sp.* 'B03'
- Six Possible SRE species were recorded primarily due to the groups being considered data deficient which included two mygalomorph spiders (*Kwonkan silvestre* and *Synothele pectinata*), two geophilid centipedes *Mecistocephalus sp*.'47 legs' and *Sepedenophilus cf. antipodes*, one isopod *Philosciidae sp. indet.* (damaged) and *Pseudoscorpions* from the family Olpiidae

The Likely SRE millipede species *Atelomastix sp.* 'B03' was recorded from four different habitats that are largely laterally continuous Eucalyptus Woodland habitats along with Woodland over shrubs and from Woodland on slopes and from multiple Project Areas including Desirables. This would indicate that the species is widespread throughout multiple habitats in the region and not restricted solely to Project areas. Most species recorded are widespread throughout the Great Western Woodland region of Western Australia.

The assessment concluded that no further invertebrate surveys for SRE or conservation significant invertebrate are required for the project areas assessed in this report.

2.7 Subterranean Fauna

Invertebrate Solutions undertook a Desktop Assessment of Subterranean Fauna for the NGP (Appendix 6) which included the Desirables Project and concluded that:

No previous stygofauna records are held within WAM databases. This is due to both an absence of previous assessments for stygofauna within the Norseman region but also reflects the general absence of stygofauna habitat within the local Norseman region. The groundwater in the Norseman area associated with the nine Project areas is mostly hypersaline, especially with depth and with proximity to the salt lakes in the immediate region. This precludes the presence of stygofauna in all the nine Project areas when combined with an absence of voids or fractures in examined core photos from all Project areas within saturated depth zones.

2.8 Heritage and Social Setting

2.8.1 Land Use and Community

The town of Norseman is located adjacent to the NGP. Norseman is the last major town in Western Australia before heading east across the Nullarbor Plain. According to the Australian Bureau of Statistics (ABS), Norseman has a population of 581 people and of this, 75 people are of Aboriginal and/or Torres Strait Islander People descent (ABS 2016).

The Norseman area is in a well-established mining region (Goldfields), with a number of other mines of various ages and phases (some operating, some in care and maintenance, and some abandoned) in the surrounding area. On final relinquishment of the NGP tenements, the land is expected to revert to vacant Crown land (Pantoro 2020). As the land is within a prospective mineralised area however, part or all of it is likely to remain under some form of mining tenure indefinitely, with any outstanding liability transferred to future tenement holders (Pantoro 2020).

Other than mining, key land uses include residential, recreation and passing tourism in the vicinity of the Norseman township with some pastoralism (cattle and sheep grazing), forest and nature reserves in the broader region (Pantoro 2020). The surrounding areas comprise native bushland and salt lake ecosystems, forming part of the Great Western Woodlands (GWW). The GWW cover a 16-million-hectare swath of woodlands and heathlands interspersed with salt lakes. It remains a largely intact ecosystem predominantly located on public lands, however only small portions of the area are currently under protection.

The post mining land use will be re-establishment of native ecosystems (Pantoro 2020). Due to the proximity to the Norseman township, a key focus will be on the protection of public safety, with all potential hazards either removed or isolated (Pantoro 2020). The amenity of the community is also a key consideration, with post mining landforms designed to be compatible with their surroundings as far as practicable.

As part of stakeholder engagement, Pantoro will ensure that the post-mining land use is further defined and agreed with key stakeholders.

2.8.2 Aboriginal Heritage

A number of Aboriginal heritage surveys have been completed for the NGP area, dating back to the 1990s, which provide an understanding of the location of heritage sites (both archaeological and ethnographic). These include:

- Smith, M. (1994). *Aboriginal Sites in Ngadju Country. Requested by the MURNKURNI Aboriginal Women's Corporation now part of Ngadju Bugarla Mirning Wamu Wamu Aboriginal Corporation.* A Report for the National Estate Programme.
- Archae-aus – Gifford, P. and Veitch, B. (April 1997). *Preliminary Advice on an Aboriginal Heritage Survey of the Proposed Lady Miller Mine Project area near Norseman Western Australia for Central Norseman Gold Corporation Pty Ltd.*
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- JCHMC Pty Ltd. (September 2020). *Site Visit Central Norseman Gold Pty Ltd (Pantoro) M63/659.* A Report Prepared for Ngadju Native Title Aboriginal Corporation.

From this, Archae-aus – Gifford, P. and Veitch, B. (April 1997) and Gleason, J. (December 1999) include M63/36, M63/112-I and M63/325-I. No Aboriginal heritage sites are known to occur within M63/36, M63/112-I and M63/325-I. These survey reports are classified as confidential, and provision of these reports will be considered upon request.

A search of the Aboriginal Heritage Inquiry System (AHIS) (DPLH 2020) found no registered Aboriginal heritage sites within M63/156.

One 'other heritage place' named 'Horse Rocks' (Place ID: 2923), described as 'artefacts/scatter, camp, water source' (DPLH 2020), is situated outside of M63/36 towards the northwest of the tenement and will not be impacted by mining activities.

Proposed activities within this application will not have any effect on Aboriginal heritage sites.

Pantoro regularly liaises with the Ngadju Native Title Aboriginal Corporation (NNTAC) to discuss all existing and proposed mining activities and will continue to maintain regular consultation with the NNTAC to ensure that the greater NGP will not result in an impact to registered Aboriginal heritage sites. Pantoro will continue to work closely with the NNTAC throughout the life of mine to ensure ongoing compliance with the *Aboriginal Heritage Act 1972*.

2.8.3 European Heritage

Traces of alluvial gold were first discovered in the Dundas area by Mr Moir of Fanny's Creek in 1890 and the Dundas Field was proclaimed in 1893. In 1894, Laurie Sinclair was prospecting just north of Dundas and discovered the rich Norseman reef which according to legend, he named after his horse (Shire of Dundas 2017).

The town of Norseman was gazetted in 1895 and replaced Dundas as the major township in the area. With continuation of mining around Norseman, the town expanded with establishment of a post office, banks, newspapers, churches, general stores and other infrastructure and a rail link between Norseman and Coolgardie was established in 1909 (Shire of Dundas 2017).

Western Mining began operations at Norseman in 1935 providing electricity to the town and facilitating development of roads and extension of the water pipeline from Coolgardie to Norseman. The history of Norseman is intrinsically linked to its mining heritage (Shire of Dundas 2017).

The Australian Heritage Database (AHD) was searched for the Norseman area which included the Desirables Project. From this, the only place currently nominated for National Heritage listing in the Norseman area is the Great Western Woodlands (GWW) of Western Australia. The GWW is nominated as possibly the largest remaining intact area of temperate woodlands left on Earth covering an area of more than 16 million hectares including NGP tenements. There are three other natural areas in the Norseman area that are registered as heritage places on the Register of the National Estate, these comprise of:

- **Binaronca Rock Nature Reserve** – located along the Coolgardie-Esperance Highway near Higginsville, approximately 60 km south of Coolgardie and 9.5 km south of the small settlement of Widgiemooltha in Western Australia. It shows important and particularly clear exposures of the Binneringie Dyke, one of the world's largest basic dyke intrusions. It is the site of important geological research and part of ongoing study of basic intrusions in the Yilgarn Block (DAWE 2020).
- **Dundas Area** – located along the Eyre Highway, approximately 30 km southeast of Norseman in Western Australia. It is representative of the southern part of the eastern goldfields and has important wilderness values. Recommended as a possible National Park or Nature Reserve (DAWE 2020).
- **Peak Charles National Park** – located along the Coogardie-Esperance Highway, 40km west of Salmon Gums and 85 km south-west of Norseman, comprising Reserve 36004. Peak Charles is an area of over 39,000 ha in the eastern part of the wheatbelt region in an area that is rich in endemic species at a national scale.

The State Inherit database was searched for the Norseman area including the Desirables Project. From this, 58 heritage places were listed including 3 state registered places. The three state registered places are comprised of:

- **Holy Trinity Church** – 100 Angove Street, Norseman. Constructed 1898 to 1968.
- **Norseman Post Office** – 82 Prinsep Street, Norseman. Constructed 1897 to 1959.
- **Doctors House (fmr)** – 66 Talbot Street, Norseman. Constructed 1939, 1960s (destroyed by fire 2008).

It is expected the proposed activities in this Clearing Permit will not have any effect on European heritage listed places.

3. PROPOSED LAND CLEARING

As outlined in Section 1.1, this NVCP (Purpose Permit) application is for the development of Desirables which forms part of the larger NGP. This application requests approval to clear a combined total of 18.1 ha of native vegetation within a PPA of 918.7 ha.

The proposed clearing of native vegetation is to allow for the proposed mining of an open pit, construction of a WRD and ROM pad and construction of supporting infrastructure at Desirables. Supporting infrastructure includes (but is not limited to), laydown area, topsoil and growth medium stockpiles, roads and abandonment bunds.

Clearing of native vegetation will be undertaken as required commencing Quarter 2 (2025) as soon as approval is received and will be undertaken in accordance with the approved associated Mining Proposal for the Project (Table 1).

A GIS shapefile in GDA94 is provided with submission of this application.

4. ASSESSMENT OF CLEARING PRINCIPLES

Clearing applications are assessed against 10 principles as outlined in Schedule 5 of the EP Act (Table 8). These principles aim to ensure that all potential impacts resulting from the removal of native vegetation can be assessed in an integrated way and applied to all lands throughout Western Australia. The principles address the four main environmental areas of biodiversity significance, land degradation, conservation estate and ground and surface water quality.

Information regarding the potential impact of clearing for mining activities on each of these principles for the Desirables Project area is provided in Table 8.

Table 8: Native Vegetation Clearing Principles

Clearing Principle		Assessment
Biodiversity Significance	a). Native vegetation should not be cleared if it comprises a high level of biological diversity.	• The area proposed to be cleared is located within the Coolgardie 3 – Eastern Goldfields Subregion of the Coolgardie Bioregion within the Southwestern Interzone botanical district (Cowan, 2001). The subregion is extensive, measuring over 5.06 million hectares, with the proposed clearing amounting to 18.1 ha, representing <0.0004% of the sub-region. • Vegetation communities are considered common and widespread in the subregion. • No live Threatened (T) Flora pursuant to Part 2, Division 1, Subdivision 2 of the *Biodiversity Conservation Act 2016* (BC Act) and as listed by DBCA, or pursuant to section 179 of the EPBC Act or listed by the Department of Agriculture, Water and the Environment (DAWE), were identified during the flora assessment. • *Eremophila purpurascens* (P3) was found at Desirables, however it was concluded (Mattiske Consulting, 2024) *that no factors would either be a concern or warrant additional surveys* (Attachment 4). • No Threatened Ecological Communities (TEC) were recorded. No Priority Ecological Communities (PEC) were recorded in the study area. One PEC '*Allocasuarina globosa* assemblages on greenstone rock', supporting the Threatened flora species *Allocasuarina globosa* (T) is located south of Norseman. Desirables is some 8 km north of Norseman hence will have no impact. • Given the above, the vegetation proposed to be cleared does not comprise a high level of biological diversity hence the proposed clearing is not likely to be at variance with this Principle.
	b). Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	• The area proposed to be cleared is located within the Coolgardie 3 – Eastern Goldfields Subregion of the Coolgardie Bioregion within the Southwestern Interzone botanical district (Cowan 2001). The subregion is extensive, measuring over 5.06 million hectares, with the proposed clearing amounting to 18.1 ha, representing <0.0004% of the sub-region. • Eight fauna habitats were identified in the greater NGP area. Fauna habitats at Desirables are considered common and widespread in the subregion and unlikely to function as ecological linkages or refugia. • No conservation significant fauna species occur within the Desirables survey area. • Given the above, the vegetation proposed to be cleared does not comprise the whole or a part of, or is necessary for the maintenance of, a significant habitat for native fauna hence is not at variance with this Principle.
	c). Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	• As stated above in Principle (a), *Eremophila purpurascens* (P3) was found at Desirables, however it was concluded (Mattiske Consulting, 2024) *that no factors would either be a concern or warrant additional surveys* (Attachment 4). • The clearing as proposed is therefore not at variance with this Principle.
	d). Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a TEC.	• No Threatened Ecological Communities (TECs) were recorded during surveys of the Desirables Project area hence the clearing as proposed is therefore not at variance with this Principle.
	e). Native vegetation should not be cleared if it is significant as a remnant of native vegetation in	• No remnant vegetation occurs within the Desirables Project area hence the clearing of vegetation as proposed is therefore not at variance with this principle.

Clearing Principle		Assessment
	an area that has been extensively cleared.	
	f). Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	• No watercourses or wetlands are located within the proposed clearing area. • Lake Cowan is the closest Salt Lake associated with the Desirables Project; however, is not listed on the Directory of Important Wetlands of Australia (Environment Australia 2001). • Although local drainage is towards Lake Cowan, there are no major river systems within the vicinity of the Desirables deposit and much of the runoff from local catchments reports to the lake by a combination of shallow sheet and channel flow via minor creeks and watercourses. For most of the year, drainage systems are dry. • No vegetation groups are classed as riparian in the proposed clearing area hence the clearing of vegetation as proposed is therefore not at variance with this principle.
Land Degradation	g). Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	• The proposed area of native vegetation clearing is 18.1 ha and will not cause any appreciable land degradation. • The nearby Slippers and North Royal Projects contain existing disturbance from historic operations and supporting infrastructure. • All disturbed areas will be rehabilitated at the completion of operations in accordance with the Mine Closure Plan, or progressively throughout operations where it is practical to do so. • Six weed species were identified throughout the Project areas (refer to section 2.4.3). Under the Department of Parks and Wildlife Weed Prioritisation Process, **Gazania linearis* is one of the 17 Goldfields Region priority alert weeds (Mattiske, 2020a). None of these species are Weeds of National Significance (DAWE 2020b). Vehicle hygiene practices will be implemented to prevent the introduction and spread of weeds. • Soils are predominantly calcareous earths and slopes range from up to 25%. • The size and nature of the clearing is unlikely to increase water and wind erosion and increases in salinity, water logging, soil acidity and nutrient export are unlikely to occur, hence the clearing of vegetation as proposed is not at variance with this principle.
Conservation Estate	h). Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	• The NGP is located within the Great Western Woodlands (GWW) nominated for National Heritage listing. Clearing activities are unlikely to have an impact on the environmental values of the GWW as the extent of clearing is a small percentage of the GWW, the majority of Project areas have experienced previous disturbance through historical mining activities, operations will be completed in accordance with strict environmental management procedures including internal Ground Disturbance Permits, rehabilitation will be completed at the end of operations, or progressively throughout operation where it is practical to do so. • There are three heritage places on the Register of the National Estate (i.e. Binaronca Rock Nature Reserve, Dundas Area and Peak Charles National Park) however these will not be impacted, hence the clearing of vegetation as proposed is not at variance with this principle.
Ground and Surface Water Quality	i). Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	• There are no major river systems in the vicinity of Desirables. • Lake Cowan is the closest Salt Lake associated with the Project. • Clearing of vegetation around tributaries of Lake Cowan has the potential to result in increased sediment loads. This will be minimised through installation of sediment control structures at locations where high sediment loads are anticipated or observed. • The proposed clearing is unlikely to cause deterioration in the quality of any surface water.

Clearing Principle		Assessment
		• The groundwater within the Project is largely hypersaline and is consistent with the surrounding region. Mining at Desirables will be above the water table hence the proposed clearing is unlikely to cause deterioration in the quality of any groundwater. • There are no groundwater dependent vegetation units within the disturbance area. • The clearing of vegetation as proposed is therefore not at variance with this principle.
	j). Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	• The NGP is in a relatively flat to slightly undulating area which may on occasion be at risk of flooding following short intense rainfall events. All the water courses and drainages in the immediate vicinity of the Project are ephemeral and for most of the year, the drainage systems are dry. However, flows will occur periodically during high rainfall events. • Some localised increase in surface runoff may occur where vegetation is cleared. However, the impact is unlikely to be detectable in the context of the range of the natural variability of runoff. Any minor effects will be short term as most of the area cleared will be revegetated on completion of operations in accordance with the Mine Closure Plan. • Stormwater management controls e.g., v-drains, bunds and berms will be constructed as necessary to direct rainfall-runoff away from mining infrastructure. • Flood protection infrastructure has been designed based on analysis of sub-catchment characteristics to ensure appropriately sized structures are built. • The clearing of native vegetation is unlikely to cause or exacerbate the incidence of flooding hence is not at variance with this principle.

5. ENVIRONMENTAL MANAGEMENT MEASURES

In respect to the control and management of clearing and ground disturbance activities, the following shall be implemented:

- All proposed operations will be carried out in accordance with the provisions of the *Aboriginal Heritage Act 1972.*
- No impact to Aboriginal heritage sites because of ground disturbance and clearing.
- Disturbance will be minimised through careful design of site layout.
- Clearing activities will be managed to ensure clearing is strictly limited to that necessary for the operations.
- Ground disturbance and clearing is restricted to approved areas, amounts and limits.
- Implementation and adherence to the NVCP and valid exemptions.
- All Threatened and Priority flora and fauna species will be avoided.
- Include GIS check of vegetation communities, fauna habitat, Threatened and Priority flora and fauna species and Aboriginal heritage sites before approving the internal site Disturbance Permit.
- Inclusion of the relevant clearing approval (e.g., CPS number) on the internal site Disturbance Permit.
- Prior to clearing, the area will be demarcated.
- Stockpiles of growth medium (topsoil) will be stored at no greater than 2 m in height and will be protected from vehicular traffic and stormwater flows. Growth medium will be used to rehabilitate disturbed areas as soon as practicable.
- Post-clearing survey of ground disturbance.
- All vehicles and other equipment should be free of weed seeds and soil prior to mobilisation to site.
- Vehicles and other equipment will travel on designed access routes and mining infrastructure areas.
- Personnel will be required to adhere to speed limits and drive to road/weather conditions to minimise the risk of fauna injuries due to traffic.
- Annual review of disturbance areas and reporting in accordance with the NVCP, Mining Rehabilitation Fund (MRF) and Annual Environmental Report (AER) requirements.
- Disturbed areas will be rehabilitated progressively where possible and in accordance with the Mine Closure Plan.
- All personnel to complete the site induction which outlines strategies to protect the environment.

6. REHABILITATION

Rehabilitation is the return of disturbed land to a safe, stable, productive, non-polluting and self-sustaining condition in consideration of beneficial uses of the land. Appropriate rehabilitation will ensure that the long-term impacts of mining in the area are minimised.

Rehabilitation will be undertaken in accordance with the Mine Closure Plan and Pantoro will comply with all tenement conditions.

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APPENDICES

APPENDIX 1: PROOF OF OWNERSHIP

Department of **Energy, Mines, Industry Regulation and Safety**

GOVERNMENT OF WESTERN AUSTRALIA

eMiTS MINERAL TITLES ONLINE

MINING TENEMENT SUMMARY REPORT

MINING LEASE 63/156

Status: Live

TENEMENT SUMMARY

Area: 831.15000 HA
Mark Out : 06/05/1987 11:40:00
Received : 12/05/1987 11:00:00
Term Granted : 21 Years (Extended)
Death Reason :
Death Date :
Commence : 06/04/1988
Expiry : 05/04/2030

CURRENT HOLDER DETAILS

Name and Address
CENTRAL NORSEMAN GOLD CORPORATION PTY LTD
AUSTWIDE MINING TITLE MANAGEMENT PTY LTD, C/- AUSTWIDE MINING TITLE MANAGEMENT PTY LTD, PO BOX 1434, WANGARA, WA, 6947, xxxxxxxxx@austwidemining.com.au, xxxxxxxxxxx400

PANTORO SOUTH PTY LTD
C/- AUSTWIDE MINING TITLE MANAGEMENT PTY LTD, PO BOX 1434, WANGARA, WA, 6947

DESCRIPTION

Locality: NORSEMAN
Datum: DP SIT NE CNR LATE SURV GML 63/2311: CNR SURV M 63/12
Boundary: BOUNDARIES BEING IDENTICAL TO SURVEYED M63/12 BACK TO DATUM INCLUDING THE TAILINGS PREVIOUSLY THE SUBJECT OF LICENCES TO TREAT TAILINGS NOS 3587H AND 4150H

Area :

Type	Dealing No	Start Date	Area
Surveyed		11/05/1995	831.15000 HA
Granted		06/04/1988	831.20000 HA
Applied For		06/05/1987	831.20000 HA

SHIRE DETAILS

Shire	Shire No	Start	End	Area
DUNDAS SHIRE	3080	06/05/1987		831.15000 HA

RENT STATUS

Due For Year End 05/04/2025: PAID IN FULL
Due For Year End 05/04/2026: $23,795.20

EXPENDITURE STATUS

Expended Year End 05/04/2024: EXPENDED IN FULL
Current Year Commitment : $83,200.00

APPENDIX 2: LETTER OF AUTHORITY

Central Norseman Gold Corporation Pty Ltd
ABN 48 005 482 860

PO Box 56
Norseman 6443

Tel : 0890399800
Fax: 0890399803

31 May 2019

The Executive Director
Environment Division
Department of Mines, Industry Regulation and Safety
Mineral House
100 Plain Street
EAST PERTH WA 6004

Dear Sir/Madam

NORSEMAN GOLD PROJECT – Refer attached tenement list

Central Norseman Gold Corporation Pty Ltd ('CNGC') is the 100% holder of the tenements associated with the Norseman Gold Project. In May 2019, Pantoro South Pty Ltd ('PSPL') entered into a purchase and 50/50 unincorporated joint venture agreement with CNGPL ('JV Agreement'). PSPL and CNGC are to be tenants in common in respect to the tenements and PSPL has management control of the tenements.

CNGC acknowledges that PSPL will be lodging Programs of Work (POW's), Clearing Permit Applications, Mining Proposals and Mine Closure Plans with the Department of Mines, Industry Regulation & Safety ('DMIRS') for tenements associated with the Norseman Gold Project, prior to the tenement equity being transferred pursuant to the terms of the JV Agreement.

CNGC hereby consents to PSPL undertaking exploration and mining programs on the tenements listed above, subject to compliance by PSPL with all statutory requirements.

CNGC hereby confirm that PSPL are authorised and responsible for the submission and management of any POW's, Clearing Permit Applications, Mining Proposals and Mine Closure Plans submitted in respect to these Norseman Gold Project tenements, and requests that the department provides PSPL with the assistance and consideration necessary for the grant of such permits.

Yours sincerely

Kevin Maloney
Chairman & CEO

Attachment 1 – Tenement List

Tenement number	Holder	Shares
E63/1640	Central Norseman Gold Corporation Pty Ltd	100
E63/1641	Central Norseman Gold Corporation Pty Ltd	100
E63/1642	Central Norseman Gold Corporation Pty Ltd	100
L63/0012	Central Norseman Gold Corporation Pty Ltd	96
L63/0013	Central Norseman Gold Corporation Pty Ltd	96
L63/0014	Central Norseman Gold Corporation Pty Ltd	96
L63/0017	Central Norseman Gold Corporation Pty Ltd	96
L63/0019	Central Norseman Gold Corporation Pty Ltd	96
L63/0032	Central Norseman Gold Corporation Pty Ltd	96
L63/0034	Central Norseman Gold Corporation Pty Ltd	96
L63/0035	Central Norseman Gold Corporation Pty Ltd	96
L63/0036	Central Norseman Gold Corporation Pty Ltd	96
L63/0037	Central Norseman Gold Corporation Pty Ltd	96
L63/0038	Central Norseman Gold Corporation Pty Ltd	96
L63/0039	Central Norseman Gold Corporation Pty Ltd	96
L63/0040	Central Norseman Gold Corporation Pty Ltd	96
L63/0041	Central Norseman Gold Corporation Pty Ltd	96
M63/0009	Central Norseman Gold Corporation Pty Ltd	96
M63/0011	Central Norseman Gold Corporation Pty Ltd	96
M63/0013	Central Norseman Gold Corporation Pty Ltd	96
M63/0014	Central Norseman Gold Corporation Pty Ltd	96
M63/0015	Central Norseman Gold Corporation Pty Ltd	96
M63/0026	Central Norseman Gold Corporation Pty Ltd	96
M63/0029	Central Norseman Gold Corporation Pty Ltd	100
M63/0035	Central Norseman Gold Corporation Pty Ltd	96
M63/0036	Central Norseman Gold Corporation Pty Ltd	96
M63/0040	Central Norseman Gold Corporation Pty Ltd	96
M63/0041	Central Norseman Gold Corporation Pty Ltd	96
M63/0042	Central Norseman Gold Corporation Pty Ltd	96
M63/0043	Central Norseman Gold Corporation Pty Ltd	96
M63/0044	Central Norseman Gold Corporation Pty Ltd	96
M63/0045	Central Norseman Gold Corporation Pty Ltd	96
M63/0046	Central Norseman Gold Corporation Pty Ltd	96
M63/0047	Central Norseman Gold Corporation Pty Ltd	96

Tenement number	Holder	Shares
M63/0048	Central Norseman Gold Corporation Pty Ltd	96
M63/0049	Central Norseman Gold Corporation Pty Ltd	96
M63/0050	Central Norseman Gold Corporation Pty Ltd	100
M63/0051	Central Norseman Gold Corporation Pty Ltd	100
M63/0052	Central Norseman Gold Corporation Pty Ltd	100
M63/0053	Central Norseman Gold Corporation Pty Ltd	100
M63/0054	Central Norseman Gold Corporation Pty Ltd	100
M63/0055	Central Norseman Gold Corporation Pty Ltd	96
M63/0056	Central Norseman Gold Corporation Pty Ltd	96
M63/0057	Central Norseman Gold Corporation Pty Ltd	96
M63/0058	Central Norseman Gold Corporation Pty Ltd	96
M63/0059	Central Norseman Gold Corporation Pty Ltd	96
M63/0060	Central Norseman Gold Corporation Pty Ltd	100
M63/0061	Central Norseman Gold Corporation Pty Ltd	96
M63/0062	Central Norseman Gold Corporation Pty Ltd	96
M63/0063	Central Norseman Gold Corporation Pty Ltd	100
M63/0064	Central Norseman Gold Corporation Pty Ltd	100
M63/0065	Central Norseman Gold Corporation Pty Ltd	100
M63/0066	Central Norseman Gold Corporation Pty Ltd	100
M63/0067	Central Norseman Gold Corporation Pty Ltd	100
M63/0068	Central Norseman Gold Corporation Pty Ltd	96
M63/0069	Central Norseman Gold Corporation Pty Ltd	96
M63/0088	Central Norseman Gold Corporation Pty Ltd	96
M63/0096	Central Norseman Gold Corporation Pty Ltd	96
M63/0099	Central Norseman Gold Corporation Pty Ltd	96
M63/0100	Central Norseman Gold Corporation Pty Ltd	96
M63/0105	Central Norseman Gold Corporation Pty Ltd	96
M63/0108	Central Norseman Gold Corporation Pty Ltd	96
M63/0110	Central Norseman Gold Corporation Pty Ltd	96
M63/0112	Central Norseman Gold Corporation Pty Ltd	100
M63/0114	Central Norseman Gold Corporation Pty Ltd	96
M63/0115	Central Norseman Gold Corporation Pty Ltd	96
M63/0116	Central Norseman Gold Corporation Pty Ltd	96
M63/0118	Central Norseman Gold Corporation Pty Ltd	96
M63/0119	Central Norseman Gold Corporation Pty Ltd	96
M63/0120	Central Norseman Gold Corporation Pty Ltd	96

Tenement number	Holder	Shares
M63/0122	Central Norseman Gold Corporation Pty Ltd	96
M63/0125	Central Norseman Gold Corporation Pty Ltd	96
M63/0126	Central Norseman Gold Corporation Pty Ltd	96
M63/0127	Central Norseman Gold Corporation Pty Ltd	96
M63/0128	Central Norseman Gold Corporation Pty Ltd	96
M63/0129	Central Norseman Gold Corporation Pty Ltd	96
M63/0130	Central Norseman Gold Corporation Pty Ltd	96
M63/0133	Central Norseman Gold Corporation Pty Ltd	100
M63/0134	Central Norseman Gold Corporation Pty Ltd	96
M63/0136	Central Norseman Gold Corporation Pty Ltd	96
M63/0137	Central Norseman Gold Corporation Pty Ltd	96
M63/0138	Central Norseman Gold Corporation Pty Ltd	96
M63/0140	Central Norseman Gold Corporation Pty Ltd	100
M63/0141	Central Norseman Gold Corporation Pty Ltd	96
M63/0142	Central Norseman Gold Corporation Pty Ltd	96
M63/0145	Central Norseman Gold Corporation Pty Ltd	100
M63/0152	Central Norseman Gold Corporation Pty Ltd	96
M63/0155	Central Norseman Gold Corporation Pty Ltd	100
M63/0156	Central Norseman Gold Corporation Pty Ltd	100
M63/0160	Central Norseman Gold Corporation Pty Ltd	96
M63/0164	Central Norseman Gold Corporation Pty Ltd	96
M63/0173	Central Norseman Gold Corporation Pty Ltd	100
M63/0174	Central Norseman Gold Corporation Pty Ltd	96
M63/0178	Central Norseman Gold Corporation Pty Ltd	96
M63/0180	Central Norseman Gold Corporation Pty Ltd	96
M63/0182	Central Norseman Gold Corporation Pty Ltd	96
M63/0184	Central Norseman Gold Corporation Pty Ltd	96
M63/0187	Central Norseman Gold Corporation Pty Ltd	96
M63/0189	Central Norseman Gold Corporation Pty Ltd	96
M63/0190	Central Norseman Gold Corporation Pty Ltd	96
M63/0207	Central Norseman Gold Corporation Pty Ltd	100
M63/0213	Central Norseman Gold Corporation Pty Ltd	100
M63/0214	Central Norseman Gold Corporation Pty Ltd	96
M63/0218	Central Norseman Gold Corporation Pty Ltd	96
M63/0219	Central Norseman Gold Corporation Pty Ltd	96
M63/0220	Central Norseman Gold Corporation Pty Ltd	100

Tenement number	Holder	Shares
M63/0224	Central Norseman Gold Corporation Pty Ltd	96
M63/0233	Central Norseman Gold Corporation Pty Ltd	100
M63/0257	Central Norseman Gold Corporation Pty Ltd	96
M63/0258	Central Norseman Gold Corporation Pty Ltd	96
M63/0259	Central Norseman Gold Corporation Pty Ltd	96
M63/0265	Central Norseman Gold Corporation Pty Ltd	100
M63/0272	Central Norseman Gold Corporation Pty Ltd	96
M63/0273	Central Norseman Gold Corporation Pty Ltd	100
M63/0274	Central Norseman Gold Corporation Pty Ltd	96
M63/0275	Central Norseman Gold Corporation Pty Ltd	96
M63/0315	Central Norseman Gold Corporation Pty Ltd	96
M63/0316	Central Norseman Gold Corporation Pty Ltd	96
M63/0325	Central Norseman Gold Corporation Pty Ltd	96
M63/0326	Central Norseman Gold Corporation Pty Ltd	96
M63/0327	Central Norseman Gold Corporation Pty Ltd	96
M63/0526	Central Norseman Gold Corporation Pty Ltd	96
P63/1391	Central Norseman Gold Corporation Pty Ltd	100
P63/1392	Central Norseman Gold Corporation Pty Ltd	100
P63/1393	Central Norseman Gold Corporation Pty Ltd	100
P63/1779	Central Norseman Gold Corporation Pty Ltd	100
P63/1835	Central Norseman Gold Corporation Pty Ltd	100
P63/1836	Central Norseman Gold Corporation Pty Ltd	100
P63/1837	Central Norseman Gold Corporation Pty Ltd	100
P63/2003	Central Norseman Gold Corporation Pty Ltd	100
P63/2004	Central Norseman Gold Corporation Pty Ltd	100
P63/2010	Central Norseman Gold Corporation Pty Ltd	100
P63/2089	Central Norseman Gold Corporation Pty Ltd	100

APPENDIX 3: MATTISKE CONSULTING, 2024: FLORA AND VEGETATION ASSESSMENT TSF 5 AND DESIRABLES AREAS, NORSEMAN GOLD PROJECT

FLORA & VEGETATION ASSESSMENT

TSF5 AND DESIRABLES AREAS

NORSEMAN GOLD PROJECT

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

Pantoro Limited

Date

December 2024

DOCUMENT STATUS				
DOCUMENT REFERENCE: CNG2401/011/24				
VERSION	**TYPE**	**AUTHOR/S**	**REVIEWER/S**	**DATE DISTRIBUTED**
V1	Internal review	K. Tribbeck	Z. Sims	
V2	Draft for client	K. Tribbeck	E. M. Mattiske	20/12/2024
V3	Final	K. Tribbeck	E. M. Mattiske	13/01/2025

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Mattiske Consulting Pty Ltd has utilised information and data supplied by Pantoro Ltd (and its agents), and sourced from government databases, literature, departments and agencies in the preparation of this report. Mattiske Consulting Pty Ltd has compiled this report on the basis that any supplied or sourced information and data was accurate at the time of publication. Mattiske Consulting Pty Ltd accepts no liability or responsibility whatsoever for the use of, or reliance upon, the whole or any part of this report by any third party.

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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BoM:	Bureau of Meteorology
CLUSTER	Hierarchical Clustering
DAWE	Department of Agriculture, Water and Environment
DBCA:	Department of Biodiversity, Conservations and Attractions
DCCEEW:	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation
DPIRD:	Department of Primary Industries and Regional Development
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
IBRA:	Interim Biogeographical Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessment
Mattiske Consulting:	Mattiske Consulting Pty Ltd
NVIS	National Vegetation Information System
Pantoro	Pantoro Limited
PEC:	Priority Ecological Community
PRIMER v7	Plymouth Routines in Multivariate Ecological Research version 7
SIMPER	Similarity Percentages
SIMPROF	Similarity Profile
TEC:	Threatened Ecological Community
WAH:	Western Australian Herbarium (PERTH)

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned in February 2024 by Pantoro Limited to undertake a detailed flora and vegetation assessment of two Norseman Gold Project areas located around Norseman, Western Australia. A desktop assessment of flora and vegetation of the greater Norseman Gold Project area was carried out in March 2024, followed in September by a four day detailed flora and vegetation field survey in two survey areas, TSF5 and Desirables. This report describes the methodology and results of that survey, and discusses their significance.

A total of 21 quadrats in the Desirables survey area and 16 quadrats in the TSF5 survey area. Overall, the detailed flora and vegetation survey recorded:

- A total of 124 vascular plant taxa which are representative of 67 genera and 31 families were recorded across the Survey Area. The majority of taxa recorded were representative of the Myrtaceae (21 taxa), Chenopodiaceae (18 taxa), Asteraceae (15 taxa), and Scrophulariaceae (12 taxa) families. These five families accounted for 53% of all taxa recorded.
- Species accumulation analysis recorded approximately 66.4 % of the flora potentially present within the two Survey Areas has been recorded. The lower proportion of flora recorded could be resultant of the small size of the Survey Areas, making it difficult to attain adequate replicates without pseudo-replication of vegetation communities.
- No threatened flora species were recorded within the two survey areas.
- Two priority flora species were recorded in the survey areas. Three records of *Eucalyptus brockwayi* (P3) and three records of *Eremophila purpurascens* (P3) were found in the TSF5 survey area, and one record of *Eremophila purpurascens* (P3) was found in the Desirables survey area.
- No declared pest organisms pursuant to section 22 of the BAM Act were recorded within the TSF5 and Desirables Survey Areas. Nine introduced weed taxon permitted under section 11 of the BAM Act were recorded in the Survey Areas, **Asphodelus fistulosus*, **Carrichtera annua*, **Centaurea melitensis*, **Lysimachia arvensis*, **Medicago minima*, **Mesembryanthemum nodiflorum*, **Oligocarpus calendulaceus*, **Sonchus asper* and **Sonchus oleraceus*.
- Eight vegetation communities were mapped across the TSF5 Survey Area: Seven Eucalypt woodland/mallee shrubland communities (NW, S, and W) and a disturbed community (CL). One community, S7, was newly defined and only occurs within the TSF5 Survey Area.
- Eight eucalypt woodland/mallee shrublands (NW, NS and W), one *Casuarina* woodland (NW11), and one disturbed community (CL). There are three newly defined communities that only occur in the Desirables Survey Area (NS5, NW16, NW17).
- No Threatened or Priority ecological communities were recorded as occurring in the Norseman Gold survey areas.
- Vegetation condition within the survey areas ranged from excellent to degraded. Overall, the Desirables survey area was in better condition, with the majority (47.6%) of sites being in excellent condition, than the TSF5 survey area, with the majority (43.8%) of sites in very good condition.
- Vegetation in the TSF5 and Desirables survey areas was found to be predominantly Eucalypt woodlands, with minor shrublands on rocky upper slopes and ridges, and narrow strips of *Casuarina* woodland and chenopod shrubland along salt lake margins.

1. INTRODUCTION

Pantoro Limited (Pantoro) is the owner/operator of the Norseman Gold Project. The Norseman Gold Project is located in the Eastern Goldfields of Western Australia, at the southern end of the highly productive Norseman-Wiluna greenstone belt. The Norseman Gold Project occupies numerous, contiguous mining tenements, with the current operational and prospective areas spanning approximately 70 km distance from north to south.

Mattiske Consulting Pty Ltd (Mattiske Consulting) has completed flora and vegetation surveys of numerous prospective mine and infrastructure areas (Mattiske Consulting 2020a, 2020b) on behalf of Pantoro, some of which are currently being actively mined. The areas which have been surveyed by Mattiske Consulting, together with their survey dates, are listed in Table 1.

Mattiske Consulting was commissioned in February 2024 by Pantoro to undertake a detailed flora and vegetation assessment of a new tailings storage facility, referred to as TSF5, and an area adjacent to North Royal, referred to as Desirables. This report summarises the results of the flora and vegetation survey of the TSF5 and Desirables survey areas, and updates both the desktop assessment (Mattiske Consulting 2020a) prepared in 2020, and merges the previous vegetation mapping (Mattiske Consulting 2020b) with that of the TSF5 and Desirables areas and provide a comprehensive report on the desktop and field findings.

1.1 Location and Scope of Project

The Norseman Gold Project is located in the Shire of Dundas, near the town of Norseman in Western Australia's Goldfields Region. The Norseman Gold Project areas are situated between Lake Cowan in the north, and Lake Dundas to the south (Figure 1). The TSF5 area is situated within mining tenements M63/133 and M63/14. The Desirables area is situated within mining tenements M63/214, M63/173, M63/155, M63/156, M63/29 and M63/11 (Figure 2). The scope of the present survey was to complete a detailed flora and vegetation assessment of the TSF5 and Desirables areas.

1.2 Environmental Legislation and Guidelines

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

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

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

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act);
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*

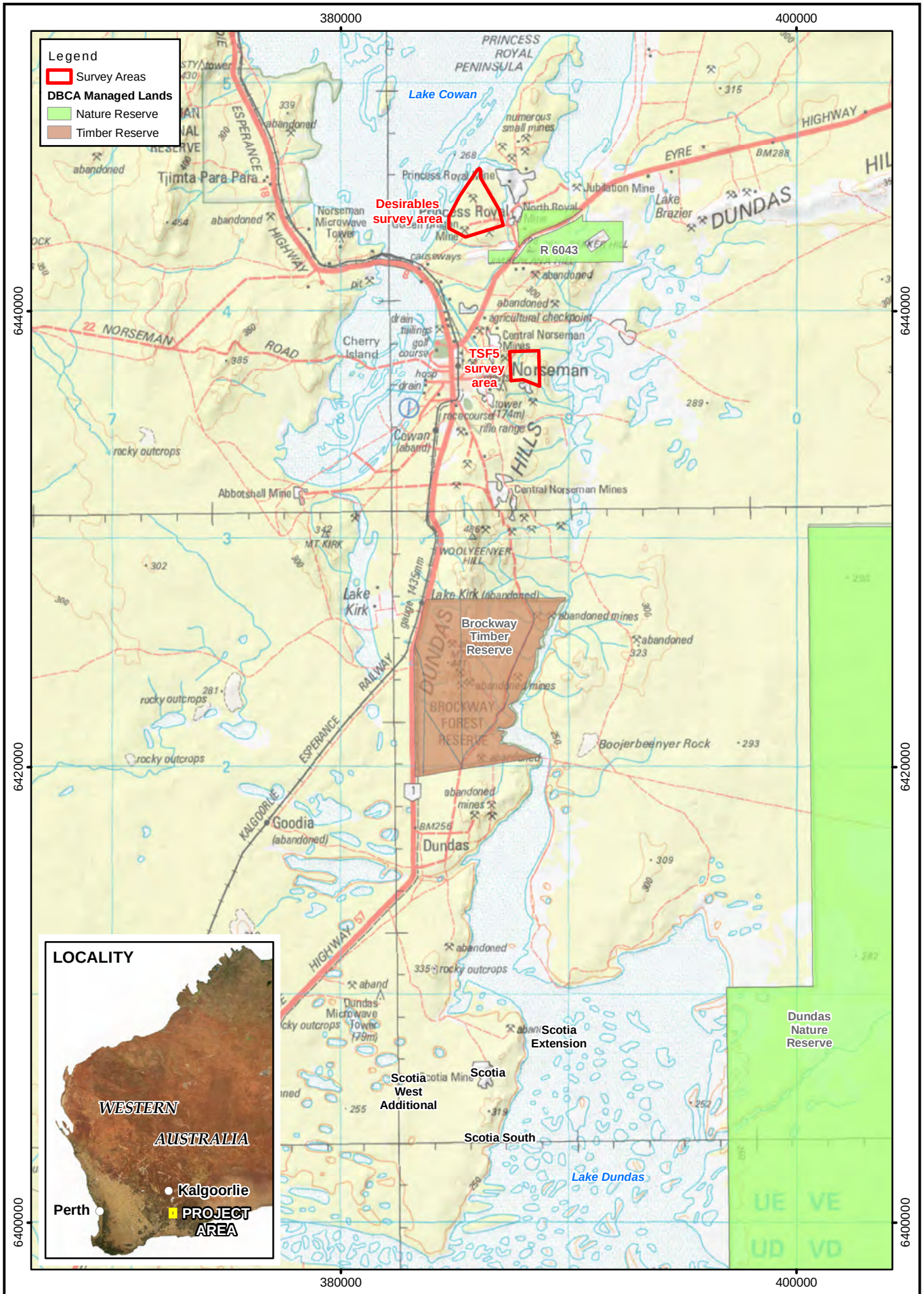
Furthermore, key Western Australian guidelines relevant to this survey are the:

- *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (Environmental Protection Authority [EPA] 2016a); and
- *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016b)

Definitions of flora and vegetation terminology commonly used throughout this report are set out in Appendices A1 – A4.

Table 1: Survey areas and dates for Mattiske Consulting surveys within the Norseman Gold Project

SURVEY AREA	SURVEY DATE(S)	AREA (ha)	REFERENCE
Gladstone	29/03/2020-3/04/2020	1,380.33	Mattiske Consulting Pty Ltd (2020a)
Gladstone / North Royal Haul Roads	29/03/2020-3/04/2020	29.11	Mattiske Consulting Pty Ltd (2020a)
Jimberlanna Pipeline	29/03/2020-3/04/2020	67.18	Mattiske Consulting Pty Ltd (2020a)
North Royal	29/03/2200-3/04/2020	379.91	Mattiske Consulting Pty Ltd (2020a)
Scotia	29/03/2020-3/04/2020	700.89	Mattiske Consulting Pty Ltd (2020a)
Camp	21/09/2020-25/09/2020 & 5/10/2020-9/10/2020	14.84	Mattiske Consulting Pty Ltd (2020b)
Cobbler	21/09/2020-25/09/2020 & 5/10/2020 – 9/10/2020	476.25	Mattiske Consulting Pty Ltd (2020b)
Gladstone Extensions (Gladstone-Jimberlanna connection)	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	29.32	Mattiske Consulting Pty Ltd (2020b)
Gladstone Extensions (Gladstone Laydown)	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	22.12	Mattiske Consulting Pty Ltd (2020b)
Maybell	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	312.32	Mattiske Consulting Pty Ltd (2020b)
North Royal Extension	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	7.61	Mattiske Consulting Pty Ltd (2020b)
OK	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	120.34	Mattiske Consulting Pty Ltd (2020b)
Scotia Extensions (Scotia Extension)	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	197.65	Mattiske Consulting Pty Ltd (2020b)
Scotia Extensions (Scotia South)	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	78.13	Mattiske Consulting Pty Ltd (2020b)
Scotia Extensions (Scotia West Additional)	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	201.25	Mattiske Consulting Pty Ltd (2020b)
Slippers	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	19.14	Mattiske Consulting Pty Ltd (2020b)
TSF 4	21/09/2020 – 25/09/2020 & 5/10/2020 – 9/10/2020	216.51	Mattiske Consulting Pty Ltd (2020b)
TSF5	2024	168.69	This report
Desirables	2024	402.59	This report
Total Area Surveyed		**4,824.18**	



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Scale: 1:225,000
MGA94 (Zone 51)

CAD Ref: a2764_f09_01

Date: December 2024 | Rev: A | A4

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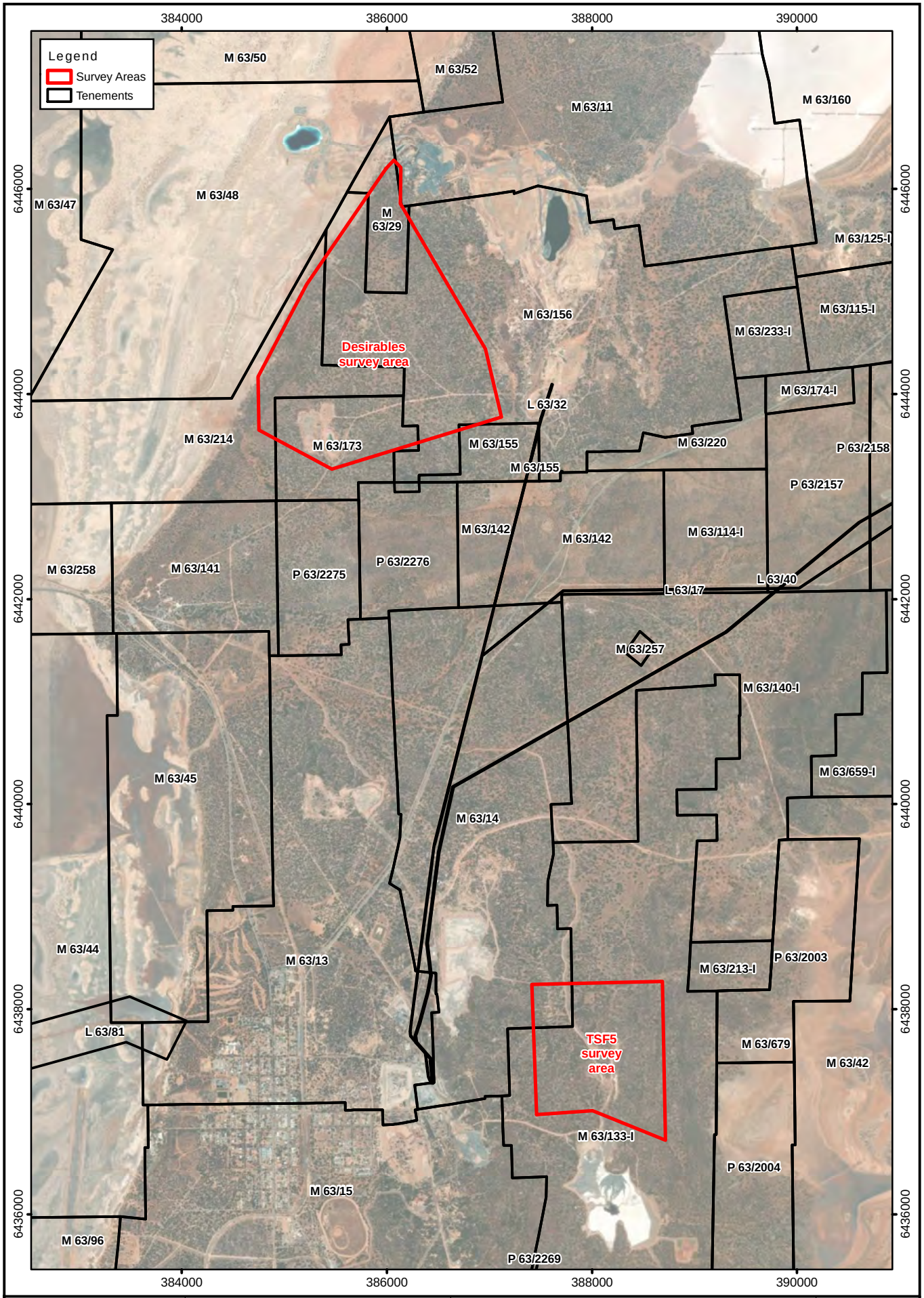
Figure: **1**



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MGA94 (Zone 51)

CAD Ref: a2764_f09_02

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Tenements

Figure: **2**

2. OBJECTIVES

The aim of this survey was to complete a flora and vegetation assessment of the TSF5 and Desirables survey areas. Specifically, the objectives included:

- undertake a desktop assessment to evaluate the botanical values of the local and broader area associated with the TSF5 and Desirables survey areas to identify any matters of botanical or conservation significance, and update the overall desktop assessment for the Norseman Gold Project;
- on the basis of the reviews, provide summaries to assist in the assessment of the potential range of values and the potential for conservation significant species and communities;
- undertake a Detailed flora and vegetation survey within the TSF5 and Desirables survey areas (Figure 2);
- collect and identify the vascular plant species present in vegetation survey quadrats, relevés, as well as opportunistically, within the TSF5 and Desirables survey areas;
- record visual observations of the fire regimes, grazing pressures and overall health of the vegetation to allow for an assessment of the overall condition of the flora and vegetation within the TSF5 and Desirables survey areas;
- review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the Department of Biodiversity, Conservation and Attractions (DBCA), and listed by the Department of Climate Change, Energy, the Environment and Water (DCCEEW 2024a) under the *Environment Protection and Biodiversity Conservation Act 1999*;
- undertake a statistical analysis of the quadrat-based data recorded within the TSF5, Desirables and all other survey areas previously surveyed by Mattiske Consulting to assist with vegetation community delineation within the TSF5 and Desirables survey areas, and provide an integrated vegetation map of the Norseman Gold Project areas; and
- Prepare a report detailing the findings.

3. METHODS

The vegetation survey was completed to the standards set out in *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a) and *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016b).

3.1 Desktop Assessment

The desktop assessment of the TSF5, Desirables and broader area was undertaken using the resources from the DBCA (2007-, 2024a, 2024c, 2024e), the DCCEEW (2024a, 2024b, 2024c), and the Western Australian Herbarium (WAH 1998-). The parameters used for database searches included a 20 km buffer about the Norseman Gold Project, based on a centreline through the northern and southern project areas, for both general, threatened and priority flora, and threatened and priority ecological community (TEC and PEC) searches.

FloraBase (WAH 1998-), NatureMap (DBCA 2007-) and Dandjoo (DBCA 2024f) databases were used to identify the possible occurrence of threatened and priority flora, TEC and PEC communities, and additional natural areas of significance within the Norseman Gold Project area. The EPBC Act Protected Matters Search Tool (DCCEEW 2024c) was used to identify botanical and vegetation units of National Environmental Significance and other matters protected by the EPBC Act within the Survey Areas. In addition, historical documentation and vegetation mapping of the region, principally that of Beard (1970, 1975, 1990), Hall and Newbey (1993) and Keighery *et al.* (1993) were reviewed.

Previous flora and vegetation surveys from the Norseman area (Botanica Consulting 2010; GHD Pty Ltd 2009, 2010a, 2010b; Goldfields Environmental Management Pty Ltd 1989; Landcare Services Pty Ltd 1995, 1996, 1997; Marianna Partners Environmental Services 1996; Mattiske Consulting 2001a, 2001b, 2002, 2005, 2013a, 2013b; Native Vegetation Solutions 2019; Outback Ecology 2003; Paul Armstrong & Associates 2004; Rally Revegetation and Environmental Services 2004, 2005; Umwelt Australia Pty Ltd 2016) were reviewed to identify the occurrence of threatened and priority flora likely to be found within the Norseman Gold Project survey areas and vegetation communities mapped in those areas (Appendix B).

The Threatened and Priority Flora (DBCA 2020) and WAH Flora (WAH 2020) databases were searched by CAD Resources for records of threatened and priority flora in the survey areas (DBCA Ref. 18-0320FL). The likelihood of occurrence of any threatened and priority flora within both the North and South Norseman Gold Project study areas was assessed on the basis of: proximity of previous records to the current survey areas, age of the record, and size of the recorded population and soil and habitat preferences (Appendix C). This data was used to map the distribution of individual taxa and to inform the assessment of species' likelihood of occurrence within the TSF5 and Desirables survey areas.

3.2 Field Survey

The detailed flora and vegetation assessment of the TSF5 and Desirables Survey Areas was undertaken by two experienced botanists from Mattiske Consulting, both of whom were familiar with the local flora, between the 16th and 19th September 2024. Both botanists held valid collection licenses to collect flora for scientific purposes, issued under Regulation 62 of the *Biodiversity Conservation Regulations* 2018.

Vegetation quadrats were established as appropriate to sample the main vegetation communities present. Vegetation quadrat locations were initially selected using aerial imagery, with modification and additions being made in the field. All vegetation survey quadrats measured 20 m x 20 m in size. In situations where vegetation community shape (e.g., drainage channels) precluded establishing quadrats of the standard dimension, an area of equivalent size (i.e., 400 m^2) was surveyed. The flora and vegetation were sampled and described systematically at each vegetation survey quadrat, and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each vegetation survey quadrat, the following floristic and environmental parameters were recorded:

- GPS location (GDA94 datum);
- photograph of the vegetation from the north-west corner of quadrat facing south-east;
- soil type, colour and any additional observations;
- local site topography;
- presence of any outcropping rocks and their type;
- aspect of the hill-slopes;
- percentage of litter cover (logs, twigs and/or leaves);
- percentage of bare ground;
- time since fire;
- condition of the vegetation, based on Keighery's (1994) condition ratings for the South West and Interzone botanical provinces (Appendix A5); and
- alive and dead percentage of foliage cover and average height of each species recorded.

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the WAH. All plant specimens were identified through comparisons with pressed specimens housed at the Mattiske Consulting herbarium and WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

3.3 Statistical Analysis of Data and Vegetation Mapping

A species accumulation curve, based on accumulated species versus number of quadrats surveyed was prepared, to evaluate the level of adequacy of the survey effort. The species accumulation curve was based on the species accumulation analysis of Colwell (2013).

Plymouth Routines in Multivariate Ecological Research version 7 (PRIMER v7) statistical analysis software was used to analyse species-by-site data and discriminate sites on the basis of their species composition (Clarke and Gorley 2015). Data collected from the 2024 survey (this survey) was merged with data from the surveys conducted by Mattiske Consulting in 2020 (Mattiske Consulting 2020a, 2020b), ensuring that vegetation communities across the entire Central Norseman Gold Project Area are described consistently. To down weight the relative contributions of quantitatively dominant species a 4th root transformation was applied to the data set. Introduced species, singletons (species recorded at only one site) and specimens that were not identified down to the species level were excluded from the analysis. Annuals were removed from the data in analysis due to the likelihood of substantial differences between years based on seasonality of local rainfall events. Taxa from the *Atriplex* and *Tecticornia* genera were identified to a genus level due a lack of flowering/fruiting material to aid in species identification. Due to their dominance in vegetation community composition, they were still used in statistical analysis. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Transformed data were analysed using a series of multivariate analysis routines including Hierarchical Clustering (CLUSTER), Similarity Profile (SIMPROF) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and the delineation of individual vegetation communities.

3.4 Vegetation Descriptions

Vegetation descriptions were based on Aplin's (1979) modification of the vegetation classification system of Specht (1970), to align with the National Vegetation Information System (NVIS). Vegetation communities were described at the association level of the NVIS classification framework, as defined by the NVIS Technical Working Group (2017) (Appendix A6).

3.5 Index of Biodiversity Surveys for Assessment

The flora and vegetation survey data and report were compiled into an Index of Biodiversity Surveys for Assessment (IBSA) package in accordance with the instructions for preparing packages for the IBSA (EPA 2023), and supplied to Pantoro for submission via the IBSA portal.

4. DESKTOP ASSESSMENT RESULTS

4.1 Bioregional Setting

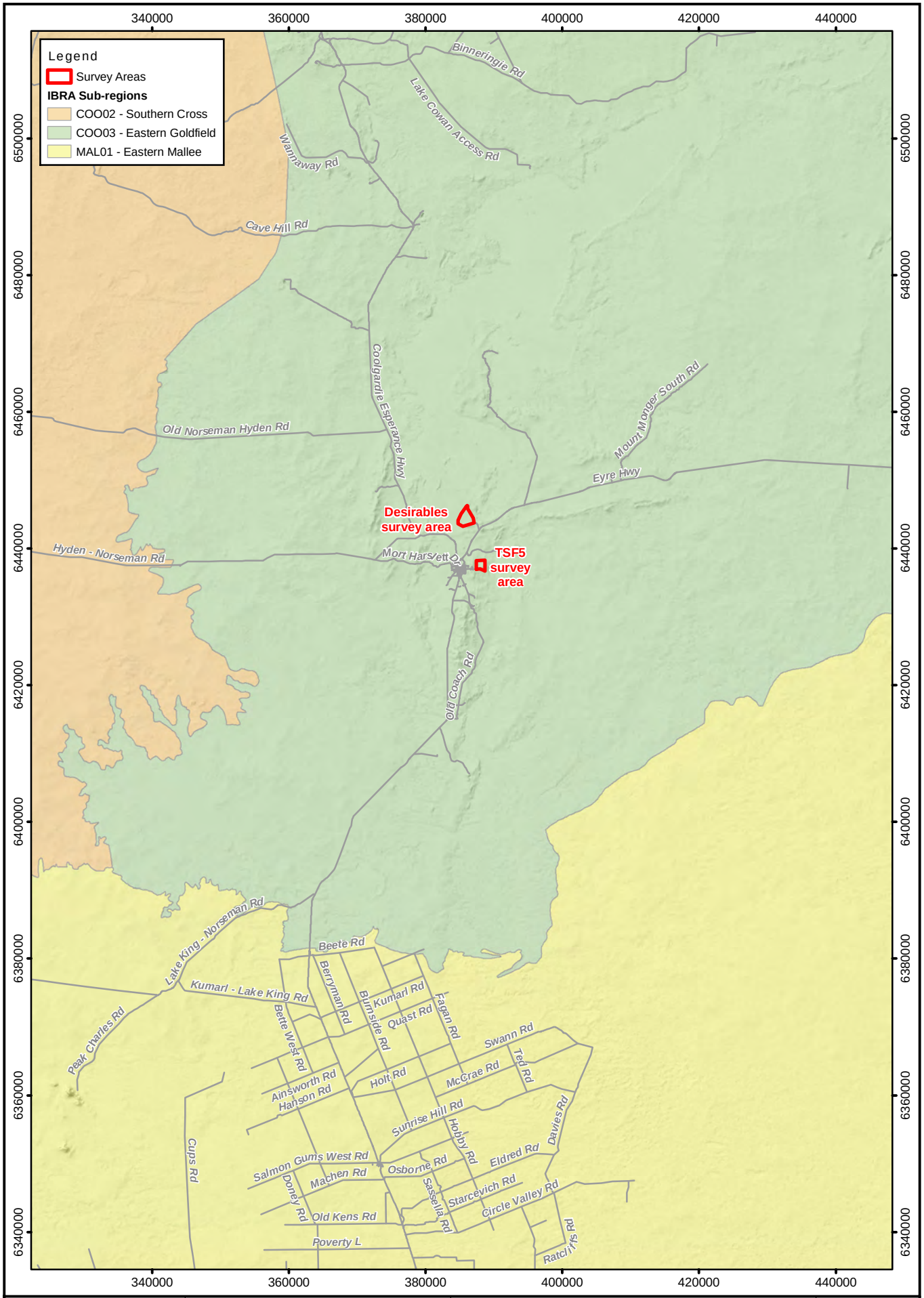
The Interim Biogeographic Regionalisation for Australia (IBRA) Version 7, delineated 89 bioregions and 419 sub-regions across Australia, based on a range of biotic and abiotic factors, including climate, vegetation, fauna, geology and landform (Thackway and Cresswell 1995; DCCEEW 2024d). The IBRA sub-regions represent more localised and homogenous geomorphological units in each bioregion (DCCEEW 2024d). The Norseman Gold Project, including the TSF5 and Desirables survey areas, is situated within the Eastern Goldfield (COO03) sub-region of the Coolgardie IBRA region (Figure 3). Cowan (2001) described the Eastern Goldfield sub-region as lying on the Yilgarn Craton's 'Eastern Goldfields Terrains'. The relief is subdued and comprises gently undulating plains interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying geology is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas. A series of large playa lakes in the western half are the remnants of an ancient major drainage line.

The vegetation is of Mallees, *Acacia* thickets and shrub-heaths on sandplains. Diverse *Eucalyptus* woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. Woodlands and *Dodonaea* shrubland occur on basic granulites of the Fraser Range. The majority of the sub-region is Unoccupied Crown Land and Crown reserves, with lesser extents of grazing-native pasture-leasehold, freehold land, conservation reserves, and mining leases.

The extent of intersection of the both the TSF5 and Desirables survey areas, and other Norseman Gold Project areas with the Eastern Goldfield IBRA sub-region is set out in Table 2.

Table 2: Extent of IBRA sub-regions intersecting the Norseman Gold Project areas

SURVEY AREA	IBRA SUB-REGION	CURRENT EXTENT (ha)	AREA OF INTERSECTION WITH SURVEY AREA (ha)	PROPORTION OF CURRENT EXTENT (%)
Camp	Eastern Goldfields	5,058,248.43	14.84	0.00
Cobbler	Eastern Goldfields	5,058,248.43	476.25	0.01
Gladstone	Eastern Goldfields	5,058,248.43	1,380.33	0.03
Gladstone / North Royal Haul Roads	Eastern Goldfields	5,058,248.43	29.11	0.00
Gladstone Extensions (Gladstone Laydown)	Eastern Goldfields	5,058,248.43	22.12	0.00
Gladstone Extensions (Gladstone-Jimberlanna connection)	Eastern Goldfields	5,058,248.43	29.32	0.00
Jimberlanna Pipeline	Eastern Goldfields	5,058,248.43	67.18	0.00
Maybell	Eastern Goldfields	5,058,248.43	312.32	0.01
North Royal	Eastern Goldfields	5,058,248.43	379.91	0.01
North Royal Extension	Eastern Goldfields	5,058,248.43	7.61	0.00
OK	Eastern Goldfields	5,058,248.43	120.34	0.00
Scotia	Eastern Goldfields	5,058,248.43	700.89	0.01
Scotia Extensions (Scotia Extension)	Eastern Goldfields	5,058,248.43	197.65	0.00
Scotia Extensions (Scotia South)	Eastern Goldfields	5,058,248.43	78.13	0.00
Scotia Extensions (Scotia West Additional)	Eastern Goldfields	5,058,248.43	201.25	0.00
Slippers	Eastern Goldfields	5,058,248.43	19.14	0.00
TSF4	Eastern Goldfields	5,058,248.43	216.51	0.00
TSF5 (this survey)	Eastern Goldfields	5,058,248.43	168.61	0.00
Desirables (this survey)	Eastern Goldfields	5,058,248.43	402.59	0.01
Totals			4,824.10	



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Scale: 1:750,000
MGA94 (Zone 51)

CAD Ref: a2764_f09_03

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Norseman Gold Project
IBRA Sub-regions

Figure: **3**

4.2 Climate

Beard (1990) describes the climate of the Coolgardie Botanical District as typically arid non-seasonal to semi-arid Mediterranean climate, with annual rainfall between 200 and 300 mm. Cowan (2001) describes the climate of the sub-region as arid to semi-arid with 200-300 mm of rainfall, sometimes in summer, but usually winter.

The nearest relevant Bureau of Meteorology (BoM) station to the Norseman Gold Project is located at Norseman Aero (BoM station 012009). Rainfall and temperature data from Norseman Aero is illustrated in Figure 4. The rainfall and temperature data shown spans the period from the commencement of Mattiske Consulting surveys in 2020, to the current survey.

The rainfall the 3 months preceding the 2024 survey (June-August) was 41.34% above the long-term average (64.1mm) at 90.6mm (BoM 2024). However, the preceding 12 months before the 2024 survey show that rainfall is 33.91% below the long-term average for the same period. Temperatures 12 months preceding the 2024 survey were also 0.8°C higher, on average, when compared to the long-term average for Norseman Aero (BoM 2024).

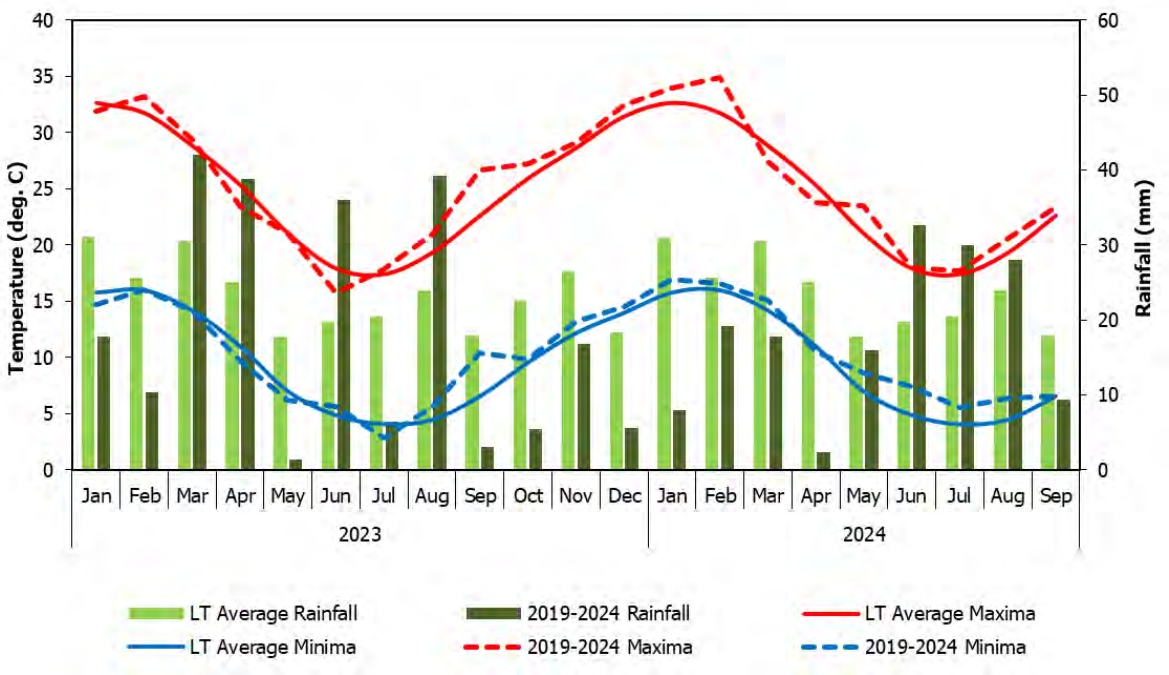


Figure 4: Rainfall and temperature data for Norseman Aero (BoM Station 012009).

4.3 Geology, Soils and Topography

The geology of the area consists of Archaean greenstones and granite of the Yilgarn Block, and Proterozoic granite and gneiss of the Fraser Range Block (Beard 1990, Cowan 2001). The topography is of gently undulating plains, interrupted by occasional ranges of low hills and ridges of Archaean greenstones, playa lakes and sandplains in the west. A horst of Proterozoic basic granulite interrupts the undulating plains to the east (Beard 1990, Cowan 2001).

Hall & Newbey (1993), in their study of the Norseman-Balladonia area, described the area in the vicinity of the Norseman Gold Project, situated between Lake Cowan and Lake Dundas, as an Archaean greenstone belt, consisting of a number of distinct formations, eroded into low hills and ridges with colluvial flats. A series of salt lakes, including Lake Dundas and Lake Cowan, represent remnants of a major Palaeodrainage channel. Prominent chains of hills in the area are the Dundas Hills, near Norseman. Shallow calcareous earths occur on slopes, low ridges and hills within the greenstone belt near Norseman. Broad Valleys, lying generally between lake Cowan and Lake Dundas, within which the Norseman Gold Project is situated, are broad, saucer-shaped valleys 2-15 km in width with internal relief usually less than 20 m and slopes rarely exceeding 2°. The valleys consist of colluvial, alluvial and aeolian fills of Palaeodrainage systems. The broad valleys are well drained by sheet movement of water or indistinct drainage lines that flow after heavy rainfall, and are dominated by deep calcareous earths with sheet deposits of Aeolian sands in some areas.

Soil-landscapes zones of Western Australia's rangelands and arid interior were defined by Tille (2006). The TSF5 and Desirables survey areas are situated within the Kambalda Zone (265) of the Kalgoorlie province (Tille 2006, Figure 5). The area is characterised by flat to undulating plains, hills, ranges, stony plains and salt lakes on greenstone and granite of the Yilgarn Craton (Tille 2006). Soils of the area include: Salt lake soils, red loamy earths, hardpan shallow loams, sandy duplexes and calcareous loamy earths. Calcareous earths are the predominant soil in the area, covering most of the plains and greenstone areas (Beard 1990, Hall & Newbey 1993, Cowan 2001, Tille 2006). Tille (2006) notes that the Stirling and Kalgoorlie Provinces grade into each other and that the boundary between the two reflects the change in terrain from Tertiary marine sediments supporting predominantly mallee vegetation with Melaleuca spp. understorey, to terrain formed by Aeolian deposits in the north that supports predominantly eucalypt woodland with halophytic understorey.

The Land Systems, mapped by Tille (2006), present within the TSF5 and Desirables survey areas (Figure 6, Table 3) include:

1. SV2: Saline valleys with some dunes including barchan forms – salt lake channels, mostly devoid of true soils, and their fringing areas
2. DD14: Flat to undulating land with small valleys occasionally broken by low narrow rocky hills and ridges, or tors and bosses
3. BB5: Rocky ranges and hills of greenstones – basic igneous rocks

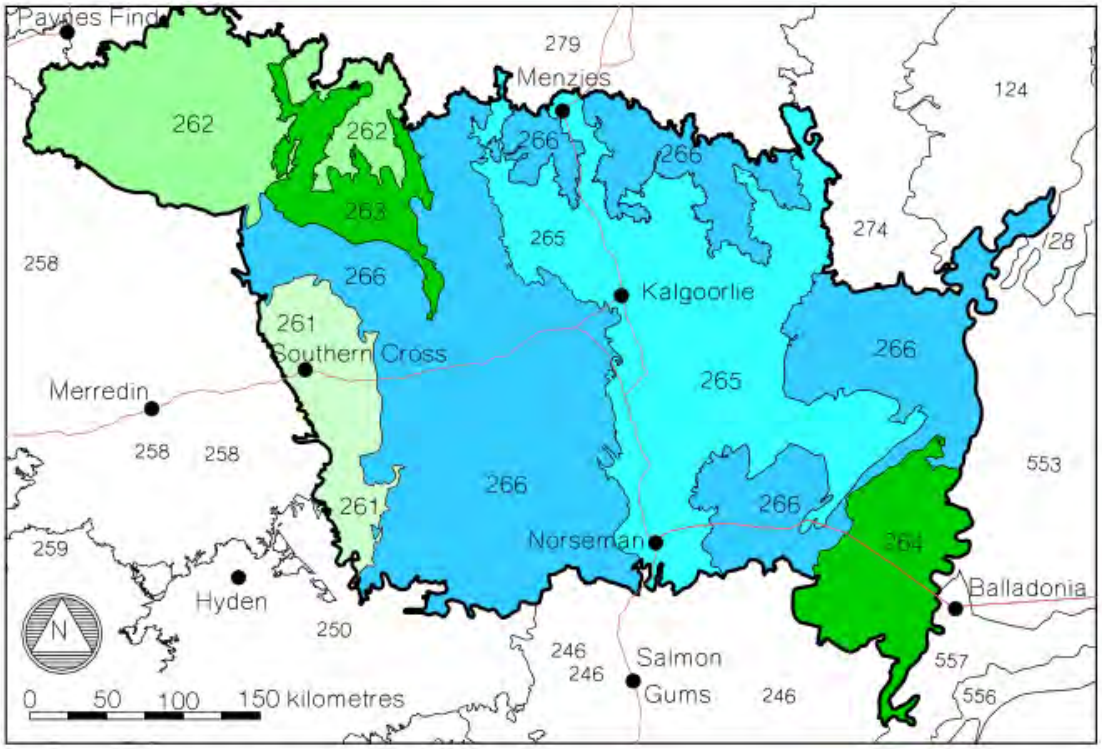
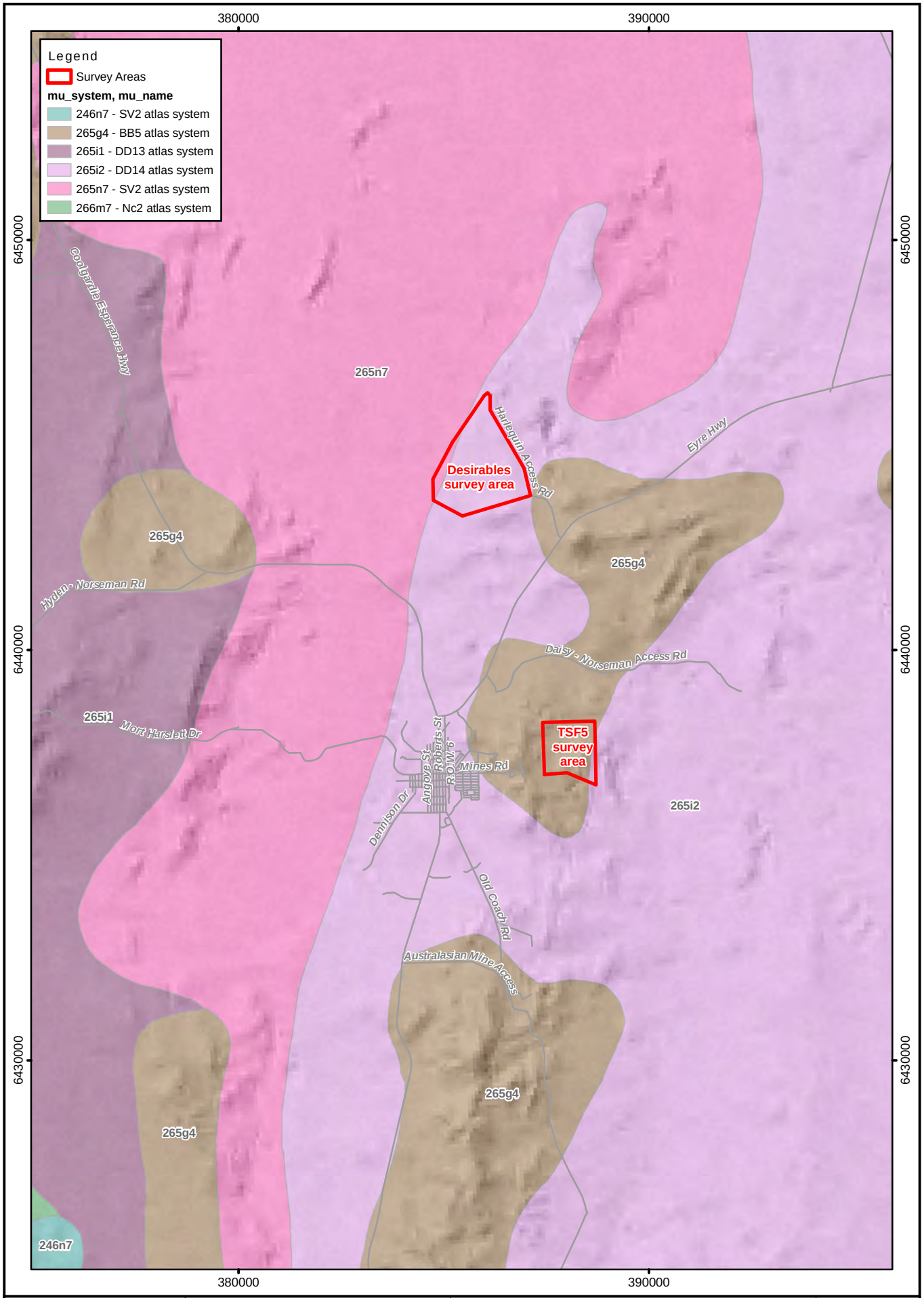


Figure 5: Soil-landscape zones of the WA rangelands and interior: Kalgoorlie Province (Tille 2006).



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Scale: 1:125,000
MGA94 (Zone 51)

CAD Ref: a2764_f09_04

Date: December 2024 | Rev: A | A4

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Pantoro Limited
Norseman Gold Project
Land Systems

Figure: **6**

Table 3: Extent of land systems intersecting the Norseman Gold Project areas

SURVEY AREA	LAND SYSTEM 265 ATLAS SYSTEM	CURRENT EXTENT (ha)	AREA OF INTERSECTION WITH SURVEY AREA (ha)	PROPORTION OF CURRENT EXTENT (%)
Camp	BB5	145065.31	14.84	0.01
Cobbler	SV2	69940.69	476.25	0.68
Gladstone	DD14	434972.34	1380.33	0.32
Gladstone / North Royal Haul Roads	BB5	145065.31	21.79	0.02
	DD14	434972.34	7.32	0.00
Gladstone Extensions (Gladstone Laydown)	DD14	434972.34	22.12	0.01
Gladstone Extensions (Gladstone-Jimberlanna connection)	DD14	434972.34	29.32	0.01
Jimberlanna Pipeline	BB5	145065.31	37.10	0.03
	DD14	434972.34	30.13	0.01
Maybell	DD14	434972.34	261.94	0.06
	SV2	87033.82	50.39	0.06
North Royal	BB5	145065.31	64.57	0.04
	DD14	434972.34	272.52	0.06
	SV2	69940.69	42.83	0.06
North Royal Extension	DD14	434972.34	7.61	0.00
OK	BB5	145065.31	8.10	0.01
	DD14	434972.34	112.28	0.03
Scotia	BB5	145065.31	6.67	0.00
	DD14	434972.34	10.89	0.00
	Lb10	38416.39	469.99	1.22
	SV2	87033.82	213.35	0.25
Scotia Extensions (Scotia Extension)	Lb10	38416.39	36.96	0.10
	SV2	87033.82	160.70	0.18
Scotia Extensions (Scotia South)	Lb10	38416.39	21.55	0.06
	SV2	87033.82	56.58	0.07
Scotia Extensions (Scotia West Additional)	DD14	434972.34	36.96	0.01
	Lb10	38416.39	120.45	0.31
	SV2	87033.82	43.85	0.05
Slippers	BB5	145065.31	18.61	0.01
	DD14	434972.34	0.53	0.00
TSF4	BB5	145065.31	139.46	0.10
	DD14	434972.34	77.05	0.02
TSF5 (this survey)	BB5	145065.31	155.47	0.11
	DD14	434972.34	13.13	0.00
Desirables (this survey)	SV2	87033.82	27.14	0.03
	DD14	434972.34	375.45	0.09

4.4 Regional Vegetation Mapping

4.4.1. Historical Vegetation Description and Mapping (Beard 1975, 1990)

The Norseman Gold Project lies within the Coolgardie Botanical District of the Southwestern Interzone (Beard 1990). Beard (1990) described the vegetation of the Coolgardie Botanical District as predominantly Eucalypt woodland, becoming open and with saltbush-bluebush understorey on calcareous soils. *Allocasuarina* thickets and scrub-heath occur on sandplains and there are patches of shrub steppe adjoining the Great Victoria Desert (Beard 1990).

Beard (1975) described the vegetation in which the Norseman Gold Project is located as forming a part of the Coolgardie System. The vegetation in which the Norseman Gold Project area is situated comprises hill systems with a *Eucalyptus torquate - Eucalyptus lesouefii* association, with an open shrub understorey of *Eremophila scoparia*, *Eremophila glabra*, *Eremophila oldfieldii*, *Dodonaea lobulata* and *Acacia* species.

The woodlands of the middle slopes comprise *Eucalyptus lesouefii*, with *Eucalyptus transcontinentalis*, *Eucalyptus salmonophloia*, *Eucalyptus oleosa*, *Eucalyptus campaspe*, and as less common species, *Eucalyptus clelandii*, *Eucalyptus flocktoniae* and *Eucalyptus gracilis*. The understorey of the middle slopes is either a 'broombrush' or 'saltbush' type, depending on the alkalinity of the soil. The broombrush understorey, on the less alkaline soils, comprises typically, Eremophila scoparia, with a mix of species including, *Eremophila decipiens, Eremophila glabra, Eremophila ionantha, Eremophila oldfieldii, Acacia hemiteles, Atriplex nummularia, Daviesia aphylla, Dodonaea adenophora, Dodonaea stenozyga, Grevillea oncogyne, Hibbertia pungens, Olearia muelleri, Prostanthera incurvata, Ptilotus obovatus, Scaevola spinescens, Thryptomene urceolaris*, and *Westringia rigida*. The saltbush type of understorey appears usually on lower ground with high alkalinity. The typical understorey comprises *Atriplex vesicaria*, *Cratystylis conocephala*, and *Maireana sedifolia.*

The woodlands of the lower slopes and flats consist typically of *Eucalyptus salmonophloia*, often with *Eucalyptus salubris*, *Eucalyptus lesouefii*, or *Eucalyptus longicornis*. The understorey is same as the middle slopes, but with increasing salinity, salt tolerant plants such as *Tecticornia* spp., and *Frankenia pauciflora* may appear. The broombrush understorey tends to be dominated by *Melaleuca pauperiflora* the heavier soils.

4.4.2. Vegetation and Flora (G.J. Keighery *et al.* 1993)

The vegetation and flora associated with the Norseman Gold Project lie within an area, described as Broad Valley by Keighery *et al.* (1993). The area comprises both colluvial and alluvial soils with a number of salt lakes in the region, including Lake Dundas and Lake Cowan, represent remnants of a major Palaeodrainage channels (Hall & Newbey, 1993).

The lake floors support *Tecticornia* low shrublands comprised of *Disphyma crassifolium*, *Tecticornia halocnemoides*, *Tecticornia indica* subsp. *bidens*, *Tecticornia lylei*, *Surreya diandra*, *Frankenia pauciflora* and *Maireana glomerifolia*. The lake slopes, margins of the extensive Lake Dundas support low woodlands of *Eucalyptus lesouefii* over *Bossiaea walkeri* with sedges of *Dianella revoluta* and *Lepidosperma* sp. Calcareous earths on the margin of the smaller salt lakes support low woodlands of *Eucalyptus oleosa* with *Eucalyptus kumarlensis* over shrubs of *Cratystylis conocephala* (Grey Bush), *Geijera linearifolia*, *Melaleuca lanceolata* and *Melaleuca quadrifaria*.

The Broad Valley, comprising flat and gentle undulating plains generally between Lake Cowan and Lake Dundas, support mixed low woodlands of *Eucalyptus dundasii*, *Eucalyptus flocktoniae*, *Eucalyptus lesouefii*, *Eucalyptus longicornis* and *Eucalyptus oleosa* in various combinations over *Acacia hemiteles*, *Eremophila scoparia*, *Exocarpos aphyllus*, *Melaleuca pauperiflora* and *Olearia muelleri*. Gentle undulating plains with deep calcareous earths support low woodlands of *Eucalyptus salubris* and *Eucalyptus cylindriflora*.

4.5 Pre-European Vegetation

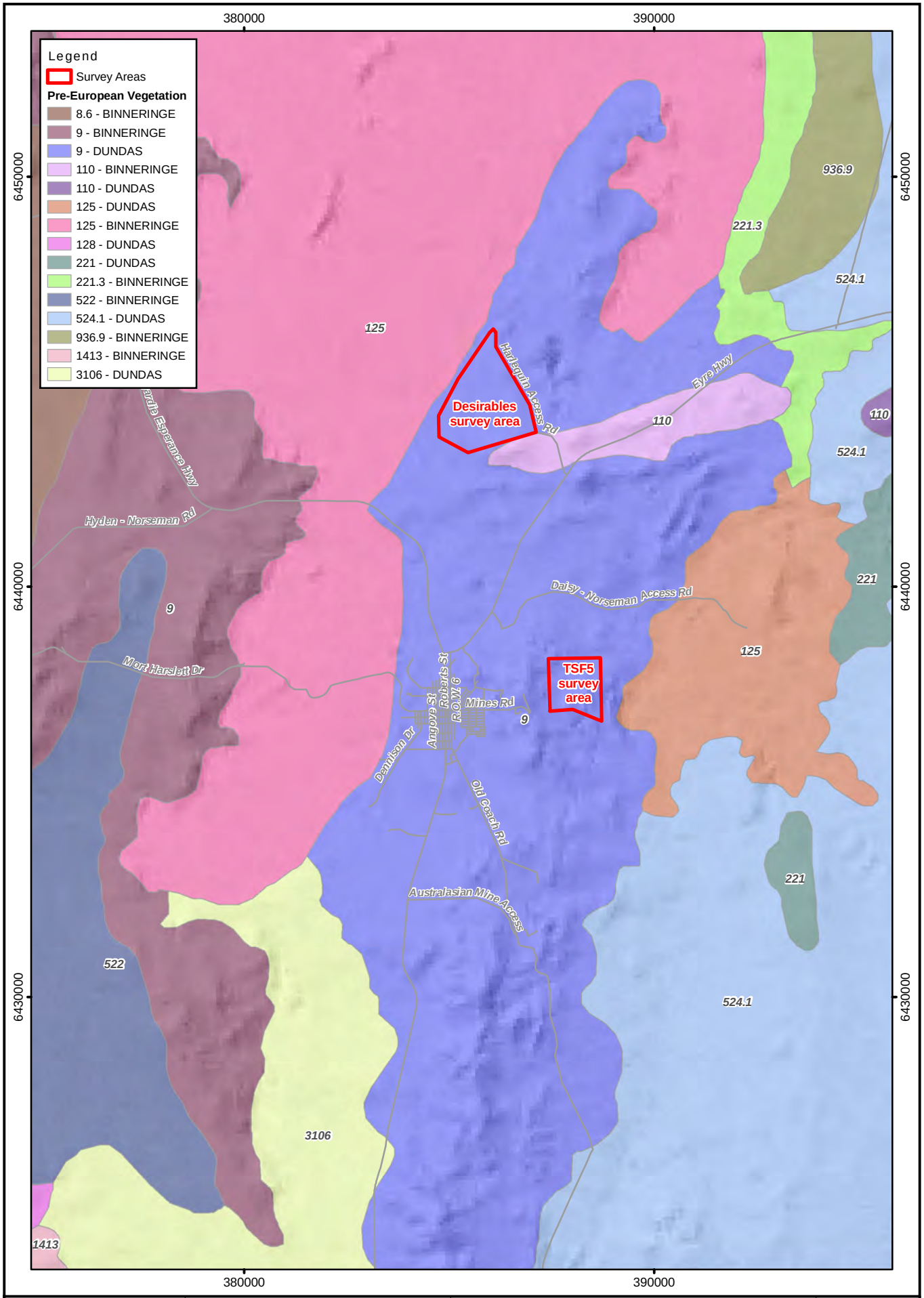
The pre-European vegetation dataset, prepared through the National Land and Water Resources Audit, describes vegetation in relation to natural resource boundaries commonly used for environmental reporting (Shepherd *et al.* 2001). The identification of the original pre-European and current extent of each of the vegetation types assist in providing baselines for managing issues such as land clearing (Shepherd *et al.* 2001). Hopkins, Beeston and Shepherd (2001) delineated a series of vegetation maps based primarily on the work of Beard carried out between the years of 1964 to 1981.

The Pre-European vegetation associations present within the TSF5 and Desirables survey areas (Figure 7, Table 4) include:

1. 110.0: Hummock grassland with scattered shrubs or mallee - *Triodia scariosa*, *Acacia* spp., *Grevillea* spp., *Eucalyptus* spp.;
2. 9.0: Medium Eucalypt woodland over *Eremophila* sparse shrubland - *Eucalyptus salubris*, *Eucalyptus oleosa*, *Eucalyptus torquata*, *Eucalyptus lesouefii*, *Eucalyptus clelandiorum* over *Eremophila scoparia*, *Eremophila glabra*, *Eremophila oldfieldii*; and,

4.6 Great Western Woodlands

The Department of Environment and Conservation's (DEC 2014) A Biodiversity and Cultural Conservation Strategy for the Great Western Woodlands outlines the issues and management responses to the protection of the internationally significant Great Western Woodlands. The purpose of the strategy is to provide a management approach to the protection of the environmental and cultural values of the Great Western Woodlands through coordination and integration of many management elements. The Great Western Woodlands are the largest remaining intact Mediterranean-climate woodland which covers almost 16 million hectares in size and extends between the edge of the Western Australian Wheatbelt in the west, to Kalgoorlie-Boulder in the north, the inland deserts to the north east and the Nullarbor Plain to the east (DEC 2014). The Great Western Woodlands spans two botanic and climatic zones, the wetter south-west and the arid interzone (into which the Norseman Gold Project area falls), and is an internationally significant area of biological richness (DEC 2014). The vegetation of the area is predominantly woodland communities, but also includes shrubland and mallee vegetation. The Great Western Woodlands supports approximately 20% of Australia's known flora and is a centre of Eucalyptus species diversity, with over 160 species of Eucalyptus found in the area (DEC 2014). The Norseman Gold Project is located in the southern portion of the Great Western Woodlands (Figure 8).



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Scale: 1:125,000
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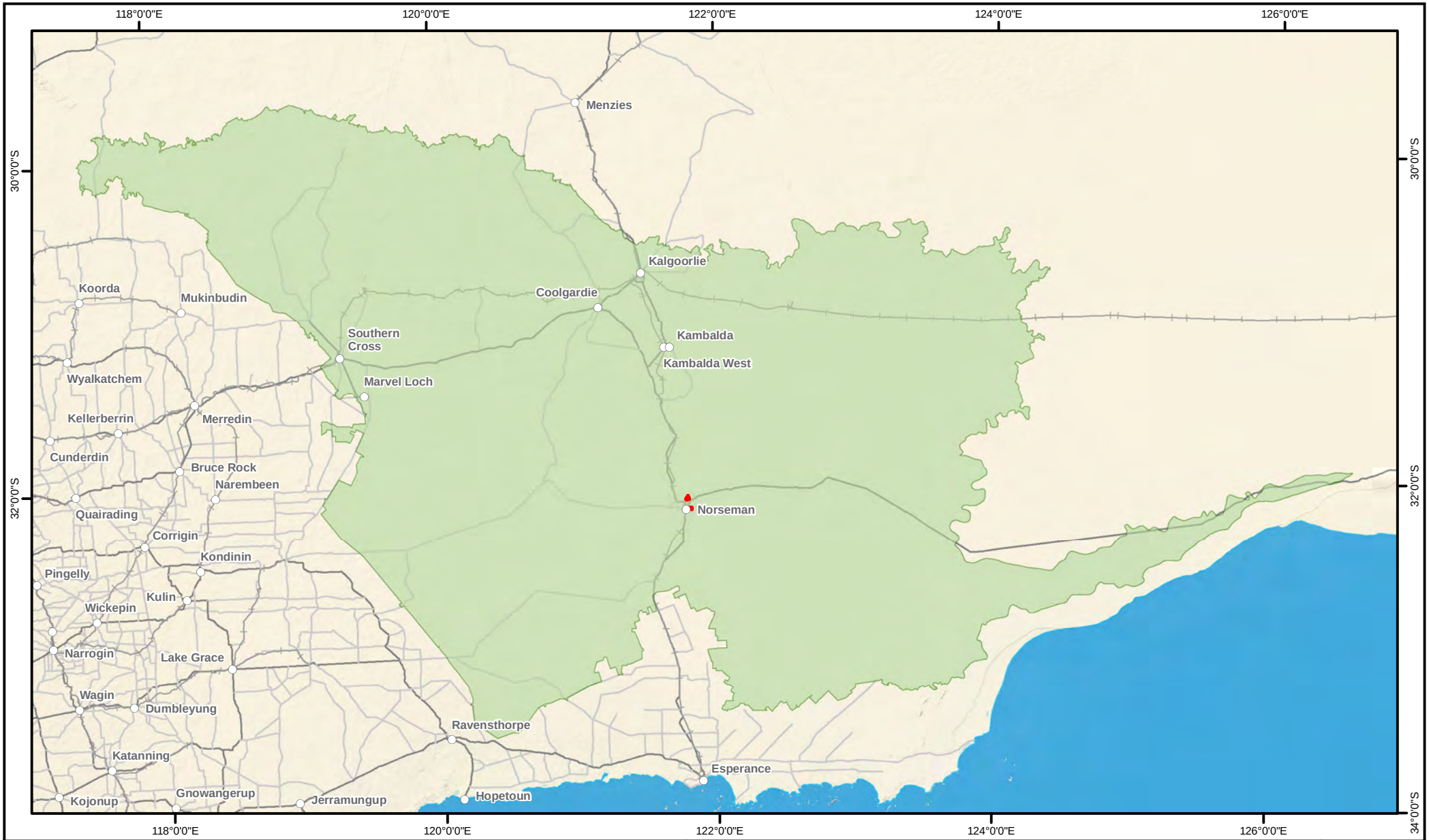
Pre-European Vegetation

Figure: **7**

Table 4: Extent of pre-European vegetation associations intersecting the Norseman Gold Project areas

SURVEY AREA	IBRA SUB-REGION	CURRENT EXTENT (ha)	AREA OF INTERSECTION WITH SURVEY AREA (ha)	PROPORTION OF CURRENT EXTENT (%)
Gladstone Extensions (Gladstone-Jimberlanna connection)	125.0	57174.68	15.18	0.027
	221.0	7745.68	14.12	0.18
Jimberlanna Pipeline	9.0	24099.43	41.97	0.17
	221.3	7745.68	6.07	0.08
	524.1	327628.09	19.14	0.01
Camp	9.0	24099.43	14.84	0.06
Cobbler	9.0	24099.43	47.75	0.20
	125.0	746.25	428.51	57.42
North Royal	9.0	24099.43	365.23	1.51
	110.0	746.25	9.48	1.27
Maybell	125.0	57174.68	73.08	0.13
	221.3	9220.75	131.70	1.43
	3106.0	52870.48	107.54	0.20
Gladstone	125.0	57174.68	1368.15	2.40
	221.3	9220.75	9.83	0.11
	524.1	327628.09	2.35	0.00
North Royal Extension	9.0	24099.43	7.61	0.03
Gladstone / North Royal Haul Roads	9.0	24099.43	26.79	0.11
	110.0	746.25	1.76	0.24
	125.0	57174.68	0.56	0.00
OK	9.0	24099.43	120.34	0.50
Scotia	125.0	57174.68	30.25	0.05
	3106.0	52870.48	665.44	1.26
Gladstone Extensions (Gladstone Laydown)	9.0	24099.43	17.53	0.07
	125.0	57174.68	4.60	0.01
Scotia Extensions (Scotia Extension)	125.0	57174.68	14.40	0.03
	3106.0	52870.48	183.25	0.35
Scotia Extensions (Scotia South)	125.0	57174.68	8.10	0.01
	3106.0	52870.48	70.03	0.13
Scotia Extensions (Scotia West Additional)	3106.0	52870.48	201.25	0.38
Slippers	9.0	24099.43	12.23	0.05
	110.0	746.25	6.90	0.93
TSF4	9.0	24099.43	216.51	0.90
TSF5 (this survey)	9.0	24099.43	168.61	0.70
Desirables (this survey)	9.0	24099.43	402.41	1.67
	110.0	746.25	0.19	0.03



Legend

- Survey Areas
- Great Western Woodlands

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Great Western Woodlands

Figure: **8**

4.7 Previous Surveys

Many flora and vegetation surveys have been conducted in and around Norseman, with one of the earliest maps being produced fifty years ago by Beard (Beard 1970) and the accompanying memoir in 1975 (Beard 1975). Many more surveys have been required recently by mining companies with activities in and around Norseman. The location, purpose, method and results of twenty-one field surveys carried out between 1989 and 2019 are reviewed and summarised in Appendix B. Eight of the previous surveys listed here were conducted by Mattiske Consulting Pty Ltd (2001a, 2001b, 2002, 2005, 2013a, 2013b, 2020a, 2020b).

4.8 Mattiske Consulting Surveys associated with the Norseman Gold Project

Mattiske Consulting has undertaken extensive survey work within the Norseman Gold Project area over the last three and a half decades with the most recent and applicable work being completed in 2020. Detailed flora and vegetation surveys undertaken in Autumn and Spring by Mattiske Consulting in 2020 recorded 178 and 168 vascular plant species respectively (Mattiske Consulting 2020a; 2020b). Over the autumn and spring surveys of 2020 a total of ten Priority flora, including four Priority 1, one Priority 2 and five Priority 3 taxa, were recorded. One additional Priority taxon, *Eremophila parvifolia* ?subsp. *parvifolia* (P4), could not be confidently identified to subspecies level due to insufficient fruiting material, but was treated as the priority subspecies as a precautionary approach (Mattiske Consulting 2020a). Thirty-two different vegetation communities were identified consisting primarily of Eucalypt woodlands and chenopod shrublands.

Mattiske Consulting (2020b) defined four vegetation communities adjacent to the TSF5 and Desirables survey areas:

- **NW10:** Mid woodland of mixed *Eucalyptus* spp. over tall sparse shrubland of *Melaleuca* ?*sheathiana* over open mid-low shrubland of *Atriplex* spp. on brown clayey loam with some surface rocks on gentle mid to upper slopes.
- **NW14:** Low-mid woodland of *Eucalyptus urna* over mid-tall shrubland of *Eremophila* ?*ionantha*, *Ricinocarpos stylosus* and *Santalum acuminatum* over mixed low shrubs on red clayey soils with some surface gravel in drainage lines.
- **NW15:** Mid woodland of *Eucalyptus lesouefii* and *E. dundasii* over open mid shrubland of *Trymalium myrtillus* subsp. *myrtillus* and *Halgania* ?*andromedifolia* on red-brown clay-gravel on mid slopes with some outcropping granite in areas disturbed in the past.
- **S4:** Open shrubland of *Grevillea nematophylla* subsp. *nematophylla* with emergent *Eucalyptus stricklandii* over *Hibbertia pungens*, *Allocasuarina acutivalvis* subsp. *acutivalvis* and *Dampiera latealata* on orange clay loam with outcropping ironstone on ridges.

4.9 Threatened and Priority Ecological Communities

No Threatened ecological communities as listed at the Commonwealth level pursuant to sections 181 and 182 of the EPBC Act and listed by the DCCEEW (2024b), or at the State level pursuant to Part 2, Division 2, Subdivision 1 of the BC Act and as listed by DBCA (2024c), either occur within the Norseman Gold Project areas nor the broader surrounding area.

No priority ecological communities (PECs) as listed at State level by DBCA (2024e) intersect any of the Norseman Gold Project areas. The Priority 1 ecological community, '*Allocasuarina globosa* assemblages on greenstone rock' (Esperance District) is listed at State level by DBCA (2024e) and occurs approximately 14 km south of the TSF5 survey area. The assemblage is only known from near Norseman and in the Bremer Range (see Bremer Range vegetation complexes (P1)). It is described as *Allocasuarina* thickets on greenstone ridges of lateritic breakaways; *Acacia duriuscula*, *Allocasuarina globosa*, *Eucalyptus georgei* subsp. *georgei* and *Eucalyptus oleosa* thickets on greenstone ridges with skeletal soils (DBCA 2024e).

4.10 State Reserves

There are a 2 reserves in the area surrounding the Norseman Gold Project (Figure 1). In the South, the Dundas Nature Reserve is located approximately 10 km east of the Scotia survey area. In the north, an unnamed Nature Reserve (R 6043) encompasses Jimberlana Hill and is adjacent to the Desirables survey area. The TSF5 area does not intersect any Reserve.

4.11 Flora

A total of 910 vascular plant taxa, representative of 76 families and 287 genera, have the potential to occur within the Norseman Gold Project area, based on NatureMap (DBCA 2007-) search results and Mattiske Consulting (2020a, 2020b) (Appendix D). The older surveys (Botanica Consulting 2010; GHD Pty Ltd 2009, 2010a, 2010b; Goldfields Environmental Management Pty Ltd 1989; Landcare Services Pty Ltd 1995, 1996, 1997; Marianna Partners Environmental Services 1996; Mattiske Consulting Pty Ltd 2001a, 2001b, 2002, 2005, 2013a, 2013b; Outback Ecology 2003; Paul Armstrong & Associates 2004; Rally Revegetation and Environmental Services 2004; Umwelt Australia Pty Ltd 2016), included in Appendix B, were not used in compiling the species list as they were (1) outdated surveys, and (2) the surveys completed by Mattiske Consulting in 2020 (2020a, 2020b) are directly relevant to the TSF5 and Desirables survey areas.

The most commonly represented families were Myrtaceae (140 taxa), Fabaceae (104 taxa) and Asteraceae (93 taxa). The most commonly represented genera were Eucalyptus (80 taxa), Acacia (53 taxa), Eremophila (39 taxa), Melaleuca (31 taxa) and Maireana (18 taxa).

4.12 Conservation Significant Flora

A total of 41 conservation significant flora taxa were recorded within the search buffer. The 41 conservation significant flora comprised three Threatened taxon, twelve Priority 1, five Priority 2, seventeen Priority 3, and four Priority 4 taxa. The Mattiske Consulting autumn and spring surveys of 2020 (2020a, 2020b) recorded ten priority taxa within the Norseman Gold project area. These taxa are;

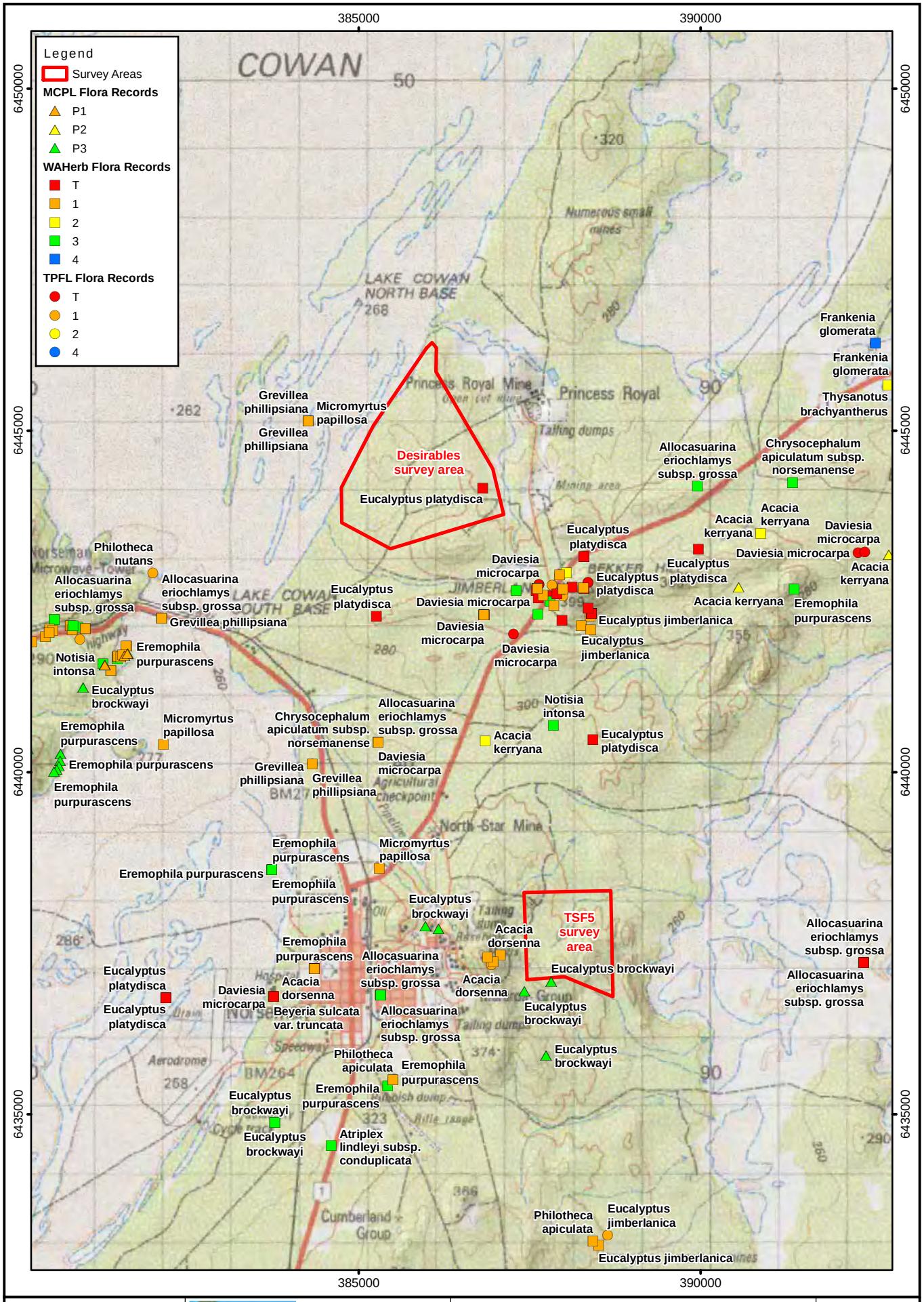
- *Micromyrtus papillosa* (P1)
- *Philotheca apiculata* (P1)
- *Eucalyptus websteriana* subsp. *norsemanica* (P1)
- *Calandrinia lefroyensis* (P1)
- *Acacia kerryana* (P2)
- *Allocasuarina eriochlamys* subsp. *grossa* (P3)

- *Eremophila purpurascens* (P3)
- *Eucalyptus brockwayi* (P3)
- *Goodenia laevis* subsp. *laevis* (P3)
- *Melaleuca coccinea* (P3)
- *Eremophila parvifolia* ?subsp. *parvifolia* (P4)

Of all these taxa recorded by Mattiske Consulting (2020a, 2020b) *Eucalyptus brockwayi* (P3) is the only taxa with assessed as having a high likelihood of being recorded within the TSF5 survey area. Five records of this species were made within adjacent survey blocks, TSF4 and Camp. Within the Desirables survey area, *Eremophila parvifolia* ?subsp. *parvifolia* (P4) has a high likelihood of being recorded. Eight records of *Eremophila parvifolia* ?subsp. *parvifolia* (P4) were made within the North Royal and Gladstone/North Royal Haul Road survey areas, adjacent to the Desirables survey area, in the autumn survey of 2020 (Mattiske Consulting 2020a).

One record of *Eucalyptus platydisca* (T) from 1974, is located within the Desirables survey area (WAH 1998-). This presents a high likelihood of this taxa occurring within the Desirables survey area.

An assessment of the likelihood of recording these listed species within the TSF5 and Desirables survey areas, along with all other conservation significant taxa recorded in the desktop assessment, based on factors including soil type, topography and distribution, is set out in Appendix C.



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Threatened & Priority Ecological Communities and Flora

Figure: **9**

4.13 Introduced (Exotic) Flora

Forty-seven introduced species could potentially occur within the Norseman Gold Project study areas (based on NatureMap (DBCA 2007-)) search results and previous surveys in the area (Botanica Consulting 2010; GHD Pty Ltd 2009, 2010a, 2010b; Goldfields Environmental Management Pty Ltd 1989; Landcare Services Pty Ltd 1995, 1996, 1997; Marianna Partners Environmental Services 1996; Mattiske Consulting Pty Ltd 2001a, 2001b, 2002, 2005, 2013a, 2013b, 2020a, 2020b; Outback Ecology 2003; Paul Armstrong & Associates 2004; Rally Revegetation and Environmental Services 2004; Umwelt Australia Pty Ltd 2016). Four of these species, **Ambrosia tenuifolia, *Opuntia ficus-indica, *Opuntia stricta and *Tamarix aphylla* are declared pest organisms pursuant to section 22 of the BAM Act. In addition, **Opuntia* species and **Tamarix aphylla* are Weeds of National Significance (DAWE 2024). None of these declared pest species have been recorded in the previous surveys summarised in this report (Appendix B); they were identified either by the NatureMap or EPBC Act searches.

**Ambrosia tenuifolia* has a declared pest organism control category of C1 Exclusion and keeping category of Prohibited for the whole of state (DPIRD 2024). A declared pest control category of C1 Exclusion requires organisms to be excluded from Western Australia. A declared pest keeping category of Prohibited requires the organism to only be kept under a permit for public display, education purposes or scientific research by entities approved by state authorities (DPIRD 2024).

**Opuntia ficus-indica* has a declared pest organism control category of C3 Management and keeping category of Exempt for the whole of state (DPIRD 2024). A declared pest control category of C3 Management requires the organisms should have management applied that would prevent or contain spread, reduce numbers or distribution or alleviate harmful impact of the organism (DPIRD 2024). A declared pest keeping category of Exempt requires no permits or conditions for keeping, although there may be other requirements under the Biosecurity and Agriculture Management Act 2007. Organisms in this category may also be regulated by legislation such as the BC Act administered by DBCA (DPIRD 2024).

**Opuntia stricta* has a declared pest organism control category of C3 Management and keeping category of Restricted for the whole of state (DPIRD 2024). A declared pest control category of C3 Management requires the organisms should have management applied that would prevent or contain spread, reduce numbers or distribution or alleviate harmful impact of the organism (DPIRD 2024). A declared pest keeping category of Restricted applies to organisms that can be kept under permit by private individuals as they have a relatively low risk of becoming a problem for primary industry, public safety or the environment (DPIRD 2024).

* *Tamarix aphylla* has a declared pest organism keeping category of Exempt for the whole of state (DPIRD 2024). A declared pest keeping category of Exempt requires no permits or conditions for keeping, although there may be other requirements under the Biosecurity and Agriculture Management Act 2007. Organisms in this category may also be regulated by legislation such as the BC Act administered by DBCA (DPIRD 2024).

A list of introduced species, their family and BAM Act listing, identified in this desktop assessment are outlined in Table 5.

Table 5: Introduced plant species in the vicinity of the Survey Area

INTRODUCED SPECIES	FAMILY	BAM ACT LISTING
**Mesembryanthemum nodiflorum* [1]	Aizoaceae	Permitted -s11
**Asphodelus fistulosus* [1,2]	Asphodelaceae	Permitted -s11
**Ambrosia tenuifolia* [1]	Asteraceae	Declared Pest - s12
**Carthamus lanatus* [1]	Asteraceae	Permitted -s11
**Centaurea melitensis* [1]	Asteraceae	Permitted -s11
**Chrysocephalum apiculatum* subsp. *norsemanense* [1]	Asteraceae	Permitted -s11 (species)
**Gazania linearis* [1,2]	Asteraceae	Permitted -s11
**Hypochaeris glabra* [1]	Asteraceae	Permitted -s11
**Monoculus monstrosus* [1]	Asteraceae	Permitted -s11
**Oligocarpus calendulaceus* [1]	Asteraceae	Permitted -s11
**Osteospermum ecklonis* [1]	Asteraceae	Permitted -s11
**Pseudognaphalium luteoalbum* [1]	Asteraceae	Permitted -s11
**Sonchus oleraceus* [1,2]	Asteraceae	Permitted -s11
**Taraxacum khatoonae* [1]	Asteraceae	Permitted -s11 (as T. officinale)
**Tragopogon porrifolius* [1]	Asteraceae	Permitted -s11
**Carrichtera annua* [1,2]	Brassicaceae	Permitted -s11
**Sisymbrium orientale* [1]	Brassicaceae	Permitted -s11
**Opuntia ficus-indica* [1]	Cactaceae	Declared Pest - s22(2)
**Opuntia stricta* [1]	Cactaceae	Declared Pest - s22(2)
**Silene gallica* var. *gallica* [1]	Caryophyllaceae	Permitted -s11
**Spergularia diandra* [1]	Caryophyllaceae	Permitted -s11
**Cucumis myriocarpus* [1]	Cucurbitaceae	Permitted -s11
**Erythrostemon gilliesii* [1]	Fabaceae	Permitted -s11 (as Caesalpinia gillesii)
**Medicago minima* [1]	Fabaceae	Permitted -s11
**Medicago sativa* [1]	Fabaceae	Permitted -s11
**Vicia monantha subsp. triflora* [1]	Fabaceae	Permitted -s11
**Malva pseudolavatera* [1]	Malvaceae	Permitted -s11 (as M. multiflora)
**Orobanche minor* [1]	Orobanchaceae	Permitted -s11
**Oxalis pes-caprae* [1]	Oxalidaceae	Permitted -s11
**Chloris virgata* [1]	Poaceae	Permitted -s11
**Pentameris airoides* subsp. *airoides* [1]	Poaceae	Permitted -s11 (species)
**Rostraria pumila* [1]	Poaceae	Permitted -s11
**Setaria verticillata* [1]	Poaceae	Permitted -s11
**Vulpia muralis* [1]	Poaceae	Permitted -s11
**Vulpia myuros* [1]	Poaceae	Permitted -s11
**Rumex vesicarius* [1]	Polygonaceae	Permitted -s11
**Lysimachia arvensis* [1]	Primulaceae	Permitted -s11
**Lycium ferocissimum* [1]	Solanaceae	Permitted -s11

INTRODUCED SPECIES	FAMILY	BAM ACT LISTING
**Nicotiana glauca* [1]	Solanaceae	Permitted -s11
**Solanum nigrum* [1]	Solanaceae	Permitted -s11
**Tamarix aphylla* [1]	Tamaricaceae	Declared Pest - s22(2)
**Tribulus terrestris* [1]	Zygophyllaceae	Permitted -s11
**Salvia verbenaca* [2]	Lamiaceae	Permitted -s11
**Bromus rubens* [1]	Poaceae	Permitted -s11
**Citrullus amarus* [1]	Cucurbitaceae	Permitted -s11
**Erodium aureum* [1]	Geraniaceae	Permitted -s11
**Sagina apetala* [1]	Caryophyllaceae	Permitted -s11

[1] NatureMap (DBCA 2007-); [2] Mattiske Consulting (2020a 2020b);

4.14 Commonwealth Protected Matters

In addition to the items reviewed in the preceding paragraphs of this desktop assessment the EPBC Act Protected Matters Report (DCCEEW 2024c) reveals that within 20 km of the Central Norseman Gold Project Area, the following applies:

World Heritage Properties none

National Heritage Places none

Wetlands of International Importance (Ramsar) none

Listed Ecological Communities none

Listed Threatened Species 3

5. FIELD SURVEY RESULTS

The detailed flora and vegetation survey was completed by two botanists between the 16th and 19th September 2024. A total of 37 vegetation survey quadrats, measuring 20 m x 20 m, were established throughout the TSF5 and Desirables Survey Areas.

The geographical coordinates of the north-west corner of the survey quadrats established over this field survey are set out in Appendix E. In addition to survey quadrats, additional species were recorded opportunistically.

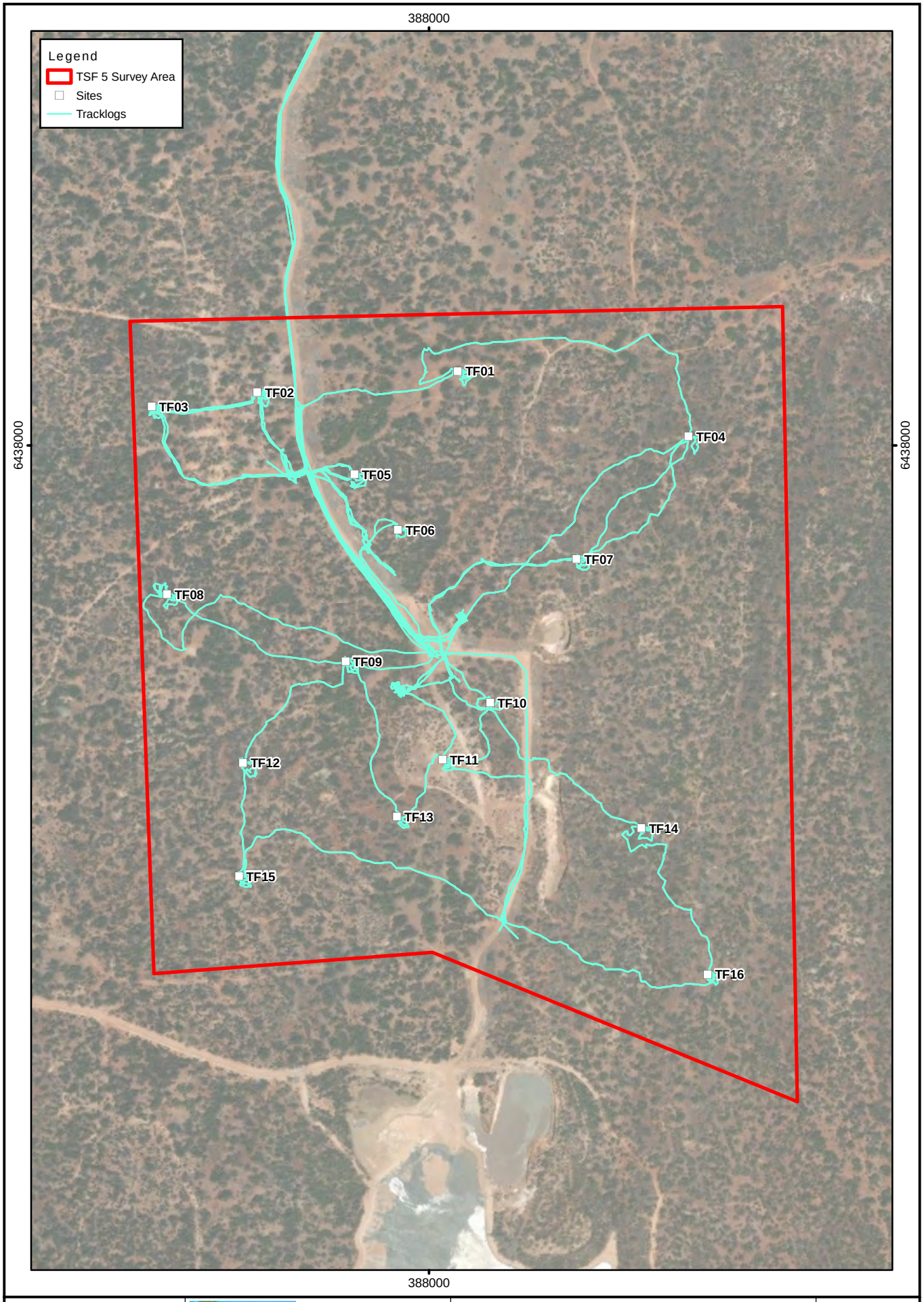
5.1 Field Survey Coverage

The coverage of the TSF5 and Desirables Survey areas, based on survey quadrat locations, tracks and foot traverses is illustrated in Figure 10 & 11. A number of tracks, accessible from the Central Norseman Gold mine and Eyre highway, bisected both survey areas.

5.2 Flora

A total of 124 vascular plant taxa which are representative of 67 genera and 31 families were recorded across the Survey Area (Appendix F). The majority of taxa recorded were representative of the Myrtaceae (21 taxa), Chenopodiaceae (18 taxa), Asteraceae (15 taxa), and Scrophulariaceae (12 taxa) families. These five families accounted for 53% of all taxa recorded. Thirteen families were represented by two taxa each, and 11 families were represented by a single taxon. The taxa recorded during this survey are set out in Appendix F. A list of plant taxa recorded at each survey quadrat within the TSF5 and Desirables Survey Areas is set out in Appendix G. Nine introduced species and two priority species were recorded across the TSF5 and Desirables Survey areas.

A number of plant species could not be confidently identified to species level due to the absence of sufficient taxonomic characters to enable accurate identification. Some plant specimens collected during the survey were submitted to the WAH for formal identification. A list of Western Australian Herbarium accessions related to formal plant identifications are set out in Table 6.



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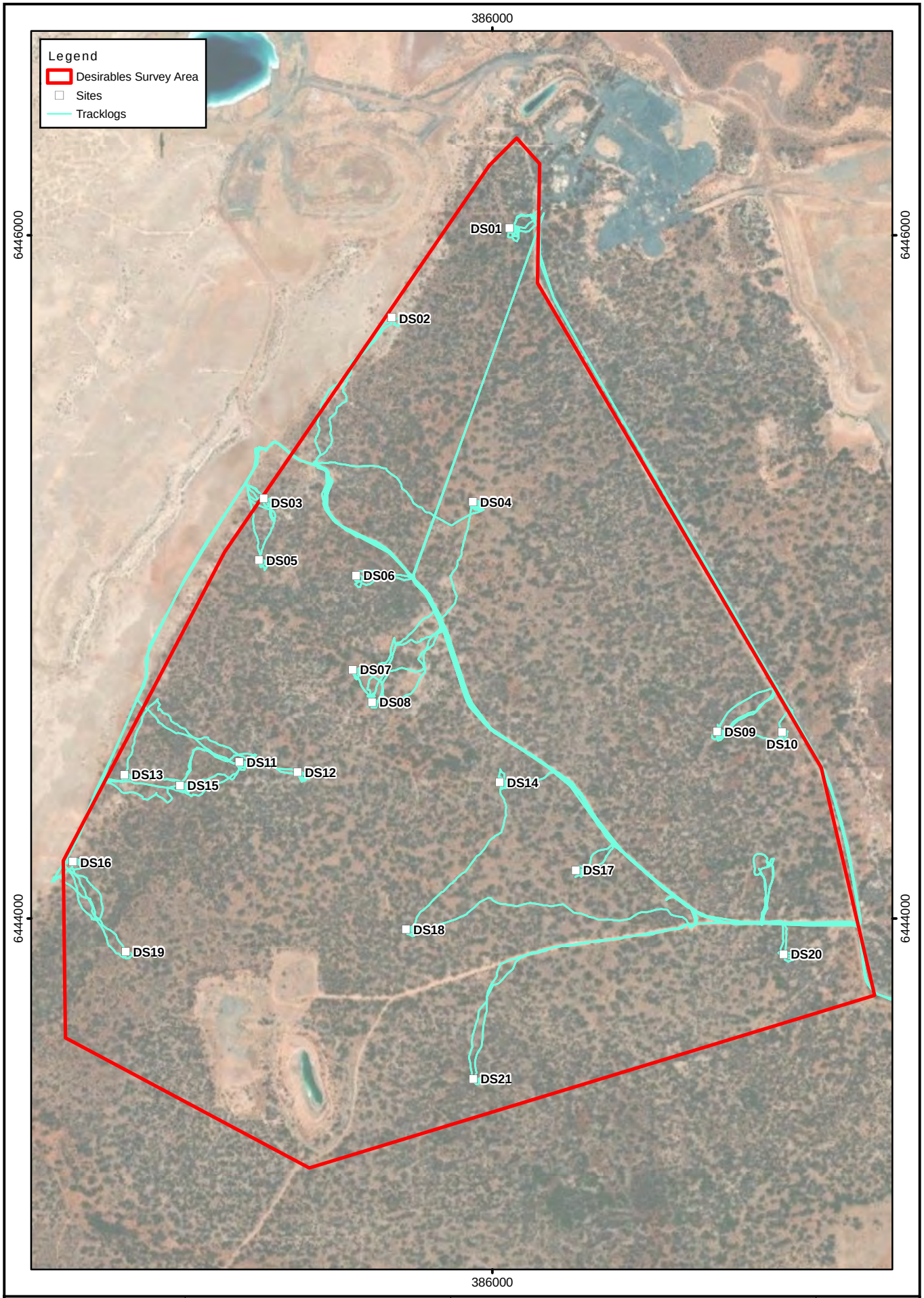
Norseman Gold Project
TSF 5 GPS Tracklogs and Site Locations

Figure:

10



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Desirables GPS Tracklogs and Site Locations

Figure: **11**

Table 6: Record of Western Australian Herbarium accessions

ACCESSION NUMBER	MATTISKE COLLECTION REFERENCE	DATE COLLECTED	QUADRAT REFERENCE	LOCATION (MGA94, Z51)		WESTERN AUSTRALIAN HERBARIUM IDENTIFICATION	WESTERN AUSTRALIAN HERBARIUM COMMENTS
				EASTING	NORTHING		
ACC/11194/E	KRT1246	17/09/2024	TF13	387937	6437277	*Eremophila purpurascens*	
	KRT1261	17/09/2024	TF01	388056	6438146	*Atriplex nummularia* subsp. *spathulata*	Although no problems on this occasion, but when collecting Atriplex try to include fruit. The identification of male or flowering only specimens is frequently very problematic.
	KRT1297	18/09/2024	DS16	384773	6444166	*Atriplex nana*	
	KRT1307	18/09/2024	DS18	385748	6443969	*Eremophila interstans* subsp. *interstans*	
	KRT1311	19/09/2024	Opportunistic	388008	6737592	*Atriplex lindleyi* subsp. *inflata*	
	MM210	17/09/2024	DS02	385706	6445758	*Darwinia* sp. Karonie (K. Newbey 8503)	
	MM222	17/09/2024	DS08	385649	6444634	*Frankenia interioris*	
	MM226	18/09/2024	DS10	386849	6444546	*Trichanthodium skirrophorum*	
ACC/11215/E	MM260	19/09/2024	Opportunistic	388069	6437664	*Eucalyptus brockwayi*	

5.3 Proportion of Flora Surveyed

A species accumulation plot based on accumulated species recorded versus sites surveyed within the Survey Area was used to provide an indication as to the level of adequacy of the survey effort. As the number of survey sites 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. When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered to be adequate.

The species accumulation curve (Figure 12), based on the species accumulation analysis of Colwell (2013) was used to evaluate the adequacy of sampling. Species by quadrat data was used in the species accumulation analysis. The asymptotic value was determined using Michaelis-Menten modelling. Based on this analysis, the incidence-based coverage estimator of species richness (Chao 2004) was calculated to be 165.61. Based on this value, and the total of 110 species recorded across the 37 survey quadrats, approximately 66.4 % of the flora potentially present within the Survey Area has been recorded.

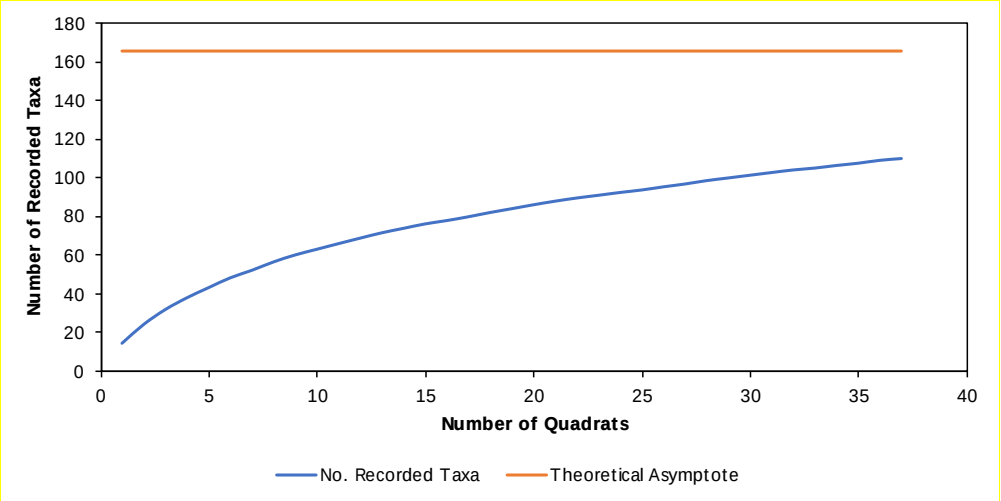

Figure 12: Average randomised species accumulation curve

5.4 Conservation Significant Flora

No threatened flora, as listed in the *Biodiversity Conservation (Listing of Native Species) (Flora) Order 2023* (DBCA 2024a), and pursuant to section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* and as listed by the DCCEEW (2024a), were recorded within the Survey Area.

Two priority taxa, as listed by the DBCA (WAH 1998 -) were recorded within the TSF5 and Desirables Survey Areas (Table 7): *Eucalyptus brockwayi* (P3) and *Eremophila purpurascens* (P3). Both taxa were identified in the desktop survey as having high and medium likelihood, respectively, of occurring within the Survey Areas have been previously recorded in by Mattiske Consulting in 2020 in the area (Mattiske Consulting 2020a, 2020b). The number and location of these conservation significant taxa within the TSF5 and Desirables Survey Areas, is set out in Table 7 and illustrated Figures 3 and 14.

Table 7: Conservation Significant Flora Records within the TSF5 and Desirables Survey Areas

TAXON	SURVEY AREA	LOCATION (MGA94, Z51)		NO. OF INDIVUALS
		EASTING	NORTHING	
Eucalyptus brockwayi (P3)	TSF5	387629	6437161	2
	TSF5	388070	6437665	3
	TSF5	388629	6437599	1
Eremophila purpurascens (P3)	Desirables	385945	6443532	1
	TSF5	387637	6437382	1
	TSF5	387937	6437277	1
	TSF5	388506	6438018	1

5.5 Introduced (Exotic) Flora

No declared pest organisms pursuant to section 22 of the BAM Act were recorded within the TSF5 and Desirables Survey Areas. Nine introduced weed taxon permitted under section 11 of the BAM Act were recorded in the Survey Areas, **Asphodelus fistulosus*, **Carrichtera annua*, **Centaurea melitensis*, **Lysimachia arvensis*, **Medicago minima*, **Mesembryanthemum nodiflorum*, **Oligocarpus calendulaceus*, **Sonchus asper* and **Sonchus oleraceus*. These taxa were recorded at 22 and 23 locations within the TSF5 and Desirables Survey Areas respectively. The number and location of these introduced taxa within the TSF5 and Desirables Survey Areas, is set out in Table 8 and illustrated in Figures 15 and 16.

Table 8: Introduced (Exotic) Flora Records within the TSF5 and Desirables Survey Areas

TAXON	SURVEY AREA	LOCATION (MGA94, Z51)		NO. OF INDIVUALS
		EASTING	NORTHING	
**Asphodelus fistulosus*	Desirables	386114	6446057	1
	Desirables	386845	6444537	5
	Desirables	386849	6444546	5
**Carrichtera annua*	Desirables	384895	6443897	100
	Desirables	384928	6443904	100
	Desirables	385332	6445229	20
	Desirables	385590	6444989	100
	Desirables	385592	6444729	1
	Desirables	385602	6445004	20
	Desirables	385792	6444770	400
	Desirables	385801	6444720	300
	Desirables	385842	6444837	100
	Desirables	385881	6444995	250
	Desirables	385945	6443532	20
	Desirables	386845	6444537	100
	Desirables	386849	6444546	50
	TSF5	387459	6438077	30
**Carrichtera annua*	TSF5	387637	6437382	1
	TSF5	387651	6438086	1
	TSF5	387662	6438094	50
	TSF5	387678	6437940	150
	TSF5	387744	6437543	250
	TSF5	387874	6437799	100
	TSF5	387937	6437277	1
	TSF5	388026	6437388	100
	TSF5	388083	6437098	250
	TSF5	388093	6437492	100
	TSF5	388119	6437499	20
	TSF5	388179	6437248	100
	TSF5	388334	6437282	100
	TSF5	388335	6437799	100
**Centaurea melitensis*	Desirables	386845	6444537	1
	Desirables	386849	6444546	3
	TSF5	388026	6437388	20
	TSF5	388179	6437248	1
	TSF5	388180	6437247	1
**Lysimachia arvensis*	Desirables	385592	6444729	1
**Medicago minima*	Desirables	385592	6444729	1

TAXON	SURVEY AREA	LOCATION (MGA94, Z51)		NO. OF INDIVUALS
		EASTING	NORTHING	
**Mesembryanthemum nodiflorum*	Desirables	385732	6444637	1
**Oligocarpus calendulaceus*	TSF5	388179	6437248	1
	TSF5	388180	6437247	1
**Sonchus asper*	TSF5	388026	6437388	2
**Sonchus oleraceus*	Desirables	386119	6446043	8
	Desirables	386849	6444546	2
	TSF5	387637	6437948	1

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Figure:

13

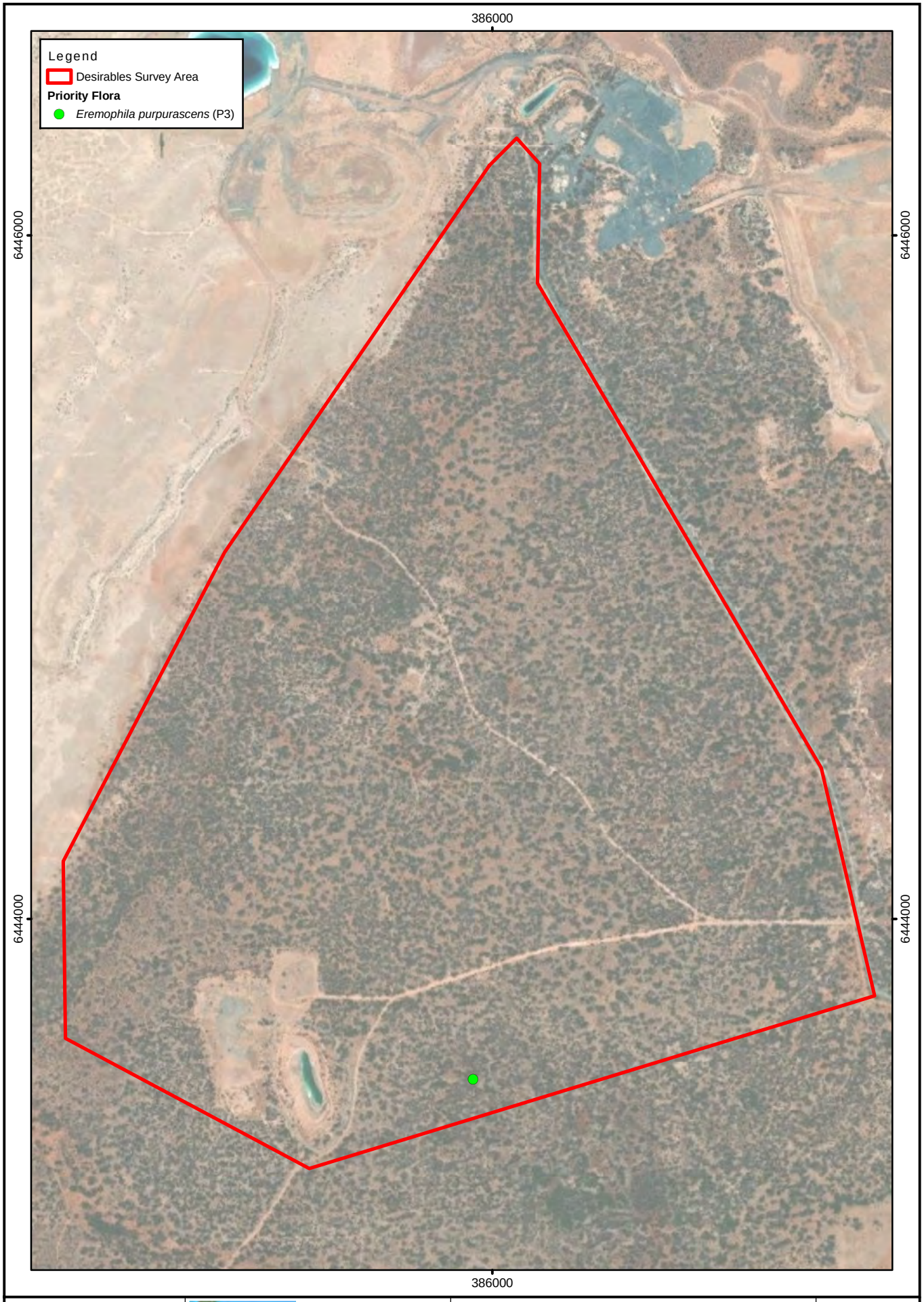

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Figure: **14**

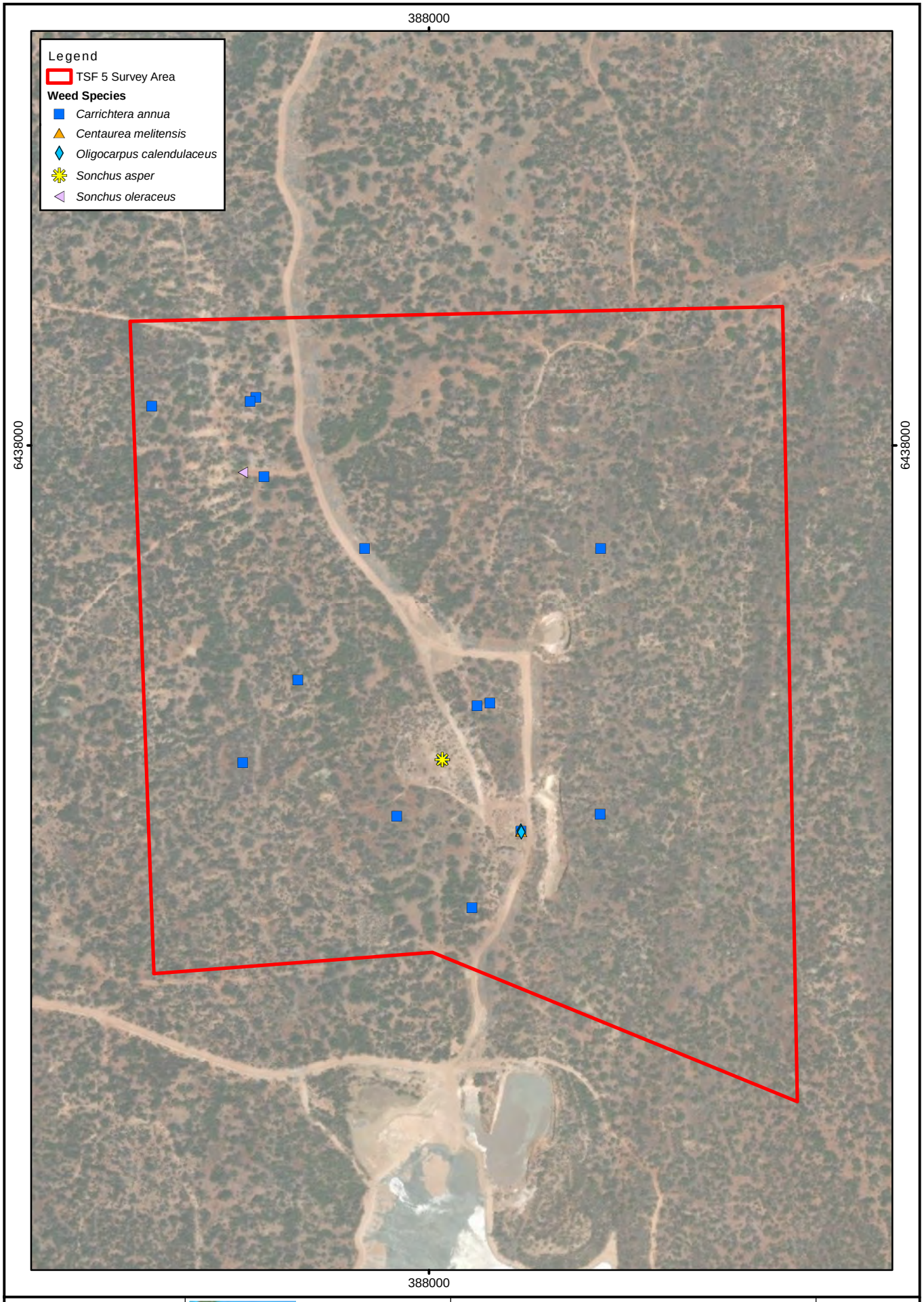

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Figure:

15

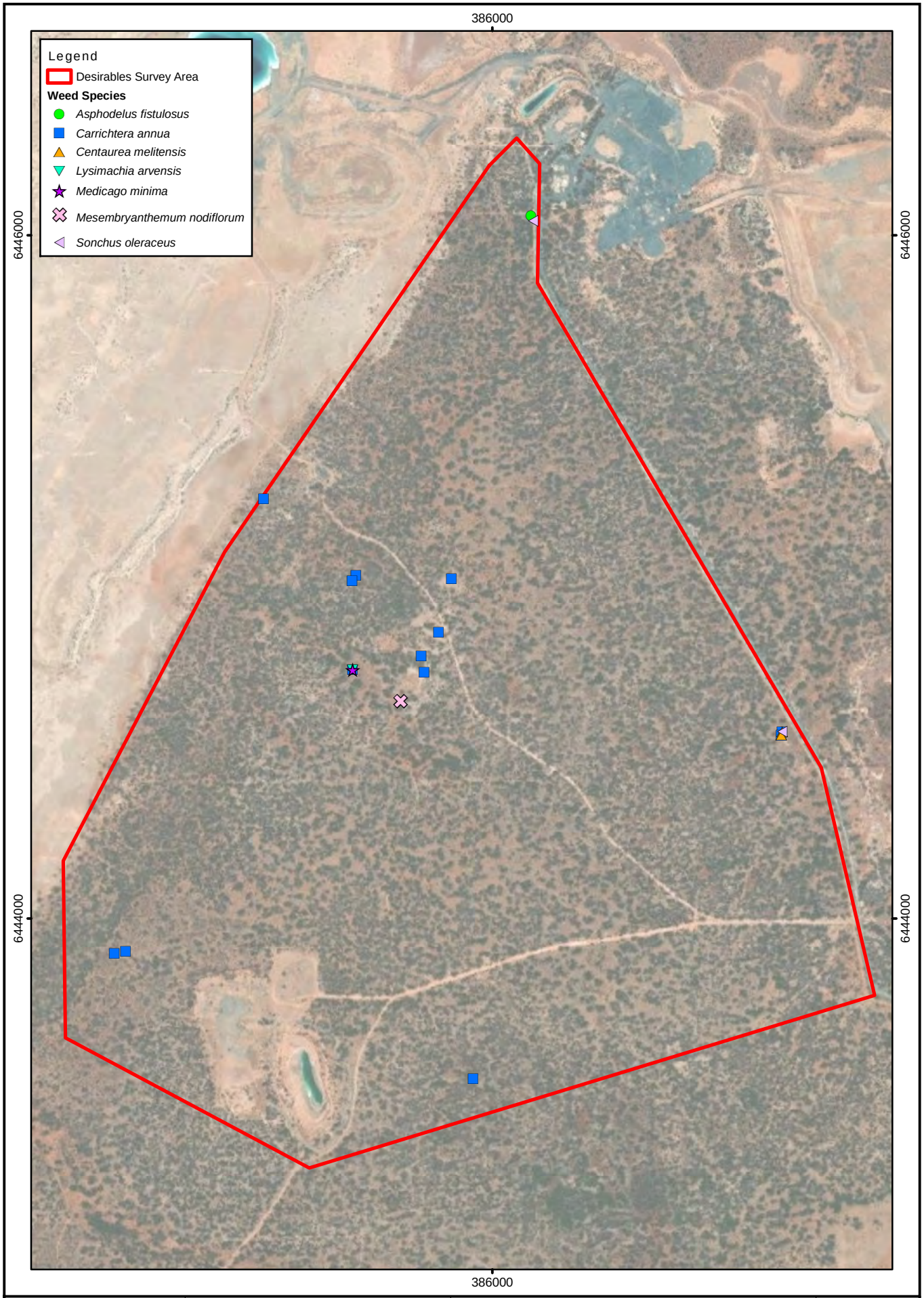

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Figure:

16

5.6 Statistical Analysis of Survey Quadrat Data

Cluster analyses derived from a species-by-site resemblance matrix (Bray-Curtis similarity) grouped survey sites into discrete clusters based on species composition (dissimilarity/distance increased) (Clarke and Gorley 2015). Only taxa which could be identified to species level were included in the analysis. Classification and ordination analyses were based on a data matrix of perennial taxa, with singularly occurring species and annual taxa omitted prior to analysis. This was justified on the basis that singleton taxa add little additional information, and annuals exhibit high inter-annual variation in distribution and abundance (Mott 1972, 1973). In addition, the omission of annual species from the statistical analysis allows for comparison of data from surveys undertaken in different seasons or survey years. Hierarchical Clustering was used in conjunction with Similarity Profile (SIMPROF), Similarity Percentages (SIMPER), site descriptions, site photos and aerial photographs; combining these methods increased the understanding of site inter-relations and thus the ability to accurately delineate those sites based on species composition.

To down weight the relative contributions of quantitatively dominant species a fourth root transformation of the data was used for statistical analysis. Introduced species, singletons (species recorded at only one quadrat), annuals and specimens that were not identified down to the species level (excluding *Tecticornia* sp. and *Atriplex* sp.) were excluded from the analysis. Taxa from the *Atriplex* and *Tecticornia* genera were identified to a genus level due a lack of flowering/fruiting material to aid in species identification. Due to their significance in vegetation community composition, they were still used in statistical analysis. Taxa which were identified to the subspecies, affinity, sensu lato, and variety levels were revised to the specific level to reduce the tendency for this to create further statistical variation in analysis which was considered unwarranted. Computation of similarity matrices was based on the Bray-Curtis similarity measure.

Where appropriate, outliers and small groupings were assigned to broader comparative vegetation units based on factors including species composition and site descriptions; this is particularly relevant where survey quadrats were established on ecotones. For the purposes of vegetation mapping, i.e., extrapolating quadrat data to generalised vegetation communities over broad areas, an inclusive rather than exclusive approach was adopted for outliers.

Following *a priori* analysis of significant groups, vegetation communities were delineated using a combination of the SIMPROF results together with landform, soil data, and associated records of the survey quadrats. Data collected from the 2024 survey (this survey) was merged with data from the surveys conducted by Mattiske Consulting in 2020 (Mattiske Consulting 2020a, 2020b). This ensures that vegetation communities across the entire Central Norseman Gold Project Area are consistent. Where appropriate outliers and small groupings were merged into broader vegetation units based on species composition and site descriptions.

Based on this approach, 14 significantly dissimilar vegetation communities were delineated within the TSF5 and Desirables Survey Areas. Ten of the vegetation communities delineated had previously been described by Mattiske Consulting in 2020. The remaining 4 vegetation communities were significantly dissimilar to any vegetation communities defined in 2020 (Mattiske Consulting 2020a, 2020b). The dendrogram representing the results of the cluster analysis is presented in Figure 17.

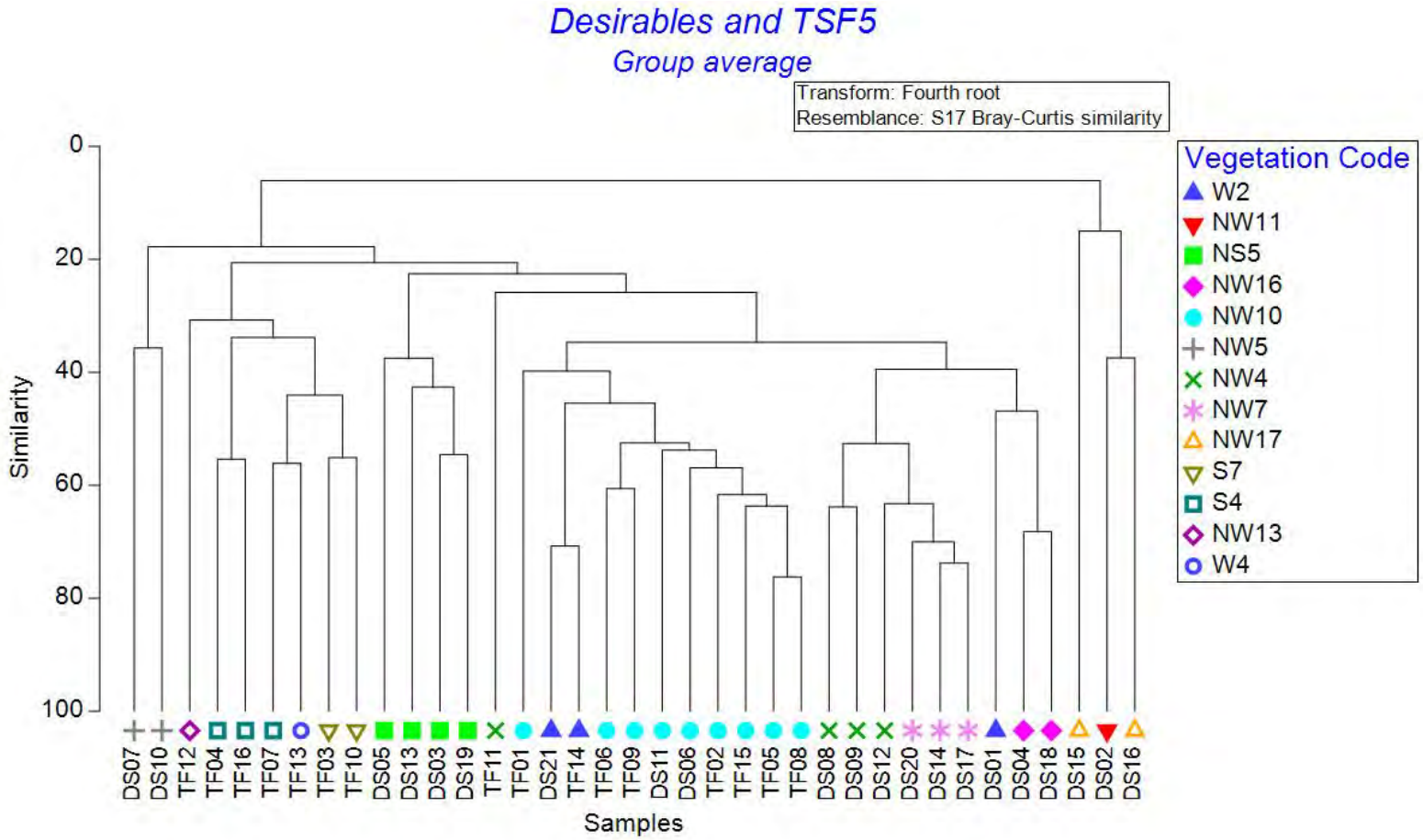

Figure 17: Dendogram of Vegetation Communities of the TSF5 and Desirables Survey Areas

5.7 Vegetation Communities and Mapping

Based on statistical analysis (section 5.6), 14 vegetation communities were defined and mapped across the TSF5 and Desirables Survey Areas. Of these 14, eight vegetation communities occurred in the TSF5 survey area with 4 being unique to that Survey Area. Ten vegetation communities occurred in the Desirables Survey Area, with 6 being unique to that Survey Area. In addition to the statistical analysis, survey quadrat physical data and aerial photographic maps were used to delineate the boundaries of the vegetation communities in the Survey Area. The descriptions of the vegetation communities were based on Aplin's (1979) modification of the vegetation classification system of Specht (1970), to align with the NVIS. Vegetation communities were described at the association level of the NVIS classification framework, as defined by the NVIS Technical Working Group (2017) (Appendix A6) and are summarised below. The vegetation mapping for the TSF5 and Desirables survey areas is presented in Figure 18 and 19. The species recorded within each vegetation community is set out in Appendix H. A summary of the vegetation communities is presented in Appendix I.

Eight vegetation communities were mapped across the TSF5 Survey Area: Seven Eucalypt woodland/mallee shrubland communities (NW, S, and W) and a disturbed community (CL) (Table 9). One community, S7, was newly defined and only occurs within the TSF5 Survey Area. The S7 community is defined by the occurrence of *Eucalyptus* ?*virella* on rocky brown sandy clay slopes (sites TF03 and TF10). One community, S4, has been slightly revised since the last vegetation survey conducted by Mattiske Consulting in 2020 (Mattiske Consulting 2020b). This community is now defined by the occurrence of *Eucalyptus stricklandii* and *Allocasuarina acutivalvis* subsp. *acutivalvis* rather than *Grevillea nematophylla* subsp. *nematophylla.* The understory has been defined by more commonly occurring species *Alyxia buxifolia* and *Scaevola spinescens,* while *Dodonaea microzyga*, *Hibbertia pungens* and *Dampiera latealata* have been removed from the structural vegetation description and are included as associated species to the vegetation community. Descriptions of the vegetation communities occurring in the TSF5 Survey Area is outlined in Table 9.

Table 9: Vegetation communities in the TSF5 Survey Area, Spring 2024

VEG. COMM.	DESCRIPTION	AREA (ha)	% of TSF5 SURVEY AREA
NW4	Open low woodland of *Eucalyptus lesouefii* over tall isolated clumps of *Melaleuca* ?*sheathiana* and *Eremophila* spp. shrubs over low isolated clumps of *Cratystylis conocephala* shrubs.	3.37	1.99
NW10	Mid woodland of mixed *Eucalyptus* spp. over tall sparse shrubland of *Melaleuca* ?*sheathiana* over open mid-low shrubland of *Atriplex* spp. on brown clayey loam with some surface rocks on gentle mid to upper slopes.	98.59	58.47
NW13	Low open forest of mixed *Eucalyptus* spp. over mid sparse shrubland of *Eremophila scoparia* and other mixed mid shrubs on pale brown clay on gentle lower slopes and flats in areas disturbed in the past.	2.34	1.39
S4	*Eucalyptus stricklandii* mid woodland over *Allocasuarina acutivalvis* subsp. *acutivalvis, Alyxia buxifolia, Scaevola spinescens* sparse mid-low shrubland on brown-red rocky clay loam slopes and rises.	39.95	23.69
S7	*Eucalyptus* ?*virella, Eucalyptus* spp. mid sparse mallee shrubland over *Grevillea haplantha, Alyxia buxifolia, Exocarpos aphyllus* mid sparse shrubland over *Atriplex* sp. 1, *Acacia erinacea, Scaevola spinescens* low sparse shrubland on rocky brown sandy clay on slopes.	4.94	2.93
W2	Woodland to open woodland of *Eucalyptus flocktoniae*, *E. urna*, *E. lesouefii* and *E. dundasii* over sparse shrubland of *Melaleuca sheathiana*, *Eremophila scoparia*, *Scaevola spinescens*, *Beyeria sulcata* and *Exocarpos aphyllus* over isolated shrubs of *Olearia muelleri* on orange-red to brown clayey loam on flats and slopes.	4.32	2.56

VEG. COMM.	DESCRIPTION	AREA (ha)	% of TSF5 SURVEY AREA
W4	Open woodland of *Eucalyptus torquata* over *Melaleuca sheathiana*, *Dodonaea microzyga*, *Alyxia buxifolia*, *Beyeria* spp. and *Eremophila* spp. over *Scaevola spinescens* and *Ptilotus obovatus* on red-brown clayey loam with surface rocks on slopes and ridges.	5.52	3.28
CL	Cleared or disturbed.	9.58	5.68

Ten vegetation communities were mapped across the Desirables Survey Area: Eight eucalypt woodland/mallee shrublands (NW, NS and W), one *Casuarina* woodland (NW11), and one disturbed community (CL). There are three newly defined communities that only occur in the Desirables Survey Area (NS5, NW16, NW17). Community NS5 is defined by *Santalum acuminatum* and *Melaleuca* species shrubland on brown-orange sandy clay on slopes and flats, and have a distinct lack of Eucalypt species present. Community NW16 is defined by *Eucalyptus oleosa,* as the primary overstorey Eucalypt, occurring over *Cratystylis conocephala* and *Melaleuca sheathiana* on orange clay flats. Community NW17 is defined by *Triodia scariosa* hummock grasses with a mixed Eucalypt overstorey on brown-orange sandy clay on flats and slopes. Descriptions of the vegetation communities occurring in the Desirables Survey Area is outlined in Table 10.

Table 10: Vegetation communities in the Desirables Survey Area, Spring 2024

VEG. COMM.	DESCRIPTION	AREA (ha)	% of DESIRABLES SURVEY AREA
NS5	*Santalum acuminatum, Melaleuca* spp*. (M.* ?*lanceolata, M. sheathiana), Eucalyptus* spp. tall open shrubland over *Eremophila scoparia, Cratystylis conocephala, Scaevola spinescens* low sparse shrubland on brown-orange sandy clay on slopes and flats.	40.58	10.08
NW4	Open low woodland of *Eucalyptus lesouefii* over tall isolated clumps of *Melaleuca* ?*sheathiana* and *Eremophila* spp. shrubs over low isolated clumps of *Cratystylis conocephala* shrubs.	61.32	15.23
NW5	Mid woodland of *Eucalyptus lesouefii* and *Eucalyptus salubris* over mid isolated shrubs of *Eremophila scoparia* and occasional low *E. parvifolia* ?subsp. *auricampi* shrubs over open low chenopod shrubland of *Tecticornia* spp. and *Atriplex* spp. on orange to brown sandy clay with some surface gravel on flats and gentle slopes.	5.12	1.27
NW7	Low woodland of *Eucalyptus salubris* and *E. lesouefii* over tall sparse shrubland of *Melaleuca* ?*sheathiana* or *M. lanceolata* over mid-low sparse shrubland of *Atriplex* ?*nummularia* and *Atriplex* ?*vesicaria* on red to brown sandy clay with scattered surface rocks on flats and lower slopes.	83.93	20.85
NW10	Mid woodland of mixed *Eucalyptus* spp. over tall sparse shrubland of *Melaleuca* ?*sheathiana* over open mid-low shrubland of *Atriplex* spp. on brown clayey loam with some surface rocks on gentle mid to upper slopes.	44.93	11.16
NW11	Open low woodland of *Casuarina obesa* over low isolated clumps of Chenopodiaceae sp. and Aizoaceae sp. shrubs and isolated tussock grassland on dry, powdery pale orange clay on low dune ridges and flats at the edge of salt lakes.	2.59	0.64
NW16	*Eucalyptus oleosa* mid sparse mallee shrubland over *Cratystylis conocephala, Melaleuca sheathiana* mid open shrubland over *Atriplex* sp. 2 low sparse shrubland on orange clay on flats.	94.19	23.40
NW17	*Eucalyptus platycorys, Eucalyptus* spp. mid sparse mallee shrubland over *Lawrencia squamata, Lomandra effusa, Westringia rigida* low sparse shrubland over *Triodia scariosa* low isolated hummock grasses on brown-orange sandy clay on flats and slopes.	17.88	4.44

VEG. COMM.	DESCRIPTION	AREA (ha)	% of DESIRABLES SURVEY AREA
W2	Woodland to open woodland of *Eucalyptus flocktoniae*, *E. urna*, *E. lesouefii* and *E. dundasii* over sparse shrubland of *Melaleuca sheathiana*, *Eremophila scoparia*, *Scaevola spinescens*, *Beyeria sulcata* and *Exocarpos aphyllus* over isolated shrubs of *Olearia muelleri* on orange-red to brown clayey loam on flats and slopes.	26.45	6.57
CL	Cleared or disturbed.	25.61	6.36

5.8 Condition of the Vegetation

The condition of the vegetation within the Survey Areas ranged from excellent to degraded according to the vegetation condition categories of Keighery (1994; Appendix A5). Of the 16 survey sites established in the TSF5 survey area, the proportional condition ratings were; 18.8% excellent, 43.8% very good, 31.3% good, and 6.3% degraded. Of the 21 survey sites established in the Desirables survey area, the proportional condition ratings were; 47.6% excellent, 42.9% very good and, 9.5% good. Areas with lower condition ratings were impacted by exploration drilling activities, historical mine shafts, litter, and introduced taxa. Nine introduced taxa were found in the TSF5 and Desirables Survey Areas. Due to the proximity of the TSF5 and Desirables Survey Areas to Norseman town, and the historical mining and exploration within the area, none of the vegetation of either Survey Area was considered pristine. Figures 20 and 21 outline the vegetation condition throughout the TSF5 and Desirables survey areas.

5.9 Field Survey Limitations and Constraints

An assessment of the survey against a range of factors which may have had an impact on the outcomes of the present survey is set out in Table 11. Based on this assessment, this survey has not been subject to constraints which would affect the thoroughness of the survey and the conclusions which have been formed.

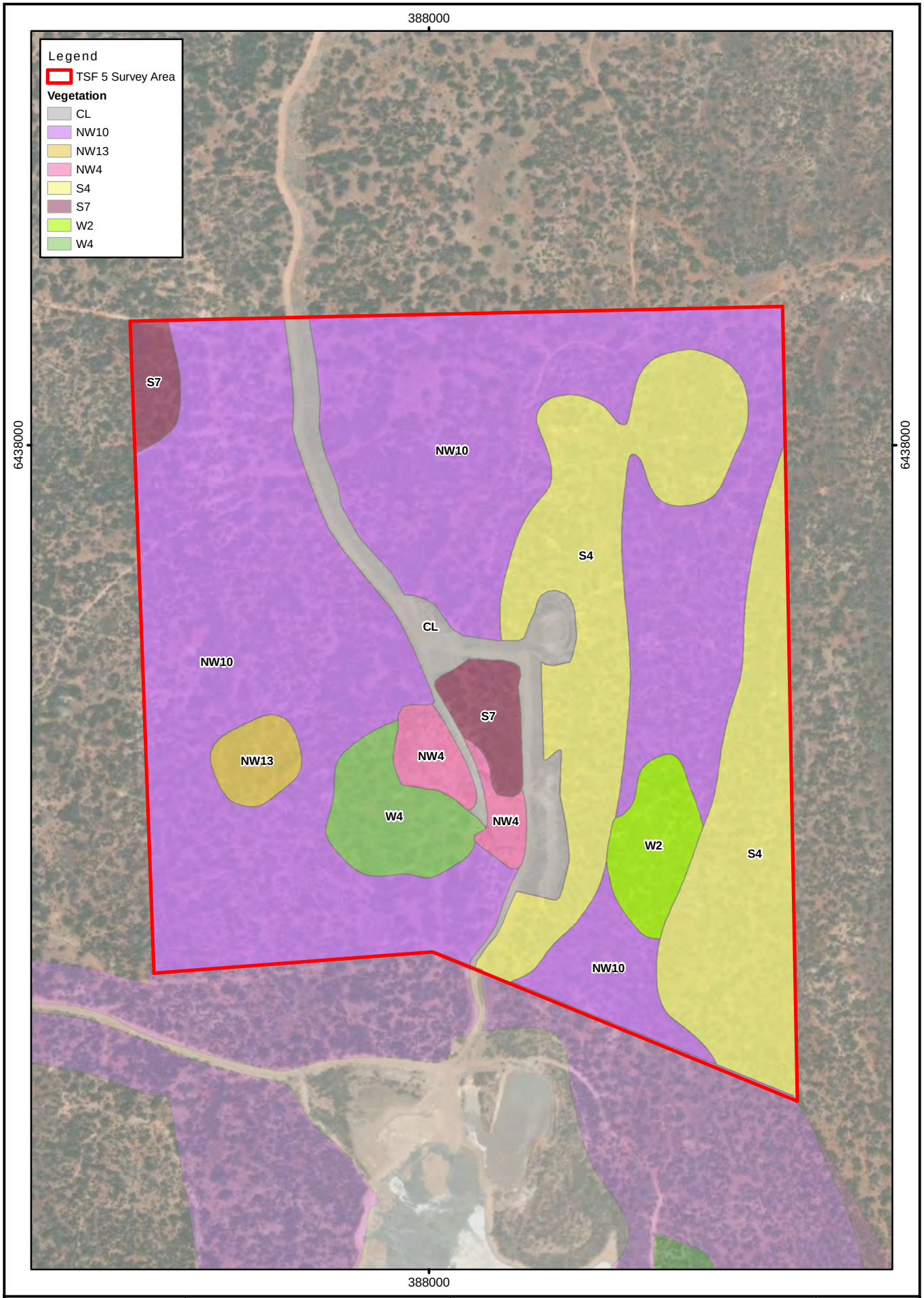

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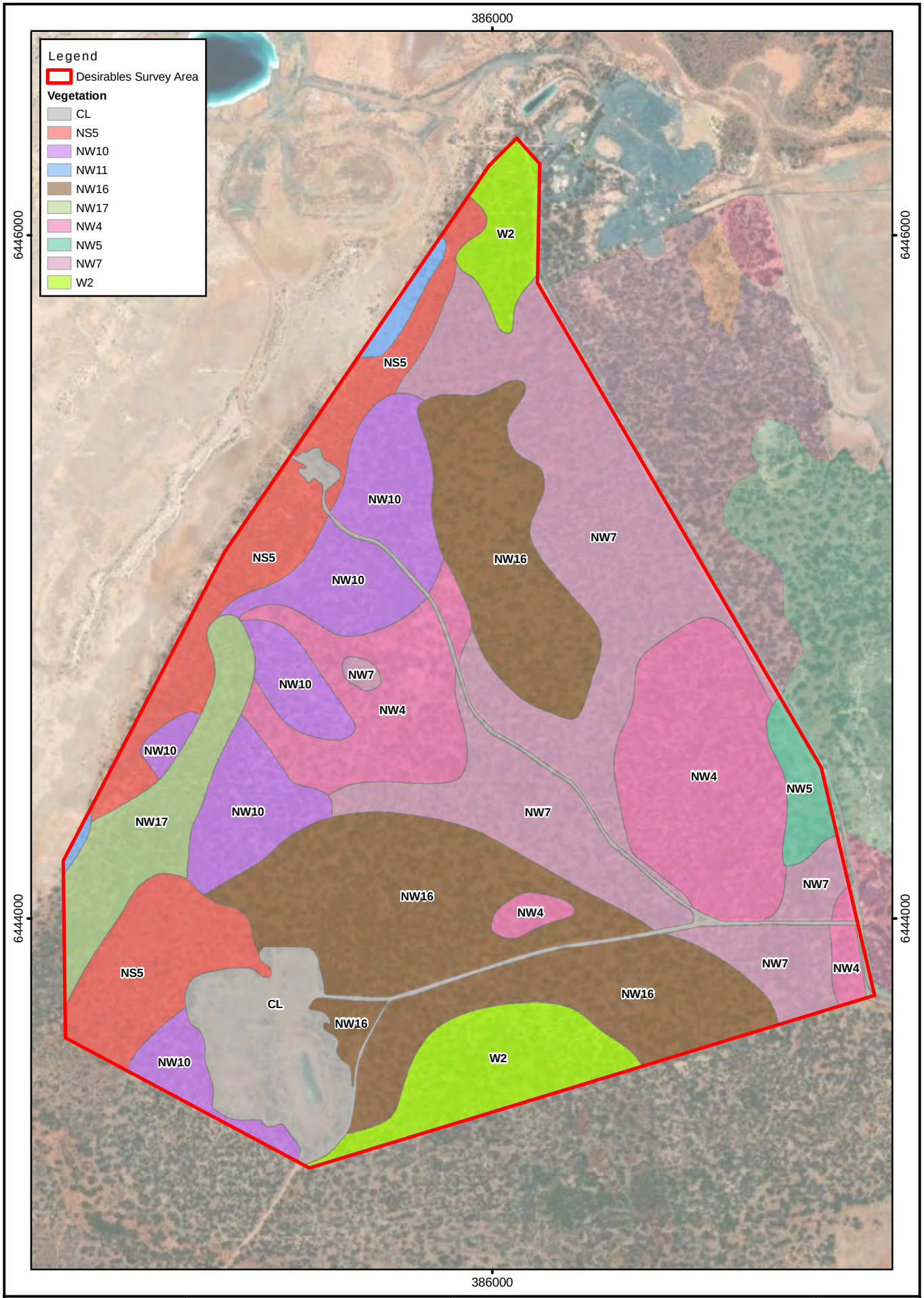
Figure:
18



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Desirables Vegetation Mapping

Figure:
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MGA94 (Zone 51)

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Figure:

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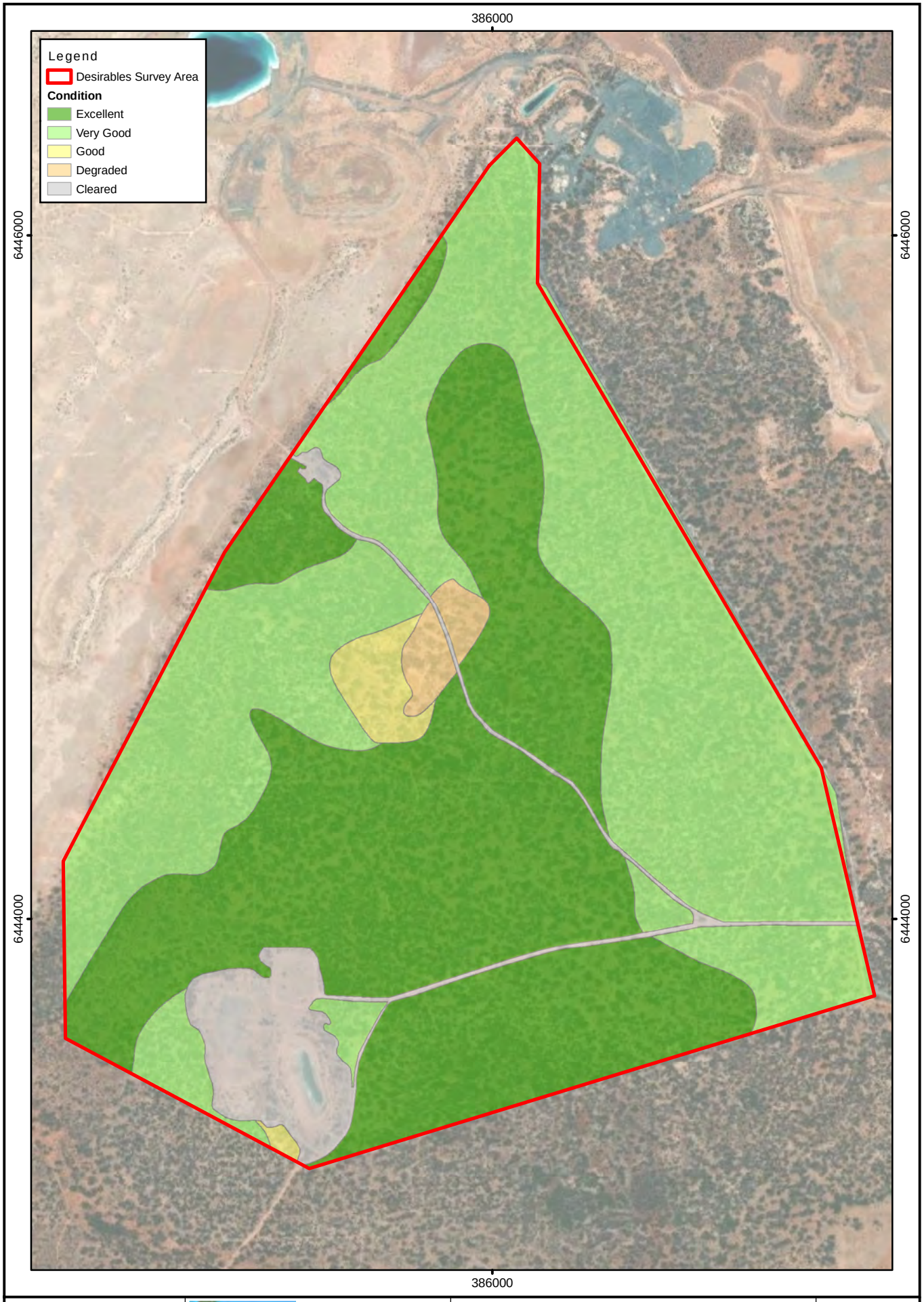

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MGA94 (Zone 51)

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Pantoro Limited
Norseman Gold Project
Desirables Vegetation Condition

Figure:

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Table 11: Potential flora and vegetation survey limitations for the Survey Areas

POTENTIAL SURVEY LIMITATION	IMPACT ON SURVEY
Sources of information and availability of contextual information (i.e., pre-existing background versus new material).	**Not a constraint.** Reference resources such as the historical documentation and vegetation mapping of the regions, principally that of Beard (1970), and survey work by Mattiske Consulting (Mattiske Consulting 2001a, 2001b, 2002, 2005, 2013a, 2013b, 2020a, 2020b), together with online flora and vegetation information, has provided an appropriate level of information for the survey.
Scope (i.e., what life forms, etc., were sampled).	**Not a constraint.** Vascular flora, which was the focus of the present survey, was sampled.
Completeness and further work which might be needed (i.e., was the survey area fully surveyed).	**Not a constraint**. The scope of this survey was to undertake a Detailed vegetation survey within the TSF5 and Desirables Survey Areas. All taxa which were not easily identifiable in the field were collected and submitted to the WAH for identification. This, combined with the experience and familiarity the botanists had with the flora of the region minimised this constraint on the survey.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Minor constraint.** Based on the survey quadrat data, it was estimated that approximately 66% of the potential flora species that may be present were recorded across the Survey Areas (refer to Section 5.3 of this report). The size of the Survey Areas makes it difficult to attain adequate replicates without pseudo-replication of vegetation communities. Based on the quadrat placement and tracklog distribution, coverage over the Survey Areas was considered good.
Mapping reliability.	**Not a constraint**. The spatial coverage of the Survey Areas are considered to be excellent. The quality of the aerial photographic maps available for the survey was considered to be excellent. Vegetation community boundaries were often discontinuous with interfaces resembling admixtures of one or more communities. This is a recognised and unavoidable limitation of vegetation mapping, particularly across mosaic *Eucalyptus* / *Melaleuca* species and other shrubs associations and open woodland associations, and in recently burnt vegetation (less than 5 years old).
Timing, weather, season, cycle.	**Not a constraint**. The EPA (2016a) recommends that flora and vegetation surveys in the South West and Interzone botanical provinces take place primarily in the Spring season (September to November), with supplementary surveys in the post-Autumn rains. During the 2024 winter (June to August) wet season rainfall was 90.6 mm, approximately 26.5 mm above the long-term average for the corresponding same months (64.1 mm). This represents an approximately 141.34% higher level of rainfall than normally experienced. The increased rain throughout this period would have resulted in reduced stress on vegetation.
Disturbances (fire, flood, accidental human intervention, etc.).	**Not a constraint**. The Survey Area exhibited high levels of disturbance, in terms of human impacts. Multiple vehicle track bisected the Survey Areas and evidence of historical mining, in the form of mine shafts, littler and weeds were also present. Evidence of logging and historical clearing was also prevalent. Despite the high level of human impact to the Survey Areas, there was little impact on the ability to undertake the survey.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint**. The intensity of the survey effort was considered to be good.
Resources (i.e., were there adequate resources to complete the survey to the required standard).	**Not a constraint**. Resources, in terms of equipment, support and personnel were good.

POTENTIAL SURVEY LIMITATION	IMPACT ON SURVEY
Access problems (i.e., ability to access the survey area).	**Not a constraint**. There were multiple tracks bisecting both the TSF5 and Desirables Survey Areas. Any areas not accessible via a track was easily accessible on foot.
Experience levels (e.g., degree of expertise in plant identification to taxon level).	**Not a constraint**. The botanists taking part in the survey had experience working in the Goldfields region, and were familiar with the local flora.

6. DISCUSSION

Mattiske Consulting was commissioned by Pantoro Ltd in February 2024 to undertake a detailed flora and vegetation assessment of the TSF5 and Desirables survey areas, within the Central Norseman Gold Project area. A desktop assessment of the survey areas was undertaken in March/April of 2024. A detailed flora and vegetation field survey was undertaken by two botanists in September 2024. Across the TSF5 and Desirables survey areas, 14 vegetation communities were delineated and approximately 66% of the potential flora species that may be present were recorded across the survey areas (refer to Section 5.3 of this report).

6.1 Flora

A total of 124 vascular plant taxa which are representative of 67 genera and 31 families were recorded across the Survey Area. The majority of taxa recorded were representative of the Myrtaceae (21 taxa), Chenopodiaceae (18 taxa), Asteraceae (15 taxa), and Scrophulariaceae (12 taxa) families. These five families accounted for 53% of all taxa recorded. Thirteen families were represented by two taxa each, and 11 families were represented by a single taxon.

The number of taxa collected during the field survey that could not confidently be identified to species level was due to a lack of fertile material. While the majority of taxa were fertile, some taxa were sterile or only had old fruiting material at the time of the field survey (i.e., *Melaleuca* spp., *Atriplex* spp., *Tecticornia* spp. and some *Eucalyptus* spp.). Some *Eucalyptus* spp. are defined by specific features on the fruit, flower or juvenile material. At the time of the survey not all of these diagnostic features were available. This made their identification problematic given the lack of diagnostic taxonomic features present, and is a known and common constraint of vegetation mapping in the region.

6.2 Conservation Significant Flora

No threatened flora species as listed by the Biodiversity Conservation (Listing of Native Species) (Flora) Order 2023 (DBCA 2024a) pursuant to section 179 of the EPBC Act as listed by DCCEEW (2024a) were recorded within the TSF5 and Desirables survey areas. One record of *Eucalyptus platydisca* (T) was identified in the desktop assessment within the Desirables survey area. During the field survey, botanists walked the area where the taxon was recorded but didn't see any evidence of the species occurring within the survey area. *Eucalyptus platydisca* (T) is known to occur on the granitic, rocky slopes of Jimberlana Hill and Mt Norcott, north-east of Norseman (Nicolle and Brooker 2006), and 2.5km south-east of the Desirables survey area. The vegetation surrounding the historical location of *Eucalyptus platydisca* (T) within the Desirables survey area (NW4), is defined as;

> "Open low woodland of *Eucalyptus lesouefii* over tall isolated clumps of *Melaleuca* ?*sheathiana* and *Eremophila* spp. shrubs over low isolated clumps of *Cratystylis conocephala* shrubs occurring on brown sandy-clay loam with some surface rocks on flats and gentle slopes." (Mattiske Consulting 2020a, 2020b, 2024).

This differs to the expected soil and topography requirements of *Eucalyptus platydica* (T) outlined by Nicolle and Brooker (2006), in terms of granite outcropping and landform. Plate 1 shows site DS09, a representative photo of the NW4 vegetation community, with a distinct lack of any granite outcropping or slopes.

Plate 1: Site DS09 from the Desirables survey area, a representative photo of the NW4 vegetation community (Photograph: M. Mrasic)

Distinct differences in vegetation community composition of the expected/historically recorded *Eucalyptus platydisca* (T) habitat, and the NW4 community recorded in the Desirables survey, suggests that the location of historical record could be incorrect. The record within the Desirables survey area was made in 1974, and with older, likely less accurate, GPS and locality equipment. It is highly likely that this record would be from the adjacent Jimberlana Hill where numerous other records of *Eucalyptus platydisca* (T) have been made.

No records of *Allocasuarina globosa* (T) and *Daviesia macrocarpa* (T) were made within the TSF5 and Desirable survey areas despite there being suitable habitat for these species within both survey areas. Coverage of the survey areas was considered good, and potential habitat areas for both species were extensively traversed with no indication of either species being present.

Of the 41 priority taxa recorded in desktop assessment, two taxa were recorded within the Desirables and TSF5 survey areas, *Eucalyptus brockwayi* (P3) and *Eremophila purpurascens* (P3). Both taxa were identified in the desktop assessment as having a high and medium likelihood, respectively, of occurring within the survey areas and have been previously recorded by Mattiske Consulting within the Norseman Gold Project Area (Mattiske Consulting 2020b).

Eucalyptus brockwayi (P3)

Eucalyptus brockwayi (P3) was recorded at 3 locations representing 6 individuals within the TSF5 survey area (Table 7). This taxon was previously recorded within the Norseman Gold Project Area by Mattiske Consulting in 2020 (Mattiske Consulting 2020b), specifically, in the TSF4 and Camp survey areas adjacent to the TSF5 survey area. Two records of this taxon occur in NW10 vegetation community and one occurring on the boarder of the NW10 and S4 vegetation communities. This is congruous with records from Mattiske Consulting's 2020 survey, where this taxon was primarily recorded within the NW10 vegetation community (Mattiske Consulting 2020b). Regionally, *Eucalyptus brockwayi* (P3) is known from 10 records in and around Norseman, 1 record 10km north east of Peak Charles National Park, and 1 record in Merredin (WAH 1998-).

Eremophila purpurascens (P3)

Eremophila purpurascens (P3) was recorded at 4 locations representing 4 individuals within the TSF5 and Desirables survey areas (Table 7). Three records were spread across the TSF5 survey area and one record was in the southern section of the Desirables survey area. This taxon was previously recorded within the Norseman Gold Project Area by Mattiske Consulting in 2020 (Mattiske Consulting 2020b). All 4 records occur within different vegetation communities across the survey areas; W4, NW13 and S4 in the TSF5 survey area, and W2 in the Desirables survey area. Previous Mattiske Consulting records have this taxon occurring in W4 and W2 vegetation communities (Mattiske Consulting 2020b). Regionally, *Eremophila purpurascens* (P3) is known from 8 records in and around Norseman (WAH 1998-).

6.3 Introduced (Exotic) Flora

Nine introduced species were recorded within the TSF5 and Desirables survey areas: **Asphodelus fistulosus*, **Carrichtera annua*, **Centaurea melitensis*, **Lysimachia arvensis*, **Medicago minima*, **Mesembryanthemum nodiflorum*, **Oligocarpus calendulaceus*, **Sonchus asper* and **Sonchus oleraceus* (Table 8). All introduced species recorded, except **Sonchus asper,* were identified during the desktop report as having the potential to occur within the survey areas. **Sonchus asper* was not identified in the desktop assessment, but is known to occur in the region and occurs over much of the state (WAH 1998-). **Carrichtera annua* was the most prolific introduced species occurring within the survey areas, with 13 locations representing approximately 1 561 individuals within the Desirables survey area and 15 locations representing approximately 1 703 individuals in the TSF5 survey area.

6.4 Vegetation Communities

Vegetation mapping based on 37 quadrats resulted in the delineation 14 vegetation communities within the TSF5 and Desirables survey areas. Eight vegetation communities were mapped across the TSF5 Survey Area: Seven Eucalypt woodland/mallee shrubland communities (NW, S, and W) and a disturbed community (CL). One community, S7, was newly defined and only occurs within the TSF5 Survey Area. Ten vegetation communities were mapped across the Desirables Survey Area: Eight eucalypt woodland/mallee shrublands (NW, NS and W), one *Casuarina* woodland (NW11), and one disturbed community (CL). There are three newly defined communities that only occur in the Desirables Survey Area (NS5, NW16, NW17). Data collected from the 2024 survey (this survey) was merged with data from the surveys conducted by Mattiske Consulting in 2020 (Mattiske Consulting 2020a, 2020b). This ensures that vegetation communities across the entire Norseman Gold Project Area are consistent.

Eucalyptus Woodlands

Eucalyptus woodlands in Norseman Gold Project survey areas comprise a mosaic of vegetation communities, with continual slight changes in canopy *Eucalyptus* species, the mid stratum species and the lower stratum.

Dominant tree species of the *Eucalyptus* woodlands in both the TSF5 and Desirables survey areas were *Eucalyptus dundasii, E. lesouefii, E. salubris* and *E. urna*, either singly or in combination. Other tree species that form part of the definition of vegetation communities include *Eucalyptus concinna, E. gracilis* and *E. ?virella*. *Eucalyptus stricklandii* and *E. torquata* were only present within the TSF5 survey area, occurring on rocky ridges and slopes of the W4 and S4 communities. *Eucalyptus oleosa* and *E. platycorys* only were only present within the Desirables survey area, occurring on the sandy clay flats of NW16 and NW17 communities.

The mid stratum was often dominated by *Melaleuca* species (particularly *M. ?sheathiana*) and/or *Eremophila* species (particularly *E. scoparia*), with contributions from *Alyxia buxifolia*, *Beyeria* spp., *Dodonaea microzyga, Exocarpos aphyllus*, *Santalum acuminatum, Senna artemisioides* subsp. *filifolia and Trymalium myrtillus* subsp. *myrtillus*. The most common species in the lower stratum were the low shrubs

Cratystylis conocephala, various *Eremophila* species*, Olearia muelleri*, *Scaevola spinescens* and *Westringia rigida,* along with Chenopodiaceae of the genera *Atriplex, Maireana, Rhagodia* and *Tecticornia*.

Distinguishing separate vegetation communities in this mosaic of *Eucalyptus* woodland vegetation proved difficult, and several survey sites were on what could be considered (in hindsight) to be ecotones, so there are very likely several approaches to defining the vegetation communities in this vegetation.

Other vegetation communities

In the Desirables survey area, there was one *Casuarina obesa* woodland, NW11, with a Chenopodiaceae sp. and Azioaceae sp. understory, occurring on the fringes of salt lakes. The occurrence of the NW11 community within the Desirables survey area can be attributed to the survey areas proximity to a salt lake and the associated heavy, saline, soils extending from the lake bed.

Vegetation mapping carried out by Mattiske Consulting in 2020 (Mattiske Consulting 2020a, 2020b), was used to guide the mapping of the 2024 survey of the TSF5 and Desirables survey areas so that vegetation community boundaries were contiguous.

The vegetation communities mapped within the TSF5 and Desirables survey areas by Mattiske Consulting in Spring 2024, fit broadly within the Pre-European vegetation associations of the area, are typical of the regional vegetation of the Great Western Woodlands, and show the same gradation from salt lake vegetation with low chenopod shrublands on salt lake fringes into woodlands with mixed *Eucalyptus* species as noted for the area by previous authors (Mattiske Consulting 2020a, 2020b), and as typical of the region.

7. CONCLUSIONS

Based on the results of the field survey of the TSF5 and Desirables survey areas, both the range of flora taxa recorded and the vegetation communities defined from the survey quadrat data are consistent with the information recorded in the desktop assessment of the survey areas. The majority of the survey areas was characterised by a mosaic of *Eucalyptus* woodlands/mallee shrublands on sandy clay or rocky soils. The Desirables survey area had a small section of vegetation fringing the edge of a salt lake, giving way to a chenopod shrubland situated on saline clay soils. Both survey areas exhibited moderate signs of disturbance in terms of tracks, litter, weeds and historical mining infrastructure. Vegetation condition within the survey areas therefore ranged from excellent to degraded. Two priority 3 species, *Eucalyptus brockwayi* (P3) and *Eremophila purpurascens* (P3), were recorded throughout the TSF5 survey area (only one record of *Eremophila purpurascens* (P3) in the desirables survey area). One priority 3 species was recorded within the Desirables survey area, *Eremophila purpurascens* (P3). Both of these species were known to occur in the area, and had been previously recorded in the Norseman Gold Project area (Mattiske Consulting 2020a, 2020b).

Based on these results, there are no factors, from a flora and vegetation perspective, which would either be a cause for concern or warrant additional survey work within the TSF5 or Desirables survey areas.

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9. PERSONNEL

The following Mattiske Consulting personnel were involved in this project:

NAME	POSITION	SURVEY INVOLVEMENT	FLORA COLLECTION PERMIT
Dr E. M. Mattiske	Managing Director & Principal Ecologist	planning, management and report review	n/a
Ms K. Tribbeck	Experienced Botanist	planning, fieldwork, plant identifications, data analysis, report preparation	FB62000467-3
Ms M. Mrasic	Botanist	fieldwork, plant identifications	FB62000616-2
Mr D. Angus	Senior Botanist	desktop preparation	n/a
Mr Z. Sims	Senior Botanist	report review	n/a

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

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

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

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

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

Threatened flora are listed in the *Biodiversity Conservation (Listing of Native Species) (Flora) Order 2023*; Department of Biodiversity, Conservation and Attractions (DBCA 2023a), and are categorised under Division 1 (threatened species – critically endangered), Division 2 (threatened species - endangered), and Division 3 (threatened species – vulnerable)**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act. Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of threatened flora species
Note: Adapted from EPA (2018).

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

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (EPA 2018). Priority species are not afforded the same level of protection under state or federal legislation as the listed Threatened species, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species
Note: Adapted from EPA (2018).

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

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

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

Table A2.1 Federal definition of threatened ecological communities
Note: Adapted from section 181 and section 182 of the EPBC Act.

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

Threatened ecological communities (TECs), under the *Biodiversity Conservation Act 2016*, are published in the Western Australian Government Gazette under the *Biodiversity Conservation (Threatened Ecological Communities) Order 2023*, and are listed by the DBCA (2024c) in the Threatened ecological communities list 2023 (23rd October 2023). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2).

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

Table A2.2 State definition of threatened ecological communities
Note: Adapted from EPA (2018).

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

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the DBCA (2024e) in the *Priority Ecological Communities for Western Australia – Version 35 (19th June 2023)*. Similarly, to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016b) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities
Note: Adapted from EPA (2018).

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

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

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

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2024).

Table A3.1 Categories and control measures of declared pest (plant) organisms
Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

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

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

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

Conservation significant flora

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

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

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

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

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of vegetation condition categories

Note: Adapted from Keighery (1994).

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

APPENDIX A6: NVIS STRUCTURAL FORMATION TERMINOLOGY

Note: Adapted from NVIS Technical Working Group (2017).

COVER CHARACTERISTICS							
Foliage cover*	70-100	30-70	10-30	<10	≈0	0-5	unknown
Crown cover**	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
% cover***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
Cover code	d	c	i	r	bi	bc	unknown

GROWTH FORM	HEIGHT RANGES (m)	STRUCTURAL FORMATION CLASSES						
tree, palm	<10, 10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1, 1-2, >2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1, 1-2, >2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1, 1-2, >2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5, >0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	spare samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2, >2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5, >0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grassland	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5, >0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	<0.5, >0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5, >0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	<0.5, >0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	<1, 1-2, >2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophytelan d	bryophytelan d	open bryophytela nd	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10, 10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	0-0.5, <1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	0-0.5, <1	closed seagrass bed	seagrass bed	open seagrass bed	sparse seagrasses	isolated seagrasses	isolated clumps of seagrasses	seagrasses

APPENDIX B: PREVIOUS FLORA AND VEGETATION FIELD SURVEYS CONDUCTED IN THE NORSEMAN AREA, 1989-2020

Note: Threatened and Priority Flora are listed with their status as at March 2020 (WAH 1998-) - see Appendix A for definitions.

SURVEY YEAR (MONTH)	AUTHOR (REPORT YEAR)	LOCATION	PURPOSE	METHODS	FLORA AND VEGETATION RESULTS
1989 (Apr)	Goldfields Environmental Management Pty Ltd (1989)	North: Red, White & Blue Lease (8km south of Norseman)	Flora, vegetation, soils, fauna habitat	2 x sampling sites of 1 ha each All flowering plants and ferns recorded	Flora: 44 flowering plant species Priority flora: 2 species – *Philotheca apiculata* (P2), *Eucalyptus brockwayi* (P3). Vegetation Communities: 2
1995 (Mar)	Landcare Services Pty Ltd (1995)	North: Harlequin, Active Tailings Dam, North Royal, Bullen Hill, OK, Viking South: Scotia Hill	Baseline vegetation and initial rehabilitation monitoring	Baseline vegetation – 30 sites of 10m x 50m Vegetation composition and structure in five 10m x 10m quadrats at 12 sites Species abundance and foliage cover recorded at 12 sites Species presence/absence recorded at 18 sites	Flora: 263 vascular plant species Threatened flora: 1 – *Eucalyptus platydisca* (T) Priority flora: 9 - *Acacia dorsenna* (P1), *Eucalyptus jimberlanica* (P1), *Grevillea phillipsiana* (P1), *Philotheca apiculata* (P2), *Comesperma calcicola* (P3), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3), *Darwinia polycephala* (P4), *Eremophila parvifolia* subsp. *parvifolia* (P4). Vegetation Communities: 14
1995 (Oct)	Landcare Services Pty Ltd (1996)	North: Active Tailings Dam, Golden Dragon, Harlequin, North Royal, Penneshaw, Polar Bear, Venture	Baseline vegetation Phase 2	Baseline vegetation – 13 areas, ?31 sites Similar to March 19995 survey	Flora: 248 vascular plant species (98 additional to March survey) Threatened flora additional to March 1995 survey: 1 – *Daviesia microcarpa* (T) Priority flora additional to March 1995 survey: 3 – *Eucalyptus websteriana* subsp. norsemanica (P1), *Diocirea microphylla* (P3), *Phebalium drummondii* (P3). Introduced flora species: 2 significant species
1996 (unknown)	Marianna Partners Environmental Services (1996)	South: Mt Henry, Iron Prince	Baseline survey – flora, soil, fauna	Survey area 175 ha Transects	Flora: 253 vascular plant species Priority flora: 2 species – *Philotheca apiculata* (P2), *Eucalyptus brockwayi* (P3). Introduced flora species: 0 species Vegetation Communities: 4

APPENDIX B: PREVIOUS FLORA AND VEGETATION FIELD SURVEYS CONDUCTED IN THE NORSEMAN AREA, 1989-2020

Note: Threatened and Priority Flora are listed with their status as at March 2020 (WAH 1998-) - see Appendix A for definitions.

SURVEY YEAR (MONTH)	AUTHOR (Report year)	LOCATION	PURPOSE	METHODS	FLORA AND VEGETATION RESULTS
1996 (Sep-Oct)/1997 (June)	Landcare Services Pty Ltd (1997)	North: East Polar Bear, Lady Miller/Penneshaw South: Albion, Bromus/Goodia	Increase knowledge of endemic flora Add to client's reference herbarium Identify priority and threatened flora	Total survey area ~218 km^2 50 sites across 4 areas	Flora: 98 endemic plant species additional to Oct 1995 cumulative total Threatened flora additional to 1995 & 1996 surveys: 1 - *Allocasuarina globosa* (T) Priority flora additional to 1995 & 1996 surveys: 4 *Ptilotus rigidus* (P1), *Acacia truculenta* (P3), *Diocirea microphylla* (P3), *Eremophila parvifolia* subsp. *parvifolia* (P4) Introduced flora species: 7 species
2001 (May)	Mattiske Consulting Pty Ltd (2001a)	North: Gladstone, Daisy	Flora and vegetation survey	Flora and Vegetation Survey: Total survey area ~10 km^2 6 sites	Flora: 144 vascular plant taxa Threatened flora species: 2 species - *Daviesia microcarpa* (T), *Eucalyptus platydisca* (T) Priority flora: 2 species – *Eremophila purpurascens* (P3), *Darwinia polycephala* (P4) Introduced flora species: 9 species Vegetation Communities: 7
2001 (Jul)	Mattiske Consulting Pty Ltd (2001b)	North: Phoenix and Venture Tailings Storage Facilities	Tree Health	Tree Health Survey: 250 trees (Phoenix), 170 trees (Venture)	Flora: 5 Eucalypt species (Phoenix), 3 Eucalypt species (Venture)
2002 (Aug)	Mattiske Consulting Pty Ltd (2002)	North: Cobbler	Flora and vegetation survey	Vehicle and foot traverse	Flora: 89 vascular plant taxa Threatened flora species: 0 species Priority flora: 3 species Introduced flora species: 1 Vegetation Communities: 15
2003 (June)	Outback Ecology Environmental Management Services (2003)	North: Lake Cowan	Baseline environmental (terrestrial and aquatic flora and fauna) Targeted flora search	5 aquatic sites	Flora: 54 vascular plant taxa Threatened flora species: 0 species Priority flora: 0 species Introduced flora species: 2 Vegetation Communities: 8

APPENDIX B: PREVIOUS FLORA AND VEGETATION FIELD SURVEYS CONDUCTED IN THE NORSEMAN AREA, 1989-2020

Note: Threatened and Priority Flora are listed with their status as at March 2020 (WAH 1998-) - see Appendix A for definitions.

SURVEY YEAR (MONTH)	AUTHOR (Report year)	LOCATION	PURPOSE	METHODS	FLORA AND VEGETATION RESULTS
2004 (Aug)	Paul Armstrong & Associates (2004)	South: North Scotia	Rare flora search Vegetation mapping	Vehicle and foot traverse	Flora: 132 plant taxa Priority flora: 3 species – *Drosera salina* (P2), *Eremophila purpurascens* (P3), *Melaleuca macronychia* subsp. *trygonoides* (P3). Introduced flora species: 6 Vegetation Communities: 10
2004 (Sep)	Rally Revegetation and Environmental Services (2004)	North: Bullen	Flora and Vegetation survey	Total survey area ~5 ha	Threatened flora species: 0 species Priority flora: 0 species Vegetation Communities: 4
2005 (Feb)	Mattiske Consulting Pty Ltd (2005)	North: Proposed Tailings Dam	Flora and Vegetation survey Vertebrate fauna habitat survey	Vehicle and foot traverse	Flora: 134 plant taxa Threatened flora species: 0 species Priority flora: 3 species – *Acacia dorsenna* (P1), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3). Introduced flora species: 2 Vegetation Communities: 17
2005 (Aug)	Rally Revegetation and Environmental Services (2005)	North: Daisy, Gladstone, Golden Dragon South: Scotia	Ecosystem Function Analysis of Waste Dumps	Transects 10 m wide x 50 m long with sampling points every 10 m Analogue transects	-
2009 (Sep, Nov)	GHD Pty Ltd (2009)	South: Mt Henry, North Scotia	Targeted Flora	Foot traverse	Threatened flora species: 0 species Priority flora: 3 species – *Philotheca apiculata* (P2), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3).
2010 (Mar)	GHD Pty Ltd (2010a)	South: Mt Henry, North Scotia	Targeted Flora	Foot traverse	Priority flora: 1 species – *Philotheca apiculata* (P2).

APPENDIX B: PREVIOUS FLORA AND VEGETATION FIELD SURVEYS CONDUCTED IN THE NORSEMAN AREA, 1989-2020

Note: Threatened and Priority Flora are listed with their status as at March 2020 (WAH 1998-) - see Appendix A for definitions.

SURVEY YEAR (MONTH)	AUTHOR (Report year)	LOCATION	PURPOSE	METHODS	FLORA AND VEGETATION RESULTS
2010 (Apr)	GHD Pty Ltd (2010b)	South: Brockway Timber Reserve	Baseline flora and flora assessment	Total survey area 300 ha Vehicle and foot traverse	Flora: 116 plant taxa Threatened flora species: 0 species Priority flora: 4 species – *Philotheca apiculata* (P2), *Beyeria sulcata* var. *truncata* (P3), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3). Introduced flora species: 3 Vegetation Communities: 5
2010 (Sep)	Botanica Consulting (2010)	South: Brockway Timber Reserve	Level 1 Flora and Vegetation survey	Total survey area 519 ha	Flora: 139 plant taxa Threatened flora species: 0 species Priority flora: 4 species – *Philotheca apiculata* (P2), *Beyeria sulcata* var. *truncata* (P3), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3). Introduced flora species: 2 Vegetation Communities: 4
2012 (Oct)	Mattiske Consulting Pty Ltd (2013a)	South: Mt Henry, Selene, North Scotia	Level 1 Flora and Vegetation survey Targeted flora (ridges)	66 sites (20 m x 20 m quadrats)	Flora: 150 vascular plant taxa Threatened flora species: 0 species Priority flora: 6 species – *Philotheca apiculata* (P2), *Allocasuarina eriochlamys* subsp. *grossa* (P3), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3), *Goodenia laevis* subsp. *laevis* (P3), *Melaleuca coccinea* (P3). Introduced flora species: 3 Vegetation Communities: 6

APPENDIX B: PREVIOUS FLORA AND VEGETATION FIELD SURVEYS CONDUCTED IN THE NORSEMAN AREA, 1989-2020

Note: Threatened and Priority Flora are listed with their status as at March 2020 (WAH 1998-) - see Appendix A for definitions.

SURVEY YEAR (MONTH)	AUTHOR (Report year)	LOCATION	PURPOSE	METHODS	FLORA AND VEGETATION RESULTS
2013 (June)	Mattiske Consulting Pty Ltd (2013b)	South: Mt Henry, Selene, North Scotia	Level 2 Flora and Vegetation survey Targeted flora (ridges)	Total survey area ~1340 ha 82 sites (20 m x 20 m quadrats)	Flora: 102 vascular plant taxa (additional to 2012 survey) Threatened flora species: 0 species Priority flora: 2 species (additional to 212 survey) – *Eucalyptus jimberlanica* (P1), *Cyathostemon* sp. Salmon Gums (B. Archer 769) (P3). Introduced flora species: 5 (additional to 2012 survey) Vegetation Communities: 11
2015 (Oct)	Umwelt (Australia) Pty Ltd (2016)	South: Maybell	Level 1 Flora and Vegetation survey in support of application for Native Vegetation Clearing Permit	20 sites Vehicle and foot traverse	Flora: 76 vascular plant taxa Threatened flora species: 0 species Priority flora: 5 species – *Philotheca apiculata* (P2), *Allocasuarina eriochlamys* subsp. *grossa* (P3), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3), *Melaleuca coccinea*(P3). Introduced flora species: 3 Vegetation Communities: 9
2019 (Nov)	Native Vegetation Solutions (2019)	South: Maybell, Lord Percy	Targeted Flora	Known locations and likely habitat targeted	Priority flora: 5 species – *Eucalyptus jimberlanica* (P1), *Philotheca apiculata* (P2), *Allocasuarina eriochlamys* subsp. *grossa* (P3), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3).
2020 (Mar)	Mattiske Consulting Pty Ltd (2020a)	North: Gladstone, North Royal, Gladstone-North Royal Haul Roads, Jimberlana Pipeline South: Scotia	Detailed Flora and Vegetation survey	Total survey area ~ 2665 ha 101 sites (20m x 20m quadrats)	Flora: 178 vascular plant taxa Threatened flora species: 0 taxa Priority flora: 3 taxa – A*cacia kerryana* (P2), *Calandrinia lefroyensis* (P1), *Eremophila parvifolia* ?subsp. *parvifolia* (P4) Introduced flora species: 2 taxa Vegetation communities: 27
2020 (Sep)	Mattiske Consulting Pty Ltd (2020b)	North: Camp, Cobbler, Gladstone extensions, North	Detailed Flora and Vegetation survey	Total survey area ~ 79 sites (20m x 20m quadrats)	Flora: 168 vascular plant taxa Threatened flora species: 0 taxa

APPENDIX B: PREVIOUS FLORA AND VEGETATION FIELD SURVEYS CONDUCTED IN THE NORSEMAN AREA, 1989-2020

Note: Threatened and Priority Flora are listed with their status as at March 2020 (WAH 1998-) - see Appendix A for definitions.

		Royal extension, OK, Slippers, TSF 4 South: Maybell, Scotia extensions			Priority flora: 8 taxa – *Allocasuarina eriochlamys* subsp. *grossa* (P3), *Eremophila purpurascens* (P3), *Eucalyptus brockwayi* (P3), *Eucalyptus websteriana* subsp. *norsemanica* (P1), *Goodenia laevis* subsp. *laevis* (P3), *Melaleuca coccinea* (P3), *Micromyrtus papillosa* (P1), *Philotheca apiculata* (P1) Introduced flora species: 5 taxa Vegetation communities: 5 vegetation communities additional to March 2020 survey

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

Notes: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GVD – Great Victoria Desert; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NUL – Nullarbor; PIL – Pilbara. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking. Survey Areas (Mattiske Consulting 2020a-b): COB – Cobbler; GLA – Gladstone; GNRHR – Gladstone/North Royal Haul Roads; JIPI – Jimberlana Pipeline; MAY – Maybell; NR – North Royal; SCO – Scotia. FB refers to Florabase (WAH 1998-), TPFL is the Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora database, and WAH is the Western Australian Herbarium.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Allocasuarina globosa	Casuarinaceae	T	VU	Habit: Dioecious shrub, to 2 m high. Flower colour: - Flowering period (indicated in green): (flowering period unknown) J F M A M J J A S **O** N D Soils & landforms: Laterite, rocky clay and loam. Ridges and rocky slopes. Mallee shrubland. IBRA Distribution: COO Florabase records: 32	Medium Habitat may occur within survey areas. Recorded by LS (1997) at Iron King (2.5 km SE of OK). Six locations in TPFL + WAH databases (1989-2008), all at Mt Deans in Brockway Timber Reserve, ~3 km NE of Maybell.
Daviesia microcarpa	Fabaceae	T	EN	Habit: Sprawling, tangled shrub, to 0.4 m high, ca 1 m wide. Flower colour: orange & red Flowering period (indicated in green): J F M A M J J A **S** O N D Soils & landforms: Weathered gravel, red-brown loam. Rocky slopes and disturbed areas. IBRA Distribution: COO Florabase records: 10	Medium Habitat may occur within survey areas. Recorded by LS (1996) and MCPL (2001a), both at Jimberlana Hill (NR & GNRHR). More than 10 locations near Norseman on TPFL + WAH databases (1974-2016), many along JIPI.
Eucalyptus platydisca	Myrtaceae	T	VU	Habit: Mallee, 2-4 m high, bark smooth. Flower colour: cream Flowering period (indicated in green): J F M **A** M J **J** A S O N D Soils & landforms: Granitic soils, clay. Stony hills. IBRA Distribution: COO Florabase records: 41	Medium Habitat may occur within survey areas. Recorded by LS (1995) and MCPL (2001a), both at Jimberlana Hill (NR & GNRHR). More than 20 locations near Norseman (Jimberlana Hill and Dundas Hills on TPFL + WAH databases (1935-2004).

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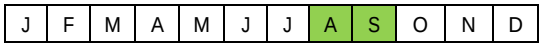
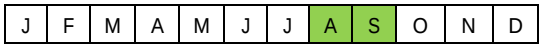
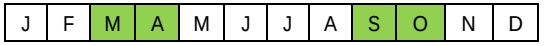
Notes: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GVD – Great Victoria Desert; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NUL – Nullarbor; PIL – Pilbara. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking. Survey Areas (Mattiske Consulting 2020a-b): COB – Cobbler; GLA – Gladstone; GNRHR – Gladstone/North Royal Haul Roads; JIPI – Jimberlana Pipeline; MAY – Maybell; NR – North Royal; SCO – Scotia. FB refers to Florabase (WAH 1998-), TPFL is the Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora database, and WAH is the Western Australian Herbarium.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia dorsenna	Fabaceae	P1	-	Habit: Dense, domed shrub, 1-1.6 m high, to 3 m wide. Flower colour: yellow Flowering period (indicated in green):  Soils & landforms: Rocky sandy loam or clay loam. Low rocky hills. IBRA Distribution: COO Florabase records: 13	Medium Habitat may occur within survey areas. Recorded by LS (1995) at Bullen mine and MCPL (2005) on the east flank of Dundas Hills. Only 2 locations near Norseman, Beacon Hill 2002 (OK/TSF4/TSF5) and west side of town 1969) on TPFL + WAH databases. All other FB records >20km north & west of Norseman.
Beyeria opaca	Euphorbiaceae	P1	-	Habit: Erect, compact shrub to 1 m high Flower colour: yellow Flowering period (indicated in green):  Soils & landforms: red sandy clay, dune slopes IBRA Distribution: COO Florabase records: 8	Low Suitable habitat for this taxon is unlikely to occur within the survey area.
Bossiaea arcuata	Fabaceae	P1	-	Habit: Erect, divaricately branched, superficially leafless shrub, to 1.5 m high. Flower colour: red/yellow Flowering period (indicated in green):  Soils & landforms: Deep white sand. Edge of salt lakes. IBRA Distribution: COO Florabase records: 12	Low Habitat occurs in the survey area. Nine records in TPFL + WAH databases (2000-2009), all 20-25 km SW of Norseman.

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

Notes: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GVD – Great Victoria Desert; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NUL – Nullarbor; PIL – Pilbara. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking. Survey Areas (Mattiske Consulting 2020a-b): COB – Cobbler; GLA – Gladstone; GNRHR – Gladstone/North Royal Haul Roads; JIPI – Jimberlana Pipeline; MAY – Maybell; NR – North Royal; SCO – Scotia. FB refers to Florabase (WAH 1998-), TPFL is the Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora database, and WAH is the Western Australian Herbarium.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Bossiaea aurantiaca	Fabaceae	P1	-	Habit: Compact, rounded or spreading, spinescent shrub, to 1.5 m high. Flower colour: red/yellow Flowering period (indicated in green): J F M A M J J A **S** **O** N D Soils & landforms: Red sand, red clay loam. Low-lying, winter-damp sites. IBRA Distribution: COO Florabase records: 13	Low Habitat potentially occurs in the survey area. 13 records in TPFL + WAH databases (1968-2014), nearest are ~8 km NW of Norseman (W side of Lake Cowan), 1 km from the W side of COB.
Calandrinia lefroyensis	Montiaceae	P1	-	Habit: Semi-erect to erect perennial herb, usually scrambling through other plants, 0.13 to 0.26 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S **O** **N** D Soils & landforms: Salt-lake flats among, brown silty loams or brown-grey sands. IBRA Distribution: COO Florabase records: 11	Medium Habitat may occur within Desirables survey area. Habitat doesn't occur in the TSF5 survey area, was recorded by MCPL (2020) in the north-eastern section of GLA fringing a salt-lake.
Eucalyptus jimberlanica	Myrtaceae	P1	-	Habit: Mallee or tree, 4-10 m high, bark smooth. Flower colour: pale yellow-yellow-cream Flowering period (indicated in green): J **F** M A M J J A S O **N** D Soils & landforms: Loam. Valley edges. IBRA Distribution: COO Florabase records: 24	Medium Habitat may occur within survey areas. Recorded by LS (1995) at Bullen minesite (TSF4) and 15 km S of Norseman (MAY road) and MCPL (2013) just S of the Mt Henry pit (~1 km from the S end of MAY). More than 20 records in TPFL + WAH databases (1967-2018).

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eucalyptus websteriana subsp. *norsemanica*	Myrtaceae	P1	-	Habit: Spreading mallee to 3 m high, bark 'minni-ritchi'. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A **S O N** D Soils & landforms: Rocky rises. IBRA Distribution: COO Florabase records: 15	Low Habitat may occur within survey areas. Recorded by LS (1995) at Lake Cowan Causeway (COB) and MCPL (2002) at COB. More than 10 records in TPFL + WAH databases (1974-2008), all just west of Lake Cowan at or near COB.
Grevillea phillipsiana	Proteaceae	P1	-	Habit: Prickly shrub, 0.8-1.5 m high. Flower colour: red/red & orange Flowering period (indicated in green): J F M A M J **J A S** O N D Soils & landforms: Red sand, stony loam. Granite hills. IBRA Distribution: COO, NUL Florabase records: 19	Low/medium Habitat may occur within survey areas. Recorded by LS (1995, 1996) at Lake Cowan Causeway. 12 records in TPFL + WAH databases (1951-2002), all just west of Lake Cowan at or near COB.
Lepidosperma lyonsii	Cyperaceae	P1	-	Habit: Tufted rhizomatous, perennial herb (sedge), leaves 0.31-0.53 m high, culms and leaves distichous. Flower colour: brown-light brown, white Flowering period (indicated in green): J F M A **M J** J **A S O** N D Soils & landforms: Pale orange skeletal sandy loam with banded ironstone gravel & rock, well-drained shallow stony loam with quartz. Gentle hill slopes, upper slopes of large hill. IBRA Distribution: COO Florabase records: 48	Low Recorded by MCPL (2012, 2013) as *Lepidosperma* aff. *lyonsii* at 7 sites around the Mt Henry pit (MAY).

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Micromyrtus papillosa	Myrtaceae	P1	-	Habit: Erect or low, spreading shrub, 0.4-1.2 m high. Flower colour: white Flowering period (indicated in green): J F M **A** M J J **A** **S** **O** N D Soils & landforms: Sandy or clay soils, ironstone, granite. Rocky sites, outcrops, on hills from base to summit. IBRA Distribution: COO Florabase records: 16	Medium Habitat may occur within survey areas. Recorded by LS (1995) at North Royal (NR) and LS (1996) at Bullen Hill North (TSF4) and MCPL (2002) at COB. 16 records in TPFL + WAH databases (1951-2014), most at Jimberlana Hill (NR & GNRHR) and Beacon Hill (OK/TSF4) and also at Brockway Timber Reserve (~5 km N of MAY; 2003) and near the Venture Pit (GNRHR; 1974).
Philotheca apiculata	Rutaceae	P1	-	Habit: Erect shrub, 0.5-1.5 m high. Flower colour: white-pink Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils & landforms: Stony clay loam. Rocky outcrops, hillsides. IBRA Distribution: AVW, COO, MAL Florabase records: 28	Low Habitat may occur within survey areas. Recorded by GS (1989) and LS (1996) in the North and LS (1995), Marianna (1996), Botanica (2010), GHD (2010), MCPL (2012, 2013), Umwelt (2016) in the South. More than 20 records in the WAH database (1965-2010), most to the S of Norseman.
Ptilotus rigidus	Amaranthaceae	P1	-	Habit: Perennial shrub to 0.3 m high Flower colour: white-pink Flowering period (indicated in green): J F M A M J J **A** **S** **O** **N** D Soils & landforms: Ironstone and quartz rocky hills IBRA Distribution: COO, MUR Florabase records: 21	Low Habitat may occur within survey areas. One WAH (1998-) record of this axon exists 14 km north of the Desirables survey area.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia kerryana	Fabaceae	P2	-	Habit: Low, spreading, domed shrub, 0.3-1 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D Soils & landforms: Granitic loamy sand, stony clayey loam or clayey sand. Low stony ridges, undulating plains. IBRA Distribution: COO Florabase records: 16	Medium Habitat may occur within survey areas. Recorded by MCPL (2020) along JIPI 5.5km NE of the TSF5 survey area.
Aotus sp. Dundas (M.A. Burgman 2835)	Fabaceae	P2	-	Habit: Shrub to 0.8 m high, to 1 m wide. Flower colour: orange, yellow/red, yellow-brown Flowering period (indicated in green): J F M A M J J A S O N D Soils & landforms: Sand, clayey sand, fine sandy loam. Flats, dunes on edge of salt lake, gentle undulating plains. IBRA Distribution: COO, MAL Florabase records: 23	Low All records located south of Norseman. Unlikely to be suitable habitat within the survey area.
Drosera salina	Droseraceae	P2	-	Habit: Erect, flexuose, tuberous, perennial herb to 0.07 m high. Flower colour: white Flowering period (indicated in green): J F M A M J J A S O N D Soils & landforms: Salt-free white sand. Margins of salt lakes. IBRA Distribution: COO, MAL Florabase records: 14	Low All records located south of Norseman. Unlikely to be suitable habitat within the survey area.

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Thysanotus brachyantherus	Asparagaceae	P2	-	Habit: Caespitose perennial, herb (with roots becoming tuberous), 0.1-0.4 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S **O N D** Soils & landforms: Clay over limestone, loam. IBRA Distribution: COO, ESP, MAL, MUR Florabase records: 16	Low Habitat may occur in the survey area. Not recorded in any of the previous surveys listed here. One record on the WAH database (1980), ~12km NE of Norseman.
Triglochin sp. Condingup (R. Davis 10877)	Juncaginaceae	P2	-	Habit: Aquatic perennial herb to 0.3 m. Flower colour: green Flowering period (indicated in green): J F M A **M** J J A S **O** N D Soils & landforms: Brown clay and mud in pools in granite. IBRA Distribution: COO, ESP, MAL Florabase records: 5	Low Habitat is unlikely to occur within the survey areas.
Acacia ancistrophylla var. *perarcuata*	Fabaceae	P3	-	Habit: Rounded or obconic shrub, 0.6-1 m high, to 6 m wide. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S** O N D Soils & landforms: Red sand, clay loam, loam. Undulating plains. IBRA Distribution: AVW, COO, MAL Florabase records: 24	Low Habitat may occur in the survey area. Not recorded in any of the previous surveys listed here. One record in WAH database (1980), ~34 km SW of Norseman.

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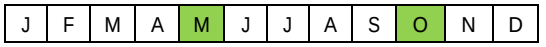
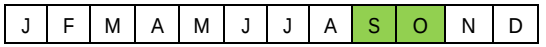
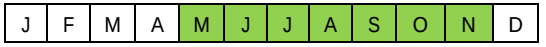
Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Acacia truculenta	Fabaceae	P3	-	Habit: Spreading, straggly, prickly shrub, 0.7-2.2 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S** O N D Soils & landforms: Sand or loam. Flats and gentle slopes. IBRA Distribution: COO, MAL Florabase records: 12	Low Habitat may occur in the survey area. One record on the WAH database (2008) ~ 7km south of Norseman.
Allocasuarina eriochlamys subsp. *grossa*	Casuarinaceae	P3	-	Habit: Dioecious or monoecious shrub, 1-3 m high, bracteoles prominently exceeding cone. Flower colour: - Flowering period (indicated in green): (flowering period unknown) J F M A M J J A S O N D Soils & landforms: Stony loam, laterite clay. Granite outcrops. IBRA Distribution: COO, NUL Florabase records: 29	Medium Habitat occurs in the survey area. Recorded by LS (1995) at North Royal, MCPL (2012) E of the Mt Henry pit, adjacent to or in MAY, and Umwelt (2016) inside MAY. Twenty records in the WAH database (1935-2007), in and around Norseman.
Atriplex lindleyi subsp. *conduplicata*	Chenopodiaceae	P3	-	Habit: Monoecious, short-lived annual or perennial, herb, ca 0.2 m high. Flower colour: - Flowering period (indicated in green): (flowering period unknown) J F M A M J J A S O N D Soils & landforms: Crabhole plains. IBRA Distribution: COO, MUR, PIL Florabase records: 5	Low Habitat may occur in the survey area. Not recorded in any of the previous surveys listed here. One record in WAH database (1997) ~500 m W of OK.

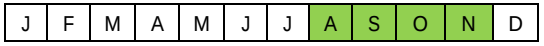
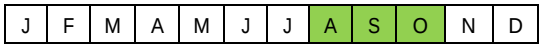
APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

Notes: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GVD – Great Victoria Desert; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NUL – Nullarbor; PIL – Pilbara. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking. Survey Areas (Mattiske Consulting 2020a-b): COB – Cobbler; GLA – Gladstone; GNRHR – Gladstone/North Royal Haul Roads; JIPI – Jimberlana Pipeline; MAY – Maybell; NR – North Royal; SCO – Scotia. FB refers to Florabase (WAH 1998-), TPFL is the Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora database, and WAH is the Western Australian Herbarium.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Beyeria sulcata var. *truncata*	Euphorbiaceae	P3	-	Habit: Shrub to 1.3 m high. Flower colour: - Flowering period (indicated in green):  Soils & landforms: Gravelly sand. IBRA Distribution: COO, MAL Florabase records: 7	Low Habitat occurs in the survey area. Recorded by LS (1996) at Harlequin (near NR) and Active Tailings Dam (~500 m S of GNRHR), Bot (2010) and GHD (2010) in Brockway Timber Reserve on Banded Iron Formation ridges. Two records in WAH database, from Norseman town (no date) and ~5 km W of COB (2018).
Chrysocephalum apiculatum subsp. *norsemanense*	Asteraceae	P3	-	Habit: Annual herb to 0.4 m high. Flower colour: yellow Flowering period (indicated in green):  Soils & landforms: Sandy loam and sandy clay. Sandplains. IBRA Distribution: COO, MUR Florabase records: 17	Low Habitat may occur in the survey area. Not recorded in any of the previous surveys listed here. Seven records in WAH database (1962-1980), NE of Norseman.
Cyathostemon sp. Salmon Gums (B. Archer 769)	Myrtaceae	P3	-	Habit: Erect, compact shrub to 3 m high Flower colour: white Flowering period (indicated in green):  Soils & landforms: Orange sand, white sand or sandy clay over granite, gypsum IBRA Distribution: COO, MAL Florabase records: 19	Low Habitat is unlikely to occur within the survey areas.

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

Notes: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GVD – Great Victoria Desert; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NUL – Nullarbor; PIL – Pilbara. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking. Survey Areas (Mattiske Consulting 2020a-b): COB – Cobbler; GLA – Gladstone; GNRHR – Gladstone/North Royal Haul Roads; JIPI – Jimberlana Pipeline; MAY – Maybell; NR – North Royal; SCO – Scotia. FB refers to Florabase (WAH 1998-), TPFL is the Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora database, and WAH is the Western Australian Herbarium.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eremophila microphylla	Scrophulariaceae	P3	-	Habit: Shrub to 0.4 m high Flower colour: white Flowering period (indicated in green):  Soils & landforms: sandy loam flats and slopes IBRA Distribution: COO Florabase records: 18	Medium Habitat may occur within the survey areas.
Eremophila purpurascens	Scrophulariaceae	P3	-	Habit: Erect, bushy shrub, 0.3-1.5 m high. Flower colour: pink & purple/red Flowering period (indicated in green):  Soils & landforms: Sandy clay, stony loam over greenstone. Granite hills & rocks. IBRA Distribution: COO Florabase records: 35	Medium Habitat occurs in the survey area. Recorded by 6 previous surveys in the North (1995-2005) and 7 in the South (1995-2016). Recorded by MCPL (2020) in COB ~7.5 km from TSF5 survey area.
Eucalyptus brockwayi	Myrtaceae	P3	-	Habit: Tree, 5-20 m high, bark smooth. Flower colour: white-cream Flowering period (indicated in green): Soils & landforms: Gravelly sandy loam. Low rocky hills & slopes. IBRA Distribution: COO, MAL Florabase records: 76	High Habitat occurs in the survey area. Multiple records by MCPL (2020) in TSF4, OK and Camp survey areas which are adjacent to the TSF5 survey area.

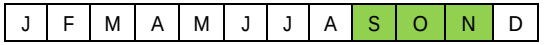
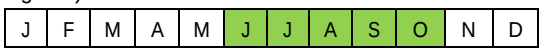
APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

Notes: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GVD – Great Victoria Desert; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NUL – Nullarbor; PIL – Pilbara. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking. Survey Areas (Mattiske Consulting 2020a-b): COB – Cobbler; GLA – Gladstone; GNRHR – Gladstone/North Royal Haul Roads; JIPI – Jimberlana Pipeline; MAY – Maybell; NR – North Royal; SCO – Scotia. FB refers to Florabase (WAH 1998-), TPFL is the Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora database, and WAH is the Western Australian Herbarium.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eucalyptus pterocarpa	Myrtaceae	P3	-	Habit: Tree, to 15 m high, bark smooth throughout, becoming ribbony, light grey over salmon cream. Flower colour: - Flowering period (indicated in green): (flowering period unknown) J F M A M J J A S O N D Soils & landforms: Red-brown sandy loam, yellow-brown silty loam. Creek edges, rocky slopes. IBRA Distribution: COO Florabase records: 17	Low Habitat may occur in the survey area. One record on the WAH database NE of Norseman.
Goodenia laevis subsp. *laevis*	Goodeniaceae	P3	-	Habit: Erect, woody shrub (subshrub), 0.1-0.25 m high, largest leaves 15-25 x 1-3mm, entire. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S O N D** Soils & landforms: Sandy loam or laterite IBRA Distribution: COO, ESP, MAL Florabase records: 20	Low Habitat may occur in the survey area. Records in WAH database occur south and west of the TSF5 survey area.
Melaleuca coccinea	Myrtaceae	P3	-	Habit: Much branched shrub, 1.5-2.6 m high, leaf blade elliptic to ovate, 1.5-2.2 times as long as wide. Flower colour: red Flowering period (indicated in green): **J** F M A M J J A **S O N** D Soils & landforms: Sandy loam over granite. Granite outcrops, sandplain, river valleys. IBRA Distribution: COO, ESP Florabase records: 33	Low Habitat occurs in the survey area. All records from previous surveys and from WAH database occurring south if the TSF5 survey area.

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

Notes: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; GVD – Great Victoria Desert; LSD – Little Sandy Desert; MAL – Mallee; MUR – Murchison; NUL – Nullarbor; PIL – Pilbara. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking. Survey Areas (Mattiske Consulting 2020a-b): COB – Cobbler; GLA – Gladstone; GNRHR – Gladstone/North Royal Haul Roads; JIPI – Jimberlana Pipeline; MAY – Maybell; NR – North Royal; SCO – Scotia. FB refers to Florabase (WAH 1998-), TPFL is the Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora database, and WAH is the Western Australian Herbarium.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Melaleuca macronychia subsp. *trygonoides*	Myrtaceae	P3	-	Habit: Multi-stemmed, spreading shrub, 1-4 m high, leaves broadly elliptic. Flower colour: red Flowering period (indicated in green): Soils & landforms: Sandy soils. Granite outcrops. IBRA Distribution: COO, MAL Florabase records: 20	Low Habitat occurs in the survey area. Recorded south of the TSF5 survey area near Lake Dundas.
Notisia intonsa	Asteraceae	P3	-	Habit: Annual herb, stem and major branches prostrate to erect, 2.5-15 cm long. Flower colour: pink, brown, grey Flowering period (indicated in green):  Soils & landforms: Brown stony saline loams, brown cracking clays, gilgai plains. IBRA Distribution: AVW, COO, ESP, MAL, MUR Florabase records: 25	Low Habitat may occur in the survey area. Not recorded in any of the previous surveys listed here. Two records in WAH database, one ~500 m NW of COB (1999) and the other <1 km from GNRHR (1974).
Phlegmatospermum eremaeum	Brassicaceae	P3	-	Habit: Prostrate to spreading annual herb, to 0.1 m high. Flower colour: white-cream Flowering period (indicated in green):  Soils & landforms: Stony loam or clay on slopes and plains. IBRA Distribution: AVW, COO, HAM, MAL, NUL Florabase records: 16	Low Habitat may occur in the survey area. Not recorded in any of the previous surveys listed here. One WAH database record, ~4 km NW of COB (1951).

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Pityrodia chrysocalyx	Lamiaceae	P3	-	Habit: Erect, branched shrub, 0.3-0.75(-1) m high. Flower colour: white Flowering period (indicated in green): J F M A M J J **A S O** N D Soils & landforms: Sandy soils. IBRA Distribution: COO, MAL Florabase records: 19	Low Habitat unlikely to occur in the survey area. Not recorded in any of the previous surveys listed here. 3 records in WAH database (1967-2002), the most recent ~1 km NW of COB.
Darwinia polycephala	Myrtaceae	P4	-	Habit: Diffuse shrub to 0.5 m high Flower colour: red-purple Flowering period (indicated in green): J F **M A M J J A S** O N D Soils & landforms: Flats near salt lakes IBRA Distribution: MAL Florabase records: 41	Medium Suitable habitat for this taxon may exist within the Desirables survey area. Suitable habitat for this taxon is unlikely to exist within the TSF5 survey area.
Eremophila parvifolia subsp. *parvifolia*	Scrophulariaceae	P4	-	Habit: Low divaricate shrub to 0.7 m high Flower colour: blue-purple Flowering period (indicated in green): J F M A M **J J A S O** N D Soils & landforms: Loam, yellow sand, clay, limestone, plains, claypans IBRA Distribution: COO, MAL, NUL Florabase records: 12	Low Suitable habitat for this taxon is unlikely to exist within the survey areas.

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN TSF5 AND DESIRABLES SURVEY AREAS

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Frankenia glomerata	Frankeniaceae	P4	-	Habit: Prostrate shrub. Flower colour: pink-white Flowering period (indicated in green): J F M A M J J A S O **N** D Soils & landforms: White sand. IBRA Distribution: AVW, COO, GAS, GES, GVD, LSD, MAL Florabase records: 65	Low Habitat unlikely to occur in the survey area. Not recorded in any of the previous surveys listed here. One record in TPFL + WAH database (2000) ~3 km N of JIPI.
Myriophyllum petraeum	Haloragaceae	P4	-	Habit: Aquatic, annual herb, stems to 0.3 m long. Flower colour: white Flowering period (indicated in green): J F M A M J J **A S O N D** Soils & landforms: Restricted to ephemeral rockpools on granite outcrops. IBRA Distribution: AVW, COO, ESP, MAL Florabase records: 55	Low Habitat unlikely to occur in the survey area.

APPENDIX D: VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE CENTRAL NORSEMAN GOLD SURVEY AREAS

NORTH and SOUTH denote the two survey regions as shown in Figure 1. * denotes introduced taxa. SCC is State Conservation Code (Appendix A; DBCA 2019z); FCC is Federal Conservation Code (Appendix A; EPBC Act 1999). EPBC is the EPBC Act Protected Matters Search Tool (DAWE 2015). NatureMap is the WA state search tool (DBCA 2007-). Gold Env denotes Goldfields Environmental Management Pty Ltd; LS is Landcare Services Pty Ltd; OE is Outback Ecology Environmental Management Services; MCPL is Mattiske Consulting Pty Ltd; Rally is F Revegetation and Environmental Services; Marianna is Marianna Partners Environmental Services; PAA is Paul Armstrong and Associates; Bot is Botanica Consulting; GHD is GHD Pty Ltd; and Umwelt is Umwelt Australia Pty Ltd.

FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
AIZOACEAE	*Carpobrotus modestus*																
	Carpobrotus sp.																
	Disphyma crassifolium								x	x	x	x			x		x
	Disphyma crassifolium subsp. *clavellatum*																
	Gunniopsis glabra																
	Gunniopsis quadrifida						x		x	x		x		x			
	Gunniopsis septifraga																
	Gunniopsis sp.																
	* *Mesembryanthemum nodiflorum*						x										
	Sarcozona praecox																
	Aizoaceae sp.																
AMARANTHACEAE	*Ptilotus aervoides*									x							
	Ptilotus carlsonii						x										
	Ptilotus drummondii						x										
	Ptilotus exaltatus						x		x	x		x					
	Ptilotus ?*eremita*																
	Ptilotus gaudichaudii									x							
	Ptilotus helichrysoides						x			x	x						
	Ptilotus holosericeus						x										
	Ptilotus obovatus						x	x	x	x	x					x	
	Ptilotus obovatus var. *obovatus*											x		x	x		x
	Ptilotus rigidus	P1		x							x						
	Ptilotus spathulatus						x										
	Ptilotus sp.																
	Surreya diandra								x	x	x			x			x

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
APIACEAE	*Daucus glochidiatus*																
APOCYNACEAE	*Alyxia buxifolia*						x	x	x	x	x	x		x	x	x	x
	Vincetoxicum lineare																
ARALIACEAE	*Hydrocotyle intertexta*						x										
	Trachymene ornata																
	Trachymene sp.									x							
ASPARAGACEAE	*Dianella revoluta*									x							
	Lomandra effusa						x		x	x							
	Lomandra sp.										x						
	Thysanotus brachyantherus	P2		x	x		x										
	Thysanotus manglesianus						x			x	x						
	Thysanotus sp.																
ASPHODELACEAE	* *Asphodelus fistulosus*											x					
	Bulbine semibarbata						x										
ASPLENIACEAE	*Asplenium subglandulosum*								x	x	x						
ASTERACEAE	*Actinobole uliginosum*									x							
	* *Ambrosia tenuifolia*						x										
	Angianthus cornutus																
	Angianthus tomentosus						x			x							
	Asteridea athrixioides						x										
	Asteridea chaetopoda								x	x				x			
	Blennospora drummondii																
	Brachyscome ciliaris						x		x	x		x					

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
ASTERACEAE	*Brachyscome iberidifolia*						x			x							
(continued)	*Brachyscome pusilla*																
	Brachyscome sp.																
	Calocephalus sp.									x							
	Calotis hispidula									x							
	* *Carthamus lanatus*													x			
	* *Centaurea melitensis*											x					
	Centipeda crateriformis subsp. *crateriformis*																
	Chondropyxis halophila									x							
	Chrysocephalum apiculatum											x					
	Chrysocephalum apiculatum subsp. *glandulosum*						x										
	* *Chrysocephalum apiculatum* subsp. *norsemanense*	P3		x	x		x										
	Chrysocephalum puteale									x							
	Cratystylis conocephala						x	x	x	x	x	x		x	x		x
	Cratystylis conocephala x *microphylla*						x										
	Cratystylis microphylla									x				x			
	Cratystylis subspinescens						x										
	Erymophyllum ramosum subsp. *ramosum*						x			x		x					
	* *Gazania linearis*						x										
	Gnaphalium indutum																
	Gnephosis angianthoides																
	Gnephosis brevifolia						x										
	Gnephosis tenuissima																
	Gnephosis tridens																
	Hyalochlamys globifera																
	Hyalosperma demissum																
	* *Hypochaeris glabra*																
	Kippistia suaedifolia						x										

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
ASTERACEAE	*Leiocarpa semicalva* subsp. *semicalva*						x										
(continued)	*Millotia myosotidifolia*						x										
	Millotia tenuifolia																
	Millotia sp.																
	Minuria cunninghamii								x			x					
	Minuria gardneri						x										
	Minuria sp.									x							
	* *Monoculus monstrosus*						x										
	Notisia intonsa	P3		x	x		x										
	Olearia axillaris								x	x	x						
	Olearia exiguifolia																
	Olearia incana						x										
	Olearia ?magniflora																
	Olearia muelleri						x	x	x	x	x	x		x	x	x	x
	Olearia pimeleoides																
	Olearia ramosissima																
	Olearia subspicata						x			x							
	Olearia sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628)						x					x					
	Olearia sp.																
	* *Oligocarpus calendulaceus*						x										
	* *Osteospermum ecklonis*						x										
	Panaetia tepperi																
	Podolepis rugata						x										
	Pogonolepis muelleriana									x							
	Pogonolepis stricta									x							
	* *Pseudognaphalium luteoalbum*						x			x							
	Rhodanthe floribunda																
	Rhodanthe haigii																

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
ASTERACEAE	*Rhodanthe laevis*						x										
(continued)	*Rhodanthe oppositifolia* subsp. *oppositifolia*						x										
	Rhodanthe pygmaea						x										
	Rhodanthe rubella						x										
	Rhodanthe spicata						x										
	Rhodanthe stricta						x										
	Schoenia cassiniana									x							
	Senecio glossanthus									x							
	Senecio lacustrinus						x										
	Senecio pinnatifolius						x					x					x
	Senecio quadridentatus																
	Senecio spanomerus									x							
	Siemssenia capillaris								x	x		x			x		
	* *Sonchus oleraceus*						x					x					
	* *Taraxacum khatoonae*						x										
	Thiseltonia gracillima						x										
	* *Tragopogon porrifolius*						x										
	Trichanthodium skirrophorum						x			x							
	Vittadinia dissecta var. *hirta*						x										
	Vittadinia gracilis																
	Vittadinia nullarborensis								x	x							
	Waitzia acuminata									x							
	Waitzia acuminata var. *acuminata*						x										
	Waitzia acuminata var. *albicans*																
	Waitzia fitzgibbonii						x			x							
	Waitzia suaveolens var. *flava*																
	Waitzia nitida						x										
	Asteraceae sp.									x		x					

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
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BORAGINACEAE	*Halgania andromedifolia*						x	x	x	x	x						
	Halgania cyanea						x		x								
	Halgania cyanea var. Charleville (R.W. Purdie +111)																
	Halgania erecta						x										
	Halgania integerrima						x										
	Halgania lavandulacea																
	Halgania sp.										x						
	Plagiobothrys australasicus						x										
BORYACEAE	*Borya constricta*																
	Borya sp.																
BRASSICACEAE	* *Carrichtera annua*					x						x			x	x	x
	Lepidium foliosum						x										
	Lepidium platypetalum						x		x	x				x			x
	Lepidium rotundum						x			x							
	Lepidium sp.																
	Menkea australis						x										
	Phlegmatospermum eremaeum	P3		x	x		x										
	* *Sisymbrium orientale*											x					
	Stenopetalum filifolium						x										
	Stenopetalum lineare var. *lineare*																
	Stenopetalum sp.						x										
	Brassicaceae sp.																
CACTACEAE	* *Opuntia ficus-indica*						x										
	* *Opuntia stricta*						x										

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
CAMPANULACEAE	*Isotoma scapigera*						x			x							
	Lithotoma petraea						x		x								
	Lobelia gibbosa									x							
	Wahlenbergia gracilenta																
CARYOPHYLLACEAE	* Sagina apetala																
	* *Silene gallica* var. *gallica*																
	* *Spergularia diandra*																
	Stellaria filiformis						x										
CASUARINACEAE	*Allocasuarina acutivalvis* subsp. *acutivalvis*						x		x	x	x	x			x		x
	Allocasuarina campestris						x	x	x					x			
	Allocasuarina corniculata																
	Allocasuarina eriochlamys subsp. *grossa*	P3		x	x		x		x								
	Allocasuarina globosa	T	VU	x			x				x						
	Allocasuarina helmsii						x		x	x		x		x			x
	Allocasuarina huegeliana									x							
	Allocasuarina trichodon																
	Casuarina obesa						x										
	Casuarina pauper								x	x	x	x			x	x	x
CELASTRACEAE	*Stackhousia monogyna*								x	x							
	Stackhousia muricata											x		x	x		
	Stackhousia ?muricata																
	Stackhousia pubescens						x										
	Stackhousia scoparia																x
	Stackhousia sp. Hairy fruited (E.N.S. Jackson 1387)																
	Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)						x										

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CENTROLEPIDACEAE	*Centrolepis cephaloformis* subsp. *cephaloformis*																
CHENOPODIACEAE	*Atriplex acutibractea* subsp. *karoniensis*						x										
	Atriplex bunburyana								x	x	x	x	x				
	Atriplex codonocarpa								x	x							
	Atriplex eardleyae						x										
	Atriplex holocarpa								x	x		x					
	Atriplex lindleyi subsp. *conduplicata*	P3		x	x		x										
	Atriplex lindleyi subsp. *inflata*						x			x							
	Atriplex nana								x	x		x		x			
	Atriplex nummularia						x	x								x	
	Atriplex nummularia subsp. *spathulata*						x			x	x	x		x	x		x
	Atriplex pumilio						x		x	x							
	Atriplex quadrivalvata var. *quadrivalvata*						x		x	x							
	Atriplex semibaccata								x	x							
	Atriplex stipitata						x	x	x	x	x						
	Atriplex suberecta						x										
	Atriplex vesicaria						x	x	x	x	x			x	x	x	x
	Atriplex sp.									x						x	
	Chenopodium curvispicatum								x	x							
	Chenopodium desertorum subsp. *desertorum*																
	Chenopodium desertorum subsp. *microphyllum*																
	Chenopodium sp.																
	Didymanthus roei																
	Dysphania glomulifera subsp. *eremaea*																
	Dysphania melanocarpa								x								
	Dysphania sp.																
	Enchylaena lanata									x							

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
CHENOPODIACEAE	*Enchylaena tomentosa*																
(continued)	*Enchylaena tomentosa* var. *tomentosa*							x	x	x		x		x		x	x
	Eriochiton sclerolaenoides						x		x	x		x					
	Maireana amoena						x										
	Maireana appressa						x		x								
	Maireana brevifolia						x		x	x							
	Maireana erioclada						x		x	x	x	x					x
	Maireana eriosphaera						x										
	Maireana georgei						x			x				x			
	Maireana glomerifolia										x	x			x		
	Maireana oppositifolia						x		x	x							
	Maireana pentatropis						x	x	x	x	x	x			x		
	Maireana platycarpa						x										
	Maireana radiata						x			x							x
	Maireana sedifolia								x			x			x		
	Maireana suaedifolia						x										
	Maireana tomentosa subsp. *tomentosa*							x				x		x		x	
	Maireana trichoptera						x		x	x							x
	Maireana triptera											x					
	Maireana turbinata						x										
	Maireana sp.									x						x	x
	Rhagodia crassifolia								x	x							x
	Rhagodia drummondii						x		x	x	x	x			x		
	Rhagodia eremaea																
	Rhagodia preissii subsp. *preissii*									x							
	Rhagodia spinescens																
	Rhagodia ulicina																
	Rhagodia sp.													x			x

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CHENOPODIACEAE	*Roycea divaricata*													x			x
(continued)	*Salsola australis*											x					
	Sclerolaena brevifolia								x	x							
	Sclerolaena cuneata						x		x	x							
	Sclerolaena diacantha							x	x	x		x					x
	Sclerolaena drummondii						x										
	Sclerolaena eurotioides																
	Sclerolaena obliquicuspis						x		x	x		x					x
	Sclerolaena parviflora								x	x							
	Sclerolaena uniflora																
	Sclerolaena sp.									x							
	Tecticornia disarticulata						x		x	x	x						x
	Tecticornia halocnemoides						x		x	x	x						
	Tecticornia halocnemoides subsp. *caudata*						x										
	Tecticornia halocnemoides subsp. *halocnemoides*											x			x		x
	Tecticornia indica subsp. *bidens*						x					x			x		x
	Tecticornia ?lepidosperma											x		x			
	Tecticornia loriae						x										
	Tecticornia lylei									x					x		
	Tecticornia moniliformis						x		x	x							
	Tecticornia peltata						x					x		x	x		x
	Tecticornia pergranulata								x	x							
	Tecticornia pergranulata subsp. *pergranulata*													x			
	Tecticornia aff. *pterygosperma*								x	x							
	Tecticornia pterygosperma subsp. *pterygosperma*									x							
	Tecticornia syncarpa								x	x							x
	Tecticornia triandra						x										x
	Tecticornia undulata						x							x			

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CHENOPODIACEAE	*Tecticornia* sp.						x			x		x					x
(continued)	Chenopodiaceae sp.																
COLCHICACEAE	*Wurmbea tenella*																
	Wurmbea sp.																
CONVOLVULACEAE	*Convolvulus recurvatus* subsp. *nullarborensis*						x										
	Convolvulus remotus						x										
	Wilsonia humilis									x							
CRASSULACEAE	*Crassula colorata*																
	Crassula colorata var. *acuminata*						x										
	Crassula exserta						x										
CUCURBITACEAE	* *Cucumis myriocarpus*											x					
	* *Citrullus amarus*						x										
CUPPRESSACEAE	*Callitris canescens*													x			
	Callitris columellaris						x		x	x							
	Callitris preissii									x	x						
CYPERACEAE	*Gahnia* sp. South West (K.L. Wilson & K. Frank KLW 9266)						x										
	Gahnia ?sp. South West (K.L. Wilson & K. Frank KLW9266)																
	Gahnia sp.																
	Isolepis congrua																
	Lepidosperma aff. *fimbriatum*																
	Lepidosperma lyonsii	P1															
	Lepidosperma pruinosum													x			

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
CYPERACEAE	*Lepidosperma sanguinolentum*																
(continued)	*Lepidosperma* sp. Bandalup Scabrid (N. Evelegh 10798)																
	Lepidosperma sp. Kambalda (A.A. Mitchell 5156)																
	Lepidosperma sp.						x		x	x	x	x		x		x	x
	Schoenus nanus																
	Cyperaceae sp.								x								
DILLENIACEAE	*Hibbertia acerosa*																
	Hibbertia exasperata																
	Hibbertia gracilipes																
	Hibbertia pungens						x		x	x	x	x					x
DROSERACEAE	*Drosera salina*	P2		x													
	Drosera sp. Branched styles (S.C. Coffey 193)						x										
	Drosera sp. (climbing)																
ELATINACEAE	*Elatine gratioloides*																
ERICACEAE	*Conostephium drummondii*								x	x							
	Conostephium preissii																
	Conostephium sp.																
	Leucopogon sp. Clyde Hill (M.A. Burgman 1207)						x										
	Leucopogon sp. Salt Lake (G.F. Craig 3069)																
	Leucopogon sp. ?Salt Lake (G. F. Craig 3069)																
	Styphelia exserta						x		x	x		x			x		
	Styphelia subulata						x										

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EUPHORBIACEAE	*Bertya dimerostigma*																
	Bertya virgata									x							
	Beyeria brevifolia								x	x	x						
	Beyeria calycina																
	Beyeria lechenaultii						x							x			
	Beyeria ?opaca	P1															
	Beyeria sulcata var. *brevipes*						x							x			x
	Beyeria sulcata var. *gracilis*						x										
	Beyeria sulcata var. *sulcata*																
	Beyeria sulcata var. *truncata*	P3		x	x		x			x							
	Euphorbia drummondii																
	Euphorbia multifaria																
	Euphorbia tannensis subsp. *eremophila*						x										
	Ricinocarpos muricatus										x						
	Ricinocarpos stylosus						x		x	x	x	x				x	x
	Ricinocarpos sp.																
FABACEAE	*Acacia acanthoclada* subsp. *acanthoclada*						x					x					
	Acacia acuminata						x							x			
	Acacia ancistrophylla var. *ancistrophylla*																
	Acacia ancistrophylla var. *perarcuata*	P3		x													
	Acacia andrewsii									x		x					x
	Acacia assimilis subsp. *assimilis*						x		x			x					
	Acacia assimilis subsp. *atroviridis*																
	Acacia ?burkittii																
	Acacia calcarata																
	Acacia camptoclada						x										
	Acacia castanostegia						x										x

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FABACEAE	*Acacia chrysella*						x										
(continued)	*Acacia collegialis*						x										
	Acacia colletioides								x	x	x						
	Acacia crassuloides						x										
	Acacia dempsteri						x										
	Acacia dissona var. *dissona*						x										
	Acacia donaldsonii						x								x		
	Acacia dorsenna	P1		x	x		x		x								x
	Acacia enervia subsp. *enervia*								x			x					
	Acacia enervia subsp. *explicata*																
	Acacia eremophila var. *eremophila*																
	Acacia erinacea						x	x	x	x	x	x		x			x
	Acacia evenulosa						x										
	Acacia fragilis									x							
	Acacia fraternalis						x										
	Acacia gibbosa																
	Acacia hemiteles						x					x					
	Acacia inamabilis						x			x	x	x					
	Acacia inceana subsp. *inceana*						x					x					x
	Acacia ?inceana subsp. *inceana*																
	Acacia jennerae																
	Acacia jibberdingensis											x					
	Acacia kalgoorliensis																x
	Acacia kerryana	P2		x	x		x										
	Acacia lachnophylla						x										
	Acacia lasiocalyx																
	Acacia leptopetala																
	Acacia ligulata						x		x	x	x						

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
FABACEAE	*Acacia merinthophora*						x										
(continued)	*Acacia merrallii*						x	x	x	x	x	x		x			x
	Acacia murrayana						x										
	Acacia neurophylla						x										
	Acacia neurophylla subsp. *neurophylla*						x		x		x			x			x
	Acacia nyssophylla						x							x			x
	Acacia pachypoda						x		x								
	Acacia poliochroa																
	Acacia pritzeliana						x										
	Acacia quadrimarginea						x										
	Acacia resinistipulea																
	Acacia spinosissima																
	Acacia tetragonophylla													x			
	Acacia truculenta	P3		x			x										
	Acacia warramaba																
	Acacia yorkrakinensis subsp. *acrita*																
	Acacia sp.										x						
	Aotus sp. Dundas (M.A. Burgman 2835)	P2		x			x										
	Bossiaea arcuata	P1		x	x												
	Bossiaea aurantiaca	P1		x			x										
	Bossiaea ?barbarae																
	Bossiaea cucullata																
	Bossiaea leptacantha									x							
	Bossiaea walkeri						x		x	x							
	Cullen discolor						x										
	Daviesia aphylla						x			x							
	Daviesia argillacea						x										
	Daviesia ?benthamii																

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
FABACEAE	*Daviesia microcarpa*	T	EN	x	x	x	x					x					
(continued)	*Daviesia* sp.																
	Dillwynia acerosa						x										
	Dillwynia uncinata											x	x	x			
	Dillwynia sp.						x										
	* *Erythrostemon gilliesii*						x										
	Glycine peratosa						x										
	Glycyrrhiza acanthocarpa																
	Indigofera australis						x		x	x							
	Indigofera occidentalis						x										
	Kennedia prorepens						x					x					
	Leptosema daviesioides																
	* *Medicago minima*						x										
	* *Medicago sativa*						x										
	Mirbelia depressa						x										
	Mirbelia granitica						x					x					
	Mirbelia microphylla						x			x				x			
	Mirbelia seorsifolia						x										
	Mirbelia sp.						x										
	Pultenaea arida						x										x
	Pultenaea sp.						x										
	Senna artemisioides						x										
	Senna artemisioides subsp. *filifolia*						x		x	x	x	x		x	x	x	x
	Senna artemisioides subsp. x *artemisioides*						x										
	Senna artemisioides subsp. x *petiolaris*						x										
	Senna cardiosperma						x		x								
	Senna manicula						x										
	Senna pleurocarpa						x										

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
FABACEAE	*Senna pleurocarpa* var. *angustifolia*																
(continued)	*Senna* sp. Pallinup River (J.W. Green 4847)						x										
	Senna sp.						x					x					
	Swainsona canescens																
	Swainsona colutoides						x										
	Swainsona tenuis						x										
	Swainsonia sp.									x							
	Templetonia sulcata																x
	* *Vicia monantha* subsp. *triflora*						x										
FRANKENIACEAE	*Frankenia cinerea*						x		x	x		x		x	x		x
	Frankenia desertorum						x					x		x	x		x
	Frankenia glomerata	P4		x	x		x										
	Frankenia interioris						x			x							
	Frankenia interioris var. *interioris*								x								
	Frankenia interioris var. *parviflora*						x										
	Frankenia irregularis									x							
	Frankenia setosa						x					x			x		x
	Frankenia tetrapetala																
	Frankenia sp.									x	x	x					
GENTIANACEAE	*Schenkia australis*									x							
GERANIACEAE	* *Erodium aureum*																
	Erodium crinitum											x					
	Erodium cygnorum						x							x			
	Pelargonium australe																

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
GERANIACEAE	*Pelargonium littorale*						x										
(continued)	*Pelargonium* sp.																
GOODENIACEAE	*Brunonia australis*						x										
	Coopernookia strophiolata						x			x							
	Dampiera latealata						x		x	x	x	x					x
	Goodenia berardiana						x		x	x							
	Goodenia collaris						x					x					
	Goodenia concinna						x										
	Goodenia daviesii						x										
	Goodenia dyeri						x										
	Goodenia granitica																
	Goodenia havilandii						x										
	Goodenia laevis subsp. *laevis*	P3		x			x										
	Goodenia occidentalis																
	Goodenia quasilibera						x			x		x					
	Goodenia trinervis									x							
	Goodenia sp.						x										
	Lechenaultia sp.						x					x					
	Scaevola bursariifolia						x		x								
	Scaevola oxyclona						x		x	x		x					
	Scaevola restiacea subsp. *divaricata*						x										
	Scaevola spinescens						x	x	x	x	x	x		x	x	x	x
	Scaevola taccada						x										
GYROSTEMONACEAE	*Codonocarpus cotinifolius*									x							
	Gyrostemon racemiger																
	Gyrostemon ramulosus									x							

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
HALORAGACEAE	*Glischrocaryon angustifolium*						x										
	Glischrocaryon aureum						x							x			
	Glischrocaryon flavescens						x			x		x					
	Haloragis dura						x					x					
	Haloragis hamata																
	Haloragis trigonocarpa						x			x							
	Myriophyllum petraeum	P4		x													
HEMEROCALLIDACEAE	*Dianella revoluta*								x	x		x		x			
	Dianella revoluta var. *divaricata*											x		x			x
	Stypandra glauca																
ISOETACEAE	*Isoetes australis*																
JUNCACEAE	*Juncus aridicola*																
JUNCAGINACEAE	*Triglochin isingiana*																
	Triglochin longicarpa																
	Triglochin minutissima																
	Triglochin mucronata																
	Triglochin sp. Condingup (R. Davis 10877)	P2		x													
LAMIACEAE	*Cyanostegia angustifolia*						x										
	Dicrastylis parvifolia						x			x							
	Hemigenia teretiuscula						x										
	Pityrodia chrysocalyx	P3		x	x		x										
	Prostanthera grylloana						x			x	x						x
	Prostanthera incurvata						x							x			x

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
LAMIACEAE	*Prostanthera laricoides*						x										
(continued)	*Prostanthera wilkieana*									x							
	Prostanthera sp.																
	* *Salvia verbenaca*																
	Teucrium sessiliflorum						x										
	Teucrium sp. Norseman (T.E.H. Aplin 1851)						x										
	Westringia cephalantha																
	Westringia rigida						x	x	x	x	x	x		x	x	x	x
	Lamiaceae sp.																x
LAURACEAE	*Cassytha glabella*																
	Cassytha melantha									x							
	Cassytha nodiflora						x										
	Cassytha sp.													x			
LOGANIACEAE	*Logania perryana*						x										
	Orianthera judithiana						x										
LORANTHACEAE	*Amyema miquelii*						x										
	Amyema preissii								x	x			x				
LYCOPODIACEAE	*Phylloglossum drummondii*																
MALVACEAE	*Abutilon cryptopetalum*																
	Alyogyne hakeifolia						x			x							
	Androcalva cuneata											x					
	Androcalva luteiflora						x										
	Commersonia craurophylla						x		x	x			x				

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
MALVACEAE	*Hannafordia bissillii* subsp. *latifolia*																
(continued)	*Lawrencia berthae*																
	Lawrencia repens						x										
	Lawrencia squamata						x		x	x							x
	Lawrencia sp.											x					
	* *Malva pseudolavatera*						x										
	Radyera farragei						x		x	x		x					
	Seringia cacaobrunnea						x										
	Seringia velutina						x										
	Sida calyxhymenia									x							
	Sida sp.																
	Thomasia sarotes																
MARSILEACEAE	*Marsilea drummondii*																
MONTIACEAE	*Calandrinia eremaea*																x
	Calandrinia granulifera																
	Calandrinia lefroyensis	P1			x												
	Calandrinia polyandra									x							
	Calandrinia porifera																
	Calandrinia sp.																
MYRTACEAE	*Aluta appressa*						x										
	Baeckea sp.									x							
	Callistemon phoeniceus																
	Calothamnus gilesii						x	x	x	x		x					x
	Calothamnus tuberosus																
	Calytrix tetragona																

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
MYRTACEAE	*Calytrix* sp.																
(continued)	*Cyathostemon* aff. *Ambiguus*																
	Cyathostemon sp. Salmon Gums (B. Archer 769)	P3		x													
	Darwinia polycephala	P4							x	x		x					
	Darwinia sp. Karonie (K. Newbey 8503)						x							x			
	Ericomyrtus serpyllifolia																
	Eucalyptus aspratilis																
	Eucalyptus brockwayi	P3		x	x		x	x	x	x							x
	Eucalyptus calycogona						x										
	Eucalyptus calycogona subsp. *calycogona*						x		x			x		x			x
	Eucalyptus campaspe							x									
	Eucalyptus capillosa									x							
	Eucalyptus celastroides						x										
	Eucalyptus clelandiorum						x	x									
	Eucalyptus concinna								x								
	Eucalyptus ?*corrugata*																
	Eucalyptus cylindriflora						x										
	Eucalyptus cylindrocarpa						x					x			x		x
	Eucalyptus delicata																
	Eucalyptus diptera												x				
	Eucalyptus ?*distuberosa* subsp. *distuberosa*						x										
	Eucalyptus dundasii						x	x	x	x	x	x	x		x	x	x
	Eucalyptus eremophila						x										
	Eucalyptus eremophila subsp. *eremophila*											x					
	Eucalyptus eremophila x *stricklandii*						x										
	Eucalyptus extensa									x							
	Eucalyptus flocktoniae						x		x	x	x						x
	Eucalyptus flocktoniae subsp. *flocktoniae*											x	x		x		

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
MYRTACEAE	*Eucalyptus gracilis*								x		x						
(continued)	*Eucalyptus* ?*gracilis*																
	Eucalyptus griffithsii						x				x	x		x			
	Eucalyptus grossa						x										
	Eucalyptus incrassata						x										x
	Eucalyptus jimberlanica	P1		x	x		x		x								
	Eucalyptus kumarlensis						x										
	Eucalyptus laevis						x										
	Eucalyptus lesouefii						x		x	x	x	x	x	x	x	x	x
	Eucalyptus longicornis						x		x	x	x	x					x
	Eucalyptus ?*longicornis*						x										
	Eucalyptus longissima						x		x	x	x						x
	Eucalyptus loxophleba subsp. *lissophloia*						x										
	Eucalyptus loxophleba subsp. *loxophleba*																
	Eucalyptus melanoxylon						x		x	x	x						
	Eucalyptus myriadena						x										
	Eucalyptus oleosa						x	x									
	Eucalyptus ?*oleosa*																
	Eucalyptus oleosa subsp. *cylindroidea*						x										
	Eucalyptus oleosa subsp. *oleosa*						x		x								x
	Eucalyptus oleosa ?subsp. *oleosa*																
	Eucalyptus ?oleosa subsp. oleosa																
	Eucalyptus planipes						x										
	Eucalyptus platycorys						x			x	x						
	Eucalyptus platydisca	T	VU	x	x	x	x		x			x					
	Eucalyptus pileata						x										
	Eucalyptus prolixa						x										
	Eucalyptus protensa									x							

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MYRTACEAE	*Eucalyptus pterocarpa*	P3		x	x		x										
(continued)	*Eucalyptus ravida*						x				x						
	Eucalyptus ?*ravida*						x										
	Eucalyptus salicola						x		x	x	x	x					x
	Eucalyptus salmonophloia							x	x	x	x	x			x	x	x
	Eucalyptus salubris						x			x	x	x	x		x		x
	Eucalyptus salubris x *tortilis*						x										
	Eucalyptus ?*scyphocalyx*																
	Eucalyptus sheathiana																
	Eucalyptus sporadica																
	Eucalyptus spreta						x		x								
	Eucalyptus ?*spreta*						x										
	Eucalyptus stricklandii						x	x	x	x	x	x					x
	Eucalyptus subangusta																x
	Eucalyptus subangusta subsp. *subangusta*																x
	Eucalyptus tenera																
	Eucalyptus tenuis																
	Eucalyptus terebra									x							
	Eucalyptus thamnoides																
	Eucalyptus torquata						x	x	x	x	x	x		x			x
	Eucalyptus tortilis						x										
	Eucalyptus transcontinentalis																
	Eucalyptus urna						x										x
	Eucalyptus valens						x										
	Eucalyptus virella																x
	Eucalyptus vittata						x										
	Eucalyptus websteriana						x										
	Eucalyptus websteriana subsp. *norsemanica*	P1		x	x		x		x					x			

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
MYRTACEAE	*Eucalyptus yilgarnensis*						x			x	x						
(continued)	*Eucalyptus* sp.																x
	Leptospermopsis erubescens						x										
	Leptospermopsis fastigiata																
	Leptospermopsis incana						x										
	Leptospermopsis roei									x	x						x
	Melaleuca acuminata									x							
	Melaleuca acuminata subsp. *acuminata*																
	Melaleuca acuminata subsp. *websteri*						x										
	Melaleuca brevifolia									x							
	Melaleuca bromelioides												x				
	Melaleuca calycina						x										
	Melaleuca cliffortioides						x		x								
	Melaleuca coccinea	P3		x			x										
	Melaleuca eleuterostachya						x										
	Melaleuca elliptica						x		x								
	Melaleuca exuvia																
	Melaleuca fulgens																
	Melaleuca fulgens subsp. *fulgens*						x										
	Melaleuca halmaturorum						x		x	x					x		
	Melaleuca hamata						x										
	Melaleuca hamulosa																
	Melaleuca johnsonii						x										
	Melaleuca lanceolata						x		x	x	x						
	Melaleuca lateriflora								x	x	x			x			x
	Melaleuca leiocarpa															x	
	Melaleuca macronychia subsp. *trygonoides*	P3		x													
	Melaleuca pauperiflora subsp. *fastigiata*							x									

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
MYRTACEAE	*Melaleuca pauperiflora* subsp. *pauperiflora*													x			
(continued)	*Melaleuca quadrifaria*													x			
	Melaleuca radula						x										
	Melaleuca sheathiana						x		x	x	x	x			x		x
	Melaleuca sparsiflora																
	Melaleuca subalaris								x	x							
	Melaleuca thyoides																
	Melaleuca uncinata							x	x	x	x	x		x			x
	Melaleuca sp.							x		x	x						
	Micromyrtus erichsenii																
	Micromyrtus papillosa	P1		x	x		x		x	x				x			
	Rinzia carnosa																
	Thryptomene australis									x		x					
	Thryptomene australis subsp. *brachyandra*																
	Thryptomene kochii						x										
	Verticordia chrysantha						x										
	Verticordia grandiflora																
	Verticordia plumosa var. *incrassata*						x										
	Myrtaceae sp.																
ORCHIDACEAE	*Caladenia horistes* x *voigtii*						x										
	Caladenia longicauda subsp. rigidulus						x										
	Caladenia microchila						x										
	Corunastylis fuscoviridis						x										
	Microtis graniticola																
	Pheladenia deformis																
	Prasophyllum gracile																
	Pterostylis mutica						x										

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						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
ORCHIDACEAE	*Pterostylis roensis*						x										
(continued)	*Pterostylis setulosa*						x										
	Pterostylis sp.									x			x				
	Thelymitra aff. *macrophylla*												x				
	Thelymitra petrophila																
	Thelymitra sp.									x							
OROBANCHACEAE	* *Orobanche minor*																
OXALIDACEAE	*Oxalis perennans*						x										
	* *Oxalis pes-caprae*											x					
	Oxalis sp.																
PHYLLANTHACEAE	*Poranthera triandra*						x										
PITTOSPORACEAE	*Billardiera coriacea*																
	Billardiera lehmanniana									x							
	Cheiranthera filifolia						x			x				x			
	Pittosporum angustifolium								x	x	x	x			x		x
PLANTAGINACEAE	*Plantago drummondii*						x			x							
	Plantago turrifera						x										
POACEAE	?*Amphipogon* sp.																
	Aristida contorta								x	x							
	Aristida sp.						x										
	Austrostipa acrociliata						x										
	Austrostipa drummondii						x			x							

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POACEAE	*Austrostipa elegantissima*						x		x	x		x		x			x
(continued)	*Austrostipa eremophila*						x			x							
	Austrostipa hemipogon									x							
	Austrostipa juncifolia						x										
	Austrostipa nitida						x		x	x							x
	Austrostipa ?*nullarborensis*																
	Austrostipa platychaeta						x										
	Austrostipa scabra													x			
	Austrostipa scabra subsp. *scabra*											x					
	Austrostipa trichophylla																
	Austrostipa variabilis						x										
	Austrostipa vickeryana						x										x
	Austrostipa sp.																
	Bromus arenarius																
	* *Bromus rubens*						x										
	Chloris truncata						x			x							
	* *Chloris virgata*						x										
	Cymbopogon obtectus						x		x	x							
	Digitaria brownii									x							
	?*Enneapogon* sp.																
	Eragrostis dielsii									x		x		x			x
	Eragrostis falcata																
	Eragrostis pergracilis									x							
	Eriachne sp.																
	Monachather paradoxus									x							
	Neurachne alopecuroidea																
	Panicum effusum						x										
	Paspalidium constrictum																

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POACEAE	* *Pentameris airoides* subsp. *airoides*						x										
(continued)	* *Rostraria pumila*																
	Rytidosperma caespitosum						x			x							x
	Rytidosperma setaceum																
	* *Setaria verticillata*						x										
	Spartochloa scirpoidea																
	Sporobolus ramigerus																
	Tragus australianus						x										
	Triodia ?irritans																x
	Triodia scariosa						x		x	x	x	x		x			
	* *Vulpia muralis*																
	* *Vulpia myuros*																
	Poaceae sp.									x							
POLYGALACEAE	*Comesperma calymega*																
	Comesperma drummondii																
	Comesperma integerrimum																
	Comesperma polygaloides						x										
	Comesperma scoparium													x			
	Comesperma volubile						x		x	x				x			
POLYGONACEAE	*Muehlenbeckia adpressa*																
	* *Rumex vesicarius*									x					x		
PORTULACACEAE	*Portulaca* sp.																
POTAMOGETONACEAE	*Althenia australis*																

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PRIMULACEAE	* *Lysimachia arvensis*						x					x					
PROTEACEAE	*Banksia nutans* var. *nutans*						x										
	Grevillea acuaria						x	x	x	x	x	x		x	x	x	x
	Grevillea anethifolia						x					x					
	Grevillea huegelii									x							
	Grevillea nematophylla																x
	Grevillea nematophylla subsp. *nematophylla*						x										
	Grevillea ?nematophylla subsp. *nematophylla*																
	Grevillea oncogyne						x										
	Grevillea phillipsiana	P1		x	x		x		x	x							
	Grevillea plurijuga						x			x	x						
	Grevillea plurijuga subsp. *plurijuga*																
	Grevillea plurijuga subsp. *superba*						x										
	Grevillea sarissa																
	Grevillea sp.							x									
	Hakea cinerea						x										
	Hakea ?commutata																
	Hakea sp.							x		x							
	Persoonia helix									x							
PTERIDACEAE	*Cheilanthes austrotenuifolia*																
	Cheilanthes distans									x							
	Cheilanthes lasiophylla						x										
	Cheilanthes sieberi subsp. *sieberi*						x			x		x		x			
	Cheilanthes sp.																

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RHAMNACEAE	*Cryptandra aridicola*						x					x			x		
	Cryptandra graniticola						x							x			
	Cryptandra minutifolia subsp. *brevistyla*																
	Cryptandra recurva																
	Cryptandra wilsonii																
	Cryptandra sp.						x		x	x				x			x
	Pomaderris forrestiana						x		x	x	x	x				x	x
	Spyridium sp.																x
	Stenanthemum stipulosum													x			
	Trymalium myrtillus subsp. *myrtillus*						x	x	x	x	x						
RUBIACEAE	*Opercularia vaginata*						x					x					
	Opercularia sp.						x										
RUTACEAE	*Boronia inornata* subsp. *inornata*																
	Boronia inornata subsp. *leptophylla*						x			x							
	Cyanothamnus coerulescens subsp. *coerulescens*																
	Cyanothamnus coerulescens subsp. *spicatus*																
	Cyanothamnus fabianoides								x	x							
	Cyanothamnus fabianoides subsp. *roseus*						x										
	Geijera linearifolia						x		x	x	x	x		x			x
	Phebalium canaliculatum						x										
	Phebalium elegans						x										
	Phebalium filifolium						x	x			x						x
	Phebalium ?filifolium																
	Phebalium lepidotum						x										
	Phebalium multiflorum						x										
	Phebalium multiflorum subsp. multiflorum						x										

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RUTACEAE	*Phebalium tuberculosum*						x		x	x							
(continued)	*Phebalium* sp.						x										
	Philotheca apiculata	P1		x	x		x	x		x							
	Philotheca coccinea						x										
	Philotheca fitzgeraldii								x		x						
	Philotheca nutans						x										
	Philotheca rhomboidea																x
SANTALACEAE	*Exocarpos aphyllus*						x	x	x	x	x	x		x	x	x	x
	Exocarpos sparteus									x							
	Santalum acuminatum							x	x	x	x	x		x	x	x	x
	Santalum murrayanum									x							x
	Santalum spicatum						x			x	x	x		x	x		
	Santalum sp.																
SAPINDACEAE	*Dodonaea adenophora*						x										x
	Dodonaea amblyophylla						x										
	?*Dodonaea bursariifolia*																
	Dodonaea concinna																
	Dodonaea lobulata									x	x		x	x	x	x	
	Dodonaea microzyga							x	x		x						
	Dodonaea microzyga var. *acrolobata*						x		x	x		x	x	x	x		
	Dodonaea stenozyga						x	x	x	x		x					x
	Dodonaea viscosa										x						
	Dodonaea viscosa subsp. *angustissima*								x	x		x			x		x
SCROPHULARIACEAE	*Eremophila alternifolia*						x		x		x			x			
	Eremophila alternifolia x purpurascens						x		x					x			

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SCROPHULARIACEAE	*Eremophila caerulea*						x		x								
(continued)	*Eremophila caerulea* subsp. *caerulea*						x										x
	Eremophila clavata						x										
	Eremophila decipiens						x										
	Eremophila decipiens subsp. *decipiens*						x										x
	Eremophila dempsteri						x			x	x						x
	Eremophila ?*dempsteri*																
	Eremophila deserti						x		x	x							x
	Eremophila dichroantha						x										
	Eremophila drummondii						x										
	Eremophila gibbosa						x		x	x	x	x		x	x		
	Eremophila ?*gibbosa*																
	Eremophila glabra						x		x	x	x					x	x
	Eremophila glabra subsp. *albicans*						x					x		x			
	Eremophila glabra subsp. *glabra*						x								x		x
	Eremophila granitica						x				x						
	Eremophila interstans						x		x	x							
	Eremophila interstans subsp. *interstans*						x					x					x
	Eremophila ionantha						x	x			x			x			x
	Eremophila labrosa						x										
	Eremophila maculata						x			x	x					x	
	Eremophila microphylla	P3															
	Eremophila oppositifolia																
	Eremophila pantonii										x						x
	Eremophila parvifolia subsp. auricampi						x					x			x		
	Eremophila parvifolia ?subsp. *auricampi*																
	Eremophila parvifolia subsp. *parvifolia*	P4									x						
	Eremophila psilocalyx						x		x	x	x	x		x		x	x

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SCROPHULARIACEAE	*Eremophila purpurascens*	P3		x	x		x		x	x	x	x		x			x
(continued)	*Eremophila purpurascens* x *E. alternifolia*																
	Eremophila rugosa																
	Eremophila saligna						x			x	x						
	Eremophila scoparia						x	x	x	x	x	x		x	x	x	x
	Eremophila serrulata																
	Eremophila subfloccosa subsp. *glandulosa*						x										
	Eremophila violacea																
	Eremophila sp.							x				x					x
	Myoporum platycarpum						x		x	x							
	Myoporum platycarpum subsp. *platycarpum*						x					x			x		x
SOLANACEAE	*Anthocercis anisantha*						x										
	Duboisia hopwoodii						x			x							
	Lycium australe						x		x	x		x			x		
	* *Lycium ferocissimum*					x	x										
	* *Nicotiana glauca*						x										
	Nicotiana rotundifolia																
	Nicotiana sp.																
	Solanum hoplopetalum								x	x							
	Solanum lasiophyllum						x		x								
	* *Solanum nigrum*															x	
	Solanum nummularium						x		x	x						x	x
	Solanum orbiculatum																
	Solanum plicatile						x			x							
	Solanum simile																
	Solanum sp.								x			x			x		

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NORTH and SOUTH denote the two survey regions as shown in Figure 1. * denotes introduced taxa. SCC is State Conservation Code (Appendix A; DBCA 2019z); FCC is Federal Conservation Code (Appendix A; EPBC Act 1999). EPBC is the EPBC Act Protected Matters Search Tool (DAWE 2015). NatureMap is the WA state search tool (DBCA 2007-). Gold Env denotes Goldfields Environmental Management Pty Ltd; LS is Landcare Services Pty Ltd; OE is Outback Ecology Environmental Management Services; MCPL is Mattiske Consulting Pty Ltd; Rally is F Revegetation and Environmental Services; Marianna is Marianna Partners Environmental Services; PAA is Paul Armstrong and Associates; Bot is Botanica Consulting; GHD is GHD Pty Ltd; and Umwelt is Umwelt Australia Pty Ltd.

FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
STYLIDIACEAE	*Stylidium adpressum*																
	Stylidium dielsianum																
TAMARICACEAE	* *Tamarix aphylla*					x											
THYMELAEACEAE	*Pimelea angustifolia*																
	Pimelea graniticola																
	Pimelea micrantha						x										
	Pimelea microcephala								x	x							
	Pimelea microcephala subsp. *microcephala*						x					x			x		
	Pimelea spiculigera var. *thesioides*						x										
	Pimelea subvillifera						x										
	Pimelea trichostachya						x			x							
URTICACEAE	*Parietaria cardiostegia*																
VIOLACEAE	*Pigea curvifolia*						x		x	x		x			x		
	Pigea epacroides																
	Pigea floribunda						x							x			
ZYGOPHYLLACEAE	*Roepera apiculata*						x		x	x							x
	Roepera aurantiaca						x		x	x				x			
	Roepera aurantiaca subsp. *aurantiaca*						x										
	Roepera ?aurantiaca subsp. *aurantiaca*																
	Roepera billardierei						x		x	x							
	Roepera compressa																
	Roepera eremaea						x		x	x		x					x
	Roepera fruticulosa						x				x						

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FAMILY	SPECIES	SCC	FCC	DBCA T&P	WAH	NORTH											
						North EPBC	North Nature Map	Gold Env 1989	LS (North) 1995	LS 1996	LS (North) 1997	MCPL Veg 2001a	MCPL Trees 2001b	MCPL 2002	OE 2003	Rally 2004	MCPL 2005
ZYGOPHYLLACEAE	*Roepera glauca*						x		x	x	x	x					
(continued)	*Roepera halophila*						x										
	Roepera iodocarpa						x										
	Roepera ovata						x		x	x		x					x
	Roepera tesquorum						x										
	Roepera sp.									x						x	
	* *Tribulus terrestris*						x										

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
AIZOACEAE	*Carpobrotus modestus*									x	x		
	Carpobrotus sp.						x				x		
	Disphyma crassifolium			x	x		x	x	x	x	x		
	Disphyma crassifolium subsp. *clavellatum*												x
	Gunniopsis glabra						x						
	Gunniopsis quadrifida		x					x	x	x	x		
	Gunniopsis septifraga		x								x		
	Gunniopsis sp.										x		
	* *Mesembryanthemum nodiflorum*										x		
	Sarcozona praecox									x			x
	Aizoaceae sp.										x		x
AMARANTHACEAE	*Ptilotus aervoides*												
	Ptilotus carlsonii												
	Ptilotus drummondii												
	Ptilotus exaltatus			x				x	x				
	Ptilotus ?*eremita*												x
	Ptilotus gaudichaudii												
	Ptilotus helichrysoides												
	Ptilotus holosericeus										x	x	
	Ptilotus obovatus		x	x	x		x	x	x	x	x	x	x
	Ptilotus obovatus var. *obovatus*												
	Ptilotus rigidus												
	Ptilotus spathulatus												
	Ptilotus sp.											x	x
	Surreya diandra							x	x	x	x		

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
APIACEAE	*Daucus glochidiatus*							x		x	x		
APOCYNACEAE	*Alyxia buxifolia*		x	x	x	x	x	x	x	x	x	x	x
	Vincetoxicum lineare								x		x		x
ARALIACEAE	*Hydrocotyle intertexta*		x										
	Trachymene ornata		x					x					
	Trachymene sp.												
ASPARAGACEAE	*Dianella revoluta*						x			x	x		x
	Lomandra effusa					x	x				x		
	Lomandra sp.												
	Thysanotus brachyantherus												
	Thysanotus manglesianus							x		x	x	x	x
	Thysanotus sp.										x		
ASPHODELACEAE	* *Asphodelus fistulosus*												x
	Bulbine semibarbata						x	x					
ASPLENIACEAE	*Asplenium subglandulosum*		x				x	x	x				
ASTERACEAE	*Actinobole uliginosum*							x					
	* *Ambrosia tenuifolia*												
	Angianthus cornutus		x										
	Angianthus tomentosus		x					x		x			
	Asteridea athrixioides										x		
	Asteridea chaetopoda												
	Blennospora drummondii		x										
	Brachyscome ciliaris							x					

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
ASTERACEAE	*Brachyscome iberidifolia*												
(continued)	*Brachyscome pusilla*		x										
	Brachyscome sp.											x	
	Calocephalus sp.												
	Calotis hispidula							x					
	* *Carthamus lanatus*												
	* *Centaurea melitensis*						x	x	x				
	Centipeda crateriformis subsp. *crateriformis*		x										
	Chondropyxis halophila												
	Chrysocephalum apiculatum												
	Chrysocephalum apiculatum subsp. *glandulosum*												
	* *Chrysocephalum apiculatum* subsp. *norsemanense*												
	Chrysocephalum puteale			x						x			x
	Cratystylis conocephala			x	x	x	x	x	x	x	x		x
	Cratystylis conocephala x *microphylla*												
	Cratystylis microphylla												
	Cratystylis subspinescens												
	Erymophyllum ramosum subsp. *ramosum*							x		x			x
	* *Gazania linearis*												x
	Gnaphalium indutum		x								x		
	Gnephosis angianthoides		x				x						
	Gnephosis brevifolia							x					
	Gnephosis tenuissima		x										
	Gnephosis tridens		x										
	Hyalochlamys globifera							x					
	Hyalosperma demissum		x										
	* *Hypochaeris glabra*						x						
	Kippistia suaedifolia												

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
ASTERACEAE (continued)	*Leiocarpa semicalva* subsp. *semicalva*												
	Millotia myosotidifolia												
	Millotia tenuifolia							x					
	Millotia sp.								x				
	Minuria cunninghamii												x
	Minuria gardneri												
	Minuria sp.												
	* *Monoculus monstrosus*												
	Notisia intonsa												
	Olearia axillaris					x							
	Olearia exiguifolia							x	x		x		
	Olearia incana												
	Olearia ?magniflora									x			
	Olearia muelleri		x	x	x	x	x	x	x	x	x	x	x
	Olearia pimeleoides							x	x	x			
	Olearia ramosissima		x										
	Olearia subspicata												
	Olearia sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628)		x				x			x	x		
	Olearia sp.												x
	* *Oligocarpus calendulaceus*												
	* *Osteospermum ecklonis*												
	Panaetia tepperi		x										x
	Podolepis rugata												
	Pogonolepis muelleriana		x										
	Pogonolepis stricta												
	* *Pseudognaphalium luteoalbum*												
	Rhodanthe floribunda							x					
	Rhodanthe haigii		x										

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
ASTERACEAE	*Rhodanthe laevis*		x					x					
(continued)	*Rhodanthe oppositifolia* subsp. *oppositifolia*		x										
	Rhodanthe pygmaea												
	Rhodanthe rubella												
	Rhodanthe spicata												
	Rhodanthe stricta												
	Schoenia cassiniana		x										
	Senecio glossanthus		x								x		
	Senecio lacustrinus		x										
	Senecio pinnatifolius										x		
	Senecio quadridentatus							x	x				
	Senecio spanomerus												
	Siemssenia capillaris					x					x		
*	*Sonchus oleraceus*						x				x	x	x
*	*Taraxacum khatoonae*												
	Thiseltonia gracillima												
*	*Tragopogon porrifolius*												
	Trichanthodium skirrophorum												
	Vittadinia dissecta var. *hirta*		x								x		x
	Vittadinia gracilis							x					
	Vittadinia nullarborensis												
	Waitzia acuminata							x					x
	Waitzia acuminata var. *acuminata*						x			x			
	Waitzia acuminata var. *albicans*												
	Waitzia fitzgibbonii					x		x		x			
	Waitzia suaveolens var. *flava*											x	
	Waitzia nitida												
	Asteraceae sp.										x		x

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
BORAGINACEAE	*Halgania andromedifolia*		x	x	x	x	x	x	x	x	x	x	x
	Halgania cyanea											x	
	Halgania cyanea var. Charleville (R.W. Purdie +111)										x		
	Halgania erecta												
	Halgania integerrima		x				x				x		
	Halgania lavandulacea												
	Halgania sp.					x							
	Plagiobothrys australasicus												
BORYACEAE	*Borya constricta*		x				x				x		
	Borya sp.		x										
BRASSICACEAE	* *Carrichtera annua*	x					x	x	x	x	x		x
	Lepidium foliosum												
	Lepidium platypetalum		x					x	x				x
	Lepidium rotundum						x						
	Lepidium sp.								x				
	Menkea australis												
	Phlegmatospermum eremaeum												
	* *Sisymbrium orientale*												
	Stenopetalum filifolium									x			
	Stenopetalum lineare var. *lineare*		x										
	Stenopetalum sp.												
	Brassicaceae sp.										x		
CACTACEAE	* *Opuntia ficus-indica*												
	* *Opuntia stricta*												

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
CAMPANULACEAE	*Isotoma scapigera*												
	Lithotoma petraea												
	Lobelia gibbosa												
	Wahlenbergia gracilenta		x										
CARYOPHYLLACEAE	* Sagina apetala		x										
CARYOPHYLLACEAE	* *Silene gallica* var. *gallica*		x									x	
	* *Spergularia diandra*										x		
	Stellaria filiformis		x										
CASUARINACEAE	*Allocasuarina acutivalvis* subsp. *acutivalvis*					x	x	x	x	x	x		x
	Allocasuarina campestris			x			x	x	x	x	x		x
	Allocasuarina corniculata		x										
	Allocasuarina eriochlamys subsp. *grossa*									x		x	x
	Allocasuarina globosa												
	Allocasuarina helmsii		x			x	x			x			x
	Allocasuarina huegeliana		x										
	Allocasuarina trichodon				x								
	Casuarina obesa												x
	Casuarina pauper												
CELASTRACEAE	*Stackhousia monogyna*			x			x			x	x		
	Stackhousia muricata											x	
	Stackhousia ?muricata												x
	Stackhousia pubescens												
	Stackhousia scoparia												
	Stackhousia sp. Hairy fruited (E.N.S. Jackson 1387)		x										
	Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)							x					

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
CENTROLEPIDACEAE	*Centrolepis cephaloformis* subsp. *cephaloformis*		x										
CHENOPODIACEAE	*Atriplex acutibractea* subsp. *karoniensis*												
	Atriplex bunburyana			x		x							
	Atriplex codonocarpa												
	Atriplex eardleyae												
	Atriplex holocarpa										x		
	Atriplex lindleyi subsp. *conduplicata*												
	Atriplex lindleyi subsp. *inflata*												
	Atriplex nana		x				x			x	x	x	
	Atriplex nummularia											x	
	Atriplex nummularia subsp. *spathulata*							x	x				x
	Atriplex pumilio			x									
	Atriplex quadrivalvata var. *quadrivalvata*												
	Atriplex semibaccata												
	Atriplex stipitata							x	x		x		
	Atriplex suberecta												
	Atriplex vesicaria		x		x	x	x	x	x	x	x	x	
	Atriplex sp.										x		x
	Chenopodium curvispicatum		x					x	x		x		x
	Chenopodium desertorum subsp. *desertorum*										x		
	Chenopodium desertorum subsp. *microphyllum*		x										
	Chenopodium sp.				x						x		
	Didymanthus roei										x		
	Dysphania glomulifera subsp. *eremaea*		x										
	Dysphania melanocarpa		x										
	Dysphania sp.					x							
	Enchylaena lanata												

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
CHENOPODIACEAE	*Enchylaena tomentosa*												x
(continued)	*Enchylaena tomentosa* var. *tomentosa*			x	x		x	x	x	x	x	x	
	Eriochiton sclerolaenoides		x	x				x			x		x
	Maireana amoena									x	x		x
	Maireana appressa		x								x	x	
	Maireana brevifolia				x								
	Maireana erioclada		x	x						x	x		x
	Maireana eriosphaera												
	Maireana georgei								x				x
	Maireana glomerifolia				x			x	x				
	Maireana oppositifolia		x							x	x		
	Maireana pentatropis			x	x	x	x	x	x	x	x		
	Maireana platycarpa							x	x				
	Maireana radiata			x						x		x	x
	Maireana sedifolia			x									x
	Maireana suaedifolia												
	Maireana tomentosa subsp. *tomentosa*							x	x				
	Maireana trichoptera				x			x	x				x
	Maireana triptera							x	x				
	Maireana turbinata												
	Maireana sp.									x	x		x
	Rhagodia crassifolia			x				x	x	x			
	Rhagodia drummondii		x	x	x			x	x		x	x	x
	Rhagodia eremaea									x		x	
	Rhagodia preissii subsp. *preissii*												
	Rhagodia spinescens			x						x		x	
	Rhagodia ulicina												x
	Rhagodia sp.									x			

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
CHENOPODIACEAE (continued)	*Roycea divaricata*		x				x						
	Salsola australis												
	Sclerolaena brevifolia												
	Sclerolaena cuneata												
	Sclerolaena diacantha			x				x	x	x	x	x	
	Sclerolaena drummondii												
	Sclerolaena eurotioides		x							x	x		
	Sclerolaena obliquicuspis								x		x		x
	Sclerolaena parviflora		x				x	x	x		x		
	Sclerolaena uniflora		x										x
	Sclerolaena sp.				x						x		
	Tecticornia disarticulata		x				x	x	x		x		
	Tecticornia halocnemoides		x			x							
	Tecticornia halocnemoides subsp. *caudata*										x		
	Tecticornia halocnemoides subsp. *halocnemoides*												
	Tecticornia indica subsp. *bidens*						x	x	x				
	Tecticornia ?lepidosperma												
	Tecticornia loriae												
	Tecticornia lylei		x	x									
	Tecticornia moniliformis										x		
	Tecticornia peltata												
	Tecticornia pergranulata												
	Tecticornia pergranulata subsp. *pergranulata*		x								x		
	Tecticornia aff. *pterygosperma*												
	Tecticornia pterygosperma subsp. *pterygosperma*												
	Tecticornia syncarpa							x	x	x			
	Tecticornia triandra												
	Tecticornia undulata												x

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
CHENOPODIACEAE	*Tecticornia* sp.				x					x	x		x
(continued)	Chenopodiaceae sp.										x		x
COLCHICACEAE	*Wurmbea tenella*										x		
	Wurmbea sp.										x		
CONVOLVULACEAE	*Convolvulus recurvatus* subsp. *nullarborensis*												
	Convolvulus remotus												
	Wilsonia humilis		x					x	x				
CRASSULACEAE	*Crassula colorata*									x			
	Crassula colorata var. *acuminata*												
	Crassula exserta												
CUCURBITACEAE	* *Cucumis myriocarpus*												
	* *Citrullus amarus*												
CUPPRESSACEAE	*Callitris canescens*												
	Callitris columellaris										x		
	Callitris preissii		x										
CYPERACEAE	*Gahnia* sp. South West (K.L. Wilson & K. Frank KLW 9266)		x										
	Gahnia ?sp. South West (K.L. Wilson & K. Frank KLW9266)												x
	Gahnia sp.										x		
	Isolepis congrua		x										
	Lepidosperma aff. *fimbriatum*									x	x		
	Lepidosperma lyonsii		x							x	x		
	Lepidosperma pruinosum												

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
	Lepidosperma sanguinolentum		x				x			x	x		
	Lepidosperma sp. Bandalup Scabrid (N. Evelegh 10798)		x										
	Lepidosperma sp. Kambalda (A.A. Mitchell 5156)							x					
	Lepidosperma sp.		x			x						x	
	Schoenus nanus		x										
	Cyperaceae sp.			x							x		
DILLENIACEAE	*Hibbertia acerosa*				x								
	Hibbertia exasperata							x	x	x			
	Hibbertia gracilipes		x										
	Hibbertia pungens						x				x		x
DROSERACEAE	*Drosera salina*		x				x						
	Drosera sp. Branched styles (S.C. Coffey 193)												
DROSERACEAE	*Drosera* sp. (climbing)										x		
ELATINACEAE	*Elatine gratioloides*		x										
ERICACEAE	*Conostephium drummondii*		x										
	Conostephium preissii										x		
	Conostephium sp.					x							
	Leucopogon sp. Clyde Hill (M.A. Burgman 1207)										x		x
	Leucopogon sp. Salt Lake (G.F. Craig 3069)		x										
	Leucopogon sp. ?Salt Lake (G. F. Craig 3069)		x								x		
	Styphelia exserta												
	Styphelia subulata										x		

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
EUPHORBIACEAE	*Bertya dimerostigma*		x										
	Bertya virgata		x			x							
	Beyeria brevifolia					x							
	Beyeria calycina			x			x						
	Beyeria lechenaultii		x								x		x
	Beyeria ?*opaca*									x			
	Beyeria sulcata var. *brevipes*		x				x			x	x		x
	Beyeria sulcata var. *gracilis*												
	Beyeria sulcata var. *sulcata*									x			
	Beyeria sulcata var. *truncata*							x	x				
	Euphorbia drummondii							x	x				
	Euphorbia multifaria		x										
	Euphorbia tannensis subsp. *eremophila*												
	Ricinocarpos muricatus		x			x							
	Ricinocarpos stylosus			x		x		x	x		x		x
	Ricinocarpos sp.		x				x						
FABACEAE	*Acacia acanthoclada* subsp. *acanthoclada*												
	Acacia acuminata		x	x		x	x						x
	Acacia ancistrophylla var. *ancistrophylla*		x										
	Acacia ancistrophylla var. *perarcuata*		x										
	Acacia andrewsii			x						x	x		x
	Acacia assimilis subsp. *assimilis*					x							
	Acacia assimilis subsp. *atroviridis*					x							
	Acacia ?*burkittii*									x	x		
	Acacia calcarata						x						
	Acacia camptoclada		x	x		x					x		
	Acacia castanostegia												

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
FABACEAE	*Acacia chrysella*		x										
(continued)	*Acacia collegialis*							x	x				
	Acacia colletioides					x		x	x	x			
	Acacia crassuloides												
	Acacia dempsteri		x	x			x				x		
	Acacia dissona var. *dissona*												
	Acacia donaldsonii												
	Acacia dorsenna												
	Acacia enervia subsp. *enervia*												
	Acacia enervia subsp. *explicata*											x	
	Acacia eremophila var. *eremophila*		x										
	Acacia erinacea		x		x		x	x	x	x	x		x
	Acacia evenulosa		x										
	Acacia fragilis					x							
	Acacia fraternalis												
	Acacia gibbosa		x										
	Acacia hemiteles												x
	Acacia inamabilis									x	x		x
	Acacia inceana subsp. *inceana*							x	x				
	Acacia ?inceana subsp. *inceana*												x
	Acacia jennerae		x										
	Acacia jibberdingensis		x	x							x		
	Acacia kalgoorliensis							x					
	Acacia kerryana												
	Acacia lachnophylla												
	Acacia lasiocalyx		x	x			x						
	Acacia leptopetala		x										
	Acacia ligulata					x							

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
FABACEAE	*Acacia merinthophora*												
(continued)	*Acacia merrallii*		x			x	x	x	x	x	x	x	x
	Acacia murrayana												
	Acacia neurophylla												
	Acacia neurophylla subsp. *neurophylla*			x			x			x	x	x	x
	Acacia nyssophylla		x				x				x		x
	Acacia pachypoda		x					x	x			x	x
	Acacia poliochroa						x						
	Acacia pritzeliana												
	Acacia quadrimarginea												
	Acacia resinistipulea		x	x						x	x		x
	Acacia spinosissima											x	
	Acacia tetragonophylla												
	Acacia truculenta					x							
	Acacia warramaba		x	x				x	x		x		
	Acacia yorkrakinensis subsp. *acrita*										x		
	Acacia sp.		x			x							x
	Aotus sp. Dundas (M.A. Burgman 2835)		x										
	Bossiaea arcuata												
	Bossiaea aurantiaca												
	Bossiaea ?barbarae										x		
	Bossiaea cucullata		x										
	Bossiaea leptacantha		x	x						x	x		
	Bossiaea walkeri					x	x			x	x		
	Cullen discolor												
	Daviesia aphylla					x				x	x		
	Daviesia argillacea					x	x	x	x	x	x		
	Daviesia ?benthamii												x

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		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
FABACEAE (continued)	*Daviesia microcarpa*												
	Daviesia sp.					x							
	Dillwynia acerosa												
	Dillwynia uncinata												
	Dillwynia sp.												
	* *Erythrostemon gilliesii*												
	Glycine peratosa										x		
	Glycyrrhiza acanthocarpa		x										
	Indigofera australis			x			x						
	Indigofera occidentalis												
	Kennedia prorepens						x						
	Leptosema daviesioides						x						
	* *Medicago minima*												
	* *Medicago sativa*												
	Mirbelia depressa												
	Mirbelia granitica												x
	Mirbelia microphylla		x	x							x		
	Mirbelia seorsifolia												
	Mirbelia sp.												
	Pultenaea arida		x					x	x	x	x		
	Pultenaea sp.												
	Senna artemisioides												
	Senna artemisioides subsp. *filifolia*			x	x	x	x	x	x	x	x	x	x
	Senna artemisioides subsp. x *artemisioides*									x		x	
	Senna artemisioides subsp. x *petiolaris*												
	Senna cardiosperma												
	Senna manicula												
	Senna pleurocarpa						x						

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
FABACEAE	*Senna pleurocarpa* var. *angustifolia*			x			x	x	x				
(continued)	*Senna* sp. Pallinup River (J.W. Green 4847)												
	Senna sp.												x
	Swainsona canescens		x										
	Swainsona colutoides												
	Swainsona tenuis												
	Swainsonia sp.												
	Templetonia sulcata												
	* *Vicia monantha* subsp. *triflora*												
FRANKENIACEAE	*Frankenia cinerea*										x		
	Frankenia desertorum							x	x	x	x		
	Frankenia glomerata												
	Frankenia interioris												
	Frankenia interioris var. *interioris*										x		x
	Frankenia interioris var. *parviflora*												
	Frankenia irregularis										x		
	Frankenia setosa												
	Frankenia tetrapetala						x						
	Frankenia sp.				x				x		x		
GENTIANACEAE	*Schenkia australis*												
GERANIACEAE	* *Erodium aureum*		x										
	Erodium crinitum												
	Erodium cygnorum							x	x				
	Pelargonium australe						x						

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GERANIACEAE	*Pelargonium littorale*												
(continued)	*Pelargonium* sp.										x		
GOODENIACEAE	*Brunonia australis*												
	Coopernookia strophiolata		x								x		
	Dampiera latealata		x	x			x	x	x	x	x	x	x
	Goodenia berardiana		x										
	Goodenia collaris												
	Goodenia concinna										x		
	Goodenia daviesii		x										
	Goodenia dyeri										x		x
	Goodenia granitica		x										
	Goodenia havilandii		x										
	Goodenia laevis subsp. *laevis*									x	x		
	Goodenia occidentalis		x										
	Goodenia quasilibera												
	Goodenia trinervis												
	Goodenia sp.										x		
	Lechenaultia sp.												
	Scaevola bursariifolia									x	x		
	Scaevola oxyclona												x
	Scaevola restiacea subsp. *divaricata*												
	Scaevola spinescens		x	x	x	x	x	x	x	x	x	x	
	Scaevola taccada												
GYROSTEMONACEAE	*Codonocarpus cotinifolius*			x									
	Gyrostemon racemiger		x				x						
	Gyrostemon ramulosus												

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		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
HALORAGACEAE	*Glischrocaryon angustifolium*												
	Glischrocaryon aureum									x			
	Glischrocaryon flavescens			x									
	Haloragis dura												
	Haloragis hamata		x										
	Haloragis trigonocarpa												
	Myriophyllum petraeum		x										
HEMEROCALLIDACEAE	*Dianella revoluta*											x	x
	Dianella revoluta var. *divaricata*												
	Stypandra glauca		x				x				x		
ISOETACEAE	*Isoetes australis*		x										
JUNCACEAE	*Juncus aridicola*		x										
JUNCAGINACEAE	*Triglochin isingiana*		x										
	Triglochin longicarpa		x										
	Triglochin minutissima		x										
	Triglochin mucronata		x										
	Triglochin sp. Condingup (R. Davis 10877)		x										
LAMIACEAE	*Cyanostegia angustifolia*		x										
	Dicrastylis parvifolia					x							
	Hemigenia teretiuscula												
	Pityrodia chrysocalyx												
	Prostanthera grylloana					x	x	x	x	x	x		x
	Prostanthera incurvata			x									x

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
LAMIACEAE	*Prostanthera laricoides*												x
(continued)	*Prostanthera wilkieana*												
	Prostanthera sp.					x							
	* *Salvia verbenaca*												x
	Teucrium sessiliflorum		x					x					
	Teucrium sp. Norseman (T.E.H. Aplin 1851)												
	Westringia cephalantha					x	x			x	x		
	Westringia rigida		x	x	x	x	x	x	x	x	x	x	x
	Lamiaceae sp.												
LAURACEAE	*Cassytha glabella*										x		
	Cassytha melantha										x		
	Cassytha nodiflora												
	Cassytha sp.										x		
LOGANIACEAE	*Logania perryana*												x
	Orianthera judithiana												
LORANTHACEAE	*Amyema miquelii*			x						x			
	Amyema preissii												
LYCOPODIACEAE	*Phylloglossum drummondii*						x						
MALVACEAE	*Abutilon cryptopetalum*										x		
	Alyogyne hakeifolia			x			x						
	Androcalva cuneata												
	Androcalva luteiflora		x				x				x		
	Commersonia craurophylla		x										

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South)	Marianna	LS (South)	PAA	Bot	GHD	MCPL	MCPL	Umwelt	MCPL
				1995	1996	1997	2004	2010	2010	2012	2013	2016	2020
MALVACEAE	*Hannafordia bissillii* subsp. *latifolia*		x										
(continued)	*Lawrencia berthae*		x										
	Lawrencia repens												
	Lawrencia squamata		x					x	x	x	x		x
	Lawrencia sp.												
	* *Malva pseudolavatera*												
	Radyera farragei												
	Seringia cacaobrunnea												
	Seringia velutina		x				x				x		
	Sida calyxhymenia										x		x
	Sida sp.			x									
	Thomasia sarotes		x										
MARSILEACEAE	*Marsilea drummondii*		x										
MONTIACEAE	*Calandrinia eremaea*		x							x	x		x
	Calandrinia granulifera							x					
	Calandrinia polyandra												
	Calandrinia porifera		x										
	Calandrinia sp.										x		x
MYRTACEAE	*Aluta appressa*												
	Baeckea sp.					x							
	Callistemon phoeniceus		x			x	x			x			
	Calothamnus gilesii									x	x	x	x
	Calothamnus tuberosus		x										
	Calytrix tetragona									x			x

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
MYRTACEAE	*Calytrix* sp.												x
(continued)	*Cyathostemon* aff. *Ambiguus*						x						
	Cyathostemon sp. Salmon Gums (B. Archer 769)										x		
	Darwinia polycephala												
	Darwinia sp. Karonie (K. Newbey 8503)		x								x		
	Ericomyrtus serpyllifolia		x										
	Eucalyptus aspratilis		x								x		
	Eucalyptus brockwayi		x		x			x	x	x	x	x	x
	Eucalyptus calycogona							x	x				
	Eucalyptus calycogona subsp. *calycogona*					x							
	Eucalyptus campaspe												
	Eucalyptus capillosa												
	Eucalyptus celastroides		x	x									
	Eucalyptus clelandiorum			x	x								
	Eucalyptus concinna										x		x
	Eucalyptus ?*corrugata*										x		
	Eucalyptus cylindriflora		x										
	Eucalyptus cylindrocarpa		x	x									
	Eucalyptus delicata												x
	Eucalyptus diptera		x										
	Eucalyptus ?*distuberosa* subsp. *distuberosa*												
	Eucalyptus dundasii		x	x	x	x	x	x	x	x	x	x	x
	Eucalyptus eremophila			x		x							
	Eucalyptus eremophila subsp. *eremophila*												
	Eucalyptus eremophila x *stricklandii*												
	Eucalyptus extensa												
	Eucalyptus flocktoniae		x	x	x							x	
	Eucalyptus flocktoniae subsp. *flocktoniae*					x							

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
MYRTACEAE	*Eucalyptus gracilis*		x			x				x	x		x
(continued)	*Eucalyptus ?gracilis*		x										
	Eucalyptus griffithsii						x			x	x		
	Eucalyptus grossa												
	Eucalyptus incrassata										x		
	Eucalyptus jimberlanica		x								x		
	Eucalyptus kumarlensis		x							x	x		
	Eucalyptus laevis												
	Eucalyptus lesouefii		x	x	x	x	x	x	x	x	x		x
	Eucalyptus longicornis		x	x		x	x			x		x	
	Eucalyptus ?longicornis												
	Eucalyptus longissima										x		
	Eucalyptus loxophleba subsp. *lissophloia*		x	x		x	x			x	x		
	Eucalyptus loxophleba subsp. *loxophleba*		x								x		
	Eucalyptus melanoxylon		x			x					x		
	Eucalyptus myriadena												
	Eucalyptus oleosa		x									x	
	Eucalyptus ?oleosa												x
	Eucalyptus oleosa subsp. *cylindroidea*		x										
	Eucalyptus oleosa subsp. *oleosa*		x	x				x	x	x	x		x
	Eucalyptus oleosa ?subsp. oleosa												x
	Eucalyptus ?oleosa subsp. oleosa												
	Eucalyptus planipes												
	Eucalyptus platycorys												
	Eucalyptus platydisca												
	Eucalyptus pileata												
	Eucalyptus prolixa												x
	Eucalyptus protensa		x			x							

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
	Eucalyptus pterocarpa												
	Eucalyptus ravida									x			
	Eucalyptus ?*ravida*												
	Eucalyptus salicola		x			x				x			
	Eucalyptus salmonophloia		x		x	x	x	x	x				x
	Eucalyptus salubris					x	x	x	x			x	x
	Eucalyptus salubris x *tortilis*												
	Eucalyptus ?*scyphocalyx*										x		
	Eucalyptus sheathiana					x							
	Eucalyptus sporadica						x						
	Eucalyptus spreta		x						x				x
	Eucalyptus ?*spreta*												
	Eucalyptus stricklandii				x			x	x	x			x
	Eucalyptus subangusta												
	Eucalyptus subangusta subsp. *subangusta*												
	Eucalyptus tenera		x										
	Eucalyptus tenuis						x						
	Eucalyptus terebra				x								
	Eucalyptus thamnoides		x										
	Eucalyptus torquata		x	x	x	x	x	x	x	x	x	x	x
	Eucalyptus tortilis												
	Eucalyptus transcontinentalis		x	x		x				x	x	x	
	Eucalyptus urna						x	x	x	x	x		x
	Eucalyptus valens												
	Eucalyptus virella		x								x		
	Eucalyptus vittata												
	Eucalyptus websteriana												
	Eucalyptus websteriana subsp. *norsemanica*												x

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		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
MYRTACEAE	*Eucalyptus yilgarnensis*		x		x	x	x						
(continued)	*Eucalyptus* sp.		x							x	x	x	x
	Leptospermopsis erubescens												
	Leptospermopsis fastigiata						x						
	Leptospermopsis incana										x		
	Leptospermopsis roei			x		x		x					
	Melaleuca acuminata					x					x		
	Melaleuca acuminata subsp. *acuminata*			x			x						x
	Melaleuca acuminata subsp. *websteri*												
	Melaleuca brevifolia												
	Melaleuca bromelioides			x		x							
	Melaleuca calycina												
	Melaleuca cliffortioides												
	Melaleuca coccinea		x							x		x	x
	Melaleuca eleuterostachya		x				x						
	Melaleuca elliptica					x					x		
	Melaleuca exuvia		x										
	Melaleuca fulgens			x									
	Melaleuca fulgens subsp. *fulgens*						x				x		
	Melaleuca halmaturorum												
	Melaleuca hamata		x								x	x	x
	Melaleuca hamulosa		x				x						
	Melaleuca johnsonii												
	Melaleuca lanceolata		x	x		x	x			x	x		x
	Melaleuca lateriflora					x	x	x		x	x		x
	Melaleuca leiocarpa												
	Melaleuca macronychia subsp. *trygonoides*		x				x						
	Melaleuca pauperiflora subsp. *fastigiata*							x	x				

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
MYRTACEAE	*Melaleuca pauperiflora* subsp. *pauperiflora*												
(continued)	*Melaleuca quadrifaria*							x	x		x		
	Melaleuca radula		x								x		
	Melaleuca sheathiana		x	x	x	x	x	x	x	x	x	x	x
	Melaleuca sparsiflora			x									
	Melaleuca subalaris					x		x	x				
	Melaleuca thyoides			x			x				x		
	Melaleuca uncinata		x	x		x	x			x	x		
	Melaleuca sp.					x					x		x
	Micromyrtus erichsenii		x										
	Micromyrtus papillosa												x
	Rinzia carnosa		x										
	Thryptomene australis			x									
	Thryptomene australis subsp. *brachyandra*		x				x				x		x
	Thryptomene kochii												
	Verticordia chrysantha												
	Verticordia grandiflora		x										
	Verticordia plumosa var. *incrassata*												
	Myrtaceae sp.												x
ORCHIDACEAE	*Caladenia horistes* x *voigtii*												
	Caladenia longicauda subsp. rigidulus												
	Caladenia microchila		x										
	Corunastylis fuscoviridis												
	Microtis graniticola		x										
	Pheladenia deformis		x										
	Prasophyllum gracile		x										
	Pterostylis mutica		x				x	x					

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
ORCHIDACEAE	*Pterostylis roensis*		x										
(continued)	*Pterostylis setulosa*		x				x						
	Pterostylis sp.												x
	Thelymitra aff. *macrophylla*												
	Thelymitra petrophila		x					x					
	Thelymitra sp.												
OROBANCHACEAE	* *Orobanche minor*		x										
OXALIDACEAE	*Oxalis perennans*							x	x	x			
	* *Oxalis pes-caprae*												
	Oxalis sp.												x
PHYLLANTHACEAE	*Poranthera triandra*												
PITTOSPORACEAE	*Billardiera coriacea*		x										
	Billardiera lehmanniana		x										
	Cheiranthera filifolia												
	Pittosporum angustifolium						x	x	x	x			
PLANTAGINACEAE	*Plantago drummondii*												
	Plantago turrifera												
POACEAE	?*Amphipogon* sp.										x		
	Aristida contorta		x			x		x	x		x		
	Aristida sp.								x				x
	Austrostipa acrociliata												
	Austrostipa drummondii												

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		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
POACEAE	*Austrostipa elegantissima*			x			x	x	x	x	x	x	
(continued)	*Austrostipa eremophila*									x			
	Austrostipa hemipogon							x					
	Austrostipa juncifolia										x		
	Austrostipa nitida										x		x
	Austrostipa ?nullarborensis												x
	Austrostipa platychaeta									x	x		x
	Austrostipa scabra												
	Austrostipa scabra subsp. *scabra*									x			
	Austrostipa trichophylla											x	
	Austrostipa variabilis												
	Austrostipa vickeryana												
	Austrostipa sp.										x	x	x
	Bromus arenarius		x										
*	*Bromus rubens*												
	Chloris truncata		x										
*	*Chloris virgata*												
	Cymbopogon obtectus												
	Digitaria brownii												
	?Enneapogon sp.										x		
	Eragrostis dielsii		x				x	x	x		x		
	Eragrostis falcata										x		
	Eragrostis pergracilis												
	Eriachne sp.								x				
	Monachather paradoxus												
	Neurachne alopecuroidea										x		
	Panicum effusum												
	Paspalidium constrictum										x		

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		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
POACEAE	* *Pentameris airoides* subsp. *airoides*							x	x	x			
(continued)	* *Rostraria pumila*		x								x		
	Rytidosperma caespitosum										x		x
	Rytidosperma setaceum									x	x		
	* *Setaria verticillata*												
	Spartochloa scirpoidea		x								x		
	Sporobolus ramigerus												x
	Tragus australianus												
	Triodia ?irritans												
	Triodia scariosa												x
	* *Vulpia muralis*		x										
	* *Vulpia myuros*		x										
	Poaceae sp.									x	x	x	x
POLYGALACEAE	*Comesperma calymega*												x
	Comesperma drummondii		x										
	Comesperma integerrimum		x										
	Comesperma polygaloides												
	Comesperma scoparium		x										
	Comesperma volubile												
POLYGONACEAE	*Muehlenbeckia adpressa*		x				x						
	* *Rumex vesicarius*												
PORTULACACEAE	*Portulaca* sp.		x				x						
POTAMOGETONACEAE	*Althenia australis*		x										

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		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
PRIMULACEAE	* *Lysimachia arvensis*						x			x	x	x	
PROTEACEAE	*Banksia nutans* var. *nutans*												
	Grevillea acuaria		x			x	x	x	x	x	x		x
	Grevillea anethifolia			x			x				x		
	Grevillea huegelii		x							x	x		
	Grevillea nematophylla											x	
	Grevillea nematophylla subsp. *nematophylla*						x	x	x	x			
	Grevillea ?nematophylla subsp. *nematophylla*												x
	Grevillea oncogyne												
	Grevillea phillipsiana												
	Grevillea plurijuga					x							
	Grevillea plurijuga subsp. *plurijuga*		x								x		
	Grevillea plurijuga subsp. *superba*												
	Grevillea sarissa							x	x				
	Grevillea sp.				x					x			
	Hakea cinerea												
	Hakea ?commutata										x		
	Hakea sp.												
	Persoonia helix		x										
PTERIDACEAE	*Cheilanthes austrotenuifolia*										x		
	Cheilanthes distans			x									
	Cheilanthes lasiophylla						x			x	x		
	Cheilanthes sieberi subsp. *sieberi*			x							x		x
	Cheilanthes sp.						x						

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FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
RHAMNACEAE	*Cryptandra aridicola*							x	x			x	
	Cryptandra graniticola									x	x		
	Cryptandra minutifolia subsp. *brevistyla*		x										
	Cryptandra recurva		x										
	Cryptandra wilsonii		x				x						x
	Cryptandra sp.			x								x	
	Pomaderris forrestiana		x	x	x	x		x	x	x	x		x
	Spyridium sp.												
	Stenanthemum stipulosum		x										
	Trymalium myrtillus subsp. *myrtillus*				x	x	x	x	x		x	x	x
RUBIACEAE	*Opercularia vaginata*												
	Opercularia sp.												
RUTACEAE	*Boronia inornata* subsp. *inornata*										x		
	Boronia inornata subsp. *leptophylla*		x										
	Cyanothamnus coerulescens subsp. *coerulescens*		x										
	Cyanothamnus coerulescens subsp. *spicatus*		x										
	Cyanothamnus fabianoides												
	Cyanothamnus fabianoides subsp. *roseus*		x										
	Geijera linearifolia		x			x		x	x	x			x
	Phebalium canaliculatum		x		x			x	x		x		
	Phebalium elegans												
	Phebalium filifolium		x			x				x			
	Phebalium ?filifolium		x										
	Phebalium lepidotum					x				x			
	Phebalium multiflorum		x										
	Phebalium multiflorum subsp. multiflorum							x					

APPENDIX D: VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE CENTRAL NORSEMAN GOLD SURVEY AREAS

NORTH and SOUTH denote the two survey regions as shown in Figure 1. * denotes introduced taxa. SCC is State Conservation Code (Appendix A; DBCA 2019z); FCC is Federal Conservation Code (Appendix A; EPBC Act 1999). EPBC is the EPBC Act Protected Matters Search Tool (DAWE 2015). NatureMap is the WA state search tool (DBCA 2007-). Gold Env denotes Goldfields Environmental Management Pty Ltd; LS is Landcare Services Pty Ltd; OE is Outback Ecology Environmental Management Services; MCPL is Mattiske Consulting Pty Ltd; Rally is Rally Revegetation and Environmental Services; Marianna is Marianna Partners Environmental Services; PAA is Paul Armstrong and Associates; Bot is Botanica Consulting; GHD is GHD Pty Ltd; and Umwelt is Umwelt Australia Pty Ltd.

FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
RUTACEAE	*Phebalium tuberculosum*					x					x		
(continued)	*Phebalium* sp.												
	Philotheca apiculata		x	x	x			x	x	x	x	x	x
	Philotheca coccinea												
	Philotheca fitzgeraldii					x		x	x		x		x
	Philotheca nutans												
	Philotheca rhomboidea												
SANTALACEAE	*Exocarpos aphyllus*		x	x	x	x	x	x	x	x	x	x	x
	Exocarpos sparteus												
	Santalum acuminatum			x	x	x	x	x	x	x	x	x	x
	Santalum murrayanum									x			
	Santalum spicatum		x	x	x		x			x	x	x	x
	Santalum sp.												x
SAPINDACEAE	*Dodonaea adenophora*											x	
	Dodonaea amblyophylla												
	?*Dodonaea bursariifolia*												x
	Dodonaea concinna		x										
	Dodonaea lobulata						x	x	x			x	
	Dodonaea microzyga				x	x		x	x				
	Dodonaea microzyga var. *acrolobata*			x			x			x	x		x
	Dodonaea stenozyga		x	x	x	x		x	x	x	x	x	x
	Dodonaea viscosa												
	Dodonaea viscosa subsp. *angustissima*		x				x						x
SCROPHULARIACEAE	*Eremophila alternifolia*												
	Eremophila alternifolia x purpurascens												x

APPENDIX D: VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE CENTRAL NORSEMAN GOLD SURVEY AREAS

NORTH and SOUTH denote the two survey regions as shown in Figure 1. * denotes introduced taxa. SCC is State Conservation Code (Appendix A; DBCA 2019z); FCC is Federal Conservation Code (Appendix A; EPBC Act 1999). EPBC is the EPBC Act Protected Matters Search Tool (DAWE 2015). NatureMap is the WA state search tool (DBCA 2007-). Gold Env denotes Goldfields Environmental Management Pty Ltd; LS is Landcare Services Pty Ltd; OE is Outback Ecology Environmental Management Services; MCPL is Mattiske Consulting Pty Ltd; Rally is Rally Revegetation and Environmental Services; Marianna is Marianna Partners Environmental Services; PAA is Paul Armstrong and Associates; Bot is Botanica Consulting; GHD is GHD Pty Ltd; and Umwelt is Umwelt Australia Pty Ltd.

FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
SCROPHULARIACEAE	*Eremophila caerulea*					x							
(continued)	*Eremophila caerulea* subsp. *caerulea*						x						
	Eremophila clavata												
	Eremophila decipiens		x		x			x	x			x	
	Eremophila decipiens subsp. *decipiens*		x								x		
	Eremophila dempsteri		x	x		x		x	x				x
	Eremophila ?*dempsteri*												x
	Eremophila deserti			x	x		x			x	x	x	
	Eremophila dichroantha												
	Eremophila drummondii												
	Eremophila gibbosa		x	x						x	x		
	Eremophila ?*gibbosa*												x
	Eremophila glabra			x	x			x	x			x	
	Eremophila glabra subsp. *albicans*		x										
	Eremophila glabra subsp. *glabra*		x				x			x	x		
	Eremophila granitica												x
	Eremophila interstans			x									
	Eremophila interstans subsp. *interstans*		x		x		x	x	x	x	x	x	
	Eremophila ionantha		x	x		x	x	x		x	x		
	Eremophila labrosa												x
	Eremophila maculata					x							
	Eremophila microphylla					x							
	Eremophila oppositifolia				x								
	Eremophila pantonii												
	Eremophila parvifolia subsp. auricampi												
	Eremophila parvifolia ?subsp. *auricampi*												x
	Eremophila parvifolia subsp. *parvifolia*												
	Eremophila psilocalyx		x	x		x	x	x	x	x	x	x	x

APPENDIX D: VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE CENTRAL NORSEMAN GOLD SURVEY AREAS

NORTH and SOUTH denote the two survey regions as shown in Figure 1. * denotes introduced taxa. SCC is State Conservation Code (Appendix A; DBCA 2019z); FCC is Federal Conservation Code (Appendix A; EPBC Act 1999). EPBC is the EPBC Act Protected Matters Search Tool (DAWE 2015). NatureMap is the WA state search tool (DBCA 2007-). Gold Env denotes Goldfields Environmental Management Pty Ltd; LS is Landcare Services Pty Ltd; OE is Outback Ecology Environmental Management Services; MCPL is Mattiske Consulting Pty Ltd; Rally is Rally Revegetation and Environmental Services; Marianna is Marianna Partners Environmental Services; PAA is Paul Armstrong and Associates; Bot is Botanica Consulting; GHD is GHD Pty Ltd; and Umwelt is Umwelt Australia Pty Ltd.

FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
SCROPHULARIACEAE	*Eremophila purpurascens*		x	x			x	x	x	x	x	x	x
(continued)	*Eremophila purpurascens* x *E. alternifolia*												x
	Eremophila rugosa												x
	Eremophila saligna		x			x		x	x	x	x		
	Eremophila scoparia		x	x	x	x		x	x	x	x	x	x
	Eremophila serrulata					x							
	Eremophila subfloccosa subsp. *glandulosa*		x				x						
	Eremophila violacea		x										
	Eremophila sp.				x							x	x
	Myoporum platycarpum							x	x	x			
	Myoporum platycarpum subsp. *platycarpum*												x
SOLANACEAE	*Anthocercis anisantha*												
	Duboisia hopwoodii												
	Lycium australe				x		x	x	x		x		x
	* *Lycium ferocissimum*												
	* *Nicotiana glauca*												
	Nicotiana rotundifolia		x										
	Nicotiana sp.						x						
	Solanum hoplopetalum							x	x		x		
	Solanum lasiophyllum							x					
	* *Solanum nigrum*						x				x		
	Solanum nummularium		x	x				x	x	x	x		x
	Solanum orbiculatum				x								
	Solanum plicatile			x		x							
	Solanum simile		x										
	Solanum sp.												

APPENDIX D: VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE CENTRAL NORSEMAN GOLD SURVEY AREAS

NORTH and SOUTH denote the two survey regions as shown in Figure 1. * denotes introduced taxa. SCC is State Conservation Code (Appendix A; DBCA 2019z); FCC is Federal Conservation Code (Appendix A; EPBC Act 1999). EPBC is the EPBC Act Protected Matters Search Tool (DAWE 2015). NatureMap is the WA state search tool (DBCA 2007-). Gold Env denotes Goldfields Environmental Management Pty Ltd; LS is Landcare Services Pty Ltd; OE is Outback Ecology Environmental Management Services; MCPL is Mattiske Consulting Pty Ltd; Rally is Rally Revegetation and Environmental Services; Marianna is Marianna Partners Environmental Services; PAA is Paul Armstrong and Associates; Bot is Botanica Consulting; GHD is GHD Pty Ltd; and Umwelt is Umwelt Australia Pty Ltd.

FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
STYLIDIACEAE	*Stylidium adpressum*		x										
	Stylidium dielsianum					x							
TAMARICACEAE	* *Tamarix aphylla*	x											
THYMELAEACEAE	*Pimelea angustifolia*						x				x		
	Pimelea graniticola		x				x						
	Pimelea micrantha												
	Pimelea microcephala			x							x		
	Pimelea microcephala subsp. *microcephala*												x
	Pimelea spiculigera var. *thesioides*		x				x			x	x		
	Pimelea subvillifera												
	Pimelea trichostachya												
URTICACEAE	*Parietaria cardiostegia*										x		
VIOLACEAE	*Pigea curvifolia*										x		
	Pigea epacroides												
	Pigea floribunda						x						x
ZYGOPHYLLACEAE	*Roepera apiculata*			x						x	x	x	x
	Roepera aurantiaca									x		x	
	Roepera aurantiaca subsp. *aurantiaca*												
	Roepera ?aurantiaca subsp. *aurantiaca*												x
	Roepera billardierei		x										
	Roepera compressa						x				x		
	Roepera eremaea		x					x	x	x	x		
	Roepera fruticulosa												

APPENDIX D: VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE CENTRAL NORSEMAN GOLD SURVEY AREAS

NORTH and SOUTH denote the two survey regions as shown in Figure 1. * denotes introduced taxa. SCC is State Conservation Code (Appendix A; DBCA 2019z); FCC is Federal Conservation Code (Appendix A; EPBC Act 1999). EPBC is the EPBC Act Protected Matters Search Tool (DAWE 2015). NatureMap is the WA state search tool (DBCA 2007-). Gold Env denotes Goldfields Environmental Management Pty Ltd; LS is Landcare Services Pty Ltd; OE is Outback Ecology Environmental Management Services; MCPL is Mattiske Consulting Pty Ltd; Rally is Rally Revegetation and Environmental Services; Marianna is Marianna Partners Environmental Services; PAA is Paul Armstrong and Associates; Bot is Botanica Consulting; GHD is GHD Pty Ltd; and Umwelt is Umwelt Australia Pty Ltd.

FAMILY	SPECIES	SOUTH											ALL AREAS
		South EPBC	South Nature Map	LS (South) 1995	Marianna 1996	LS (South) 1997	PAA 2004	Bot 2010	GHD 2010	MCPL 2012	MCPL 2013	Umwelt 2016	MCPL 2020
ZYGOPHYLLACEAE (continued)	*Roepera glauca*							x		x	x		
	Roepera halophila												
	Roepera iodocarpa												
	Roepera ovata									x	x		
	Roepera tesquorum												
	Roepera sp.												
	* *Tribulus terrestris*												

APPENDIX E: LOCATION OF QUADRATS ESTABLISHED WITHIN THE TSF5 AND DESIRABLES SURVEY AREAS, 2024

SURVEY AREA	QUADRAT	LOCATION (GDA94, Zone 51)	
		EASTING (mE)	NORTHING (mN)
Desirables	DS01	386050	6446020
	DS02	385706	6445758
	DS03	385332	6445229
	DS04	385943	6445220
	DS05	385317	6445049
	DS06	385602	6445004
	DS07	385592	6444729
	DS08	385649	6444634
	DS09	386658	6444548
	DS10	386849	6444546
	DS11	385261	6444458
	DS12	385430	6444428
	DS13	384924	6444422
	DS14	386022	6444399
	DS15	385086	6444390
	DS16	384773	6444166
	DS17	386245	6444142
	DS18	385748	6443969
	DS19	384928	6443904
	DS20	386852	6443896
	DS21	385945	6443532
TSF5	TF01	388056	6438146
	TF02	387665	6438105
	TF03	387459	6438077
	TF04	388506	6438018
	TF05	387854	6437945
	TF06	387939	6437836
	TF07	388288	6437779
	TF08	387489	6437710
	TF09	387837	6437580
	TF10	388119	6437499
	TF11	388026	6437388
	TF12	387637	6437382
	TF13	387937	6437277
	TF14	388414	6437254
	TF15	387629	6437161
	TF16	388543	6436970

APPENDIX E: LOCATION OF QUADRATS ESTABLISHED WITHIN THE TSF5 AND DESIRABLES SURVEY AREAS, 2024

SURVEY AREA	QUADRAT	LOCATION (GDA94, Zone 51)	
		EASTING (mE)	NORTHING (mN)

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN TSF5 AND DESIRABLES SURVEY AREAS, 2024

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (EPA 2018). PMST - Protected Matters Search Tool (DCCEEW 2024c).

FAMILY	SPECIES	Desirables	TSF5
Aizoaceae	* *Mesembryanthemum nodiflorum*	x	
	Sarcozona praecox	x	x
Amaranthaceae	*Ptilotus obovatus* var. *obovatus*	x	x
Apocynaceae	*Alyxia buxifolia*	x	x
	Vincetoxicum lineare		x
Asparagaceae	*Lomandra effusa*	x	
	Thysanotus manglesianus	x	
Asphodelaceae	* *Asphodelus fistulosus*	x	
Asteraceae	*Brachyscome ciliaris*	x	
	Calotis hispidula		x
	* *Centaurea melitensis*	x	x
	Cratystylis conocephala	x	x
	Kippistia suaedifolia	x	
	Olearia muelleri	x	x
	* *Oligocarpus calendulaceus*		x
	Rhodanthe oppositifolia		x
	Senecio glossanthus		x
	Senecio lacustrinus	x	x
	Siemssenia capillaris	x	
	* *Sonchus asper*		x
	* *Sonchus oleraceus*	x	x
	Trichanthodium skirrophorum	x	
	Waitzia fitzgibbonii	x	x
	Asteraceae sp.	x	
Boraginaceae	*Halgania andromedifolia*	x	x
Brassicaceae	* *Carrichtera annua*	x	x
Casuarinaceae	*Allocasuarina acutivalvis* subsp. *acutivalvis*		x
	Casuarina obesa	x	
Chenopodiaceae	*Atriplex lindleyi* subsp. *inflata*		x
	Atriplex nana	x	
	Atriplex nummularia subsp. *spathulata*	x	x
	Atriplex sp. 1	x	x
	Atriplex sp. 2	x	x
	Enchylaena tomentosa		x
	Maireana erioclada	x	
	Maireana pentatropis	x	
	Maireana ?pentatropis	x	
	Maireana radiata	x	x

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN TSF5 AND DESIRABLES SURVEY AREAS, 2024

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (EPA 2018). PMST - Protected Matters Search Tool (DCCEEW 2024c).

FAMILY	SPECIES	Desirables	TSF5
	Maireana ?trichoptera	x	x
	Maireana triptera	x	x
	Rhagodia crassifolia	x	x
	Rhagodia drummondii	x	
	Sclerolaena cuneata		x
	Sclerolaena diacantha	x	x
	Sclerolaena ?obliquicuspis	x	x
	Tecticornia sp.	x	x
Convolvulaceae	*Convolvulus remotus*	x	
Cupressaceae	*Callitris columellaris*	x	
Dilleniaceae	*Hibbertia* sp.		x
Euphorbiaceae	*Beyeria sulcata* var. *brevipes*		x
	Ricinocarpos stylosus	x	x
Fabaceae	*Acacia erinacea*		x
	Acacia ligulata	x	
	Acacia merrallii	x	
	Acacia nyssophylla	x	
	Acacia pachypoda		x
	* *Medicago minima*	x	
	Senna artemisioides subsp. *filifolia*	x	x
	Templetonia sp.	x	
Frankeniaceae	*Frankenia interioris*	x	
	Frankenia interioris var. *interioris*	x	
	Frankenia sp.	x	
Goodeniaceae	*Goodenia quasilibera*		x
	Scaevola spinescens	x	x
Lamiaceae	*Prostanthera grylloana*		x
	Westringia rigida	x	x
Malvaceae	*Lawrencia squamata*	x	x
Myrtaceae	*Darwinia* sp. Karonie (K. Newbey 8503)	x	
	Eucalyptus brockwayii (P3)		
	Eucalyptus dundasii		x
	Eucalyptus ?dundasii		x
	Eucalyptus ?extensa		x
	Eucalyptus gracilis	x	
	Eucalyptus ?horistes	x	
	Eucalyptus ?incrassata	x	

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN TSF5 AND DESIRABLES SURVEY AREAS, 2024

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (EPA 2018). PMST - Protected Matters Search Tool (DCCEEW 2024c).

FAMILY	SPECIES	Desirables	TSF5
	Eucalyptus kumarlensis	x	
	Eucalyptus lesouefii	x	x
	Eucalyptus oleosa ?subsp. *oleosa*	x	
	Eucalyptus ?*platycorys*	x	
	Eucalyptus salubris	x	
	Eucalyptus stricklandii		x
	Eucalyptus torquata		x
	Eucalyptus urna	x	x
	Eucalyptus ?*virella*		x
	Leptospermopsis fastigiata		x
	Melaleuca ?*lanceolata*	x	
	Melaleuca sheathiana	x	x
	Melaleuca ?*sheathiana*		x
Poaceae	*Austrostipa elegantissima*	x	
	Austrostipa ?*elegantissima*	x	x
	?*Austrostipa elegantissima*	x	
	Austrostipa nitida		x
	Austrostipa sp.	x	
	Bromus ?*arenarius*	x	
	Triodia ?*scariosa*	x	
Primulaceae	* *Lysimachia arvensis*	x	
Proteaceae	*Grevillea haplantha* subsp. *haplantha*		x
	Grevillea ?*nematophylla* subsp. *nematophylla*		x
Pteridaceae	*Cheilanthes* sp.		x
Rhamnaceae	?*Pomaderris forrestiana*	x	x
	Trymalium myrtillus subsp. *myrtillus*		x
Rutaceae	*Geijera linearifolia*	x	x
Santalaceae	*Exocarpos aphyllus*	x	x
	Santalum acuminatum	x	x
	Dodonaea lobulata	x	
	Dodonaea microzyga var. *acrolobata*		x
Scrophulariaceae	*Eremophila caerulea* subsp. *caerulea*		x
	Eremophila decipiens subsp. *decipiens*	x	
	Eremophila dempsteri	x	x
	Eremophila ?*deserti*	x	
	Eremophila glabra subsp. *albicans*	x	x
	Eremophila ?*glabra* subsp. *albicans*	x	x
	Eremophila interstans subsp. *interstans*	x	
	?*Eremophila parvifolia* subsp. *auricampi*	x	

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN TSF5 AND DESIRABLES SURVEY AREAS, 2024

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (EPA 2018). PMST - Protected Matters Search Tool (DCCEEW 2024c).

FAMILY	SPECIES	Desirables	TSF5
	Eremophila psilocalyx	x	x
	Eremophila purpurascens (P3)		
	Eremophila scoparia	x	x
	Myoporum platycarpum		x
Solanaceae	*Solanum hoplopetalum*	x	
	Solanum nummularium	x	
Thymelaeaceae	*Pimelea microcephala* subsp. *microcephala*	x	
Zygophyllaceae	*Roepera* ?*aurantiaca* subsp. *aurantiaca*	x	x
	Roepera reticulata	x	x
	Roepera sp.	x	x

APPENDIX G: SUMMARY OF VASCULAR PLANT SPECIES RECORDED BY QUADRAT, CENTRAL NORSMEN GOLD PROJECT, TSF5 AND DESIRABLES

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2024d, WAH 1998-); Oppo - denotes opportunistically recorded taxon

	Taxon	DS01	DS02	DS03	DS04	DS05	DS06	DS07	DS08	DS09	DS10	DS11	DS12	DS13	DS14	DS15	DS16	DS17	DS18	DS19	DS20	DS21	OPPO (DES)	TF01	TF02	TF03	TF04	TF05	TF06	TF07	TF08	TF09	TF10	TF11	TF12	TF13	TF14	TF15	TF16	OPPO (TSF5)
	Acacia erinacea																									x				x			x						x	
	Acacia ligulata															x																								
	Acacia merrallii																						x																
	Acacia nyssophylla			x																																			
	Acacia pachypoda																																		x					
	Allocasuarina acutivalvis subsp. *acutivalvis*																										x												x	
	Alyxia buxifolia	x	x		x		x			x																x	x			x			x		x	x		x	x	
*	*Asphodelus fistulosus*										x												x																	
	Asteraceae sp.																						x																	
	Atriplex lindleyi subsp. *inflata*																																							x
	Atriplex nana																x																							
	Atriplex nummularia subsp. *spathulata*																				x			x																
	Atriplex sp. *1*								x	x							x	x							x	x		x	x	x		x		x	x			x		
	Atriplex sp. *2*	x		x	x			x	x	x	x	x	x	x	x			x	x	x	x			x	x	x		x	x	x		x	x	x		x		x	
	Austrostipa elegantissima																			x																				
	Austrostipa ?*elegantissima*						x																																	
	?*Austrostipa elegantissima*																		x																					
	Austrostipa nitida																																			x				
	Austrostipa sp.																x																							
	Beyeria sulcata var. *brevipes*																										x			x										
	Brachyscome ciliaris							x																																
	Bromus ?*arenarius*										x												x																	
	Callitris columellaris		x																																				
	Calotis hispidula																																			x				
*	*Carrichtera annua*			x			x	x			x									x		x	7			x							x	x	x	x			x	
	Casuarina obesa		x																																					
*	*Centaurea melitensis*										x												x												x					x
	Cheilanthes sp.																										x													
	Convolvulus remotus										x																													
	Cratystylis conocephala	x			x	x			x	x		x	x	x	x			x	x	x	x					x													
	Darwinia sp. Karonie (K. Newbey 8503)		x																																				
	Dodonaea lobulata						x																																
	Dodonaea microzyga var. *acrolobata*																										x			x			x	x	x	x			x	
	Enchylaena tomentosa																																		x					
	Eremophila caerulea subsp. *caerulea*																														x									

APPENDIX G: SUMMARY OF VASCULAR PLANT SPECIES RECORDED BY QUADRAT, CENTRAL NORSMEN GOLD PROJECT, TSF5 AND DESIRABLES

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2024d, WAH 1998-); Oppo - denotes opportunistically recorded taxon

Taxon	DS01	DS02	DS03	DS04	DS05	DS06	DS07	DS08	DS09	DS10	DS11	DS12	DS13	DS14	DS15	DS16	DS17	DS18	DS19	DS20	DS21	OPPO (DES)	TF01	TF02	TF03	TF04	TF05	TF06	TF07	TF08	TF09	TF10	TF11	TF12	TF13	TF14	TF15	TF16	OPPO (TSF5)
Eremophila decipiens subsp. *decipiens*			x							x									x																			
Eremophila dempsteri				x														x						x				x			x		x			x		
Eremophila ?deserti			x									x	x	x					x																			
Eremophila glabra subsp. *albicans*							x																						x	x				x				
Eremophila ?glabra subsp. *albicans*						x		x	x	x																x						x							
Eremophila interstans subsp. *interstans*						x												x																				
Eremophila psilocalyx					x				x												x				x	x			x				x		x			
?Eremophila parvifolia subsp. auricampi					x			x	x		x	x		x						x	x													x				
Eremophila purpurascens (P3)																					x					x								x	x			
Eremophila scoparia			x	x	x		x	x		x			x	x			x	x	x	x				x			x							x				
Eucalyptus brockwayii (P3)																																				x		x
Eucalyptus dundasii																									x										x			
Eucalyptus ?dundasii								x	x												x		x					x			x							x
Eucalyptus ?extensa																																						x
Eucalyptus gracilis															x																							
Eucalyptus ?horistes					x																																	
Eucalyptus ?incrassata																x																						
Eucalyptus kumarlensis													x		x																							
Eucalyptus lesouefii						x			x		x	x		x			x			x	x	x	x	x			x		x	x	x			x	x		x	x	
Eucalyptus oleosa ?subsp. oleosa	x			x							x	x						x																				
Eucalyptus ?platycorys													x		x	x																						
Eucalyptus salubris								x	x			x		x			x			x																			
Eucalyptus stricklandii																										x			x									x	
Eucalyptus torquata																																	x		x				
Eucalyptus urna						x					x												x	x			x	x		x	x	x			x				
Eucalyptus ?virella																									x						x	x							
Exocarpos aphyllus	x			x					x		x		x				x	x			x				x		x	x	x	x		x			x	x	x		
Frankenia interioris								x																															
Frankenia interioris var. *interioris*				x			x					x	x																										
Frankenia sp.		x														x																							
Geijera linearifolia				x		x	x									x									x										x				
Goodenia quasilibera																										x			x										
Grevillea ?nematophylla subsp. *nematophylla*																																			x				
Grevillea haplantha subsp. *haplantha*																									x	x			x			x			x			x	

APPENDIX G: SUMMARY OF VASCULAR PLANT SPECIES RECORDED BY QUADRAT, CENTRAL NORSMEN GOLD PROJECT, TSF5 AND DESIRABLES

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2024d, WAH 1998-); Oppo - denotes opportunistically recorded taxon

	Taxon	DS01	DS02	DS03	DS04	DS05	DS06	DS07	DS08	DS09	DS10	DS11	DS12	DS13	DS14	DS15	DS16	DS17	DS18	DS19	DS20	DS21	OPPO (DES)	TF01	TF02	TF03	TF04	TF05	TF06	TF07	TF08	TF09	TF10	TF11	TF12	TF13	TF14	TF15	TF16	OPPO (TSF5)
	Halgania andromedifolia	x																				x						x	x									x		
	Hibbertia sp.																										x													
	Kippistia suaedifolia		x														x																							
	Lawrencia squamata		x														x								x															
	Leptospermopsis fastigiata																										x													
	Lomandra effusa																x																							
*	*Lysimachia arvensis*							x																																
	Maireana erioclada			x																																			
	Maireana pentatropis																				x																			
	Maireana ?pentatropis	x																x																						
	Maireana radiata																	x																	x					
	Maireana triptera	x							x						x			x								x		x						x						
	Maireana ?trichoptera				x			x	x		x		x		x					x					x	x								x	x				x		
*	*Medicago minima*							x																																
	Melaleuca ?lanceolata													x																										
	Melaleuca sheathiana	x			x		x	x	x	x		x	x		x			x	x	x	x	x				x		x	x	x	x	x					x	x		
	Melaleuca ?sheathiana																								x															
*	*Mesembryanthemum nodiflorum*																						x																	
	Myoporum platycarpum																																		x					
	Olearia muelleri								x	x					x											x		x			x							x		
*	*Oligocarpus calendulaceus*																																						x	
	Pimelea microcephala subsp. *microcephala*				x						x					x							x																	
	?*Pomaderris forrestiana*					x				x												x					x								x		x			
	Prostanthera grylloana																										x													
	Ptilotus obovatus var. *obovatus*	x		x			x		x	x												x				x	x		x			x		x	x			x		
	Rhagodia crassifolia				x										x					x	x					x							x							
	Rhagodia drummondii			x										x			x					x																		
	Rhodanthe oppositifolia																										x													
	Ricinocarpos stylosus	x																								x														
	Roepera ?aurantiaca subsp. *aurantiaca*	x							x				x	x				x		x						x		x			x			x					
	Roepera reticulata			x		x								x			x			x									x										
	Roepera sp.	x					x												x																			x		
	Santalum acuminatum	x		x		x	x					x		x	x			x		x		x				x	x	x	x	x			x	x			x	x	x	
	Sarcozona praecox		x														x						x																	x

APPENDIX G: SUMMARY OF VASCULAR PLANT SPECIES RECORDED BY QUADRAT, CENTRAL NORSMEN GOLD PROJECT, TSF5 AND DESIRABLES

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2024d, WAH 1998-); Oppo - denotes opportunistically recorded taxon

	Taxon	DS01	DS02	DS03	DS04	DS05	DS06	DS07	DS08	DS09	DS10	DS11	DS12	DS13	DS14	DS15	DS16	DS17	DS18	DS19	DS20	DS21	OPPO (DES)	TF01	TF02	TF03	TF04	TF05	TF06	TF07	TF08	TF09	TF10	TF11	TF12	TF13	TF14	TF15	TF16	OPPO (TSF5)
	Scaevola spinescens	x	x	x	x	x		x		x				x			x	x		x		x				x			x	x		x		x		x	x	x	
	Sclerolaena cuneata																							x															
	Sclerolaena diacantha				x		x	x	x	x					x			x			x				x			x	x		x			x	x		x			
	Sclerolaena ?*obliquicuspis*				x																			x																
	Senecio glossanthus																									x														
	Senecio lacustrinus																						x											x						
	Senna artemisioides subsp. *filifolia*					x		x		x										x		x				x	x			x			x	x	x	x				
	Siemssenia capillaris							x								x	x																							
	Solanum hoplopetalum	x																																						
	Solanum nummularium										x																													
*	*Sonchus asper*																																	x						
*	*Sonchus oleraceus*										x												x																	x
	Tecticornia sp.		x		x			x			x						x				x																		x
	Templetonia sp.			x																																			
	Thysanotus manglesianus															x				x																			
	Trichanthodium skirrophorum										x																													
	Triodia ?*scariosa*															x	x																							
	Trymalium myrtillus subsp. *myrtillus*																													x									
	Vincetoxicum lineare																													x									
	Waitzia fitzgibbonii								x																		x											x	
	Westringia rigida	x		x		x	x			x						x						x					x			x			x		x	x	x		

APPENDIX H: SUMMARY OF VASCULAR PLANT SPECIES RECORDED BY VEGETATION COMMUNITY

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2024b, WAH 1998-);
Oppo - denotes opportunistically recorded taxon

Taxon	NS5	NW10	NW11	NW13	NW16	NW17	NW4	NW5	NW7	S4	S7	W2	W4
Acacia erinacea										x	x		
Acacia ligulata						x							
Acacia nyssophylla	x												
Acacia pachypoda				x									
Allocasuarina acutivalvis subsp. *acutivalvis*										x			
Alyxia buxifolia		x	x	x	x		x			x	x	x	x
**Asphodelus fistulosus*								x					
Atriplex nana						x							
Atriplex nummularia subsp. *spathulata*		x							x				
Atriplex sp. 1		x				x	x		x	x	x		
Atriplex sp. 2	x	x			x		x	x	x	x	x	x	x
Austrostipa elegantissima	x												
Austrostipa ?elegantissima		x									x		
?Austrostipa elegantissima					x								
Austrostipa nitida													x
Austrostipa sp.						x							
Beyeria sulcata var. *brevipes*										x			
Brachyscome ciliaris								x					
Bromus ?arenarius								x					
Callitris columellaris			x										
Calotis hispidula													x
**Carrichtera annua*	x	x		x			x	x			x	x	x
Casuarina obesa			x										
**Centaurea melitensis*							x	x					
Cheilanthes sp.										x			
Convolvulus remotus								x					
Cratystylis conocephala	x	x			x		x		x		x	x	
Darwinia sp. *Karonie* (K. Newbey 8503)			x										
Dodonaea lobulata		x											
Dodonaea microzyga var. *acrolobata*				x			x			x	x		x
Enchylaena tomentosa				x									
Eremophila caerulea subsp. *caerulea*		x											
Eremophila decipiens subsp. *decipiens*	x							x					
Eremophila dempsteri		x			x		x						
Eremophila ?deserti	x						x		x				
Eremophila glabra subsp. *albicans*		x						x		x			x
Eremophila ?glabra subsp. *albicans*		x					x	x		x	x		
Eremophila interstans subsp. *interstans*		x			x								
?Eremophila parvifolia subsp. *auricampi*	x	x					x		x			x	
Eremophila psilocalyx	x	x					x			x	x	x	x
Eremophila purpurascens (P3)				x						x		x	x
Eremophila scoparia	x	x			x		x	x	x				
Eucalyptus brockwayii (P3)		x											
Eucalyptus dundasii											x	x	
Eucalyptus ?dundasii		x					x					x	
Eucalyptus gracilis						x							
Eucalyptus ?horistes	x												
Eucalyptus ?incrassata						x							
Eucalyptus kumarlensis	x					x							
Eucalyptus lesouefii		x		x			x		x	x		x	
Eucalyptus oleosa ?subsp. *oleosa*		x			x		x					x	
Eucalyptus ?platycorys	x					x							
Eucalyptus salubris							x		x				
Eucalyptus stricklandii										x			
Eucalyptus torquata							x						x
Eucalyptus urna		x									x		
Eucalyptus ?virella		x									x		
Exocarpos aphyllus	x	x		x	x		x		x	x	x	x	x
Frankenia interioris							x						

APPENDIX H: SUMMARY OF VASCULAR PLANT SPECIES RECORDED BY VEGETATION COMMUNITY

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2024b, WAH 1998-);
Oppo - denotes opportunistically recorded taxon

Taxon	NS5	NW10	NW11	NW13	NW16	NW17	NW4	NW5	NW7	S4	S7	W2	W4
Frankenia interioris var. *interioris*	x				x		x	x					
Frankenia sp.			x			x							
Geijera linearifolia		x			x	x		x			x		x
Goodenia quasilibera										x			
Grevillea haplantha subsp. *haplantha*										x	x		x
Grevillea ?*nematophylla* subsp. *nematophylla*													x
Halgania andromedifolia		x										x	
Hibbertia sp.										x			
Kippistia suaedifolia			x			x							
Lawrencia squamata		x	x			x							
Leptospermopsis fastigiata										x			
Lomandra effusa						x							
**Lysimachia arvensis*								x					
Maireana erioclada	x												
Maireana pentatropis									x				
Maireana ?*pentatropis*									x			x	
Maireana radiata							x		x				
Maireana ?*trichoptera*	x	x			x		x	x	x	x	x	x	
Maireana triptera		x					x		x		x	x	x
**Medicago minima*								x					
Melaleuca ?*lanceolata*	x												
Melaleuca sheathiana	x	x			x		x	x	x	x	x	x	
Melaleuca ?*sheathiana*		x											
Myoporum platycarpum				x									
Olearia muelleri		x					x		x		x		
Pimelea microcephala subsp. *microcephala*					x	x		x					
?*Pomaderris forrestiana*	x			x			x			x		x	
Prostanthera grylloana										x			
Ptilotus obovatus var. *obovatus*	x	x		x			x			x	x	x	x
Rhagodia crassifolia	x	x			x				x		x		
Rhagodia drummondii	x					x						x	
Rhodanthe oppositifolia										x			
Ricinocarpos stylosus											x	x	
Roepera ?*aurantiaca* subsp. *aurantiaca*	x	x					x		x		x	x	
Roepera reticulata	x	x				x							
Roepera sp.		x			x							x	
Santalum acuminatum	x	x							x	x	x	x	x
Sarcozona praecox			x			x							
Scaevola spinescens	x	x	x	x	x	x	x	x	x	x	x	x	x
Sclerolaena cuneata		x											
Sclerolaena diacantha		x			x		x	x	x	x	x		x
Sclerolaena ?*obliquicuspis*		x			x								
Senecio glossanthus											x		
Senecio lacustrinus							x						
Senna artemisioides subsp. *filifolia*	x			x			x	x		x	x	x	x
Siemssenia capillaris						x		x					
Solanum hoplopetalum												x	
Solanum nummularium								x					
**Sonchus asper*							x						
**Sonchus oleraceus*								x					
Tecticornia sp.			x		x	x		x	x				
Templetonia sp.	x												
Thysanotus manglesianus	x					x							
Trichanthodium skirrophorum								x					
Triodia ?*scariosa*						x							
Trymalium myrtillus subsp. *myrtillus*										x			
Vincetoxicum lineare										x			
Waitzia fitzgibbonii							x			x			
Westringia rigida	x	x		x		x	x			x	x	x	x

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description

Vegetation map code: NS5

Structural

Santalum acuminatum, *Melaleuca* spp. (*M.* ?*lanceolata*, *M. sheathiana*), *Eucalyptus* spp. tall open shrubland over *Eremophila scoparia*, *Cratystylis conocephala*, *Scaevola spinescens* low sparse shrubland on brown-orange sandy clay on slopes and flats

Associated species

Roepera reticulata

Soils and Landforms: Brown-orange sandy clay on slopes and flats.

Outcropping: Absent.

Average similarity: 42.05%

Total area: 40.58 ha

Proportion of TSF5 Survey Area: 0%

Proportion of Desirables Survey Area: 10.08%

Number of Quadrats: 4

Species richness: 13.8 ± 1.5 (s.e.)

Representative Photograph

Quadrat DS19

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: S4 **Structural** *Eucalyptus stricklandii* mid woodland over *Allocasuarina acutivalvis* subsp. *acutivalvis*, *Alyxia buxifolia*, *Scaevola spinescens* sparse mid-low shrubland on brown-red rocky clay loam slopes and rises. **Associated species** *Grevillea nematophylla* subsp. *nematophylla, ok* **Soils and Landforms:** Orange clay loam and ironstone outcropping. **Outcropping:** Moderate banded ironstone **Average similarity:** 42.19% **Total area:** 39.95 ha **Proportion of TSF5 Survey Area:** 23.69% **Proportion of Desirables Survey Area:** 0% **Number of Quadrats:** 3 **Species richness:** 18.3 ± 3.9 (s.e.)
Representative Photograph
 Quadrat TF07

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description

Vegetation map code: S7

Structural

Eucalyptus ?*virella*, *Eucalyptus* spp. mid sparse mallee shrubland over *Grevillea haplantha*, *Alyxia buxifolia*, *Exocarpos aphyllus* mid sparse shrubland over *Atriplex* sp. 1, *Acacia erinacea*, *Scaevola spinescens* low sparse shrubland on rocky brown sandy clay on slopes

Associated species

Senna artemisioides subsp. *filifolia*

Soils and Landforms: Rocky brown sandy clay on slopes.

Outcropping: Absent.

Average similarity: 55.13%

Total area: 4.94 ha

Proportion of TSF5 Survey Area: 2.93%

Proportion of Desirables Survey Area: 0%

Number of Quadrats: 2

Species richness: 23.0 ± 1.0 (s.e.)

Representative Photograph

Quadrat TF03

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description

Vegetation map code: W2

Structural

Woodland to open woodland of *Eucalyptus flocktoniae*, *E. urna*, *E. lesouefii* and *E. dundasii* over sparse shrubland of *Melaleuca sheathiana*, *Eremophila scoparia*, *Scaevola spinescens*, *Beyeria sulcata* and *Exocarpos aphyllus* over isolated shrubs of *Olearia muelleri* on orange-red to brown clayey loam on flats and slopes.

Associated species

Eremophila scoparia, *Senna artemisioides* subsp. *filifolia, Alyxia buxifolia.*

Soils and Landforms: Orange-red to brown clayey loam on flats and slopes.

Outcropping: Either absent of moderate ironstone.

Average similarity: 32.64%

Total Area: 30.77 ha

Proportion of TSF5 Survey Area: 2.56%

Proportion of Desirables Survey Area: 6.57%

Number of Quadrats: 3

Species richness: 14.7 ± 2.3 (s.e.)

Representative Photograph

Quadrat DS01

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: W4 **Structural** Open woodland of *Eucalyptus torquata* over *Melaleuca sheathiana*, *Dodonaea microzyga*, *Alyxia buxifolia*, *Beyeria* spp. and *Eremophila* spp. over *Scaevola spinescens* and *Ptilotus obovatus* on red-brown clayey loam with surface rocks on slopes and ridges. **Associated species** *Exocarpos aphyllus*, *Myoporum platycarpum*, *Ptilotus obovatus, Senna artemisioides subsp. filifolia, Trymalium myrtillus subsp. myrtillus.* **Soils and Landforms:** Red-brown clayey loam with surface rocks on slopes and ridges. **Outcropping:** Moderate ironstone or possible quartz. **Average similarity:** 41.88% **Total Area:** 5.52 ha **Proportion of TSF5 Survey Area:** 3.28% **Proportion of Desirables Survey Area:** 0% **Number of Quadrats:** 1 **Species richness:** 23 ± 0.0 (s.e.)
Representative Photograph
 Quadrat TF13

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description

Vegetation map code: NW4

Structural
Open low woodland of *Eucalyptus lesouefii* over tall isolated clumps of *Melaleuca ?sheathiana* and *Eremophila* spp. shrubs over low isolated clumps of *Cratystylis conocephala* shrubs.

Associated species

Atriplex ?vesicaria.

Soils and Landforms: Brown sandy clayey loam with some surface rocks on flats and gentle slopes.

Outcropping: Absent.

Average similarity: 37.76%

Total Area: 64.69 ha

Proportion of TSF5 Survey Area: 1.99%

Proportion of Desirables Survey Area: 15.23%

Number of Quadrats: 4

Species richness: 15.8 ± 2.4 (s.e.)

Representative Photograph

Quadrat DS12

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description

Vegetation map code: NW5

Structural

Mid woodland of *Eucalyptus lesouefii* and *Eucalyptus salubris* over mid isolated shrubs of *Eremophila scoparia* and occasional low *E. parvifolia* ?subsp. *auricampi* shrubs over open low chenopod shrubland of *Tecticornia* spp. and *Atriplex* spp. on orange to brown sandy clay with some surface gravel on flats and gentle slopes.

Associated species

Maireana spp., *Atriplex* spp.

Soils and Landforms: Orange to brown sandy clay with some surface gravel on flats and gentle slopes.

Outcropping: Absent.

Average similarity: 35.98%

Total Area: 5.12 ha

Proportion of TSF5 Survey Area: 0%

Proportion of Desirables Survey Area: 1.27%

Number of Quadrats: 2

Species richness: 15.5 ± 0.5 (s.e.)

Representative Photograph

Quadrat DS07

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: NW7 **Structural** Low woodland of *Eucalyptus salubris* and *E. lesouefii* over tall sparse shrubland of *Melaleuca* ?*sheathiana* or *M. lanceolata* over mid-low sparse shrubland of *Atriplex* ?*nummularia* and *Atriplex* ?*vesicaria* on red to brown sandy clay with scattered surface rocks on flats and lower slopes. **Associated species** *Eremophila scoparia, Santalum acuminatum* **Soils and Landforms:** Red to brown sandy clay with scattered surface rocks on flats and lower slopes. **Outcropping:** **Average similarity:** 46.77% **Total area:** 83.93 ha **Proportion of TSF5 Survey Area:** 0% **Proportion of Desirables Survey Area:** 20.85% **Number of Quadrats:** 3 **Species richness:** 13.7 ± 1.1 (s.e.)
Representative Photograph
 Quadrat DS20

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: NW10 **Structural** Mid woodland of mixed *Eucalyptus* spp. over tall sparse shrubland of *Melaleuca* ?*sheathiana* over open mid-low shrubland of *Atriplex* spp. on brown clayey loam with some surface rocks on gentle mid to upper slopes. **Associated species** *Eucalyptus distuberosa* subsp. *distuberosa, E. dundasii, E.* ?*urna, ?Geijera linearifolia, Alyxia buxifolia, Scaevola spinescens.* **Soils and Landforms:** Brown clayey loam with some surface rocks on gentle mid slopes. **Outcropping:** Absent. **Average similarity:** 36.95% **Total area:** 143.52 ha **Proportion of TSF5 Survey Area:** 58.47% **Proportion of Desirables Survey Area:** 11.16% **Number of Quadrats:** 9 **Species richness:** 11.2 ± 2.1 (s.e.)
Representative Photograph
 Quadrat TF15

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: NW11 **Structural** Open low woodland of *Casuarina obesa* over low isolated clumps of Chenopodiaceae sp. and Aizoaceae sp. shrubs and isolated tussock grassland on dry, powdery pale orange clay on low dune ridges and flats at the edge of salt lakes. **Associated species** *Maireana appressa.* **Soils and Landforms:** Dry, powdery cream clay on low dune ridges at the edge of salt lakes. **Outcropping:** Absent. **Average similarity:** 43.08% **Total area:** 2.59 ha **Proportion of TSF5 Survey Area:** 0% **Proportion of Desirables Survey Area:** 0.64% **Number of Quadrats:** 1 **Species richness:** 11.0 ± 0.0 (s.e.)
Representative Photograph
 Quadrat DS02

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: NW13 **Structural** Low open forest of mixed *Eucalyptus* spp. over mid sparse shrubland of *Eremophila scoparia* and other mixed mid shrubs on pale brown clay on gentle lower slopes and flats in areas disturbed in the past. **Associated species** *Maireana amoena, Acacia merrallii.* **Soils and Landforms:** Pale brown clay on gentle lower slopes and flats in areas disturbed in the past. **Outcropping:** Absent. **Average similarity:** 25.45% **Total area:** 2.34 ha **Proportion of TSF5 Survey Area:** 1.39% **Proportion of Desirables Survey Area:** 0% **Number of Quadrats:** 1 **Species richness:** 14.0 ± 0.0 (s.e.)
Representative Photograph
 Quadrat TF12

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: NW16 **Structural** *Eucalyptus oleosa* mid sparse mallee shrubland over *Cratystylis conocephala*, *Melaleuca sheathiana* mid open shrubland over *Atriplex* sp. 2 low sparse shrubland on orange clay on flats. **Soils and Landforms:** Orange clay flats. **Outcropping:** Absent. **Average similarity:** 68.19% **Total area:** 94.19 ha **Proportion of TSF5 Survey Area:** 0% **Proportion of Desirables Survey Area:** 23.40% **Number of Quadrats:** 2 **Species richness:** 13.5 ± 3.5 (s.e.)
Representative Photograph
 Quadrat DS04

APPENDIX I: A SUMMARY OF VEGETATION COMMUNITIES RECORDED WITHIN TSF5 AND DESIRABLES SURVEY AREAS, SEPTEMBER 2024

Vegetation Community Description
Vegetation map code: NW17 **Structural** *Eucalyptus platycorys*, *Eucalyptus* spp. mid sparse mallee shrubland over *Lawrencia squamata*, *Lomandra effusa*, *Westringia rigida* low sparse shrubland over *Triodia scariosa* low isolated hummock grasses on brown-orange sandy clay on flats and slopes. **Associated species** *Tecticornia* sp., *Pimelea microcephala* and *Scaevola spinescens.* **Soils and Landforms:** Brown-orange sandy clay on flats and lower slopes. **Outcropping:** Absent. **Average similarity:** 30.03% **Total area:** 17.88 ha **Proportion of TSF5 Survey Area:** 0% **Proportion of Desirables Survey Area:** 4.44% **Number of Quadrats:** 2 **Species richness:** 13.0 ± 4.0 (s.e.)
Representative Photograph
 Quadrat DS15

APPENDIX 4: WESTERN WILDLIFE, 2024: NORSEMAN GOLD PROJECT BASIC VERTEBRATE FAUNA SURVEY AND TARGETED MALLEEFOWL SURVEY OF TSF5 AND DESIRABLES.

Norseman Gold Project:

Basic Vertebrate Fauna Survey and Targeted Malleefowl Survey of TSF5 and Desirables, 2024

Prepared for: Pantoro Limited

Prepared by: Western Wildlife
570 Clare Rd
Hovea WA 6071
Ph 0427 510 934

December 2024

Executive Summary

Introduction

Pantoro South Pty Ltd (Pantoro) operate the Norseman Gold Project in the Goldfields region of Western Australia. As they propose to extend their mining footprint, Pantoro commissioned Western Wildlife to carry out a basic vertebrate fauna survey of the expansion areas in October 2024. Malleefowl (*Leipoa ocellata*) are known to occur in the region so the survey also included a component to target this species.

The aims of the fauna survey were to:

- Identify the fauna habitats present in the study area.
- Survey the area for evidence of Malleefowl presence.
- List the vertebrate fauna that were recorded in the study area and/or have the potential to occur in the study area.
- Identify species of conservation significance, or habitats of particular importance for fauna, that potentially occur in the study area.

Methods

The fauna survey was undertaken in accordance with *Environmental factor guideline – terrestrial fauna* (EPA 2016), *Technical guidance: terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) and relevant State and Federal Guidelines on surveying conservation significant fauna.

The desktop survey included searches of relevant databases, previous fauna reports and literature on the distribution, ecology and status of vertebrate fauna in the region.

The field survey was carried out on the 10th -11th October 2024, and included:

- Fauna habitat identification.
- Targeted survey for signs of the Malleefowl (*Leipoa ocellata*), walking 75km of transect.
- Keeping opportunistic records of all vertebrate fauna observed.

Species of conservation significance were classified as: **Threatened** if listed as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or *Biodiversity Conservation Act 2016* (BC Act); **Migratory** if listed as Migratory under the EPBC Act and/or BC Act, excluding those species also listed as threatened; **Specially Protected** if listed as Other Specially Protected Species or Conservation Dependent Fauna under the BC Act; **Priority** if listed as Priority by DBCA and **Locally Significant** if considered by the author to potentially be of local significance.

Results and Discussion

Fauna Habitats

Six fauna habitats were identified across the study areas:

- Eucalypt woodland on rocky hills
- Eucalypt woodland on plains
- Mallee woodland over spinifex
- Shrubland on sandy lake edges
- Gypsum dune
- Rehabilitation

The habitats present are common in the region. Habitats that are less common in the region, such as granite outcrops or freshwater wetlands, were absent from the study area. Although all habitats have importance in supporting native fauna, the habitats of the study area are unlikely to be of particular significance as ecological linkages or refugia.

Faunal Assemblage

The faunal assemblage of the study area is likely to be largely intact, as the study area is situated within a larger tract of native vegetation. Many of the species that occur are widely distributed through semi-arid Australia. The predicted faunal assemblage includes up to nine frogs, 66 reptiles, 159 birds, 24 native mammals and eight introduced mammals, noting that only a subset of these are likely to be present due to the small size of the study area and the lack of some habitats available elsewhere in the local area. The observed assemblage on this survey included no frogs, two reptiles, 34 birds, one native mammal and three introduced mammals.

Vertebrate Conservation Significant Fauna

A total of 18 conservation significant fauna may occur in the vicinity of the study areas: seven Threatened, four Migratory, one Specially Protected and six Priority species.

Threatened Species

Seven Threatened species potentially occur in the study area:

- Curlew Sandpiper (*Calidris ferruginea*) – EPBC Act (Critically Endangered and Migratory), BC Act (Critically Endangered)
- Night Parrot (*Pezoporus occidentalis*) – EPBC Act (Endangered), BC Act (Critically Endangered)
- Common Greenshank (*Tringa nebularia*) – EPBC Act (Endangered and Migratory), BC Act (Migratory)
- Sharp-tailed Sandpiper (*Calidris acuminata*) – EPBC Act (Vulnerable and Migratory), BC Act (Migratory)
- Southern Whiteface (*Aphelocephala leucopsis*) – EPBC Act (Vulnerable)
- Chuditch (*Dasyurus geoffroii*) – EPBC Act (Vulnerable), BC Act (Vulnerable)
- Malleefowl (*Leipoa ocellata*) – EPBC Act (Vulnerable), BC Act (Vulnerable)

No Threatened species were recorded on the fauna survey. The Chuditch possibly occurs in woodlands in low densities, but it is likely that study areas are outside the current distribution of this species. The Malleefowl is known to occur in the region and potentially occurs, at least as a foraging visitor, however, no evidence of the Malleefowl was recorded in the study area despite 75km of transects walked. The Southern Whiteface possibly occurs on occasion, but the study area is south of the usual range of this species and there are no nearby records on databases. The study area lacks any habitat to support the Curlew Sandpiper, Sharp-tailed Sandpiper or Common Greenshank, although these species may occur nearby. The study area lacks any spinifex of sufficient height or density to support the Night Parrot.

Migratory species

Four Migratory species may occur in the study area:

- Common Sandpiper (*Actitis hypoleucos*) – EPBC Act (Migratory), BC Act (Migratory)
- Red-necked Stint – (*Calidris ruficollis*) – EPBC Act (Migratory), BC Act (Migratory)
- Pectoral Sandpiper (*Calidris melanotos*) – EPBC Act (Migratory), BC Act (Migratory)
- Fork-tailed Swift (*Apus pacificus*) – EPBC Act (Migratory), BC Act (Migratory)

The study area lacks any habitat to support the Common Sandpiper, Red-necked Stint or Pectoral Sandpiper, although these species may occur nearby. The Fork-tailed Swift is a Migratory species that is thought to be almost entirely aerial when visiting Australia, so the study area is not likely to provide important habitat for this species.

Specially Protected species

One Specially Protected species potentially occurs in the study area:

- Peregrine Falcon (*Falco peregrinus*) – BC Act (Other Specially Protected)

The Peregrine Falcon is likely to occur as a foraging visitor and may breed in abandoned open pits.

Priority species

Six Priority species may occur in the study area, of which one was recorded:

- Lake Cronin Snake (*Paroplocephalus atriceps*) – Priority 3
- Central Long-eared Bat (*Nyctophilus major tor*) – Priority 3
- Hooded Plover (*Thinornis cucullata*) – Priority 4
- Inland Western Rosella (*Platycercus icterotis xanthagenys*) – Priority 4
- Blue-billed Duck (*Oxyura australis*) - Priority 4
- Western Brush Wallaby (*Notamacropus irma*) – Priority 4

The Inland Western Rosella was recorded during this fauna survey and is likely to occur in eucalypt woodlands, potentially breeding in tree hollows. The Central Long-eared Bat is known to occur in the region and is likely to occur in eucalypt woodlands. The Western Brush Wallaby may occur in woodland habitats, but the study areas represent the extreme eastern edge of this species range. The Lake Cronin Snake possibly occurs, but it is rarely recorded. The study area lacks any habitat to support the Hooded Plover or Blue-billed Duck, although these species may occur nearby.

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1. Introduction

Pantoro South Pty Ltd (Pantoro) operate the Norseman Gold Project in the Goldfields region of Western Australia. As they propose to extend their mining footprint, Pantoro commissioned Western Wildlife to carry out a basic vertebrate fauna survey of the expansion areas and associated infrastructure in October 2024. Malleefowl (*Leipoa ocellata*) are known to occur in the region so the survey also included a component to target this species.

The aims of the fauna survey were to:

- Identify the fauna habitats present in the study area.
- Survey the area for evidence of Malleefowl presence.
- List the vertebrate fauna that were recorded in the study area and/or have the potential to occur in the study area.
- Identify species of conservation significance, or habitats of particular importance for fauna, that potentially occur in the study area.

This report details the combined findings of the desktop survey, basic fauna survey and targeted Malleefowl survey conducted between June 2020 and January 2021.

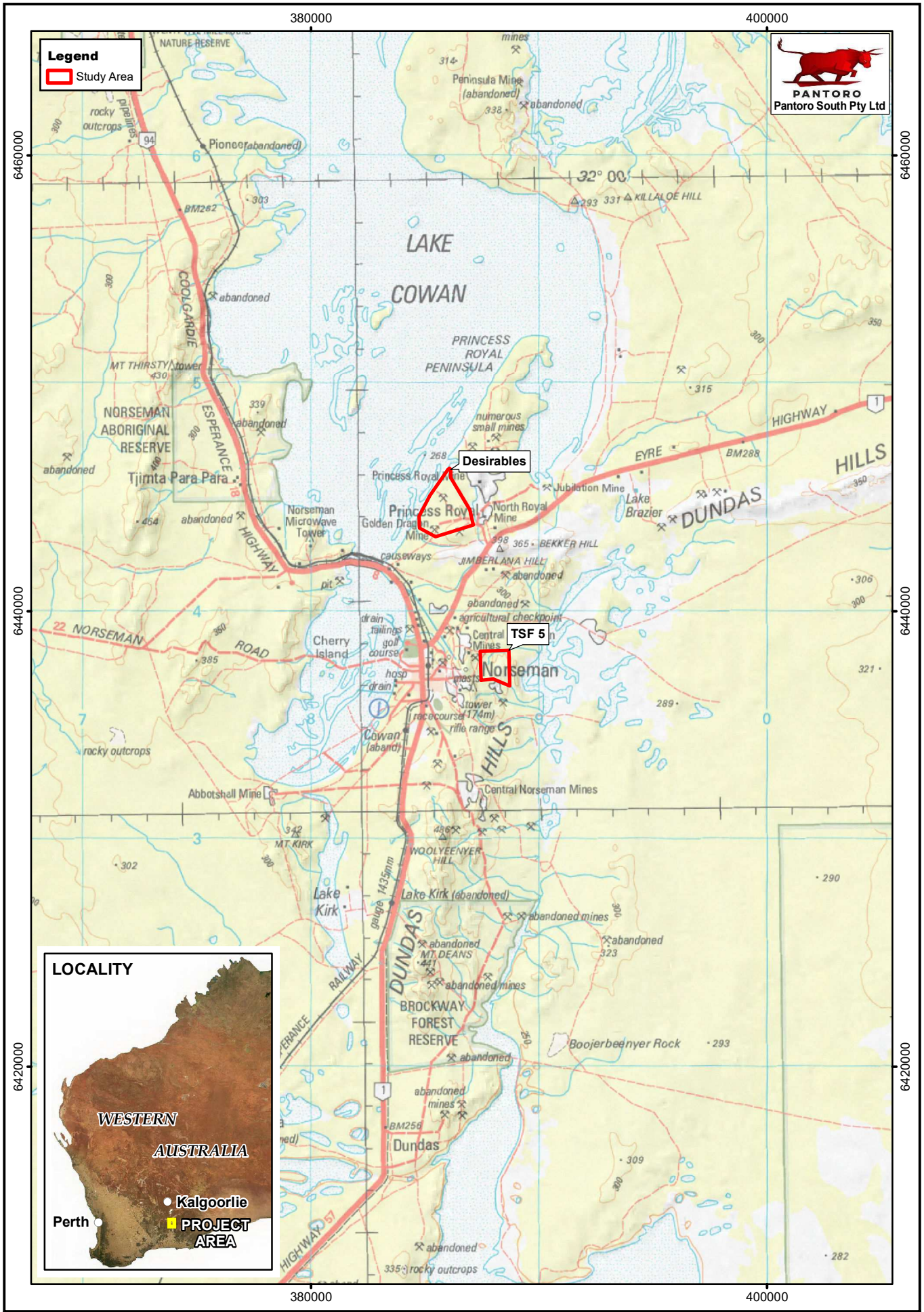
1.1 The Study Area

The Norseman Gold Project is located in the Shire of Dundas in the Goldfields region of Western Australia. The Project is in the vicinity of the town of Norseman and about 160km south of Kalgoorlie (Figure 1). The overall study area of 571.2ha is comprised of two separate areas, TSF5 (168.6ha) and Desirables (402.6ha).

1.2 Regional Context

1.2.1 Parks and Reserves

The study area does not overlap any reserves, but an un-named Conservation Reserve of 930ha occurs within 1km of the Desirables study area (Figure 2). The southern boundary of the 2,610 ha Brockway Forest Reserve is adjacent to the Maybelle Haul Road and the very large 780,000 ha Dundas Nature Reserve is located 13.5km southeast of the TSF5 study area.



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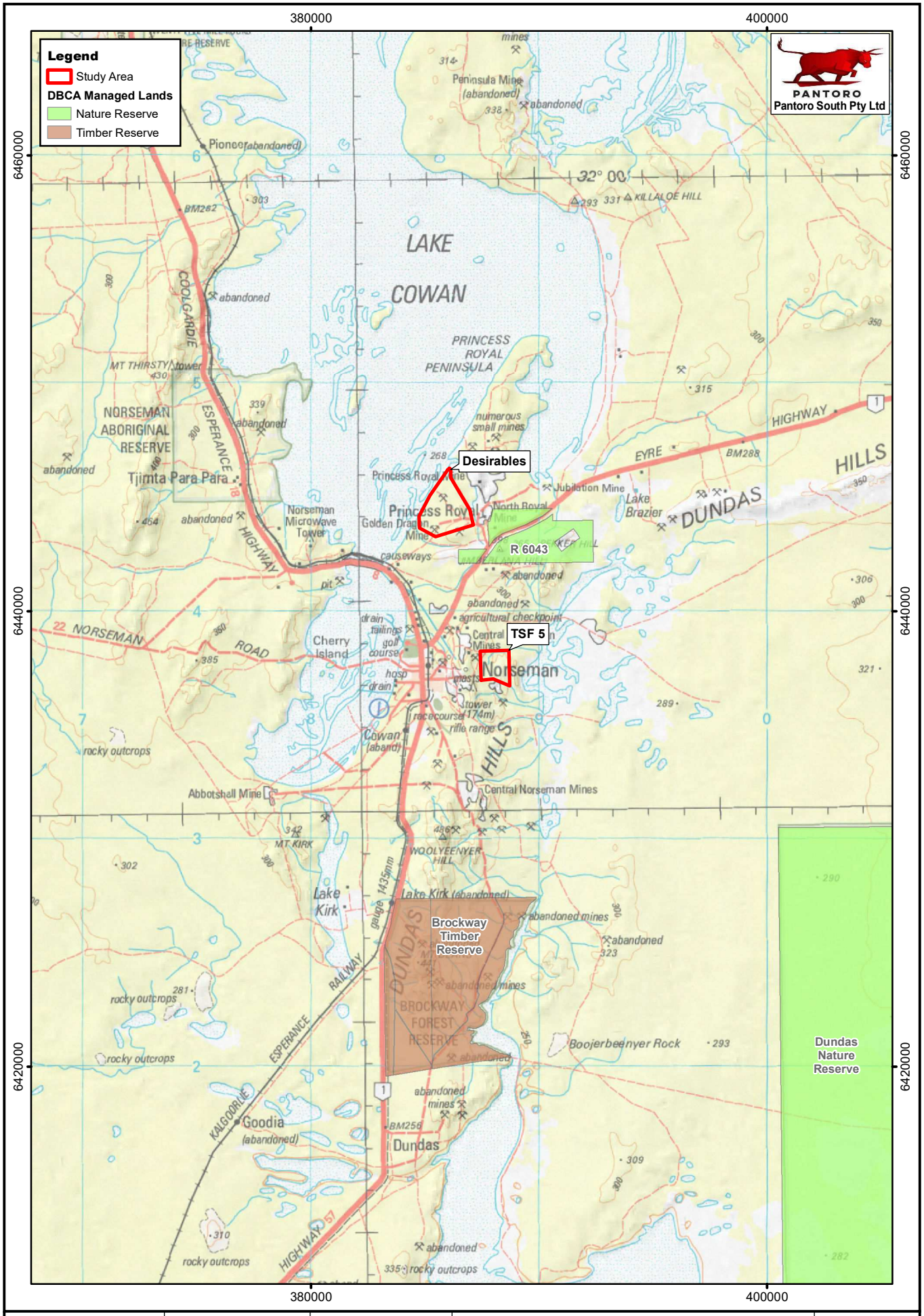
Date: December 2024 | Rev: B | Author: J. Wilcox				


Legend
Study Area
DBCA Managed Lands
Nature Reserve
Timber Reserve
PANTORO
Pantoro South Pty Ltd
380000
400000
6460000
6440000
6420000
Desirables
R 6043
TSF 5
Brockway Timber Reserve
Dundas Nature Reserve
LAKE COWAN
PRINCESS ROYAL PENINSULA
NORSEMAN ABORIGINAL RESERVE
Tjimta Para Para
Norseman
Cherry Island
Cowan (abandd)
Lake Kirk
Lake Kirk (abandoned)
Goodia (abandoned)
Dundas
Central Norseman Mines
Abbotshall Mine
Princess Royal Mine
Golden Dragon Mine
North Royal Mine
Jubilation Mine
Peninsula Mine (abandoned)
Pioneer (abandoned)
Norseman Microwave Tower
MT THIRSTY tower
COOLGARDIE ESPERANCE HIGHWAY
NORSEMAN ROAD
EYRE HIGHWAY
DUNDAS HILLS
KALGOORLIE ESPERANCE RAILWAY
HIGHWAY 57
BROCKWAY FOREST RESERVE
Boojerbeenyer Rock
KILLALOE HILL
WOOLYEENYER HILL
MT KIRK
Lake Brazier
32° 00'
numerous small mines
abandoned mines
rocky outcrops
agricultural checkpoint
racecourse (174m)
rifle range
causeways
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Author: J. Wilcox
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1.2.2 IBRA Bioregion

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the land surface of Australia into 89 Bioregions and 419 subregions, each defined by a set of environmental influences that impact the occurrence of flora and fauna and their interaction with the physical environment (DoEE 2018).

The study area lies in the Eastern Goldfields Subregion (COO3) of the Coolgardie Bioregion of the IBRA classification system (DoEE 2018). The subregion is characterised by gently undulating plains with low greenstone hills in the east and a series of large playa lakes (Cowan 2001). The vegetation is dominated by mallees, *Acacia* thickets and shrublands, with diverse eucalypt woodlands on the ridges, valleys and around salt lakes (Cowan 2001). The salt lakes also support low samphire shrublands (Cowan 2001).

Special fauna values of this subregion include Rowles Lagoon, Clear and Muddy Lakes, a large system of semi-permanent freshwater wetlands that supports up to 41 species of waterbird, and Swan Lake, a semi-permanent freshwater lake in which water persists longer than on surrounding lakes, thus providing a refuge for waterbirds (Cowan 2001).

1.2.3 Botanical Province

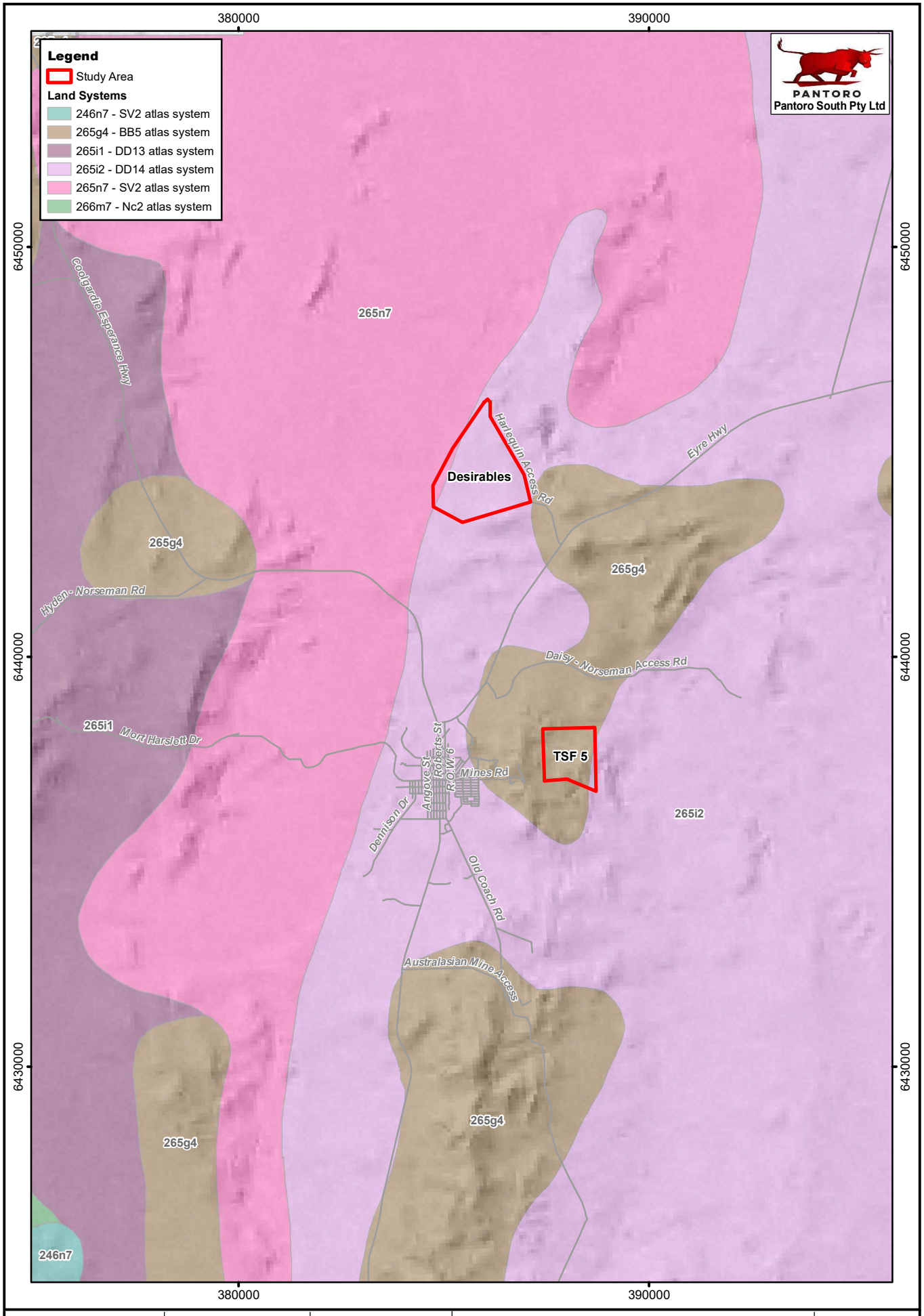
The Botanical Provinces are determined by vegetation mapping (Beard 1980) and broadly correspond to climactic regions; the Southwest (Bassian) Province experiencing warm dry summers and cool wet winters, the Northern Province experiencing warm wet summers and cool dry winters and the Eremaean Province experiencing low, irregular rainfall. The study area is in Southwest Interzone, the transitional area between the Bassian and Eremaean Provinces.

1.2.4 Land Systems

Land systems are broad descriptions of landform, geology and soils. The study areas intersect four land systems (Figure 3), which are characterised as follows:

- **DD14:** Flat to undulating land with small valleys occasionally broken by low narrow rocky hills and ridges, or tors and bosses.
- **BB5:** Rocky ranges and hills of greenstones – basic igneous rocks.
- **SV2:** Saline valleys with some dunes including barchan forms – salt lake channels, mostly devoid of true soils, and their fringing areas.

The TSF5 study area is comprised mainly of the BB5 land system, with some DD14, and the Desirables study area is comprised mainly of the DD14 land system, with some SV2.



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CAD Ref: a2783Fa0014_03 | A4				
Date: December 2024 | Rev: B	Author: J. Wilcox			

1.2.5 Great Western Woodlands

The study area is within the Great Western Woodlands (GWW), a 16-million-hectare area extending from the wheatbelt to the edge of the deserts that is the largest intact area of Mediterranean Woodland on earth (DEC 2010). The GWW includes open eucalypt woodlands (63%), mallee eucalypt woodlands, shrublands and grasslands (Fox *et al*. 2016). Less common habitats in the GWW include granite outcrops, banded ironstone formations, salt lakes and freshwater wetlands (Fox *et al*. 2016). The relative intactness of the GWW is recognised as a key value (Fox *et al*. 2016), in that it provides connectivity for birds in a landscape that varies both spatially and temporally. The south-western half of the GWW provides habitat for many birds that are locally extinct or have reduced populations in the adjacent and substantially cleared wheatbelt (Fox *et al*. 2016).

1.3 Climate and Weather

The climate of the IBRA subregion is arid to semi-arid with 200 – 300mm annual rainfall, usually in winter (Cowan 2001). The climate statistics for Norseman Aero (Bureau of Meteorology Weather Station 012009) are presented in Figure 4. This weather station has been in operation since 1999, so the long-term monthly rainfall is an average based on 24 years of data. The annual rainfall over this period averages 279.3mm and the annual rainfall in 2023 was a little below average at 222.8mm. The rainfall in the months prior to the fauna survey were below average for the summer and above average for winter. Weather during the fauna survey was warm and dry.

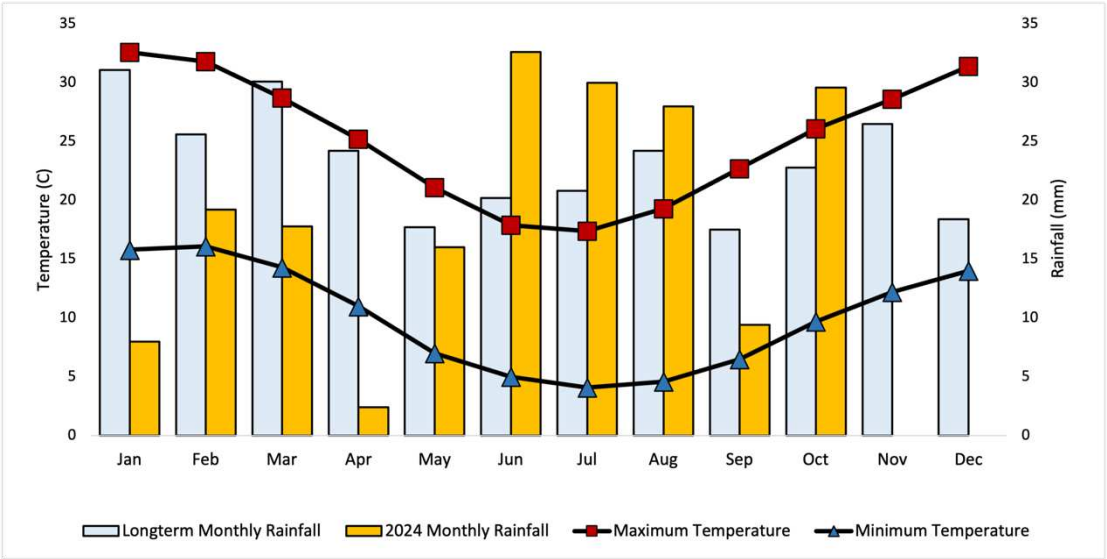


Figure 4. Mean monthly temperature and rainfall at Norseman Aero.

2. Methods

2.1 Overview

The fauna survey included a search of available literature and databases (a 'desktop' study), and a field survey. The field survey comprised a two-day site visit in October 2024 including the following two components: a basic vertebrate fauna survey and a targeted Malleefowl survey. The field survey served to put the desktop study into context, as well as allowing for the identification of fauna habitats and likely fauna assemblages of the site. The targeted survey was designed to provide additional data on a key Threatened species known to occur in the region.

2.2 Guidance and Licencing

The fauna survey was conducted with reference to the following documents:

- Environmental factor guideline – terrestrial fauna (EPA 2016)
- Technical guidance: terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)
- Survey guidelines for Australia's threatened birds (DEWHA 2010)
- National Malleefowl Monitoring Manual (National Malleefowl Recovery Team 2020)

As the fauna survey was observational only, no Fauna Taking (Biological Assessment) Licence was required.

2.3 Personnel

Two zoologists from Western Wildlife carried out the fauna survey (Table 1). Each has many years' experience in fauna studies, have previously undertaken surveys in the bioregion and have undertaken targeted surveys for Malleefowl.

Table 1. Fauna survey personnel.

Name	Role	Qualification	Experience
Jenny Wilcox	Supervising Zoologist (plan and lead fieldwork, prepare report)	BSc.Biol./Env.Sci., Hons.Biol.	24 years
Brenden Metcalf	Field zoologist (collect data)	BSc.Biol./Env.Sci., Hons.Biol.	24 years

2.4 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report follow the Western Australian Museum checklists.

2.5 Literature Review

Lists of fauna expected to occur in the study area were produced using information from a number of sources. These included publications that provide information on general patterns of distribution of frogs (Tyler *et al*. 2000), reptiles (Storr *et al*. 1983, 1990, 1999 and 2002, Wilson and Swan 2017), birds (Barrett *et al*. 2003; Johnstone and Storr 1998; Johnstone and Storr 2004) and mammals (Churchill 2007, Menkhorst and Knight 2011; Van Dyck and Strahan 2008).

The databases in Table 2 were searched for fauna records in and around the study area. Some species may occur on database results that are not likely to be present in the study area, usually due either to lack of suitable habitat or the study area being outside the known range of the species (i.e. erroneous records or records of vagrants). Where possible, these species are not included in lists of expected fauna.

Table 2. Databases used in the preparation of this report.

Database	Type of records held on database	Area searched
Dandjoo Database	Observational and specimen records from several sources including the Western Australian Museum and the DBCA Fauna Survey Database.	-32.1634°S, 121.8066°E with a 40km buffer.
ALA Database (ALA 2024)	Observational and specimen records from several sources including the Western Australian Museum, interstate museums, iNaturalist, Historical Bird Atlas, Birds Australia Birdata, ebird and others.	Study area with a 40km buffer.
DBCA's Threatened and Priority Fauna Database (DBCA 2024)	Records of Threatened and Priority species in Western Australia, also drawing from the databases above.	387250 E, 6441000 N (Zone 51) with a 70km buffer.
EPBC Act Protected Matters Search Tool	Records on matters protected under the EPBC Act, including Threatened species.	Study area with a 40km buffer.

In addition, the results of the following fauna survey reports were used to compile the fauna lists:

- *The Biological Survey of the Eastern Goldfields of Western Australia Part 9: Norseman Balladonia Study Area* (Hall and McKenzie 1993). One of the sites in this study, at Jyndabinbin Rocks in Dundas Nature Reserve, is located about 45km east of the study area. The survey was undertaken in October 1979, August 1980 and February 1989.

- *Fauna Survey of the Proposed Harlequin Gold Mine Development Site* (Halpern Glick Maunsell 1994). The Harlequin Gold Mine is adjacent to the Slippers survey area. The survey was undertaken in February 1994 and comprised four trapping sites (two with six pitfall traps, 12 Elliott traps and two cage traps; two with 12 Elliott traps only), spot-lighting, hand-searching and bird surveys. A total of seven reptiles, 36 birds, three or four native mammals and two introduced mammals were recorded. No species currently listed as conservation significant were recorded.

- *Fauna Monitoring Program: Baseline Fauna Survey 1998 – 1999* (Ecologia 1999). The survey sites in this study are in the vicinity of the Cobbler, Slippers and Gladstone study areas. The survey was undertaken in October 1998 and March 1999 and comprised eleven trapping sites (each with five pitfall traps and 20 Elliott traps), spot-lighting, hand-searching, mist-netting for bats and bird surveys. A total of six frogs, 42 reptiles, 82 birds 13 native mammals and five introduced mammals were recorded. One species of conservation significance was recorded: the Peregrine Falcon (*Falco peregrinus*).

- *Mt Henry Study Area Baseline Fauna Survey: Level 2 Fauna Survey 2012 & 2013* (Western Wildlife 2013). This survey overlaps the Maybelle study area. The survey was undertaken in November 2012 and February 2013 and comprised trapping at ten sites (each with ten pitfalls, ten funnel traps, ten Elliott traps and two cage traps), spotlighting, bat survey with bat detectors and mist-nets and bird surveys. A total of one frog, 44 reptiles, 74 birds 13 native mammals and seven introduced mammals were recorded. Four species currently listed as conservation significant were recorded: the Peregrine Falcon (*Falco peregrinus*), Inland Western Rosella (*Platycercus icterotis xanthogenys*), Red-necked Stint (*Calidris ruficollis*) and Hooded Plover (*Thinornis cucullata*). Long-inactive Malleefowl (*Leipoa ocellata*) mounds were also recorded.

- *Flora, vegetation and vertebrate fauna survey on proposed tailings dam* (Mattiske Consulting Pty Ltd and Ninox Wildlife Consulting 2005). This survey overlaps the TSF4 study area. The survey was undertaken in February 2005 and comprised opportunistic observations only. A total of one reptile, 21 birds, one native mammal and two introduced mammals were recorded. No species currently listed as conservation significant were recorded.

- *Report for Brockway Exploration Area: Flora and Fauna Assessment May 2010* (GHD 2010). This survey was in the Brockway Forest Reserve, located between Norseman and the Maybelle study area. The survey was undertaken in May 2010 and comprised opportunistic observations only. A total of seven reptiles, 31 birds, three native mammal and four introduced mammals were recorded. No species currently listed as conservation significant were recorded.

- *Baseline Environmental Study: Lake Cowan* Outback Ecology (2003). This survey was undertaken on Lake Cowan in June 2003 and comprised a targeted waterbird survey. Four species were recorded: the Hooded Plover (3 birds), Red-capped Plover (30 birds), Pink-eared Duck (6 birds) and Australian Shelduck (50 birds). One species currently listed as conservation significant was recorded: the Hooded Plover.
- *Biological Monitoring of Lake Cowan, January 2006* (Outback Ecology 2006). This survey was undertaken on Lake Cowan in June 2003 and comprised a targeted waterbird survey and opportunistic observations of fauna. A total of 1 reptile, 23 species of bird, one native mammal and 5 introduced mammals were recorded. No species currently listed as conservation significant were recorded.
- *Norseman Gold Project Basic Vertebrate Fauna Survey and Targeted Malleefowl Survey 2020* (Western Wildlife 2021). This survey was undertaken across several sites, two of which were adjacent to the study areas, and included 153km of transect searching for Malleefowl mounds. A total of 46 birds, and 5 introduced mammals were recorded. One conservation significant species was recorded: the Inland Western Rosella.

2.6 Field Studies

2.6.1 Basic Fauna Survey

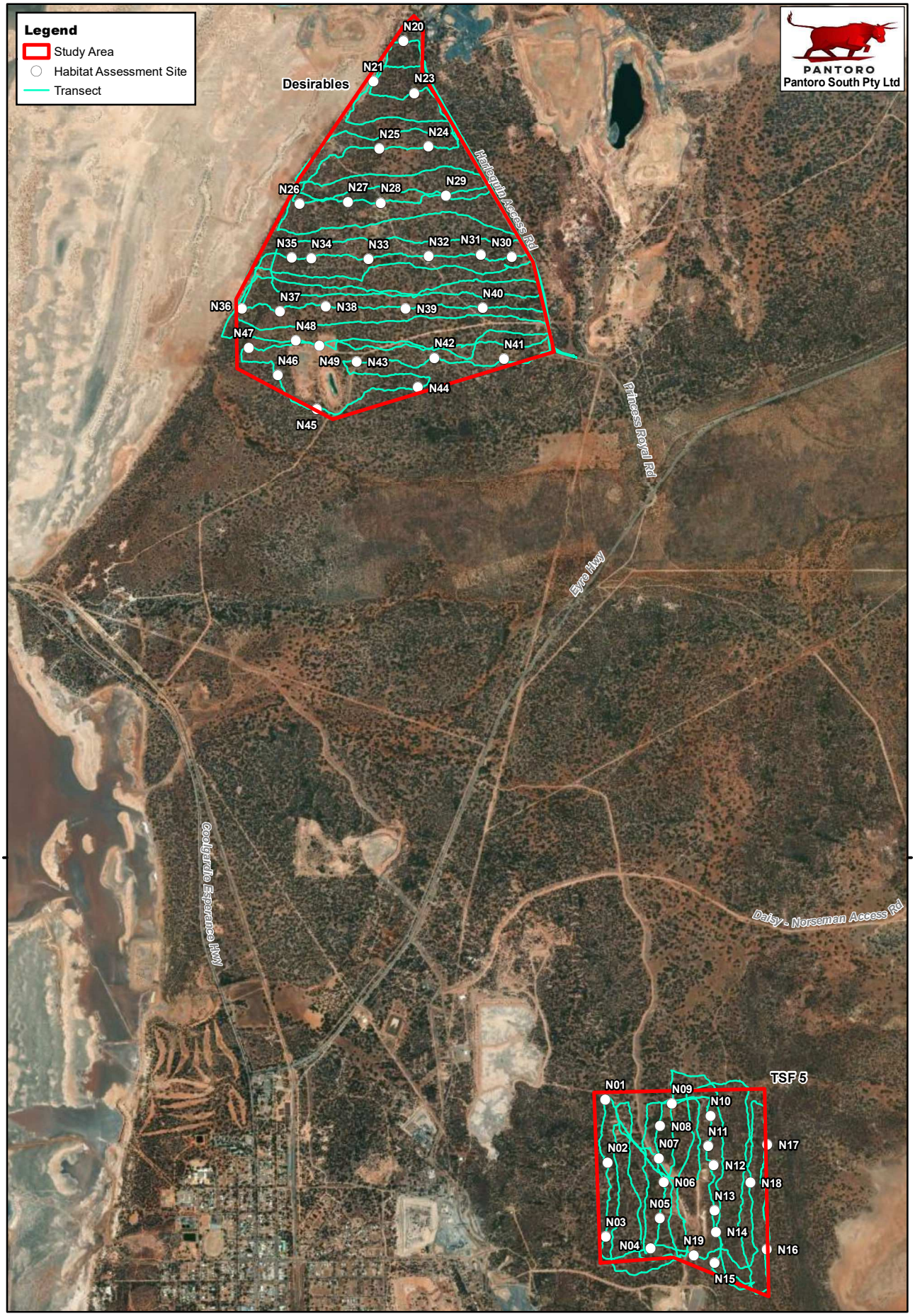
The field study component of a basic fauna survey aims to inventory, so far as possible, the habitats and vertebrate fauna present on the site. As no trapping is undertaken, observations of fauna are restricted to larger diurnal species such as birds, and evidence of other species such as tracks, scats and diggings. The study areas were surveyed on the 10th - 11th October 2024. All vertebrate fauna encountered were recorded and notes were made on the fauna habitats present on the site.

2.6.2 Targeted Malleefowl Survey

Malleefowl were targeted by walking transects across each study area, totalling approximately 75km (Figure 5). Any mounds identified were recorded using the descriptors in the National Malleefowl Monitoring Manual (National Malleefowl Recovery Team 2020), including a GPS location, photograph, description of the habitat, estimated age of the mound and any evidence of shell fragments. Excavations or diggings that were not used for nesting (i.e. the mound attempt abandoned or site deemed unsuitable by the Malleefowl) were also recorded as evidence of Malleefowl activity in the area.

2.7 Habitat Assessment and Mapping

Habitat assessments were undertaken across 19 sites in the TSF5 study area and 29 sites in the Desirables study area (Figure 5). Habitat mapping was undertaken using existing vegetation mapping (Mattiske Consulting 2024), observations made by fauna personnel in the field and interpretation of aerial photography.



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Date: December 2024 | Rev: B	Author: J. Wilcox			

Elements of each habitat likely to be important for fauna were identified. Important habitat elements may include, but are not limited to, rocky crevices, caves, tree hollows, tree crevices, accumulations of leaf litter or sands suitable for burrowing.

2.8 Likelihood of Occurrence

Fauna of conservation significance were assessed and ranked for their likelihood of occurrence in the study area, according to the criteria in Table 3.

Table 3. Criteria for assessing likelihood of occurrence.

Likelihood	Criteria
Unlikely	• The study area is outside the current known distribution of the species as presented in the literature. • No suitable habitat was identified as being present during the field survey. • For some species, individuals may occur occasionally as vagrants, especially if suitable habitat is located nearby, but the study area itself would not support the species. • May include species generally accepted as being locally extinct.
Possible	• The study area is within or just outside the current known distribution of the species, as presented in the literature. • Any habitat present is either limited in extent or of marginal suitability at best. • No recent or nearby records of the species on databases. • The species is generally known to be less common in the vicinity of the study area (e.g., for inland sites, where the species usually occurs on the coast).
Potential	• The study area is within the current known distribution of the species, as presented in the literature. • Habitat of reasonable suitability was identified as being present during the field survey. • There are some recent and/or nearby records of the species of databases.
Likely	• The study area is well within the current known distribution of the species, as presented in the literature. • Habitat of good suitability was identified as being present during the field survey. • Many recent and nearby records of the species on databases.
Known to occur	• The species was positively identified in the study area during this field survey or recorded as occurring in the study area on previous recent field surveys. • Note that for a species 'known to occur', the habitat may still be marginal and therefore the population may be small, or the species may visit the site irregularly.

2.9 Assessing Conservation Significance of Fauna

2.9.1 Legislative Protection for Fauna

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Commonwealth Government's primary piece of environmental legislation. Listed under Part 3 of the EPBC Act are 'Matters of National Environmental Significance' (MNES); these include threatened species, threatened ecological communities and migratory species. Threatened fauna species are assessed against categories based on International Union for Conservation of Nature (IUCN) criteria.

The migratory species listed under the EPBC Act are those recognised under international agreements. These agreements are the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), or species listed under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) for which Australia is a range state.

Matters of National Environmental Significance (MNES) include the following categories:

- **Extinct in the wild (EW)**: Taxa known to survive only in captivity.
- **Critically Endangered (Cr)**: Taxa facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered (En)**: Taxa facing a very high risk of extinction in the wild in the near future.
- **Vulnerable (Vu)**: Taxa facing a very high risk of extinction in the wild in the medium-term future.
- **Migratory (Mi):** Taxa listed under international agreements to which Australia is a party.

Reports on the conservation status of most vertebrate fauna species have been produced by the federal Department of Environment and Energy (DoEE) in the form of Action Plans. An Action Plan is a review of the conservation status of a taxonomic group against IUCN categories. Action Plans have been prepared for amphibians (Tyler 1998), reptiles, (Cogger *et al*. 1993), lizards and snakes (Chapple *et al*. 2019), birds (Garnett and Baker 2021) and mammals (Woinarski *et al*. 2014). These publications also use categories similar to those used by the EPBC Act. The information presented in some of the earlier Action Plans may be out of date due to changes since publication.

The *Biodiversity Conservation Act 2016* (BC Act) is State legislation that aims to conserve and protect biodiversity and biodiversity components in Western Australia, including threatened fauna. It is administered by the Department of Biodiversity, Conservation and Attractions (DBCA). In addition to threatened fauna, the BC Act has scope to protect threatened ecological communities and important habitats.

Fauna species are listed under the BC Act as threatened species using IUCN categories, or as specially protected species, as described below.

Threatened Species:

- **Extinct in the wild (EW)**: Taxa known to survive only in captivity.
- **Critically Endangered (Cr)**: Taxa facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered (En)**: Taxa facing a very high risk of extinction in the wild in the near future.
- **Vulnerable (Vu)**: Taxa facing a very high risk of extinction in the wild in the medium-term future.

Specially Protected Species:

- **Migratory (Mi)**: A subset of the migratory fauna that are known to visit Western Australia that are protected under the international agreements or treaties, excluding species that are listed as Threatened species.
- **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
- **Other specially protected species (OS):** fauna in need of special protection to ensure their conservation.

The BC Act supersedes the *Western Australian Wildlife Conservation Act 1950* (WC Act).

Priority species are not listed under State or Commonwealth Acts. In Western Australia, DBCA maintains a list of Priority Fauna made up of species that are possibly Threatened but do not meet adequacy of survey requirements or are otherwise data deficient. There are four levels of Priority as defined by DBCA, as listed below.

- **Priority 1:** Poorly known species (on threatened lands)
- **Priority 2:** Poorly known species in few locations (some on conservation lands)
- **Priority 3:** Poorly known species in several locations (some on conservation lands)
- **Priority 4:** Rare, near threatened and other species in need of monitoring

2.9.2 Levels of Conservation Significance in this report

Five levels of conservation significance are used within this report to indicate the level of significance of fauna species, according to the following criteria:

- **Threatened (T):** Taxa listed as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the EPBC Act and/or BC Act. These species are grouped as they are all species considered to be at risk of extinction, are often rare and are likely to be subject to on-going threatening processes.
- **Migratory (Mi):** Taxa listed as Migratory under the EPBC Act and/or BC Act, excluding those species also listed as threatened. These species are grouped as they are not necessarily rare but may be dependent on specific habitats for a portion of their life-cycle. For these species, loss of important foraging, breeding or stop-over sites may have a disproportionately large impact on populations.
- **Specially Protected (SP):** Taxa listed as Other Specially Protected Species or Conservation Dependent Fauna under the BC Act. These species are not necessarily rare but may be dependent on on-going conservation to ensure their protection.
- **Priority (P):** Taxa listed as Priority by DBCA. These species are grouped as they are either conservation dependent or data deficient and in need of further survey.
- **Locally Significant (LS):** Locally significant taxa are not listed under State or Commonwealth Acts or in publications on threatened fauna or as Priority species by DBCA but are considered by the author to potentially be of local significance because, for example, they are at the limit of their distribution in the area, they have a very restricted range or they occur in breeding colonies (e.g. some waterbirds). This level of significance has no legislative recognition and is based on interpretation of information on the species patterns of distribution. For example, the Government of Western Australia (2000) used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of Bush Forever. Recognition of such species is consistent with the aim of preserving regional biodiversity.

3. Survey Limitations

All fauna surveys have limitations. Examples of possible limitations are given in the Technical Guidelines (EPA 2020) and have been addressed in Table 4.

Not all fauna species present on the site are likely to be sampled during a survey. Fauna may not be recorded because they are rare, they are difficult to trap or observe, or because they are only present on the site for part of the year. In the case of the study area, there were no limitations other than those in common with all surveys of this type.

Table 4. Fauna survey limitations.

Potential Limitation	Extent of limitation for the fauna survey	
Availability of data and information	Not limiting	A reasonable amount of data are available on databases and from previous nearby studies.
Competency/experience of the survey team, including experience in the bioregion surveyed	Not limiting	Both personnel have over 20 years' experience with fauna surveys in Western Australia and are experienced with targeted Malleefowl surveys. Both personnel have undertaken previous surveys, including detailed trapping surveys, in the bioregion.
Scope of survey (e.g. faunal groups excluded from the survey)	Not limiting	The level of survey restricted fauna records mainly to opportunistic observations of diurnal species, and observations in a single season. Although a limitation to describing the known faunal assemblage of the study area in particular, this is ameliorated by the literature review and is not considered part of a basic survey. Key conservation significant species (Malleefowl) were targeted.
Timing, weather and season	Not limiting	A basic fauna survey and targeted Malleefowl survey are not overly dependent on timing, weather or season. The weather during the survey was cool with some rain, and adequate for opportunistically observing birds. Malleefowl mounds can be observed in any season, and the survey was within the time period specified for detection of active mounds.
Disturbance that may have affected the results	Not limiting	Although much of the study area is likely to have been historically disturbed, this is unlikely to have significantly affected the outcome of the survey as the survey investigated the current situation. Malleefowl mounds persist in the landscape for many years, and the key purpose of the basic survey was habitat assessment. The majority of species are predicted on the basis of the literature review.
The proportion of fauna identified, recorded or collected	Not limiting	As a basic fauna survey, the fauna identified were mostly restricted to diurnal birds and mammals. Reptiles, frogs, small terrestrial mammals and bats were not sampled as part of this survey, and their likely presence was determined with a review of the available literature.
The adequacy of the survey intensity and proportion of survey achieved (e.g. extent to which the area was surveyed)	Not limiting	The intensity and coverage of the fauna survey was adequate and appropriate for the level of survey. All habitats were visited and all study areas were surveyed.
Access problems	Not limiting	Within the survey period all areas were accessible on foot and/or by vehicle (see Figure 5).
Problems with data and analysis, including sampling biases	Not limiting	No complex analyses were undertaken, and no problems were noted.

4. Fauna Habitat

4.1 Fauna Habitats in the Study Areas

Six broad fauna habitats were identified in study areas, plus 36.0ha of cleared areas (Tables 5 and 6). The habitats are described in the sections below, with the vegetation descriptions after Mattiske Consulting (2024).

Table 5. Fauna habitats – key habitat elements.

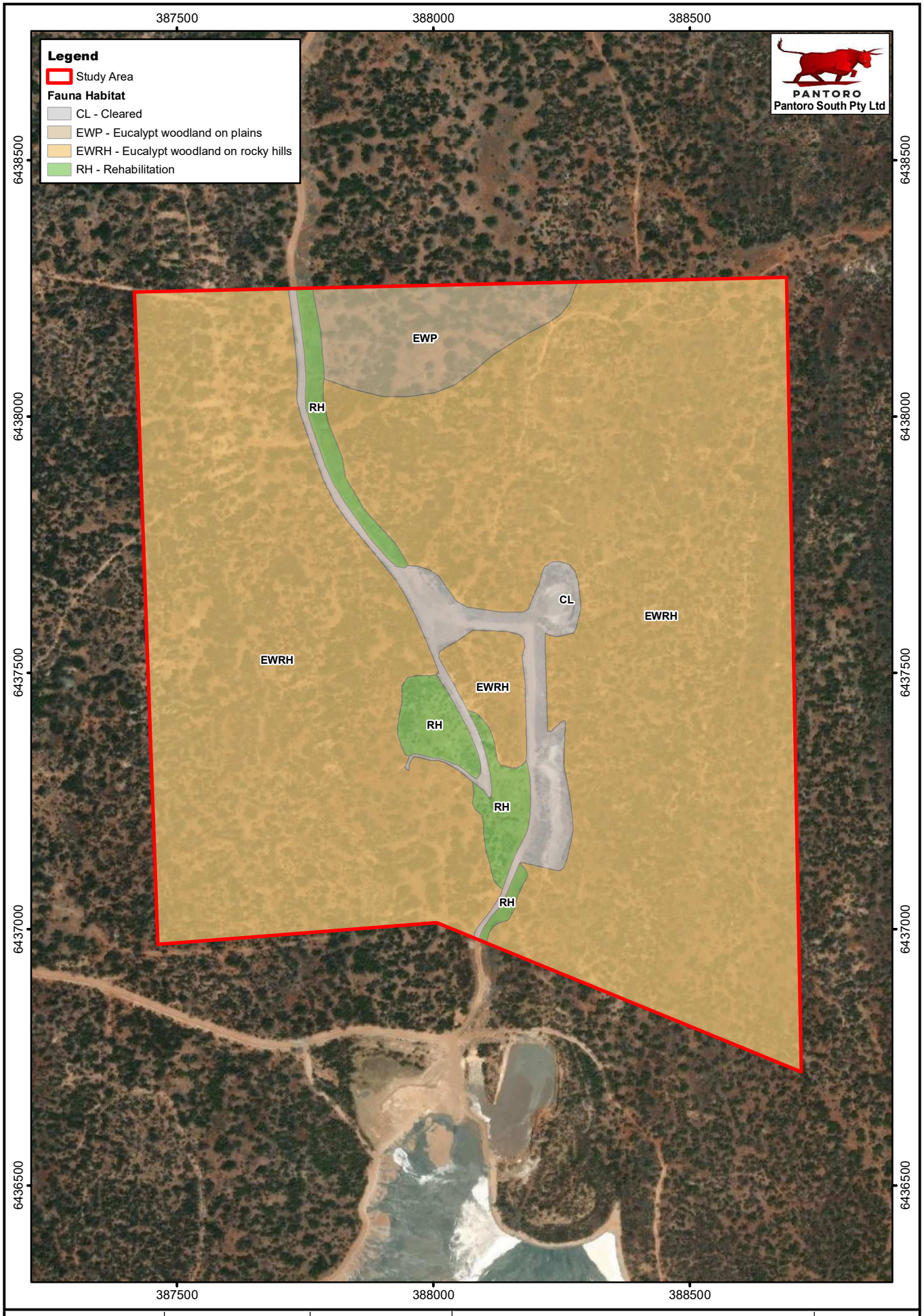
Fauna Habitat	Key Habitat Elements
Eucalypt woodland on rocky hills	• Eucalypts provide crevices and tree hollows for arboreal reptiles, mammals and birds. • Occasional rocky outcrops provide crevices for reptiles. • Occasional hollow logs provide reptile and small mammal habitat. • Seasonal nectar resource (*Eucalyptus* and *Eremophila* spp.). • Patches of shrubby vegetation provide nesting habitat for small birds.
Eucalypt woodland on plains	• Eucalypts provide crevices and tree hollows for arboreal reptiles, mammals and birds. • Occasional hollow logs provide reptile and small mammal habitat. • Seasonal nectar resource (*Eucalyptus* and *Eremophila* spp.).
Mallee woodland over spinifex	• Spinifex provides shelter for reptiles. • Sandy soil provides a substrate for burrowing species.
Shrubland on sandy lake edge	• Shrubby vegetation provides nesting habitat for small birds. • Seasonal nectar resource (*Eremophila* spp.).
Gypsum dunes	• Dense aggregations of leaf litter under she-oaks. • Seasonal nectar resource (*Grevillea* and *Eremophila* spp.)
Rehabilitation	• Patches of shrubby vegetation provide nesting habitat for small birds.
Cleared	• Abandoned open pits may provide nesting habitat for birds of prey.

The fauna habitats of the study area are relatively common in the subregion. The majority of the habitat present in both study areas was comprised of eucalypt woodlands, either on plains (53.1% of the area surveyed) or on rocky hills (28.8% of the area surveyed) (Table 6). The least common habitat was gypsum dune at 0.4% of the area surveyed, however, this is unlikely to be rare in the region as it is associated with the many salt lakes.

There is disturbance to some areas from timber cutting, historical mining activities, firebreaks and tracks. Rabbits (*Oryctolagus cuniculus*) and Camels (*Camelus dromedarius*) were recorded from the study areas and other feral herbivores and predators are known to occur in the region.

Table 6. Fauna habitats – extent in each study area.

Fauna Habitat	Area of each habitat (ha)		
	TSF5	Desirables	Total
Eucalypt woodland on rocky hills	146.6	18.2	164.8
Eucalypt woodland on plains	8.1	295.2	303.2
Mallee woodland over spinifex	-	17.9	17.9
Shrubland on sandy lake edge	-	40.6	40.6
Gypsum dune	-	2.6	2.6
Rehabilitation	6.1	-	6.1
Cleared	7.8	28.2	36.0
	168.6	**402.6**	**571.2**



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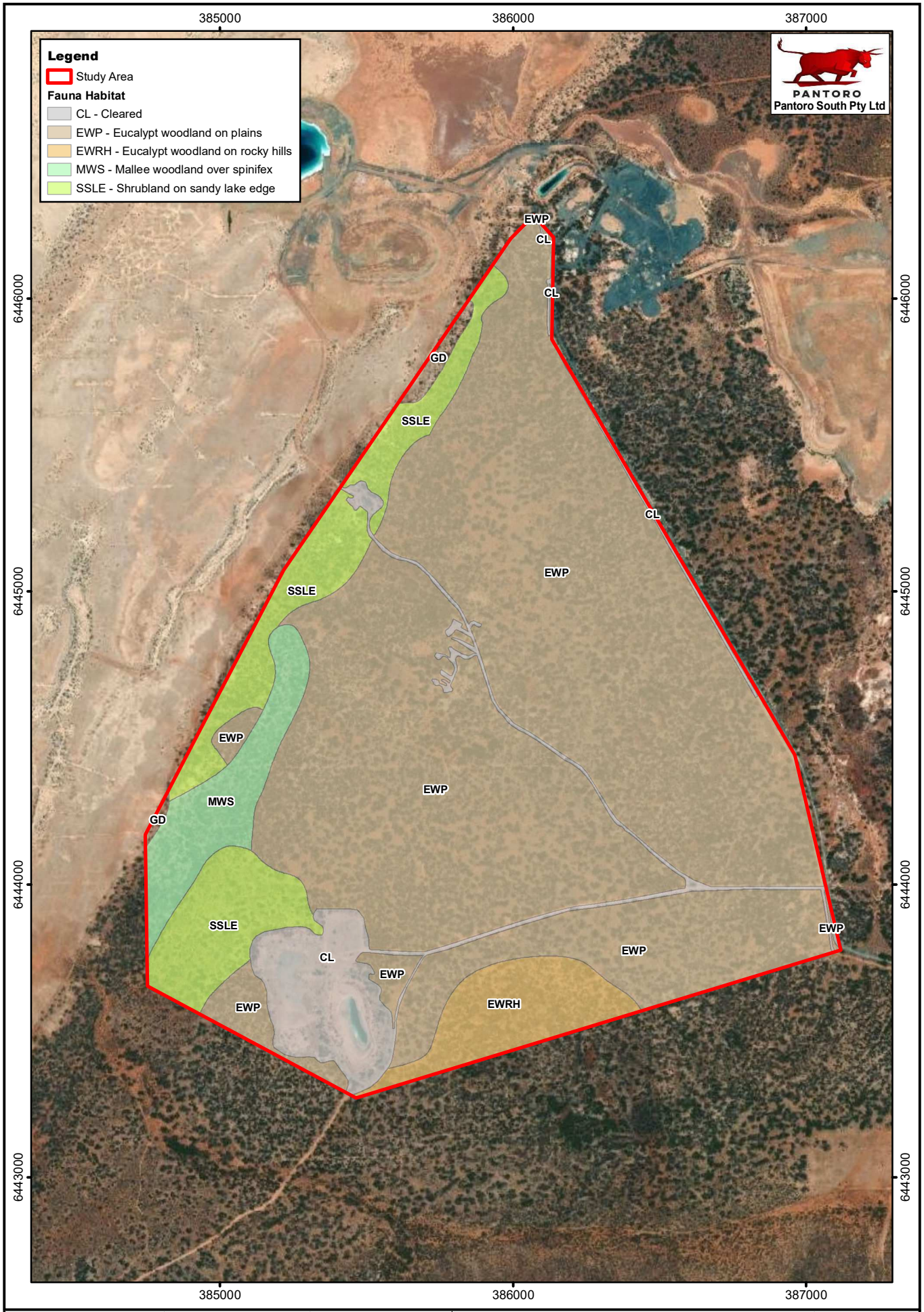
Western Wildlife

Norseman Gold Project
Fauna Habitats (TSF5)

Figure: **6**



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Western Wildlife

Norseman Gold Project
Fauna Habitats (Disirables)

Figure: **7**

4.1.1 Eucalypt Woodland on Rocky Hills

Low rocky hills have surface rocks and occasional small outcroppings on a clay-loam soil but lack caves or areas of deep rock crevices. The low rocky hills support a eucalypt woodland, the canopy including one or more eucalypts such as Coral Gum (*Eucalyptus torquata*), Goldfields Blackbutt (*Eucalyptus lesouefii*), Red Merrit (*Eucalyptus flocktoniae*), Merrit (*Eucalyptus urna*) and/or Strickland's Gum *(Eucalyptus stricklandii)* over patchy tall shrubs such as Boree (*Melaleuca sheathiana*) (Plates 1 – 3). The understorey vegetation is generally very open, but there are small patches of denser shrubland with she-oaks (*Allocasuarina acutivalvis*) and Waterbush (*Grevillea nematophylla*). Attributes of this habitat overlap with the eucalypt woodland on plains habitat.

Conservation significant fauna that may use this habitat include the Inland Western Rosella (*Platycercus icterotis xanthagenys*), Central Long-eared Bat (*Nyctophilus major tor*) and possibly the Malleefowl (*Leipoa ocellata*) or Chuditch (*Dasyurus geoffroii*).

Plate 1. Eucalypt Woodlands on Rocky Hills (TSF5).

Plate 2. Eucalypt Woodlands on Rocky Hills (Desirables).

Plate 3. Patches of shrubland within the Eucalypt Woodland on Rocky Hills (TSF5).

4.1.2 Eucalypt Woodland on Plains

Extensive undulating red-brown clay-loam plains, sometimes with surface pebbles and stones, support eucalypt woodlands (Plates 4 and 5). The canopy includes one or more of Gimlet (*Eucalyptus salubris*), Goldfields Blackbutt (*Eucalyptus lesouefii*) or Giant Mallee (*Eucalyptus oleosa*), usually over patchy stands of Boree (*Melaleuca sheathiana*). The understory can be relatively open or support a range of shrubs including *Eremophila spp.* and *Atriplex spp*. Conservation significant fauna that may use this habitat include the Inland Western Rosella (*Platycercus icterotis xanthagenys*), Central Long-eared Bat (*Nyctophilus major tor*) and possibly the Malleefowl (*Leipoa ocellata*) or Chuditch (*Dasyurus geoffroii*).

Plate 4. Eucalypt Woodland on Plains (Desirables).

Plate 5. Eucalypt Woodland on Plains (TSF5).

4.1.3 Mallee Woodland over Spinifex

An open mallee eucalypt woodland over Spinifex occurs on gently sloping sandy-rises (Plate 6). The open canopy is of Boorabbin Mallee (*Eucalyptus platycorys*) and other mixed Eucalypt species. The understory is of mixed shrubs and sedges, such as *Lawrencia squamata*, *Westringia rigida* and *Lomandra effusa*, over a spinifex (*Triodia scariosa*) hummock grassland. Conservation significant fauna that may use this habitat include the Inland Western Rosella (*Platycercus icterotis xanthagenys*), Central Long-eared Bat (*Nyctophilus major tor*) and possibly the Malleefowl (*Leipoa ocellata*) or Chuditch (*Dasyurus geoffroii*).

Plate 6. Mallee Woodland over Spinifex (Desirables).

4.1.4 Shrubland on Sandy Lake Edges

Flats and low rises of saline red sandy-clays occur on the salt lake margins and low-lying areas. The vegetation consists of an open shrubland of Quandong (*Santalum acuminatum*) and *Melaleuca spp*., over a mix of Currant Bush (*Scaevola spinescens*), *Cratysylis conocephala*, Silver Emubush (*Eremophila scoparia*), and mixed chenopods (Plate 7). No conservation significant fauna are likely to be particularly reliant on this habitat. Conservation significant fauna that may use this habitat include the Inland Western Rosella (*Platycercus icterotis xanthagenys*) and possibly the Malleefowl (*Leipoa ocellata*) or Chuditch (*Dasyurus geoffroii*).

Plate 7. Shrubland on Sandy Lake Edges (Desirables).

4.1.5 Gypsum Dunes

Low gypsum dunes occur in association with salt lakes. Sparsely vegetated, they support a very open woodland of Swamp She-oak (*Casuarina obesa*) over scattered shrubs and grasses (Plate 8). This habitat is likely to support a small but distinct faunal assemblage. No conservation significant fauna are likely to be particularly reliant on this habitat.

Plate 8. Gypsum Dunes (Desirables).

4.1.6 Rehabilitation

Small areas of rehabilitation support mixed species of eucalypt and shrubs, often with open patches (Plate 9). No conservation significant species are likely to be particularly reliant on this habitat.

Plate 9. Rehabilitation (TSF5).

4.1.7 Cleared

Cleared areas were primarily comprised of tracks, existing open pits and waste rock landforms. These areas have limited value for fauna, although a few native species are still likely to occur in low numbers. A conservation significant species that may occur in cleared areas is the Peregrine Falcon (*Falco peregrinus*).

Plate 10. Cleared areas (Desirables).

5. Vertebrate Fauna of the Study Area

5.1. Vertebrate Fauna Assemblage

The results of the desktop survey and the field survey were combined to form lists of the vertebrate fauna potentially occurring in the study area. The lists of frogs, reptiles, birds and mammals that potentially occur in the study area are presented in Appendices 1 – 4 and are summarised below in Table 7.

Table 7. Summary of vertebrate fauna potentially occurring in the study area.

Taxon	Total species	Introduced species	Recorded on this survey	Conservation significant species				
				Threatened	Migratory	Specially Protected	Priority	Locally Significant
Amphibians	9	-	-	-	-	-	-	-
Reptiles	66	-	2	-	-	-	1	-
Birds	159	2	34	6	4	1	3	-
Mammals	32	8	4	1	-	-	2	-
Totals:	**266**	**10**	**40**	**7**	**4**	**1**	**6**	**0**

As it is situated in a larger tract of native vegetation, the study area is likely to support a relatively intact faunal assemblage, with only regionally extinct species likely to be missing. The study area is in Southwest Interzone, the transitional area between the Bassian and Eremaean Provinces. Therefore, the faunal assemblage of the area is likely to be relatively diverse, including both Eremaean and Bassian components. The faunal assemblage of the study areas is likely to be a smaller subset of the species listed in Appendices 1 – 4, as the study areas are relatively small and lack some of the habitats present elsewhere in the region, such as salt lakes, freshwater lakes, granite outcrops, samphire shrublands or *Acacia* shrublands.

The predicted faunal assemblages and fauna of conservation significance are discussed in the sections below. The results of the EPBC Act Protected Matters search are given in Appendix 6. The results of the DBCA Threatened and Priority Fauna Database search are shown in Figure 8.

5.1.1 Amphibians

There are nine frog species that potentially occur in the study area (Appendix 1). Most of the species expected to occur are burrowing frogs that use seasonal or ephemeral wetlands for breeding. Some species are likely to breed in pools on granite outcrops, however, although they occur in the region there are no granite outcrops in the study area. Frogs are also likely to breed opportunistically in man-made depressions and in the study area frogs may breed anywhere that holds fresh water after rainfall. During the non-breeding season burrowing frogs are likely to forage in terrestrial habitats in the study area.

5.1.2 Reptiles

There are up to 66 species of reptile that potentially occur in the study area (Appendix 2). Two were observed opportunistically during the site visit. Given its setting in a large, continuous tract of native vegetation, the study area is likely to support a relatively intact reptile assemblage in each habitat.

The reptile assemblage of each habitat is likely to be influenced by the substrate (e.g. rocky, clayey or sandy), but there is also likely to be considerable overlap with many species being widely distributed and occurring across several habitats. Tree-dwelling reptiles, such as the Reticulated Velvet Gecko (*Hespeoedura reticulata*), are likely to be restricted to the Eucalypt woodland habitats. Hollow logs in eucalypt woodlands potentially provide shelter habitat for the Carpet Python (*Morelia spilota imbricata)* and other species. As the only habitat in the study area containing a spinifex understory, the mallee woodland over spinifex is likely to support a distinct reptile assemblage.

5.1.3 Birds

There are 159 species of bird that potentially occur in the study area, of which 34 were observed during the fauna survey (Appendix 3). As the study area is in the Southwest Interzone, the bird assemblage includes both Eremaean and Bassian components. Eremaean species are widespread, occurring across the inland arid areas of Australia, while Bassian species are likely to be on the north-eastern limit of their range in the vicinity study area, with their distributions extending into the wetter southwest.

Honeyeaters and the Purple-crowned Lorikeet (*Parvipsitta porphyrocephala*) feed on nectar and move to take advantage of seasonal flowering resources. These species are likely to fluctuate in abundance, both seasonally and between years, and are likely to be abundant in the study area when the shrublands or eucalypt canopy is flowering. Eucalypt trees are also likely to have hollows suitable for nesting birds, although historical tree cutting has resulted in few larger hollows.

A dense cover of shrubs is favoured by the Shy Heathwren (*Hylacola cauta*), Blue-breasted Fairy-wren (*Malurus pulcherrimus),* Southern Scrub-robin (*Drymodes brunneopygia*) and Copperback Quail-thrush (*Cinclosoma clarum*). These and other species nest in dense vegetation in shrubland habitats or shrubby understorey in woodlands, some, such as the Southern Scrub-Robin, on the ground and many, such as the Inland Thornbill (*Acanthiza apicalis*), within a metre of the ground. These nests can be vulnerable to feral predators, (foxes and cats), when dense habitats are fragmented.

Several waterbirds, including swans, ducks, herons, stilts and migratory shorebirds, potentially occur in the region, however, these are unlikely to occur in study area (Appendix 3). These species may occur nearby on salt lakes, only when water is present. As the Desirables study area is adjacent to Lake Cowan, waterbirds may occur nearby but are not likely to be in the study area. The TSF5 study area does not have waterbird habitat and is 500m from potential salt lake waterbird habitat.

5.1.4 Mammals

There are 33 mammals with the potential to occur in the study area, of which 25 are native and eight are introduced (Appendix 4). Only introduced mammals were observed opportunistically during the site visit. The mammal assemblage also demonstrates both Bassian and Eremaean influences. Species such as the Ooldea Dunnart (*Sminthopsis ooldea*) have an arid distribution, contrasted to species such as the Western Pygmy Possum (*Cercartetus concinnus*), with a distribution that extend into the south-west.

The mammal assemblage is likely to be relatively intact, missing only those species extinct in the bioregion. Many of the critical weight range mammals, including species such as the Common Brushtail Possum (*Trichosurus vulpecula*), were noted to be lost from the semi-arid and arid regions in the vicinity of the study area by 1906 (Short 2004).

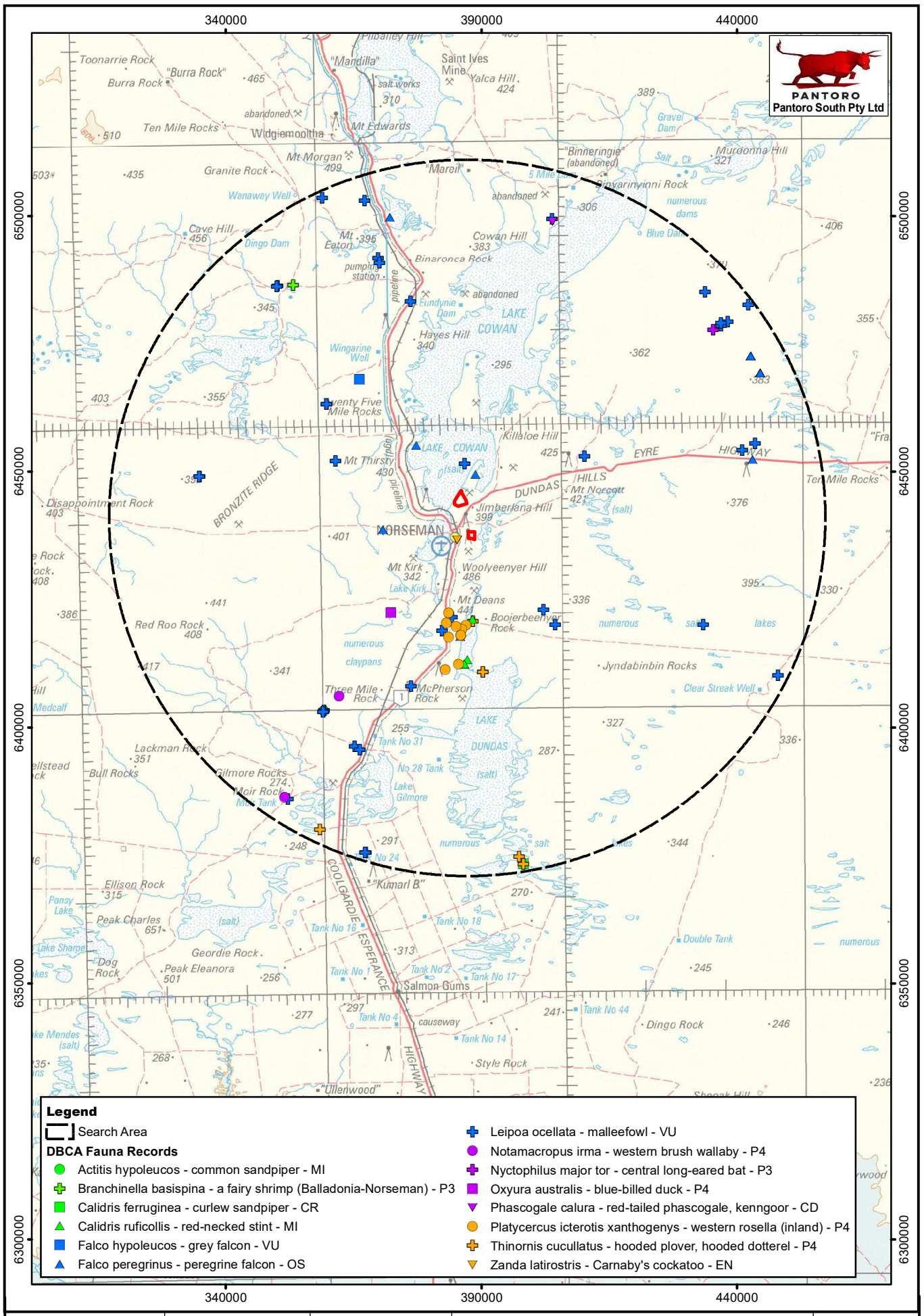
5.2 Vertebrate Fauna of Conservation Significance

There are 18 vertebrate fauna of conservation significance that potentially occur in the study area: seven Threatened, four Migratory, one Specially Protected and six Priority species. No Locally Significant species were identified. Each species is summarised in Table 8 and discussed in the sections below.

Three birds listed on database searches in the area have been omitted from Appendix 3 and the discussion below. Records of Carnaby's Cockatoo (*Zanda latirostris*) in Norseman are from 1905 to 1975, and the study area is well outside the current known range of the species. The Grey Wagtail (*Motacilla cinerea*) is a vagrant in the region. The study area is outside the usual distribution of the Grey Falcon (*Falco hypoleucos*), which occurs in semi-arid areas further north. This single record of this species is from 1979 (DBCA 2024) and is likely to be a vagrant.

One mammal species is locally extinct from the region and has been omitted from the list of potentially occurring mammals in Appendix 4 and the discussion below. The Red-tailed Phascogale (*Phascogale calura*) is only represented by one uncertain night sighting (DBCA 2024), and generally considered locally extinct in this region.

Invertebrates listed on database searches were excluded as being outside the scope of the survey.



Fauna Records: DBCA, Image: DigitalGlobe (27/11/2016)

Drawn: CAD Resources www.cadresources.com.au Tel: (08) 9246 3242	Western Wildlife	**Norseman Gold Project** **DBCA records of conservation significant fauna**	Figure: **8**
CAD Ref: a2783Fa0014_07 A4 Date: December 2024 Rev: B Author: J. Wilcox			

Table 8. Summary of Conservation Significant Vertebrate Fauna.

Key to Status: Mig = Migratory, En = Endangered, Vu = Vulnerable, OS = Other Specially Protected Fauna, P = Priority, LS = locally significant.

Species	Status				Likelihood of Occurrence	Habitat preferences	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
REPTILES							
Paroplocephalus atriceps **Lake Cronin Snake**			P3		Possible	Woodlands and shrublands.	Although the habitats present are potentially suitable, but this species is rarely recorded.
BIRDS							
Pezoporus occidentalis **Night Parrot**	En	Cr			Unlikely	Mature spinifex grasslands, chenopods and herb lands.	This species is extremely rare and the study areas lacks suitably large spinifex to support breeding and roosting
Calidris ferruginea **Curlew Sandpiper**	Cr, Mi	Mi			Unlikely	Wetlands, salt lakes, beaches	Although it may occur in the region, the study areas lack suitable habitat.
Tringa nebularia **Common Greenshank**	En, Mi	Mi			Unlikely	Wetlands, salt lakes, beaches	Although it may occur in the region, the study areas lack suitable habitat.
Calidris acuminata **Sharp-tailed Sandpiper**	Vu, Mi	Mi			Unlikely	Wetlands, salt lakes, beaches	Although it may occur in the region, the study areas lack suitable habitat.
Leipoa ocellata **Malleefowl**	Vu	Vu			Potential	Acacia thickets, mallee woodlands and shrublands with leaf litter. Also forages in adjacent habitats.	This species is known to occur in the region, but no evidence of its presence was recorded during the field survey despite extensive searching.
Aphelocephala leucopsis **Southern Whiteface**	Vu				Possible	Open woodlands and shrublands with a shrubby and/or grassy understory.	The study area is likely to be on the very southern limit of the distribution of this species. There are no nearby records of this species on databases.
Falco peregrinus **Peregrine Falcon**		OS			Likely	Variety of habitats, nests in tall trees, cliffs, open pits.	Although likely to occur, foraging in most open habitats, the study area is unlikely to be of particular importance to this species.
Actitis hypoleucos **Common Sandpiper**	Mi	Mi			Unlikely	Wetlands, salt lakes, beaches	Although it may occur in the region, the study areas lack suitable habitat.
Calidris ruficollis **Red-necked Stint**	Mi	Mi			Unlikely	Wetlands, salt lakes, beaches	Although it may occur in the region, the study areas lack suitable habitat.

Table 8. (cont.)

Species	Status				Likelihood of Occurrence	Habitat preferences	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
Calidris melanotos **Pectoral Sandpiper**	Mi	Mi			Unlikely	Freshwater wetlands, other inland waters.	Although it may occur in the region, the study areas lack suitable habitat.
Apus pacificus **Fork-tailed Swift**	Mi	Mi			Potential	Overfly any habitat.	This species is largely aerial in Australia, and although it may overfly the area the terrestrial habitats of the study area are not likely to be important for this species.
Thinornis cucullata **Hooded Plover**			P4		Unlikely	Wetlands, salt lakes and sandy beaches.	Although it may occur in the region, the study areas lack suitable habitat.
Platycercus icterotis xanthagenys **Inland Western Rosella**			P4		Known to occur	Woodlands and shrublands.	This species was recorded in the TSF5 study area during the 2024 field survey and is likely to be a breeding resident.
Oxyura australis **Blue-billed Duck**			P4		Unlikely	Deep wetlands.	Although it may occur in the region, the study areas lack suitable habitat.
MAMMALS							
Dasyurus geoffroii **Chuditch**	Vu	Vu			Possible	Forests, woodlands & shrublands, denning in hollow logs, babbler nests, burrows or rock crevices.	Although the habitats present are suitable, there are few records of this species in the region.
Nyctophilus major tor **Central Long-eared Bat**			P3		Potential	Woodlands, roosting in tree hollows and crevices.	This species is known to occur in the region and its favoured woodland habitats are present.
Notamacropus irma **Western Brush Wallaby**			P4		Possible	Woodlands and shrublands.	This species may occur at low densities in the region, although it is likely to be at the very eastern limit of its distribution in the vicinity of the study areas.

5.2.1 Threatened Fauna

Seven species of Threatened fauna may occur in the study area (Table 8). Threatened species are those that are considered in danger of extinction as their populations have declined and/or are still declining, and their total population size is small and/or fragmented or geographically restricted. Sites that support these species may be important for their long-term conservation, particularly if the site supports a resident breeding population.

Curlew Sandpiper – *Calidris ferruginea*

The Curlew Sandpiper is listed as Migratory under the BC Act and both Critically Endangered and Migratory under the EPBC Act.

The Curlew Sandpiper breeds in the northern hemisphere and is a non-breeding visitor to Australia. This species favours coastal habitats such as tidal mudflats, estuaries and brackish lagoons, but is also known to use both freshwater and saline inland waters (Garnett and Baker 2021).

Threats to this species occur mainly outside Australia in its coastal stopover locations (Garnett and Baker 2021). Within Australia the key threats include increased frequency and length of droughts and sea level rise due to climate change, loss and degradation of coastal and wetland habitats (Garnett and Barker 2021, DCCEEW 2023b). Critical habitat for this species is defined in the Conservation Advice and includes a mosaic of foraging and roosting habitat. Foraging habitat is primarily tidal mudflats and beaches, although it is noted that this species occurs inland on occasion. Roosting habitat is primarily large intertidal sandflats, spits and banks, with other coastal habitats used less frequently and inland sites include the edges of marshes, large rivers, lakes, and salt pans (DCCEEW 2023b).

There is a single record of the Curlew Sandpiper within 70km on DBCA's Threatened and Priority Fauna Database, from Burraminya, 64km south of the study area (Figure 8). Although this species may be an occasional visitor to the region, the study area lacks suitable habitat to support this species.

Night Parrot – *Pezoporus occidentalis*

The Night Parrot is listed as Endangered under the EPBC Act and Critically Endangered under the BC Act.

Historically, the Night Parrot was recorded across a large range in the arid and semi-arid interior of Australia (Garnett *et al*. 2011). Currently, however, there are very few verified records of the species and the population is thought to be very small (200 – 500 adults) and declining (Garnett and Baker 2021). Reliable records in recent times are from two main areas, western Queensland and the northern arid zone of Western Australia (TSSC 2016, Garnett and Baker 2021). Western Australia locations include the vicinity of Lake Gregory in the southern Kimberley, a site near Wiluna and near the Fortescue Marsh in the Pilbara (NPRT 2021, Davis and Metcalf 2008).

The key habitats for the Night Parrot are thought to be chenopod shrublands and Spinifex grasslands, with the chenopod shrublands a refuge during dry conditions (Garnett *et al*. 2011). Nesting and roosting sites are in mature Spinifex, often large ring-forming clumps (DPAW 2017, Garnett and Baker 2021). Foraging habitats are likely to vary across Australia, but include herbs, grasses, grass-like plants, *Sclerolaena spp*. and other chenopods (DPAW 2017). Although critical habitat has not been defined for this species, all occupied habitats can be considered critical.

With the reasons for its decline unknown, potential threats to the species remain unconfirmed (TSSC 2016). Key threats to the species are considered to be habitat degradation from overgrazing, habitat loss due to potash mining, large fires that do not leave unburnt patches and cat predation (Garnett and Baker 2021).

Knowledge about the current distribution and habitat requirements of the Night Parrot in Western Australia is based on very few records. Therefore, there is considerable uncertainty when assessing the likelihood of occurrence of this species. There were some ring-forming spinifex clumps present, however, all spinifex observed was short (<30cm), forming narrow bands rather than dense clumps, and heavily treed. Therefore, the habitat is not likely to be suitable for roosting or nesting according to current knowledge.

Common Greenshank – *Tringa nebularia*

The Common Greenshank is listed as Migratory under the BC Act and both Endangered and Migratory under the EPBC Act.

The Common Greenshank breeds in the northern hemisphere and is a visitor to Australia generally between September and March (Johnstone and Storr 1998). It inhabits a range of fresh and salt waters both on the coast and inland (Geering *et al*. 2007, Johnstone and Storr 1998).

Threats to this species occur mainly outside Australia in its coastal stopover locations (Garnett and Baker 2021). Within Australia the key threats include increased frequency and length of droughts and sea level rise due to climate change, loss and degradation of coastal and wetland habitats and disturbance at foraging and roosting sites (Garnett and Barker 2021, DCCEEW 2023a). Critical habitat for this species is defined in the Conservation Advice and includes a mosaic of foraging and roosting habitat, occurring in marine, freshwater or artificial wetlands (DCCEEW2023a). The Common Greenshank avoids open coastlines, but has been recorded in swamps, lakes, large rivers, sewage farms, saltworks, inundated rice fields, reservoirs, flooded grasslands, saltmarsh, sandy or muddy coastal flats, mangroves estuaries, lagoons and pools on tidal reefs (DCCEEW 2023a).

A site is deemed nationally important for this species if it regularly supports at least 110 birds (Table 9). Although this species is likely to be a visitor to the region, the study area is not likely to support this species due to lack of suitable habitat.

Sharp-tailed Sandpiper – *Calidris acuminata*

The Sharp-tailed Sandpiper is listed as Migratory under the BC Act and both Vulnerable and Migratory under the EPBC Act.

This species was recently listed as Vulnerable due to population decline (DCCEEW 2024a). The Sharp-tailed Sandpiper favours non-tidal freshwater, brackish or hypersaline wetlands, though it also occurs in other habitats including coasts and sewage farms (Geering *et al*. 2007, Garnett and Baker 2021, DCCEEW 2024a). It occurs on both coastal and inland waters, and in years of heavy inland rainfall they may remain at ephemeral wetlands instead of migrating to Southern Australia (Weller *et al*. 2019). This species is a non-breeding visitor to the southwest, mostly between September and March (Johnstone and Storr 1998).

Threats to this species occur mainly outside Australia in its coastal stopover locations (Garnett and Baker 2021). Within Australia the key threats include increased frequency and length of droughts and sea level rise due to climate change, loss and degradation of wetland habitats (Garnett and Barker 2021, DCCEEW 2024a). Critical habitat for this species is defined in the Conservation Advice and it is noted that this species is more adaptable in its habitat choice compared to other shorebirds, using both coasts and inland waters, with some of the highest densities occurring in the grassy edges of shallow inland freshwaters (DCCEEW 2024a).

A site is deemed nationally important for this species if it regularly supports at least 85 birds (Table 9). Although this species is likely to be a visitor to the region, the study area is not likely to support this species due to lack of suitable habitat.

Malleefowl – *Leipoa ocellata*

The Malleefowl is listed as Vulnerable under the BC Act and EPBC Act.

The Malleefowl is a bird of dense shrublands, mulga woodlands and mallee woodlands. It used to be common in the southern arid and semi-arid areas of Western Australia (Johnstone and Storr 1998). In order to construct their nest mounds, the Malleefowl needs leaf litter on sandy substrates (Garnett and Crowley 2010). The mounds are usually constructed intermittently by a pair of birds between autumn and spring. Between early spring and mid to late summer, 15 - 25 eggs are laid in the mound by the female, while the male continues to tend the mound. The chicks emerge between November and January (sometimes as late as March), and as they receive no parental care, chick mortality can be high (Benshemesh 2007). As Malleefowl nest on the ground, the eggs and flightless chicks are vulnerable to predation by feral predators. Malleefowl will often breed in the same general area year after year, and new mounds may be constructed, or old mounds re-used. The adult birds have been found to range over one to several square kilometres, and these home ranges overlap (Benshemesh 2007).

The main threats to Malleefowl are habitat loss, the fragmentation and degradation of remaining habitat, increase in the scale and intensity of wildfire, increase in the frequency and length of drought conditions, predation by cats and foxes, and the death of adults on roads (Benshemesh 2007, Garnett and Baker 2021). Fire can have a significant impact on populations, by killing adult birds, causing local extinctions in fragmented habitats and causing a cessation in breeding activity for many years after a fire (Benshemesh 2007).

Critical habitat for the Malleefowl is discussed in the Recovery Plan (Benshemesh 2007). As Malleefowl occur in a range of habitats, critical habitat is hard to define and can only be described in general terms, additionally, no particular areas can be described as being more or less important for the long-term survival of the species (Benshemesh 2007). Consequently, any occupied habitat, or habitat that is temporarily unoccupied (e.g. due to fire) that may be used in the future, may be considered habitat critical to the survival of the species.

There are many records of Malleefowl within 70km of the study area on DBCA's Threatened and Priority Fauna Database, ranging from 1938 to 2022 (Figure 8). The most recent records include one from Dundas Nature Reserve in 2022 (about 48km southwest of the study area) and two from the Redross Project in 2018 (about 47km north of the study area). The closest record is a 2002 sighting in the vicinity of Jimberlana Hill (DBCA 2024), within about 2km of the Desirables study area.

All habitats in the study area are potential foraging habitat for Malleefowl. Possible breeding habitat occurs in the eucalypt woodlands on rocky hills and eucalypt woodland on plains, but such habitat is very patchy, as much of the understory is sparsely vegetated and lacking in leaf litter. Despite extensive searching (Figure 5), no Malleefowl mounds were detected in the study area during the field survey. Similarly, no Malleefowl mounds were detected in adjacent areas in the 2020 survey on the Norseman Gold Project (Western Wildlife 2021). If present, the Malleefowl appears to be uncommon.

Southern Whiteface – *Aphelocephala leucopsis*

The Southern Whiteface is listed as Vulnerable under the EPBC Act.

In Western Australia, the Southern Whiteface occurs across the semi-arid and arid regions, south of the Kimberley and northeast of the wheatbelt. It is also widespread in other States. It was listed as Vulnerable in 2023 due to a substantial and continuing population decline (DCCEEW 2023a). The Southern Whiteface inhabits a range of sparsely treed woodlands and shrublands with an open understory of grasses or shrubs (Garnett and Baker 2021). This species forages on the ground, usually in small groups but occurring in larger flocks during the non-breeding season. It breeds from July to October and builds a nest in a hollow, crevice or low shrub (DCCEEW 2023a).

The threats to this species are not well understood (Garnett and Barker 2021) but include habitat loss in the eastern part of its range, habitat degradation and the increased frequency and duration of drought conditions, heatwaves or wildfire due to climate change (DCCEEW 2023a). Critical habitat for this species is defined in the Conservation Advice for this species and includes relatively undisturbed open woodlands and shrublands with an understory of shrubs and/or grasses, habitat with low tree densities and an herbaceous understory litter cover providing essential foraging habitat and living and dead trees with crevices for roosting and nesting (DCCEEW 2023a).

As it is not listed under State legislation, there are no records of this species on DBCA's Threatened and Priority Fauna Database, however, there are no records within 40km on the ALA and Dandjoo Databases (Appendix 3). The Southern Whiteface possibly occurs in the study area; however, it is likely the study area is south of the usual range of this species. The habitats of the study area are marginally suitable, and this species is likely to prefer the open Mulga habitats that occur further north. It is unlikely that the study area provides habitat that would be regularly used by the Southern Whiteface.

Chuditch – *Dasyurus geoffroii*

The Chuditch is listed as Vulnerable under the BC Act and EPBC Act.

The Chuditch used to occur across much of the continent but is now restricted to the southwest of Western Australia. Although they used to occupy a range of habitats, the majority of Chuditch now occur in the Jarrah forest with some wheatbelt/goldfields populations in drier woodlands, heath and mallee shrublands (Van Dyck and Strahan 2008; Orrell and Morris 1994). Up until recently, there were only occasional records of the Chuditch from the wheatbelt and goldfields, with this population estimated at 2,000 mature individuals (Woinarski *et al*. 2014, DoEE 2016). In recent years a substantial population has been recorded at Forrestiana (pers. obs., Raynor et al. 2011), about 180km south-west of the study area.

Chuditch are highly mobile, and typically have large home-ranges (Woinarski *et al*. 2014). In the study at Forrestiana, the average distance travelled between consecutive refuge sites was 500 m for females and 3.3km for males, with the maximum distance travelled 1.5 km for females and 4.5 - 12 km for males (Rayner *et al*. 2011). Males were found to occur across large core home ranges averaging 2,125 ha which overlapped with other males and females. Females inhabited a smaller core home range of 189 ha (Rayner *et al*. 2011). The core home range describes the area contained by den locations, and the actual area over which individuals can range is much higher (DEC 2012). As Chuditch use up to 180 different dens sites within their core home range (Woinarski *et al*. 2014), no particular den site is likely to be of particular importance.

The current major threats to Chuditch are land clearing (including fragmentation of continuous habitat), predation by and competition with feral predators (foxes and cats) and deliberate and accidental mortality from poisoning, trapping, illegal shooting or road kills (DEC 2012). There are no records of Chuditch within 70km of the study area on DBCA's Threatened and Priority Fauna Database (Figure 8). Although the Chuditch may occur in the study area, the likelihood is low. If present, the Chuditch potentially occurs in any woodland or shrubland habitat.

5.2.2 Migratory Fauna

There are four Migratory species that may occur in the study area (Table 8). Three additional Migratory species, the Curlew Sandpiper (*Calidris ferruginea*), Common Greenshank (*Tringa nebularia*) and Sharp-tailed Sandpiper (*Calidris acuminata*), are also listed as Threatened so are discussed in the preceding section.

Migratory species are not always present at a site, but a particular site may have significance as a seasonal or ephemeral foraging, breeding or shelter area. Impacts to these sites may then impact the population both within the site and further afield. For Migratory shorebirds, a site is deemed internationally important if it regularly supports more than 1% of the flyway population of a species, or a total abundance of at least 20,000 shorebirds, and nationally important if it regularly supports more than 0.1% of the flyway population of a species, at least 2,000 shorebirds or at least 15 shorebird species (Hansen *et al*. 2016, Commonwealth of Australia 2017). The flyway population estimates, 1% and 0.1% criteria for selected shorebirds are given in Table 9.

The study area is adjacent to salt lake habitat but does not include potential shorebird habitat.

Table 9. Flyway Population Estimates for Selected Migratory Shorebirds.

Species	Flyway Population Estimate*	1% Flyway Population Criterion*	0.1% Flyway Population Criterion*
Common Sandpiper	190,000	1,900	190
Curlew Sandpiper	90,000	900	90
Sharp-tailed Sandpiper	85,000	850	85
Common Greenshank	110,000	1,100	110
Red-necked Stint	475,000	4,750	475
Pectoral Sandpiper	1,220,000 – 1,930,000	12,200	1,220

*Data from Hansen *et al*. (2016).

Common Sandpiper – *Actitis hypoleucos*

The Common Sandpiper is listed as Migratory under the BC Act and EPBC Act.

Although it may be present at any time of the year, the Common Sandpiper is most common in the southwest from September to March (Johnstone and Storr 1998). This species occurs in a range of salt and freshwater habitats, including coasts, river pools, drying swamps and floodwaters (Johnstone and Storr 1998), however, it is most common on the coast (Geering *et al*. 2007). A site is deemed nationally important for this species if it regularly supports at least 190 birds (Table 9).

There is a single record within 70km on DBCA's Threatened and Priority Fauna Database, from 1977 (Figure 8). Although this species is known to be a visitor to the region, the study area is not likely to support this species due to lack of suitable habitat.

Red-necked Stint – *Calidris ruficollis*

The Red-necked Stint is listed as Migratory under the BC Act and EPBC Act.

The Red-necked Stint occurs across a wide range of fresh and saltwater habitats, including freshwater wetlands (Geering *et al*. 2007). It is a non-breeding visitor to southwest Australia, between October and March (Johnstone and Storr 1998). A site is deemed nationally important for this species if it regularly supports at least 475 birds (Table 9). Very small flocks of up to four birds were observed on Lake Dundas in 2012 (Western Wildlife 2013). These records are also captured on DBCA's Threatened and Priority Fauna Database and are shown on Figure 8. Although this species is known to be a visitor to the region, the study area is not likely to support this species due to lack of suitable habitat.

Pectoral Sandpiper – *Calidris melanotos*

The Pectoral Sandpiper is listed as Migratory under the BC Act and EPBC Act.

The Pectoral Sandpiper favours freshwater wetlands, although it may also occur on brackish waters or samphire flats (Geering et al. 2007, Johnstone and Storr 1998). It is a non-breeding visitor to south-west Australia between December and March (Johnstone and Storr 1998). A site is deemed nationally important for this species if it regularly supports at least 1,220 birds (Table 9). There are no records of this species within 70km on DBCA's Threatened and Priority Fauna Database. Although this species may be a visitor to the region, the study area is not likely to support this species due to lack of suitable habitat.

Fork-tailed Swift – *Apus pacificus*

The Fork-tailed Swift is listed as Migratory under the BC Act and EPBC Act.

The Fork-tailed Swift is a non-breeding visitor to Australia between September and April (Boehm 1962). While it can be common further north, in southwest Australia this species is generally scarce (Johnstone and Storr 1998). The bird is primarily observed foraging for insects in proximity to cyclonic weather (Boehm 1962). Although a migratory species, the Fork-tailed Swift has a large range and a large population that appears to be stable (Birdlife International 2024). There are no records of this species within 70km on DBCA's Threatened and Priority Fauna Database (Figure 8). Although it is likely to occur periodically, in Western Australia the Fork-tailed Swift is a largely an aerial species and study area is not likely to be of particular importance to the species.

5.2.3 Specially Protected Fauna

There is one specially protected species that potentially occurs in the study area (Table 8).

The populations of Specially Protected species are large enough that they are not considered to be Threatened. However, they require on-going conservation intervention (i.e. Conservation Dependent) or be specially protected in order to prevent them from becoming Threatened.

Peregrine Falcon – *Falco peregrinus*

The Peregrine Falcon is listed as Other Specially Protected Fauna under the BC Act.

The Peregrine Falcon is a widespread bird of prey that globally has a very large range and a very large population that appears to be secure (BirdLife International 2024). In Western Australia the population is secure, though this species may experience reductions at a local level due to human disturbance at nesting sites (Debus 1998). The Peregrine Falcon nests mainly on ledges on cliffs or rocky outcrops, and it may also use tall trees (Johnstone and Storr 1998). This species often takes advantage of man-made structures such as abandoned open pits or quarries.

There are several records of the Peregrine Falcon within 70km of the study area on DBCA's Threatened and Priority Fauna Database (Figure 8). This species is likely to occur in the study area and breeding habitat may be present in existing open pits. If a pair nests nearby, they are likely to forage in the study area, preferring more open areas of habitat, including cleared areas.

5.2.4 Priority Fauna

There are six Priority fauna species that may occur in the study area (Table 8).

Priority 1, 2 or 3 species are considered to be in need of further survey, as insufficient data exist to adequately determine their status. Many Priority 1, 2 and 3 species are known from only a few records in a limited number of locations, thus determining their status in the study area may be problematic. Priority 4 species are considered to require regular monitoring, as although they are adequately known, they are either rare, near threatened or recently removed from the threatened list.

Lake Cronin Snake – *Paroplocephalus atriceps*

The Lake Cronin Snake is listed as Priority 3 by DBCA.

The Lake Cronin Snake is known from very few localities in the semi-arid southern interior of Western Australia (Storr *et al*. 2002). The Lake Cronin Snake has been recorded from areas of woodland (including Salmon Gum woodlands) and tall shrubland and, although not known to have declined, this species may be threatened by clearing for agriculture and mining (Cogger *et al*. 1993, Bush *et al*. 2007). In the most recent Action Plan, this species is assessed as being of Least Concern (Chapple *et al*. 2019)

There are no records of this species within 70km of the study area on the DBCA Threatened Fauna Database (DBCA 2024), however, the study area is potentially within the known distribution of this species as indicated by recorded locations in Chappel *et al*. (2019). The Lake Cronin Snake possibly occurs in the study area, however, the overall low number of records of this species makes its status difficult to ascertain.

Hooded Plover – *Thinornis cucullata*

The Hooded Plover is listed as Priority 4 by DBCA.

The Hooded Plover is a small shorebird that inhabits both coastal areas and salt lakes. This bird often occurs in pairs or small groups but is also known to form large flocks of up to 400 birds in the Esperance area (Johnstone and Storr 1998). The Hooded Plover has been recorded breeding at Lake Dundas and at Norseman (Raines 2002). The Hooded Plover is vulnerable to predation by introduced predators and to human disturbance, as it nests on the ground in the open on the beach or on the margins of salt lakes. The eggs take about a month to hatch and then the young are flightless for the first 6 weeks of life (Raines 2002).

The Hooded Plover was recorded on Lake Dundas on DBCA's Threatened and Priority Fauna Database (Figure 8). Hooded Plover is known to occur nearby on Lake Cowan, but the study areas lack suitable habitat to support this species.

Inland Western Rosella – *Platycercus icterotis xanthagenys*

The Inland Western Rosella is listed as Priority 4 by DBCA.

The Inland Western Rosella is endemic to southern Western Australia. The population of this species is thought to be declining in the western wheatbelt due to clearing, but stable in the western woodlands (Garnett and Crowley 2000). Although still listed as a Priority species, the Inland Western Rosella was not listed in the 2010 Action Plan for Australian Birds as the population is considered too large and the decline too slow to be designated Near Threatened (Garnett *et al*. 2011). This species occurs in eucalypt and casuarina woodlands, nesting in tree hollows (Johnstone and Storr 1998).

The Inland Western Rosella was recorded in both the TSF5 and Desirables study areas during the fauna survey (a single bird in each area) and is also known from several records on DBCA's Threatened and Priority Fauna Database (Figure 8). The Inland Western Rosella is likely to forage in woodland and shrubland habitats in the study area, potentially breeding in woodland habitats with tree hollows.

Central Long-eared Bat – *Nyctophilus major tor*

The Central Long-eared Bat is listed as Priority 3 by DBCA.

The Central Long-eared Bat is widespread across the arid south of Australia, and though thought to have a population of substantially more than 10,000 individuals, the reliability of this estimate is low (Woinarski *et al*. 2014). It is considered locally common in some Bioregions, including the Coolgardie Bioregion (Duncan *et al*. 1999). It occurs in eucalypt woodlands with a tall shrub understorey and around granite outcrops, roosting beneath bark, in tree crevices or in the foliage of trees (Duncan *et al*. 1999, Van Dyck and Strahan 2008, Churchill 2008). Current threats to this species are inferred and include habitat loss and fragmentation or inappropriate fire regimes leading to a loss of habitat and/or roost sites (Woinarski *et al*. 2014).

There is a single record of this species within 70km of the study area on DBCA's Threatened and Priority Fauna Database (Figure 8), however, this is unsurprising as records of this bat are reliant on captures as it is not possible to distinguish it from related species on the basis of its call. The Central Long-eared Bat may occur in the eucalypt woodlands of the study area.

Western Brush Wallaby – *Notamacropus irma*

The Western Brush Wallaby is listed as Priority 4 by DBCA.

The Western Brush Wallaby is endemic to the southwest of Western Australia and occurs in open forests or woodlands (Van Dyck and Strahan 2008). The home-range size of this species has been estimated at about 9.9 ha for males and 5.3 ha for females (Bamford and Bamford 1999), so the study area potentially supports many individuals. However, this species is only known from two locations within 70km on DBCA's Threatened and Priority Fauna Database, the nearest about 24km to the west of the study area (Figure 8). These are both reliable records from 1990 and 2017, suggesting that this species occurs in low densities in the region. Although this species may occur in the study area, the likelihood is low as the study areas represent the eastern extremity of this species' known range. If present, it may occur in eucalypt woodlands, resting by day in areas of denser understory.

Blue-billed Duck – *Oxyura australis*

The Blue-billed Duck is listed as Priority 4 by DBCA.

The Blue-billed Duck occurs across much of southwestern and south-eastern Australia, but its population may be as small as 10,000 and declining. This species occurs on both fresh and saline wetlands, preferring deep, open, permanent waters near dense vegetation (Garnett *et al*. 2011). Key threats to the species include diversion of water for agriculture, loss of wetland habitats to agriculture or urban development, increased salinisation and degradation of wetland habitats (Garnett *et al*. 2011).

There is one record of this species within 70km of the study area on DBCA's Threatened and Priority Fauna Database (Figure 8), from Picnic Lake (DBCA 2024). This species possibly occurs in the region but the study areas lack suitable habitat to support this species.

5.2.5 Locally Significant Fauna

No Locally Significant fauna were identified. As the study area is within the relatively intact vegetation of the Great Western Woodlands, most species in this region remain common and widespread. The study area lacks restricted habitats and is not known or likely to support significant congregations of any species.

5.3 Important Habitats

All habitats have some importance in that they support native fauna, however, habitats may be of particular importance if they:

- support very diverse or unique faunal assemblages
- are restricted or rare in the region (and thus the associated faunal assemblages are restricted or rare)
- are refugia (e.g. from drought or fire)
- provide ecological linkage
- support conservation significant fauna

The habitats in the study area are common and widespread in the IBRA subregion and are unlikely to function as ecological linkages or refugia, except on a very local level. Although the habitats may support conservation significant fauna, the likelihood of most species occurring is low, or if they are likely to occur, the habitats of the study areas are unlikely to be of particular importance.

For example, the eucalypt woodlands in the study areas are known to support the Inland Western Rosella (*Platycercus icterotis xanthogenys*: Priority 4), but habitat for this species is extensive in the region, and this species is not listed in the 2020 Action Plan for Australian Birds (Garnett and Baker 2021). It is unlikely that the woodlands of the study areas are of particular importance for this species.

There is one Threatened species for which the habitats of the study area may be important. The Malleefowl (*Leipoa ocellata*; Vulnerable) is known to occur in the region and there are nearby recent records of this species on databases (DBCA 2024). No mounds were found on this survey, and although breeding habitat (critical habitat) is possible present, the likelihood appears low. If present locally, Malleefowl may forage in the study area, and foraging habitat may be considered at least to be supporting habitat for this species.

6. Conclusions

The study areas contain six broad fauna habitats. Although all habitats have importance in supporting native fauna, the habitats of the study area are unlikely to be of particular significance as ecological linkages or refugia.

The faunal assemblage of the study areas is likely to be largely intact, as the study area is situated within a larger tract of native vegetation. Many of the species that occur are widely distributed through semi-arid Australia. The predicted faunal assemblage includes up to nine frogs, 66 reptiles, 159 birds, 24 native mammals and eight introduced mammals. The observed assemblage on this survey included no frogs, two reptiles, 34 birds, one native mammals and three introduced mammals.

Eighteen vertebrate conservation significant fauna potentially occur in the vicinity of the study areas: seven Threatened, four Migratory, one Specially Protected and six Priority species.

Species known to occur

The only species recorded during this survey was the Inland Western Rosella (*Platycercus icterotis xanthogenys:* Priority 4). This species is likely to occur in the eucalypt woodlands, potentially breeding in eucalypt hollows.

Species likely to occur

The only species considered likely to occur is the Peregrine Falcon (*Falco peregrinus:* other specially protected fauna). This species is represented by many records in the region, and is likely to occur, potentially nesting in the existing open pits and foraging in cleared areas. Although likely to occur, the study area is unlikely to be important for the Peregrine Falcon, as this species is not considered to be in decline and its habitat is widespread.

Species that potentially occur

The Malleefowl (*Leipoa ocellata*: Vulnerable), Fork-tailed Swift (*Apus pacificus*: Migratory) and Central Long-eared Bat (*Nyctophylus major tor*: Priority 3) all potentially occur in the study areas. The Malleefowl was targeted as part of this survey, but despite walking 75.8km of transect, no mounds were detected, and no mounds have been detected on previous nearby surveys in involving 158km of transect (Western Wildlife 2021). If present locally, and recent records in the area suggest that they are, Malleefowl may forage in the study area, and foraging habitat may be considered at least to be supporting habitat for this species.

Although it may overfly the region, the study area is unlikely to be important for the Fork-tailed Swift as it is a primarily aerial species in Australia. The Central Long-eared Bat may occur in the eucalypt woodlands.

Species that may possibly occur

Species that possibly occur include the Lake Cronin Snake (*Paroplocephalus atriceps*: Priority 3), Southern Whiteface (*Aphelocephala leucopsis*: Vulnerable), Chuditch (*Dasyurus geoffroii*: Vulnerable) and Western Brush Wallaby (*Notamacropus irma*: Priority 4). In general, the study area is at the edge or just outside of the known range of these species.

Species that are unlikely to occur

The majority of species considered unlikely to occur are shorebirds, including the Common Sandpiper (*Actitis hypoleucos:* Migratory), Sharp-tailed Sandpiper (*Calidris acuminata*: Vulnerable), Curlew Sandpiper (*Calidris ferruginea:* Critically Endangered), Pectoral Sandpiper (*Calidris melanotos*: Migratory), Common Greenshank (*Tringa nebularia*: Endangered), Red-necked Stint (*Calidris ruficollis*: Migratory) and the Hooded Plover (*Thinornis cucullata*: Priority 4). These species may occur on nearby salt lakes, but the study areas do not contain habitat to support these species. Similarly, there is no habitat to support the Blue-billed Duck (*Oxyura australis*: Priority 4).

The Night Parrot (*Pezoporus occidentalis*: Endangered) requires mature spinifex for roosting and breeding. Although spinifex is present in the Desirables study area, it is too short and insufficiently dense to provide habitat for this extremely rare species.

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Appendices

Appendix 1. Frogs that Potentially Occur in the Study Area

Key to records:
This survey = species recorded in the survey area in October 2024.
Norseman Gold 2020 = species recorded adjacent to the survey area, 2020 (Western Wildlife 2021).
Mt Henry = species recorded in and adjacent to the southern part of the survey area, 2012 - 2013 (Western Wildlife 2013).
Norseman Gold 1999 = species recorded in and adjacent to the survey area, 1998 – 1999 (Ecologia 1999).
Harlequin Mine = species recorded adjacent to the survey area in 1994 (Halpern Glick Maunsell 1994).
Dundas NR = species recorded in Dundas Nature Reserve 1977 – 1980, 45km east of the survey area (Hall and McKenzie 1993)
ALA Database = species records within 40km from the ALA Database (see Table 2).
Dandjoo Database = species records within 40km from the Dandjoo Database (see Table 2).
DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).

Species		Conservation status	Records									
			This survey	Norseman Gold 2020	Mt Henry	Norseman Gold 1999	Harlequin Gold	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Pelodryadidae (tree frogs)												
Spotted-thighed Frog	*Litoria cyclorhyncha*								+			
Limnodynastidae (burrowing frogs)												
Western Banjo Frog	*Limnodynastes dorsalis*					+				+		
White-footed Trilling Frog	*Neobatrachus albipes*					+			+	+		
Northern Burrowing Frog	*Neobatrachus aquilonius*								+	+		
Kunapalari Frog	*Neobatrachus kunapalari*					+			+	+		
Humming Frog	*Neobatrachus pelobatoides*								+	+		
Shoemaker Frog	*Neobatrachus sutor*								+			
Myobatrachidae (ground frogs)												
Bleating Froglet	*Crinia pseudinsignifera*					+			+	+		
Western Toadlet	*Pseudophryne occidentalis*					+		+	+	+		
Number of frog species predicted (recorded):		**9 (0)**										

Appendix 2. Reptiles that Potentially Occur in the Study Area

Key to records:
This survey = species recorded in the survey area in October 2024.
Norseman Gold 2020 = species recorded adjacent to the survey area, 2020 (Western Wildlife 2021).
Mt Henry = species recorded in and adjacent to the southern part of the survey area, 2012 - 2013 (Western Wildlife 2013).
Norseman Gold 1999 = species recorded in and adjacent to the survey area, 1998 – 1999 (Ecologia 1999).
Harlequin Mine = species recorded adjacent to the survey area in 1994 (Halpern Glick Maunsell 1994).
Dundas NR = species recorded in Dundas Nature Reserve 1977 – 1980, 45km east of the survey area (Hall and McKenzie 1993)
ALA Database = species records within 40km from the ALA Database (see Table 2).
Dandjoo Database = species records within 40km from the Dandjoo Database (see Table 2).
DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).

Species		Conservation Status	Records									
			This survey	Norseman Gold 2020	Mt Henry	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Carphodactylidae (knob-tailed geckoes)												
Barking Gecko	*Underwoodisaurus milii*				+	+			+	+		
Diplodactylidae (ground geckos)												
Clawless Gecko	*Crenadactylus ocellatus*				+	+		+	+	+		
Wheatbelt Stone Gecko	*Diplodactylus granariensis*				+	+		+	+	+		
Western Saddled Ground Gecko	*Diplodactylus pulcher*					+			+	+		
	Lucasium maini				+	+	+	+	+	+		
Reticulated Velvet Gecko	*Hesperoedura reticulata*				+			+	+	+		
Goldfields Spiny-tailed Gecko	*Strophurus assimilis*					+			+	+		
Western Spiny-tailed Gecko	*Strophurus strophurus*								+	+		
Gekkonidae (geckoes)												
Marbled Gecko	*Christinus marmoratus*				+	+		+	+	+		
Purplish Dtella	*Gehyra pupurescens*								+			
Variegated Dtella	*Gehyra variegata*				+	+		+	+	+		
Bynoe's Gecko	*Heteronotia binoei*				+	+		+	+	+		
Pygopodidae (legless lizards)												
	Delma australis				+	+		+	+	+		
	Delma butleri											
Fraser's Legless Lizard	*Delma fraseri*				+	+			+	+		
Burton's Legless Lizard	*Lialis burtonis*				+	+		+	+	+		
Common Scaly-foot	*Pygopus lepidopodus*				+	+			+	+		
Agamidae (dragon lizards)												
Western Ring-tailed Dragon	*Ctenophorus caudicinctus*								+	+		
Eastern Heath Dragon	*Ctenophorus chapmani*							+	+	+		
Crested Dragon	*Ctenophorus cristatus*		+		+	+	+	+	+	+		
Spotted Military Dragon	*Ctenophorus maculatus*											
Ornate Crevice Dragon	*Ctenophorus ornatus*				+				+	+		
Western Netted Dragon	*Ctenophorus reticulatus*								+	+		
Salt Lake Dragon	*Ctenophorus salinarum*				+	+	+	+	+	+		
Lozenge-marked Dragon	*Ctenophorus scutulatus*								+	+		

Appendix 2. (cont.)

Species		Conservation Status	Records									
			This survey	Norseman Gold 2020	Mt Henry	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Agamidae (dragon lizards)												
Thorny Devil	*Moloch horridus*				+	+		+	+	+		
Bearded Dragon	*Pogona minor*				+	+		+	+	+		
Goldfields Pebble Dragon	*Tympanocryptis pseudopsephos*					+			+			
Scincidae (skink lizards)												
Fence Skink	*Cryptoblepharus buchananii*				+	+		+	+	+		
	Ctenotus atlas					+		+	+	+		
	Ctenotus schomburgkii				+			+	+	+		
	Ctenotus severus								+	+		
	Ctenotus uber				+	+		+	+	+		
	Cyclodomorphus melanops				+	+		+	+	+		
	Egernia formosa								+	+		
	Egernia richardi				+	+		+	+	+		
Desert Skink	*Liopholis inornata*							+				
	Liopholis multiscutata				+	+		+	+	+		
Five-toed Earless Skink	*Hemiergis initialis*				+	+	+	+	+	+		
	Lerista dorsalis				+			+	+	+		
	Lerista kingi				+				+	+		
	Lerista picturata				+	+		+	+	+		
	Lerista timida				+				+	+		
	Lerista tridactyla					+			+	+		
Dwarf Skink	*Menetia greyii*				+	+		+	+	+		
	Morethia butleri				+	+		+	+	+		
Dusky Morethia	*Morethia obscura*				+	+		+	+	+		
Western Blue-tongue	*Tiliqua occipitalis*				+		+	+	+	+		
Bobtail	*Tiliqua rugosa*				+	+		+	+	+		
Varanidae (monitor-lizards)												
Gould's Goanna	*Varanus gouldii*		+		+	+	+	+	+	+		
Southern Heath Monitor	*Varanus rosenbergi*							+				
Black-tailed Monitor	*Varanus tristis*				+	+			+	+		
Typhlopidae (blind-snakes)												
Southern Blind Snake	*Anilios australis*				+	+			+	+		
	Anilios bicolor				+					+		
	Anilios bituberculatus					+			+	+		
Pythonidae (Australian pythons)												
Carpet Python (south-west)	*Morelia spilota imbricata*					+			+	+		

Appendix 2. (cont.)

Species		Conservation Status	Records									
			This survey	Norseman Gold 2020	Mt Henry	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Elapidae (front-fanged snakes)												
Southern Shovel-nosed Snake	*Brachyurophis semifasciatus*				+					+		
Bardick	*Echiopsis curta*											
Black-naped Snake	*Neelaps bimaculatus*				+			+		+		
Lake Cronin Snake	*Paroplocephalus atriceps*	P									+	
Gould's Hooded Snake	*Suta gouldii*				+	+		+	+	+		
Black-backed Snake	*Parasuta nigriceps*				+					+		
Mulga Snake	*Pseudechis australis*				+	+			+	+		
Dugite	*Pseudonaja affinis*					+		+	+	+		
Gwardar	*Pseudonaja mengdeni*				+	+			+	+		
Jan's Banded Snake	*Simoselaps bertholdi*				+				+	+		
Number of reptile species predicted (recorded):		**66 (2)**										

Appendix 3. Birds that Potentially Occur in the Study Area

Key to records:
This survey = species recorded in the survey area in October 2024.
Norseman Gold 2020 = species recorded adjacent to the survey area, 2020 (Western Wildlife 2021).
Mt Henry = species recorded in and adjacent to the southern part of the survey area, 2012 - 2013 (Western Wildlife 2013).
Norseman Gold 1999 = species recorded in and adjacent to the survey area, 1998 – 1999 (Ecologia 1999).
Harlequin Mine = species recorded adjacent to the survey area in 1994 (Halpern Glick Maunsell 1994).
Dundas NR = species recorded in Dundas Nature Reserve 1977 – 1980, 45km east of the survey area (Hall and McKenzie 1993)
Birdata = species records from the Birdata Database (see Table 2).
ALA Database = species records within 40km from the ALA Database (see Table 2).
Dandjoo Database = species records within 40km from the Dandjoo Database (see Table 2).
DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).

Species	Conservation status	Records										
		This survey	Norseman Gold 2020	Mt Henry	Brockway Reserve	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Dromaiidae (emus)												
Emu *Dromaius novaehollandiae*				+	+	+	+	+	+	+		
Anatidae (ducks & swans)												
Musk Duck *Biziura lobata*									+			
Black Swan *Cygnus atratus*						+			+			
Australian Shelduck *Tadorna tadornoides*				+	+	+			+	+		
Australian Wood Duck *Chenonetta jubata*						+			+			
Grey Teal *Anas gracilis*					+	+			+			
Chestnut Teal *Anas castanea*									+			
Pacific Black Duck *Anas superciliosa*						+			+	+		
Australasian Shoveler *Spatula rhynchotis*									+			
Pink-eared Duck *Malacorhynchus membranaceus*					+	+			+			
Hardhead *Aythya australis*												
Blue-billed Duck *Oxyura australis*	P								+		+	
Megapodiidae (mound-builders)												
Malleefowl *Leipoa ocellata*	T			?				+	+		+	+
Podargidae (frogmouths)												
Tawny Frogmouth *Podargus strigoides*		+		+			+	+	+	+		
Phasianidae (pheasants and quails)												
Stubble Quail *Coturnix pectoralis*						+			+			
Caprimulgidae (nightjars)												
Spotted Nightjar *Eurostopodus argus*				+				+	+	+		
Aegothelidae (owlet-nightjars)												
Australian Owlet-Nightjar *Aegotheles cristatus*				+				+	+	+		
Apodidae (swifts)												
Fork-tailed Swift *Apus pacificus*	Mi											+
Otididae (bustards)												
Australian Bustard *Ardeotis australis*									+			

Appendix 3. (cont.)

Species		Conservation status	Records										
			This survey	Norseman Gold 2020	Mt Henry	Brockway Reserve	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Cuculidae (cuckoos)													
Pallid Cuckoo	*Heteroscenes pallidus*							+	+	+			
Fan-tailed Cuckoo	*Cacomantis flabelliformis*									+	+		
Black-eared Cuckoo	*Chalcites osculans*				+					+	+		
Horsfield's Bronze-Cuckoo	*Chalcites basalis*		+				+			+	+		
Shining Bronze-Cuckoo	*Chalcites lucidus*				+					+	+		
Columbidae (pigeons and doves)													
Domestic Pigeon	*Columba livia*	Int.								+			
Common Bronzewing	*Phaps chalcoptera*				+	+	+		+	+	+		
Brush Bronzewing	*Phaps elegans*			+				+		+			
Crested Pigeon	*Ocyphaps lophotes*				+		+	+		+	+		
Laughing Turtle-dove	*Spilopelia chinensis*									+			
Spotted Turtle-dove	*Spilopelia senegalensis*									+			
Rallidae (crakes, rails & gallinules)													
Black-tailed Native-Hen	*Tribonyx ventralis*									+			
Eurasian Coot	*Fulica atra*					+				+			
Podicipedidae (grebes)													
Australasian Grebe	*Tachybaptus novaehollandiae*									+	+		
Hoary-headed Grebe	*Poliocephalus poliocephalus*						+			+			
Turnicidae (button-quails)													
Little Button-quail	*Turnix velox*									+			
Recurvirostridae (stilts & avocets)													
Black-winged Stilt	*Himantopus himantopus*					+							
Banded Stilt	*Cladorhynchus leucocephalus*									+	+		
Red-necked Avocet	*Recurvirostra novaehollandiae*									+			
Charadriidae (lapwings and plovers)													
Banded Lapwing	*Vanellus tricolor*								+				
Red-capped Plover	*Charadrius ruficapillus*			+	+					+	+		
Black-fronted Dotterel	*Elseyornis melanops*									+	+		
Hooded Plover	*Thinornis cucullatus*	P			+					+		+	
Inland Dotterel	*Peltohyas australis*	LS											
Scolopacidae (snipe, godwits, sandpipers & stints)													
Common Sandpiper	*Actitis hypoleucos*	Mi										+	+
Common Greenshank	*Tringa nebularia*	T,Mi										+	
Curlew Sandpiper	*Calidris ferruginea*	T,Mi										+	+
Red-necked Stint	*Calidris ruficollis*	Mi			+								
Sharp-tailed Sandpiper	*Calidris acuminata*	T,Mi								+			+
Pectoral Sandpiper	*Calidris melanotos*	Mi											+

Appendix 3. (cont.)

Species	Conservation status	Records										
		This survey	Norseman Gold 2020	Mt Henry	Brockway Reserve	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Laridae (gulls, terns, skuas, jaegers & noddies)												
Silver Gull *Larus novaehollandiae*									+			
Phalacrocoracidae (cormorants)												
Little Pied Cormorant *Microcarbo melanoleucos*									+			
Great Cormorant *Phalacrocorax carbo*									+			
Little Black Cormorant *Phalacrocorax sulcirostris*									+			
Threskiornithidae (ibis and spoonbills)												
Australian White Ibis *Threskiornis molucca*									+	+		
Straw-necked Ibis *Threskiornis spinicollis*									+			
Ardeidae (herons, egrets & bitterns)												
White-necked Heron *Ardea pacifica*									+			
Cattle Egret *Bubulcus ibis*									+			
White-faced Heron *Egretta novaehollandiae*					+	+			+			
Pelecanidae (pelicans)												
Australian Pelican *Pelecanus conspicillatus*						+						
Accipitridae (kites, hawks and eagles)												
Black-shouldered Kite *Elanus axillaris*									+	+		
Square-tailed Kite *Lophoictinia isura*				+			+	+	+	+		
Whistling Kite *Haliastur sphenurus*								+	+	+		
Spotted Harrier *Circus assimilis*												
Brown Goshawk *Accipiter fasciatus*				+		+			+	+		
Collared Sparrowhawk *Accipiter cirrocephalus*			+						+	+		
Wedge-tailed Eagle *Aquila audax*						+		+	+			
Little Eagle *Hieraaetus morphnoides*								+	+	+		
Tytonidae (barn owls)												
Eastern Barn Owl *Tyto javanica*												
Strigidae (hawk-owls)												
Southern Boobook Owl *Ninox boobook*			+	+		+		+	+	+		
Alcedinidae (forest kingfishers)												
Red-backed Kingfisher *Todiramphus pyrrhopygius*								+	+	+		
Sacred Kingfisher *Todiramphus sanctus*		+		+				+	+	+		
Meropidae (bee-eaters)												
Rainbow Bee-eater *Merops ornatus*		+		+		+	+	+	+	+		
Falconidae (falcons)												
Peregrine Falcon *Falco peregrinus*	OS			+		+			+		+	
Australian Hobby *Falco longipennis*								+	+			
Brown Falcon *Falco berigora*			+	+				+	+	+		
Australian Kestrel *Falco cenchroides*				+		+		+	+	+		

Appendix 3. (cont.)

Species		Conservation status	Records										
			This survey	Norseman Gold 2020	Mt Henry	Brockway Reserve	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Cacatuidae (cockatoos)													
Galah	*Eolophus roseicapilla*									+	+		
Psittaculidae (lorikeets & parrots)													
Budgerigar	*Melopsittacus undulatus*									+			
Elegant Parrot	*Neophema elegans*									+			
Scarlet-chested Parrot	*Neophema splendida*	LS			+					+	+		
Purple-crowned Lorikeet	*Parvipsitta porphyrocephala*		+	+	+	+	+	+	+	+	+		
Regent Parrot	*Polytelis anthopeplus*			+	+				+	+	+		
Inland Western Rosella	*Platycercus icterotis xanthogenys*	P	+	+	+				+	+	+	+	
Night Parrot	*Pezoporus occidentalis*	T											+
Australian Ringneck	*Barnardius zonarius*		+	+	+		+	+	+	+	+		
Mulga Parrot	*Psephotellus varius*							+	+	+	+		
Climacteridae (treecreepers)													
Rufous Treecreeper	*Climacteris rufus*		+	+	+	+	+		+	+	+		
Maluridae (fairy-wrens)													
Splendid Fairy-wren	*Malurus splendens*		+				+			+	+		
Blue-breasted Fairy-wren	*Malurus pulcherrimus*		+	+	+	+	+		+	+	+		
White-winged Fairy-wren	*Malurus leucopterus*			+			+			+	+		
Meliphagidae (honeyeaters)													
Black Honeyeater	*Sugomel niger*									+			
Red Wattlebird	*Anthochaera carunculata*		+	+	+	+	+	+	+	+	+		
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*			+	+	+	+	+	+	+	+		
Yellow-throated Miner	*Manorina flavigula*		+	+	+		+		+	+	+		
Singing Honeyeater	*Gavicalis virescens*			+		+	+	+		+	+		
Tawny-crowned Honeyeater	*Glyciphila melanops*							+		+	+		
Purple-gaped Honeyeater	*Lichenostomus cratitius*			+	+					+	+		
White-eared Honeyeater	*Nesoptilotis leucotis*		+	+	+	+	+	+	+	+	+		
Yellow-plumed Honeyeater	*Ptilotula ornata*		+	+	+	+	+	+	+	+	+		
Brown-headed Honeyeater	*Melithreptus brevirostris*			+	+		+		+	+	+		
Brown Honeyeater	*Lichmera indistincta*		+	+	+	+	+		+	+	+		
White-fronted Honeyeater	*Purnella albifrons*				+		+	+	+	+	+		
White-cheeked Honeyeater	*Phylidonyris niger*							+		+	+		
New Holland Honeyeater	*Phylidonyris novaehollandiae*				+					+	+		
Pied Honeyeater	*Certhionyx variegatus*												
Crimson Chat	*Epthianura tricolor*									+			
White-fronted Chat	*Epthianura albifrons*						+		+	+	+		

Appendix 3. (cont.)

Species	Conservation status	Records										
		This survey	Norseman Gold 2020	Mt Henry	Brockway Reserve	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Pardalotidae (pardalotes)												
Spotted Pardalote *Pardalotus punctatus*			+	+				+	+	+		
Striated Pardalote *Pardalotus striatus*		+	+	+		+	+	+	+	+		
Acanthizidae (thornbills, gerygones & allies)												
Southern Whiteface *Aphelocephala leucopsis*	T											+
White-browed Scrubwren *Sericornis frontalis*				+					+	+		
Shy Heathwren *Calamanthus cautus*				+		+		+	+	+		
Rufous Fieldwren *Calamanthus campestris*									+			
Redthroat *Pyrrholaemus brunneus*		+	+	+	+	+	+	+	+	+		
Weebill *Smicrornis brevirostris*		+	+	+	+	+	+	+	+	+		
Western Gerygone *Gerygone fusca*		+			+		+	+	+	+		
Inland Thornbill *Acanthiza apicalis*		+	+	+	+	+	+	+	+	+		
Slender-billed Thornbill *Acanthiza iredalei*									+			
Chestnut-rumped Thornbill *Acanthiza uropygialis*				+		+	+		+	+		
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*				+	+	+	+		+	+		
Pomatostomidae (Australian babblers)												
White-browed Babbler *Pomatostomus superciliosus*		+	+	+	+	+		+	+	+		
Cinclosomatidae (quail-thrush)												
Chestnut (Copper-back) Quail-Thrush *Cinclosoma clarum*		+		+				+	+	+		
Artamidae (woodswallows)												
Masked Woodswallow *Artamus personatus*				+					+	+		
Black-faced Woodswallow *Artamus cinereus*					+	+		+	+	+		
Dusky Woodswallow *Artamus cyanopterus*		+	+	+	+			+	+	+		
Cracticidae (butcherbirds, currawongs & magpie)												
Grey Butcherbird *Cracticus torquatus*			+	+	+	+	+	+	+	+		
Pied Butcherbird *Cracticus nigrogularis*				+		+		+	+	+		
Australian Magpie *Gymnorhina tibicen*				+		+			+	+		
Grey Currawong *Strepera versicolor*		+	+	+		+	+	+	+	+		
Campephagidae (cuckoo-shrikes and trillers)												
Ground Cuckoo-shrike *Coracina maxima*									+			
Black-faced Cuckoo-shrike *Coracina novaehollandiae*		+	+	+		+	+	+	+	+		
White-winged Triller *Lalage tricolor*				+					+			
Neosittidae (sittellas)												
Varied Sittella *Daphoenositta chrysoptera*			+	+	+	+		+	+	+		
Oreoicidae (bellbird)												
Crested Bellbird *Oreoica gutturalis*		+		+		+	+	+	+	+		

Appendix 3. (cont.)

Species	Conservation status	Records										
		This survey	Norseman Gold 2020	Mt Henry	Brockway Reserve	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Pachycephalidae (whistlers)												
Crested Shrike-tit *Falcunculus frontatus*				+				+	+	+		
Gilbert's Whistler *Pachycephala inornata*		+	+	+		+		+	+	+		
Western Golden Whistler *Pachycephala occidentalis*			+	+		+		+	+	+		
Rufous Whistler *Pachycephala rufiventris*		+	+	+		+			+	+		
Grey Shrike-thrush *Colluricincla harmonica*		+	+	+	+	+		+	+	+		
Rhipiduridae (wagtails and fantails)												
Grey Fantail *Rhipidura albiscapa*				+					+			
Willie Wagtail *Rhipidura leucophrys*		+	+	+		+		+	+	+		
Monarchidae (monarchs and flycatchers)												
Magpie-lark *Grallina cyanoleuca*						+			+	+		
Restless Flycatcher *Myiagra inquieta*			+					+	+	+		
Corvidae (ravens and crows)												
Australian Raven *Corvus coronoides*			+	+	+	+	+	+	+	+		
Little Crow *Corvus bennetti*							+	+	+			
Petroicidae (Australian robins)												
Jacky Winter *Microeca fascinans*		+	+	+		+	+	+	+	+		
Hooded Robin *Melanodryas cucullata*				+					+	+		
Red-capped Robin *Petroica goodenovii*			+	+	+	+		+	+	+		
Western Yellow Robin *Eopsaltria griseogularis*		+	+	+	+			+	+	+		
Southern Scrub-robin *Drymodes brunneopygia*						+		+	+			
Hirundinidae (swallows)												
White-backed Swallow *Cheramoeca leucosterna*			+			+	+		+	+		
Fairy Martin *Hirundo ariel*						+			+			
Welcome Swallow *Hirundo neoxena*		+	+						+	+		
Tree Martin *Petrochelidon nigricans*			+	+			+	+	+	+		
Locustellidae (Old World warblers, songlarks & grassbirds)												
Brown Songlark *Cincloramphus cruralis*								+				
Rufous Songlark *Cincloramphus mathewsi*										+		
Zosteropidae (white-eyes)												
Silvereye *Zosterops lateralis*			+	+			+	+	+	+		
Dicaeidae (flower-peckers)												
Mistletoebird *Dicaeum hirundinaceum*		+		+					+	+		
Motacillidae (pipits and true wagtails)												
Australian Pipit *Anthus australis*						+	+	+	+	+		
Number of bird species predicted (recorded):	**159 (34)**											

Appendix 4. Mammals that Potentially Occur in the Study Area

Key to records:
This survey = species recorded in the survey area in October 2024.
Norseman Gold 2020 = species recorded adjacent to the survey area, 2020 (Western Wildlife 2021).
Mt Henry = species recorded in and adjacent to the southern part of the survey area, 2012 - 2013 (Western Wildlife 2013).
Norseman Gold 1999 = species recorded in and adjacent to the survey area, 1998 – 1999 (Ecologia 1999).
Harlequin Mine = species recorded adjacent to the survey area in 1994 (Halpern Glick Maunsell 1994).
Dundas NR = species recorded in Dundas Nature Reserve 1977 – 1980, 45km east of the survey area (Hall and McKenzie 1993)
ALA Database = species records within 40km from the ALA Database (see Table 2).
Dandjoo Database = species records within 40km from the Dandjoo Database (see Table 2).
DBCA = species records from the DBCA Threatened and Priority Species Database (see Table 2).
EPBC = species & species habitat from the EPBC Protected Matters Search Tool (see Table 2).

Species		Conservation status	Records									
			This survey	Norseman Gold 2020	Mt Henry	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Tachyglossidae (echidnas)												
Echidna	*Tachyglossus aculeatus*					+			+	+		
Dasyuridae (carnivorous marsupials)												
Kultarr	*Antechinomys laniger*											
Chuditch	*Dasyurus geoffroii*	T										+
Southern Ningaui	*Ningaui yvonneae*				+	+				+		
Fat-tailed Dunnart	*Sminthopsis crassicaudata*				+			+	+	+		
Little Long-tailed Dunnart	*Sminthopsis dolichura*				+	+		+	+	+		
Gilbert's Dunnart	*Sminthopsis gilberti*											
Ooldea Dunnart	*Sminthopsis ooldea*				+					+		
Burramyidae (pygmy possums)												
Western Pygmy Possum	*Cercartetus concinnus*				+	+	+	+	+	+		
Macropodidae (kangaroos and wallabies)												
Euro	*Osphranter robustus*				+				+	+		
Western Grey Kangaroo	*Macropus fuliginosus*		+			+		+	+	+		
Western Brush Wallaby	*Notamacropus irma*	P									+	
Muridae (rodents)												
House Mouse	*Mus musculus*	Int.			+	+		+	+	+		+
Mitchell's Hopping-Mouse	*Notomys mitchelli*				+	+		+	+	+		
Bolam's Mouse	*Pseudomys bolami*				+	+	?	+		+		
Black Rat	*Rattus rattus*	Int.			+				+	+		+
Molossidae (free-tailed bats)												
White-striped Free-tailed Bat	*Austronomus australis*				+	+		+	+	+		
Western Free-tailed Bat	*Ozimops kitcheneri*								+			
Inland Free-tailed Bat	*Ozimops petersi*											

Appendix 4. (cont.)

Species		Conservation status	Records									
			This survey	Norseman Gold 2020	Mt Henry	Norseman Gold 1999	Harlequin Mine	Dundas NR	ALA Database	Dandjoo Database	DBCA	EPBC
Vespertilionidae (evening bats)												
Gould's Wattled Bat	*Chalinolobus gouldii*				+	+		+		+		
Chocolate Wattled Bat	*Chalinolobus morio*				+	+		+	+	+		
Lesser Long-eared Bat	*Nyctophilus geoffroyi*							+				
Central Long-eared Bat	*Nyctophilus major tor*	P						+	+		+	
Inland Broad-nosed Bat	*Scotorepens balstoni*				+					+		
Southern Forest Bat	*Vespadelus regulus*				+	+		+	+	+		
Canidae (dogs & foxes)												
Dingo	*Canis familiaris dingo*					+		+				
Dog	*Canis familiaris familiaris*	Int.	+	+	+			+		+		+
Fox	*Vulpes vulpes*	Int.				+		+	+	+		+
Felidae (cats)												
Feral Cat	*Felis catus*	Int.		+	+		+		+	+		+
Camelidae (camels)												
Dromedary Camel	*Camelus dromedarius*	Int.	+	+	+			+	+			+
Bovidae (goats & cows)												
Goat	*Capra hircus*	Int.		+						+		
Leporidae (rabbits)												
European Rabbit	*Oryctolagus cuniculus*	Int.	+	+	+	+	+	+	+	+		+
Number of native mammal species predicted (recorded):		**24 (1)**										
Number of introduced mammal species predicted (recorded):		**8 (3)**										

Appendix 5. Habitat Assessments

Appendix 5	
Habitat Assessment	**Photograph**
Site: N01 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: some leaf litter **Wetlands**: none	
Site: N02 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over patchy Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining**,** timber cutting **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	
Site: N03 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: dense vegetation, some leaf litter **Wetlands**: minor ephemeral drainage	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N04 **Habitat**: Eucalypt woodland on rocky hills **Landform**: hilltop **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: woody debris, small tree hollows, some leaf litter **Wetlands**: none	
Site: N05 **Habitat**: Eucalypt woodland on rocky hills **Landform**: steep slope **Vegetation**: Eucalypts over open shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: woody debris, some leaf litter **Wetlands**: none	
Site: N06 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, woody debris, some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N07 **Habitat**: Rehabilitation **Landform**: slope **Vegetation**: Rehabilitation - young eucalypts and shrubs **Fire age**: no recent fire **Disturbance**: clearing **Soil**: clay-loam **Rock**: surface rocks **Important elements**: woody debris **Wetlands**: none	
Site: N08 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	
Site: N09 **Habitat**: Eucalypt woodland on plains **Landform**: flat **Vegetation**: Eucalypts over low chenopod shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter **Wetlands**: possible winter wet area	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N10 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over mixed shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: some leaf litter **Wetlands**: none	
Site: N11 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over mixed shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: some leaf litter **Wetlands**: none	
Site: N12 **Habitat**: Eucalypt woodland on rocky hills **Landform**: hilltop **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining**,** digs **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N13 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over very open Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: some leaf litter **Wetlands**: none	
Site: N14 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over mixed shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter, dense vegetation **Wetlands**: none	
Site: N15 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N16 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: some leaf litter **Wetlands**: none	
Site: N17 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	
Site: N18 **Habitat**: Eucalypt woodland on rocky hills **Landform**: slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N19 **Habitat**: Rehabilitation **Landform**: slope **Vegetation**: Rehabilitation - young eucalypts and shrubs **Fire age**: no recent fire **Disturbance**: clearing **Soil**: clay-loam **Rock**: surface rocks **Important elements**: woody debris **Wetlands**: none	
Site: N20 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: small tree hollows, some leaf litter**, woody debris** **Wetlands**: none	
Site: N21 **Habitat**: Gypsum dune **Landform**: gentle slope **Vegetation**: Sheoaks over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining**,** rabbits **Soil**: gypsum **Rock**: surface rocks **Important elements**: mounds of sheoak leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N23 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	
Site: N24 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over mixed low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: smooth-barked eucalypts, some leaf litter **Wetlands**: none	
Site: N25 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N26 **Habitat**: Mallee woodland over spinifex **Landform**: low rise **Vegetation**: Mallee eucalypts over open shrubs over spinifex **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: red sand **Rock**: none **Important elements**: sand for burrowing **Wetlands**: none	
Site: N27 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter**, woody debris** **Wetlands**: none	
Site: N28 **Habitat**: Cleared **Landform**: flat/gentle slope **Vegetation**: Some cleared, patches of eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: recent exploration **Soil**: clay-loam **Rock**: surface rocks **Important elements**: none noted **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N29 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	
Site: N30 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: smooth-barked eucalypts, woody debris, small tree hollows, some leaf litter **Wetlands**: none	
Site: N31 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N32 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: smooth-barked eucalypts, small tree hollows, some leaf litter **Wetlands**: none	
Site: N33 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: smooth-barked eucalypts, small tree hollows, some leaf litter **Wetlands**: none	
Site: N34 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N35 **Habitat**: Mallee woodland over spinifex **Landform**: low rise **Vegetation**: Mallee eucalypts over open shrubs over spinifex **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: red sand **Rock**: none **Important elements**: sand for burrowing **Wetlands**: none	
Site: N36 **Habitat**: Mallee woodland over spinifex (edge of habitat) **Landform**: low rise **Vegetation**: Mallee and tall eucalypts over open shrubs over spinifex **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: red sand **Rock**: none **Important elements**: sand for burrowing **Wetlands**: none	
Site: N37 **Habitat**: Shrubland on sandy lake edge **Landform**: flat **Vegetation**: Spares eucalypts over mixed shrubs incl. Eremophila sp. **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: orange clay-loam **Rock**: none **Important elements**: denser shrubs provide bird habitat. **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N38 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	
Site: N39 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: some leaf litter **Wetlands**: none	
Site: N40 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: some leaf litter**,** woody debris **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N41 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: some leaf litter **Wetlands**: none	
Site: N42 **Habitat**: Eucalypt woodland on plains **Landform**: lower slope **Vegetation**: Eucalypts over Melaleuca sheathiana over low shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: smooth-barked eucalypts, some leaf litter, woody debris **Wetlands**: none	
Site: N43 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small tree hollows, some leaf litter**, woody debris** **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N44 **Habitat**: Eucalypt woodland on rocky hills **Landform**: upper slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **including Eremophila sp.** **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface rocks **Important elements**: small rocky outcrops, some leaf litter **Wetlands**: none	
Site: N45 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining**, some recent mining/rehab** **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: some leaf litter **Wetlands**: none	
Site: N46 **Habitat**: Eucalypt woodland on plains **Landform**: gentle slope **Vegetation**: Eucalypts over Melaleuca sheathiana over sparse shrubs **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: small tree hollows, some leaf litter **Wetlands**: none	

Appendix 5	
Habitat Assessment	**Photograph**
Site: N47 **Habitat**: Shrubland on sandy lake edge **Landform**: flat **Vegetation**: Spares eucalypts over mixed shrubs incl. Eremophila sp. **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: orange clay-loam **Rock**: none **Important elements**: denser shrubs provide bird habitat. **Wetlands**: none	
Site: N48 **Habitat**: Shrubland on sandy lake edge **Landform**: flat **Vegetation**: Sparse eucalypts over mixed shrubs incl. Eremophila sp. **Fire age**: no recent fire **Disturbance**: historical mining **Soil**: clay-loam **Rock**: none **Important elements**: denser shrubs provide bird habitat. **Wetlands**: none	
Site: N49 **Habitat**: Cleared **Landform**: flat **Vegetation**: sparse Eucalypts over chenopods **Fire age**: no recent fire **Disturbance**: recent mining, near pit **Soil**: clay-loam **Rock**: surface pebbles **Important elements**: none noted **Wetlands**: none	

Appendix 6. EPBC Act Protected Matters Search Tool Results

Fauna species listed for the area within a 40km radius of the study areas, excluding marine species.

Species	Status	Type of presence
Curlew Sandpiper *Calidris ferruginea*	Critically Endangered & Migratory	Species or species habitat **MAY** occur within area
Southern Whiteface *Aphelocephala leucopsis*	Vulnerable	Species or species habitat **LIKELY** to occur within area
Malleefowl *Leipoa ocellata*	Vulnerable	Species or species habitat **KNOWN** to occur within area
Night Parrot *Pezoporus occidentalis*	Endangered	Species or species habitat **MAY** occur within area
Chuditch *Dasyurus geoffroii*	Vulnerable	Species or species habitat **MAY** occur within area
Fork-tailed Swift *Apus pacificus*	Migratory (marine)	Species or species habitat **LIKELY** to occur within area
Grey Wagtail *Motacilla cinerea*	Migratory (terrestrial)	Species or species habitat **MAY** occur within area
Common Sandpiper *Actitis hypoleucos*	Migratory (wetland)	Species or species habitat **MAY** occur within area
Sharp-tailed Sandpiper *Calidris acuminata*	Vulnerable, Migratory (wetland)	Species or species habitat **MAY** occur within area
Pectoral Sandpiper *Calidris melanotos*	Migratory (wetland)	Species or species habitat **MAY** occur within area

APPENDIX 5: INVERTEBRATE SOLUTIONS, 2024: SURVEY FOR SHORT RANGE ENDEMIC FAUNA FOR THE NORSEMAN GOLD PROJECT, NORSEMAN, WESTERN AUSTRALIA.

Survey for Short Range Endemic Fauna for the Norseman Gold Project, Norseman, Western Australia.

PANTORO

Report by *Invertebrate Solutions Pty Ltd*
for Pantoro South Pty Ltd

October 2024

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Frontispiece: The widespread millipede *Antichiropus exclamatus*

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Executive Summary

Pantoro South Pty Ltd (Pantoro) is currently in the process of developing the Norseman Gold Project (the Project), a series of open pit and underground gold mines located southern Goldfield region of Western Australia, near the Norseman townsite.

The Desktop Study Area contains three Confirmed SRE species, four Likely SRE species and 12 Possible SRE species. The species are summarised below:

- Three Paradoxosomatid millipedes (*Antichiropus anconus, A. buchanorum* and *A. incomptus*) – Confirmed SRE species.
- Two isopods (*Troglarmadillo sp.'B35'* and *Philosciidae sp.'B28')* – Likely SRE species.
- Two Iulomorphid millipedes (*Atelomastix bamfordi*? and Iulomorphidae [Atelomastix] *sp.'B03')* – Likely SRE species.
- Four trapdoor spiders, four land snails, two pseudoscorpions, two isopods, and one millipede – Possible SRE species.

The remaining species identified from desktop resources were found to be widespread.

An additional five conservation significant invertebrates (widespread, non-SRE species) were identified in the desktop assessment:

- A fairy shrimp - *Branchinella simplex* – DBCA Priority 1
- A fairy shrimp - *Branchinella denticulata*– DBCA Priority 3
- A mygalomorph spider – *Idiosoma intermedium* - DBCA Priority 3
- A butterfly – The Inland Hairstreak (*Jalmenus aridus*) – DBCA Priority 1
- A butterfly – The Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – BC Act Critically Endangered / EPBC Act Critically Endangered

Of these five conservation significant species only the Arid Bronze Azure Butterfly is considered as possibly having potential habitat within the Project area.

A field habitat assessment for ABAB including both presence of suitable vegetation combined with the presence of the sugar ant *Camponotus sp. nr. terebrans* was undertaken. This assessed potential habitat presence in Desirables and TSF5 to determine the presence or absence of the ABAB host ant *Camponotus sp. nr. terebrans*. Whilst vegetated areas were dominated by smooth barked eucalyptus, no individuals, or nests of *Camponotus sp. nr. terebrans* were recorded from either Desirables or TSF5 survey areas, hence the likelihood of ABAB being present is Very Low.

The SRE field surveys in 2020 and 2024 recorded seven potential SRE invertebrate species from within the nine SRE Survey Areas. These seven taxa included no Confirmed SRE species, one Likely SRE species and six Possible SRE species.

One species were identified as a Likely SRE species:

- the millipede *Atelomastix sp. 'B03'*

Six Possible SRE species were recorded primarily due to the groups being considered data deficient:

- Two mygalomorph spiders (*Kwonkan silvestre* and *Synothele pectinata*)
- Two geophilid centipedes *Mecistocephalus sp.'47 legs'* and *Sepedenophilus cf. antipodus*
- One isopod Philosciidae *sp. indet*. (damaged)
- Pseudoscorpions from the family Olpiidae

The Likely SRE millipede species *Atelomastix* sp. 'B03' was recorded from four different habitats that are largely laterally continuous *Eucalyptus* Woodland habitats along with Woodland over shrubs and from Woodland on slopes and from multiple Project Areas (Desirables, Gladstone and Maybell). This would indicate that the species is widespread throughout multiple habitats in the region and not restricted solely to Project areas.

The majority of species recorded are widespread throughout the Great Western Woodland region of Western Australia.

No further invertebrate surveys for SRE or conservation significant invertebrate are required for the nine project areas assessed in this report.

1. Introduction

Pantoro South Pty Ltd (Pantoro) is currently in the process of developing the Norseman Gold Project (the Project), a series of open pit and underground gold mines located southern Goldfield region of Western Australia, near the Norseman townsite (Figure 1).

The Proposed Project areas are:

- Gladstone and associated dewatering pipeline and access/haul road -Potential additional Open Pits, WRD extensions and Open Pit Cutbacks
- North Royal area – Potential additional Open Pits, WRD extensions, Open Pit Cutbacks and extensions of existing underground.
- Desirables deposit – Potential additional Open Pits, WRD extensions, Open Pit Cutbacks
- Scotia and associated dewatering pipeline and access/haul road. Open Pits, WRD extensions, Open Pit Cutbacks and extensions of existing underground
- OK- Potential existing Underground expansion and WRD expansion
- TSF 4 and TSF 5 and associated pipeline- Tailings Storage Facility (TSF) expansion- reapplication of expired CPS area
- Maybell and associated access track- Open Pits, WRD and extensions of existing small underground
- Cobbler (some additional areas for access/haul roads to be determined)-Lake based pit and WRD. Potential Open pit and Underground.

Invertebrate Solutions has previously undertaken a baseline Short Range Endemic (SRE) invertebrate assessment for seven initial areas for the Project in 2020 (Invertebrate Solutions 2021). Following the reactivation of mining at the previously assessed areas, an additional two areas; Desirables and TSF 5 have been identified as requiring a Level 2 short range endemic (SRE) invertebrate survey to complete future environmental approvals.

Short range endemic (SRE) invertebrates occur within terrestrial habitats and possess naturally restricted ranges and poor dispersal capabilities. The high degrees of local endemism and lack of habitat connectivity makes SRE fauna susceptible to high levels impacts from sometimes localised projects, with species' extinction a real possibility if they are not adequately considered during project planning phases.

1.1 Purpose of this report

Invertebrate Solutions has been requested by Pantoro to undertake the following scope of works within the Pantoro project area, Norseman, Western Australia:

- Undertake a desktop assessment for SRE invertebrates to determine known SRE fauna in the area, as well as habitats in which they likely occur, and include an individual risk assessment for each of the 9 project areas for SRE species.
- Summarise previous SRE fauna surveys for the Project areas and other relevant studies from the region as part of the desktop assessment.
- Undertake a level 2 field survey for short range endemic (SRE) invertebrates within the seven original project areas, and the two additional areas (as shown in Figure 1) to enable a thorough understanding of the local distribution of all previously identified and any newly recorded potential SRE taxa.
- Identify any potential SRE invertebrates collected to the lowest practical taxonomic level.
- Provide recommendations and any suggested requirements for further work to comply with relevant legislation.
- Provide a standalone SRE baseline survey report including distributions maps of any likely or confirmed SRE species with 3 or more records.
- Provide all spatial data in electronic format and data packages in accordance with the Index of Biodiversity Surveys for Assessments (IBSA) (EPA 2018)
- The desktop assessment and field survey program will be undertaken with regard to Technical Guidance Sampling of short range endemic invertebrate fauna (EPA 2016).

1.2 Study Area and Background Environmental Information

The Norseman Gold Project is located in the vicinity of the Norseman townsite, in the Goldfields region of Western Australia and is shown in Figure 1. The desktop study area comprised approximately 17,000 km^2 bounded by the north west corner (31.702523°S, 121.041734°E) and the south east corner (32.877950 °S, 122.449994°E) centred on the Project.

The Norseman Gold Project consists of nine separate Project areas: North Royal-Slippers, Desirables, Cobbler, Gladstone-Daisy, TSF4, TSF5, Ok, Maybell and Scotia Figure 2.

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation, and species information (DCCEEW 2022). The Project is located within the Coolgardie bioregion. The Coolgardie region is comprised of the granite strata of the Yilgarn Craton with archaean greenstone intrusions in parallel belts. Drainage is occluded, generally ending in salt lakes. Mallees and scrubs are present on sandplains associated with lateritised uplands, playas and granite outcrops. Diverse woodlands rich in endemic eucalypts are present on low greenstone hills, valley alluvials and broad plains of calcareous earth. The climate is arid to semi-arid Warm Mediterranean. (Environment Australia 2000).

The land tenure for the Project area is a mix of unallocated crown land, mining tenement and pastoral lease. The localised climate is classified as semi-Arid with an average annual rainfall of

288 mm recorded at the Bureau of Meteorology (BoM) Station 012065 at Norseman (BoM, 2024), located in the centre of the Project area. Annual rainfall shows minor seasonality with most rainfall occurring during the winter months, linked to low pressure systems in the Southern Ocean (May to August) (Plate 1).

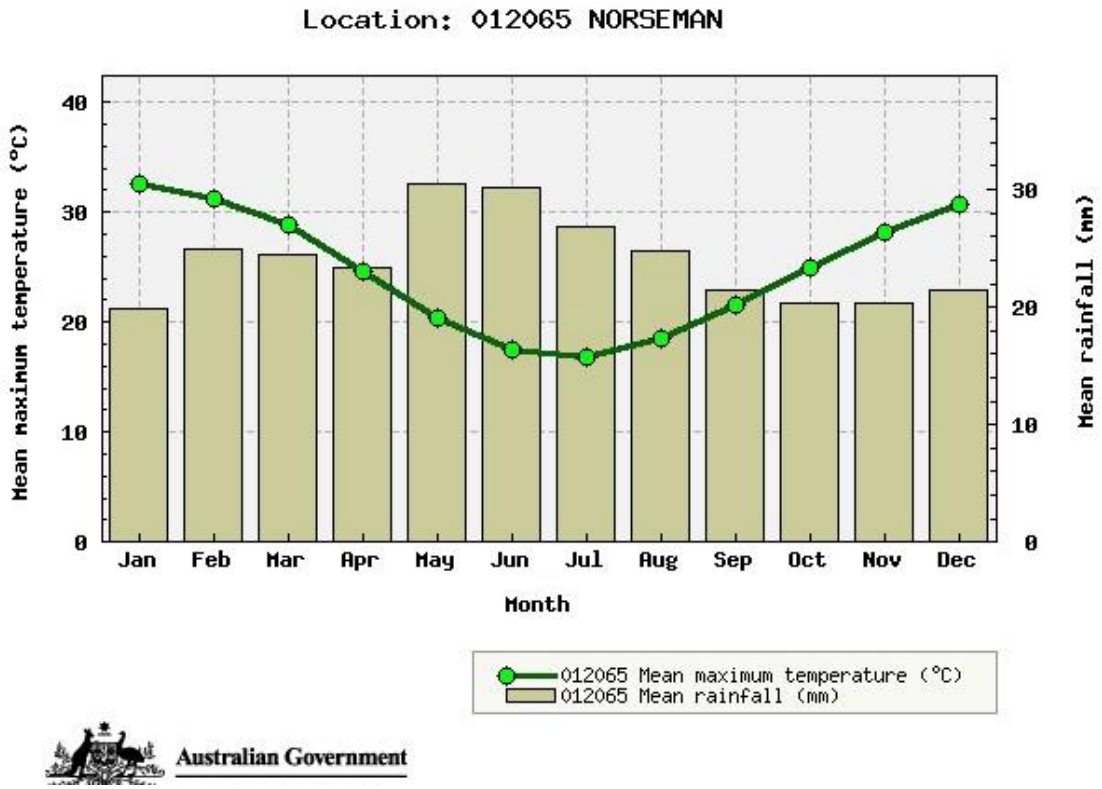


Plate 1 Norseman long term climate data (After BOM.gov.au).

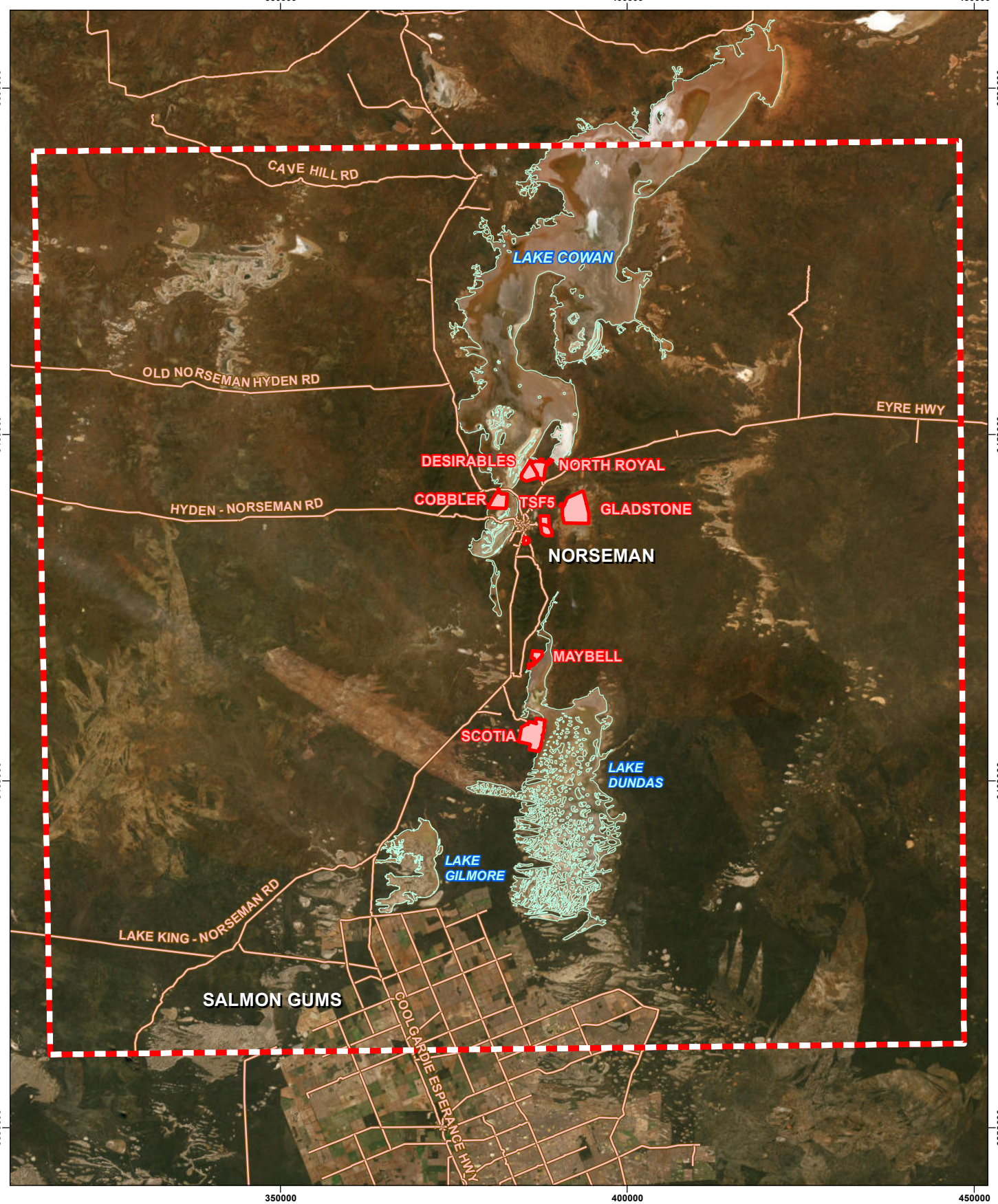
1.3 Survey Staff Qualifications

Field sampling for invertebrates was undertaken by an experienced invertebrate ecologist:

- Dr Timothy Moulds *BSc (Hons) Geol., PhD. Invert. Ecol.* (Invertebrate Solutions)

Sampling for SRE invertebrates was undertaken by Dr Tim Moulds. Invertebrate extraction, sorting and identification was completed by Dr Timothy Moulds. Survey work was undertaken under the collection licences issued by the Department of Biodiversity, Conservation and Attractions:

- BA27000248; Licensee Timothy Moulds (Invertebrate Solutions); Valid until 10/05/2021.
- BA27001032; Licensee Timothy Moulds (Invertebrate Solutions); Valid until 08/04/2025.



Legend

- Dekstop Study Area
- Norseman Gold Project Area

0 5 10 20 km

Scale: 1:750,000 @ A4

N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

- IMAGERY SOURCED FROM OPEN SOURCE

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PROJECT ID	DATE
Norseman Gold Project	26/09/2024

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 51

CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

Pantoro South Pty Ltd

Figure 1

Norseman Gold Project
Location and Short Range Endemic Invertebrate Fauna Desktop Study Area

ENVIRONMAPS t: 0406 590 006 Environmental Mapping Solutions www.environmaps.com.au

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C:\GIS\Jobs\Invertebrate Solutions\Pantoro South - SRE and Subterranean Fauna\Figures\PantoroSth_F01 Norseman Gold Project Location and Short Range Endemic Invertebrate Fauna Desktop Study Area_240926.mxd

1.4 Introduction to SRE fauna

Short range endemic (SRE) invertebrates are species with restricted distributions. The isolation of invertebrates in specific habitats or bioregions leads to endemism at various spatial scales. The vast majority of invertebrates are capable of dispersing substantial distances at some phase of their life cycle. Some groups, however, are susceptible to short-range endemism which describes endemic species with restricted ranges, arbitrarily defined in Western Australia as less than 10,000 km^2 (100 km x 100 km) (Harvey, 2002). Taxa that have been more commonly found to contain SRE representatives include:

- Onychophorans (velvet worms);
- Crustaceans (Isopoda);
- Arachnids (mygalomorph spiders, pseudoscorpions, opiliones, scorpions, schizomids);
- Myriapods (millipedes and centipedes);
- Molluscs (land snails); and
- Insects (hemipterans, grasshoppers, butterflies).

SRE invertebrate fauna taxa are generally found in sheltered, relatively mesic environments such as isolated habitats (e.g. boulder piles, isolated hills, dense patches of vegetation, gullies) and can include microhabitats within these environments such as deep leaf litter accumulation, large logs, under bark, cave areas and springs and permanent water bodies.

Many processes contribute to taxa being susceptible to short range endemism. Generally, these factors are related to the isolation of a species which can include the ability and opportunity to disperse, life history, physiology, habitat requirements, and habitat availability. Taxa that exhibit short range endemism generally exhibit poor dispersal, low growth rates, low fecundity and reliance on habitat types that are discontinuous (Harvey, 2002). Taxa that reside within easily isolated habitats surrounded by physical barriers such as islands, mountains, aquifers, lakes and caves are also more susceptible to becoming SRE species often including additional taxa not otherwise generally forming SREs.

Taxa that exhibit short range endemism are particularly vulnerable to disturbance, either natural or anthropogenic, as they are reliant upon specialised and often restricted habitats (often moist) (Framenau, *et al*., 2008). Short range endemic taxa are unable to disperse to *refugia* when their habitats are threatened or destroyed, thus making them a priority for conservation efforts.

The allocation of short range endemism status can be difficult due to the often incomplete taxonomic framework of many invertebrate groups and the often frequent need for substantial revision to enable accurate identification. Short Range Endemic status is assigned using the categories described in Table 1, based upon the available information from the Western Australian Museum (WAM) database and discussion with appropriate taxonomic authorities for various invertebrate groups. Insufficient information exists for many invertebrate species due to specimens being juvenile, the wrong sex to allow identification, damaged, or inadequate taxonomic frameworks, precluding the assignment of SRE status.

Table 1 Short Range Endemic Status of Species

SRE Status	Definition
Confirmed	A confirmed SRE species. A known distribution of < 10,000 km^2 (after Harvey 2002). Taxonomy of the group is well known. The group is well represented in collections, or via comprehensive sampling.
Likely	Likely to be a SRE species based upon knowledge of the family/genus, where other closely related species show evidence of short range endemism. Where habitats containing the specimens show discontinuity within the landscape.
Possible	Based upon existing knowledge of the genus / family there is a possibility that the species may have a restricted range. Where habitats containing the specimens may show discontinuity within the landscape. Possible SRE species may be assigned one of the sub categories below: A. Data deficient i.e. new species, lack of distribution, taxonomic or collecting knowledge, juvenile specimens, wrong sex for identification B. Habitat indicators C. Morphology indicators D. Molecular evidence E. Research and expertise of WAM staff/taxonomic specialists
Widespread	Not a SRE, a wide ranging distribution of > 10,000 km^2

Table 2 SRE habitat suitability definitions

SRE habitat Likelihood of occurrence	Definition
High	The habitat has a High likelihood of containing SRE species as it has at least three microhabitat factors that support the presence of SRE species such as: SE facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation, or habitats known to contain SRE species.
Moderate	The habitat has a Moderate likelihood of containing SRE species as it has at least two microhabitat factors that support the presence of SRE species such as: SE facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation or habitats known to contain SRE species.
Low	The habitat has a Low likelihood of containing SRE species as it has only a single microhabitat factor that support the presence of SRE species such as: SE facing slopes, moisture, rocky areas, habitat isolates, deep leaf litter, mountainous areas, deep gullies or gorges, riparian vegetation or habitats known to contain SRE species.
Nil	No potential habitat exists for SRE species within the vegetation type / condition area. This includes areas that are totally cleared, completely degraded or urbanised. This also includes areas that are dominated by weeds or exotic vegetation species.

1.5 Conservation Legislation and Guidance Statements

Terrestrial SRE species are protected under state legislation via the *Biodiversity Conservation Act 2016* (BC Act) which came into effect on 1st January 2019, replacing the *Wildlife Conservation Act 1950*. The BC Act is aligned with the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The assessment of SRE fauna for environmental impact assessment (EIA) is undertaken in Western Australia with regard to Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

At the State level, the BC Act provides a list of threatened species that have special protection as species listed under Part 2 of BC Act. This notice is updated periodically by the Department of Biodiversity, Conservation and Attractions (DBCA) (formerly the Department of Parks and Wildlife (DPaW) and the current list (October 2022) includes numerous threatened SRE species from the Wheatbelt, South Coast, Murchison and Pilbara regions. Included in the list are crustaceans, arachnids and myriapods that are considered to be "rare or likely to become extinct, as critically endangered fauna, or are declared to be fauna that is in need of special protection" (DBCA 2022).

In addition to the specially protected fauna, DBCA also maintains a list of Priority fauna that are considered to be of conservation significance but do not meet the criteria for formal listing under the BC Act. Priority is not a listing category under the BC Act, however, all fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (DBCA 2022). Species that may possibly be threatened but do not meet the criteria for formal listing under the BC Act because of data deficiencies, are added to the Priority Fauna List under Priorities 1, 2 or 3, in order of prioritisation for evaluation of conservation status so that consideration can be given to potential listing as threatened DBCA (2022). Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. The Priority fauna list is irregularly updated by DBCA. The Pilbara bioregion contains numerous conservation significant millipedes from the genus *Antichiropus* along with various land snails.

The BC Act provides the ability for the state government of Western Australia to formally list Threatened Ecological Communities (TECs), and Priority Ecological Communities (PECs) along with threatening processes.

The federal EPBC Act protects both species and ecological communities. Sixteen invertebrates are listed in Western Australia with nine of these species being from the far southwest corner of the state. The most relevant Western Australian listing for Goldfields is the Critically Endangered Arid Bronze Azure butterfly (ABAB) (*Ogyris subterrestris petrina*) that occurs in smooth barked *Eucalyptus* woodlands in the Goldfields, northern Wheatbelt to Shark Bay.

1.7 Report Limitations and Exclusions

This study was limited to the written scope provided to the client by Invertebrate Solutions (20th March 2024) and in Section 1.1. This study was limited to the extent of information made available to Invertebrate Solutions at the time of undertaking the work. Information not made available to this

study, or which subsequently becomes available may alter the conclusions made herein. Assessment of potential impacts to SRE fauna was based on proposed development plans provided by the client.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Invertebrate Solutions has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by Invertebrate Solutions described in this report (this section and throughout this report). Invertebrate Solutions disclaims liability arising from any of the assumptions being incorrect.

Invertebrate Solutions has prepared this report on the basis of information provided by Pantoro South Pty Ltd and others (including Government authorities), which Invertebrate Solutions has not independently verified or checked beyond the agreed scope of work. Invertebrate Solutions does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Site conditions may change after the date of this report. Invertebrate Solutions does not accept responsibility arising from, or in connection with, any change to the site conditions. Invertebrate Solutions is also not responsible for updating this report if the site conditions change.

Species were identified to the lowest practical taxonomic level, taking into consideration that the taxonomic framework of many invertebrate groups is incomplete and often in need of substantial revision to enable accurate identification. Short Range Endemic status was assigned using the available information from the WAM database and discussion with appropriate taxonomic authorities for various invertebrate groups. Insufficient information exists for many invertebrate species due to specimens being juvenile, the wrong sex to allow identification, damaged, or inadequate taxonomic frameworks, precluding the assignment of SRE status.

Field surveys for SRE invertebrates require multiple seasonal surveys to fully record all species that may be present in an area, and in varying weather conditions. The current survey was undertaken in a single seasons and additional surveys at different times of the year may record additional species, however, the combination of collection techniques and the intensity of the survey provides a high degree of certainty that majority of potential SRE invertebrates present within the survey area were recorded.

1.7.1 Potential Survey Specific Limitations

The following specific comments are made with regard to potential project specific limitations for the Project:

- **Sampling effort** – The 2020 survey included 30 hours of active searching and 30 leaf litter samples extracted in Tullgren funnels over six areas, whilst the 2024 survey included 12 hours of active searching and 12 leaf litter samples extracted in Tullgren funnels over two areas. This survey effort provides a high degree of certainty that the majority of potential SRE invertebrates present at the time of survey were recorded.

- **Timing** – Both surveys (2020 and 2024) were undertaken in May, which is within the suggested timing for the Goldfields region (May – October) according to the EPA Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).
- **Methods** – a wide variety of collecting techniques were used including active searching, leaf litter sieving, leaf litter extracted in Tullgren funnels, bark peeling and excavation of mygalomorph spider burrows providing a high degree of certainty that the majority of potential SRE invertebrates present at the time of the survey were recorded.
- **Habitats sampled** – All significant potential SRE habitats within the Survey Areas were sampled using a combination of techniques.
- **Access to areas** – No access restrictions were encountered for any of the nine sites.

2. Methods

Invertebrate Solutions undertook the following tasks for the 2020 and 2024 SRE survey of the Norseman Gold Project areas:

- SRE desktop assessment based upon Western Australian Museum Records and previous survey reports by Bennelongia (2013).
- SRE survey of seven Project Areas in 2020 (30 sites – 1 hour active searching and leaf litter samples).
- SRE survey of Desirables and TSF5 Project Areas in 2024 (12 sites – 1 hour active searching and leaf litter samples).

The survey program was undertaken with regard to the Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

2.1 SRE Desktop Methodology

A search of the WAM databases for Arachnids, Crustacea and Molluscs was undertaken for potential SRE taxa occurring in the Norseman region. In addition, other published reports for the area were examined including a previous survey for SRE invertebrates at the adjacent Mt Henry mine area (Bennelongia 2013). The desktop analysis was used to identify any potential SRE species that may occur in the Norseman region and target those taxa during the subsequent field survey of the Project areas.

2.1.1 Likelihood of SRE invertebrate occurrence

The likelihood of SRE invertebrate species occurring in the Project area was assessed using a combination of regional and local botanical and landform information and database searches including:

- Analysis of published and unpublished reports concerning SRE invertebrate from the region, primarily Bennelongia (2013).
- Botanical and vegetation mapping (Mattiske 2020) and other information available for the Project area.
- Results of a Protected Matters Search from the Federal Government's Department of Climate Change, Energy, and the Environment (DCCEEW) website.
- Records of fauna held by the WAM.

Based on the analysis of all available information, potential SRE invertebrate species were assigned a level of likelihood to be present within habitats contained in the Study area of either 'Very Low', 'Low', 'Moderate', 'High', or 'Definite'. The likelihood that a particular vegetation unit potentially contains or supports SRE species is defined in Table 3.

Table 3 SRE species likelihood of occurrence definitions

SRE Species Likelihood of occurrence	Definition
Definite	The species is confirmed to occur within the Project area.
High	Habitat for the species is known to occur within the Project area and known records of the species are within 20 km.
Moderate	Habitat for the species is known to occur within the Project area and known records of the species are within 50 km.
Low	The species has been recorded from within 50 km, however, no habitat is present for the species within the Project area.
Very low	No habitat exists for the species within the Project area and no records of the species are within 50 km or the distribution of the species is known well enough to exclude its presence within the Project area.

2.2 Survey Effort and Timing

Invertebrate Solutions completed SRE surveys at the Pantoro Project areas in May 2020 and May 2024. This comprised 30 sites throughout the initial seven Project areas, and an additional 12 sites evenly distributed between Desirables and TSF5 in May 2024. Each site was actively sampled for SRE invertebrates including litter sifting and hand searching of appropriate microhabitats (Table 4, Appendix 3). All coordinates in UTM are using datum GDA and located in Zone 51H. A map showing the locations of the SRE sampling sites is shown in Figure 2.

Although the SRE survey included the Cobbler tenement area, a site assessment undertaken during the 2020 survey identified no potential habitat for SRE species as the Cobbler Project area is located entirely on the surface of Lake Cowan, a salt lake providing no suitable habitat for SRE invertebrates.

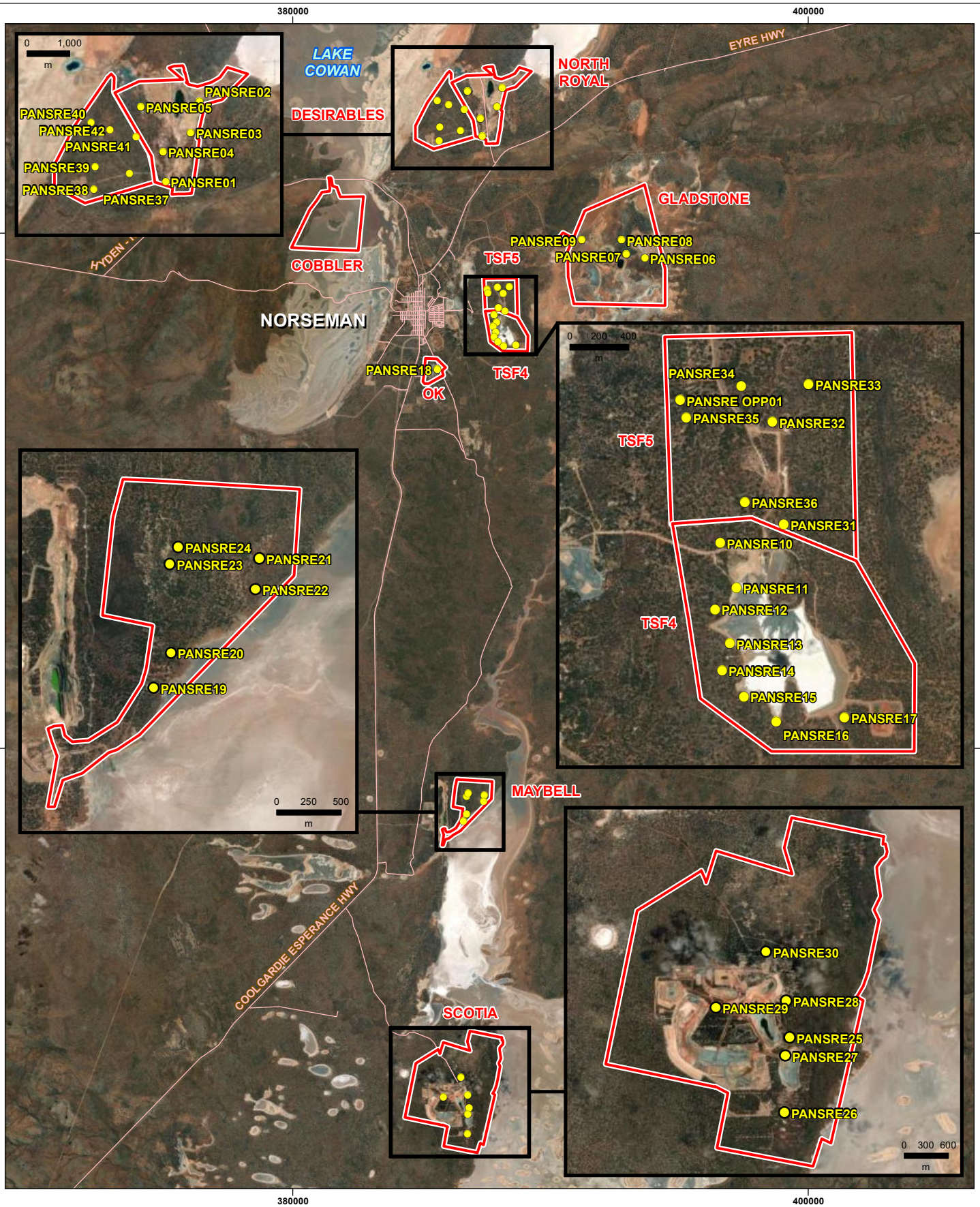
Both the 2020 and 2024 SRE surveys were preceded by suitable rainfall and undertaken with regard to Technical Guidance Sampling of short range endemic invertebrate fauna (EPA 2016).

.

Table 4 Locations actively searched for SRE invertebrates

Sample Site	Easting	Northing	Survey Area	Habitat	Active search date
PANSRE01	387340	6443772	North Royal	Open Low Woodland	12th May 2020
PANSRE02	388130	6445640	North Royal	Open Low Woodland	12th May 2020
PANSRE03	387926	6444911	North Royal	Open Low Woodland	12th May 2020
PANSRE04	387283	6444462	North Royal	Open Low Woodland	12th May 2020
PANSRE05	386761	6445508	North Royal	Mid Woodland	12th May 2020
PANSRE06	393653	6439042	Gladstone	Open Low Woodland	12th May 2020
PANSRE07	392935	6439201	Gladstone	Open Low Woodland	12th May 2020
PANSRE08	392754	6439730	Gladstone	Open Low Woodland	12th May 2020
PANSRE09	391203	6439736	Gladstone	Mallee and Acacia shrubland	13th May 2020
PANSRE10	387797	6436843	TSF4	Mid Woodland	13th May 2020
PANSRE11	387908	6436537	TSF4	Mid Woodland	13th May 2020
PANSRE12	387760	6436390	TSF4	Mid Woodland	13th May 2020
PANSRE13	387862	6436157	TSF4	Mid Woodland	13th May 2020
PANSRE14	387808	6435975	TSF4	Mid Woodland	13th May 2020
PANSRE15	387956	6435797	TSF4	Mid Woodland	13th May 2020
PANSRE16	388177	6435627	TSF4	Mid Woodland	13th May 2020
PANSRE17	388640	6435652	TSF4	Mid Woodland	13th May 2020
PANSRE18	385595	6434726	OK	Open Low Woodland	14th May 2020
PANSRE19	386608	6417175	Maybell	Shrubland near salt lakes	14th May 2020
PANSRE20	386741	6417447	Maybell	Shrubland near salt lakes	14th May 2020
PANSRE21	387426	6418179	Maybell	Shrubland near salt lakes	14th May 2020
PANSRE22	387397	6417939	Maybell	Shrubland near salt lakes	14th May 2020
PANSRE23	386732	6418137	Maybell	Woodland/ Shrubland on slopes	14th May 2020
PANSRE24	386796	6418268	Maybell	Woodland/ Shrubland on slopes	14th May 2020
PANSRE25	386841	6406045	Scotia	Woodland over shrubs	15th May 2020
PANSRE26	386767	6405028	Scotia	Woodland/ Shrubland on slopes	15th May 2020
PANSRE27	386778	6405799	Scotia	Woodland over shrubs	15th May 2020
PANSRE28	386791	6406544	Scotia	Woodland over shrubs	15th May 2020
PANSRE29	385834	6406450	Scotia	Woodland over shrubs	15th May 2020
PANSRE30	386520	6407208	Scotia	Woodland over shrubs	15th May 2020

Sample Site	Easting	Northing	Survey Area	Habitat	Active search date
PANSRE31	387340	6443772	TSF5l	Mid Woodland	16th May 2024
PANSRE32	388130	6445640	TSF5l	Mid Woodland	16th May 2024
PANSRE33	387926	6444911	TSF5l	Woodland over shrubs	14th May 2024
PANSRE34	387283	6444462	TSF5l	Woodland over shrubs	15th May 2024
PANSRE35	386761	6445508	TSF5l	Woodland over shrubs	14th May 2024
PANSRE36	393653	6439042	TSF5l	Mid Woodland	14th May 2024
PANSRE37	392935	6439201	Desirables	Mid Woodland	16th May 2024
PANSRE38	392754	6439730	Desirables	Mid Woodland	16th May 2024
PANSRE39	391203	6439736	Desirables	Mid Woodland	16th May 2024
PANSRE40	387797	6436843	Desirables	Woodland over shrubs	17th May 2024
PANSRE41	387908	6436537	Desirables	Mid Woodland	17th May 2024
PANSRE42	387760	6436390	Desirables	Mid Woodland	17th May 2024



Legend

- Norseman Gold Project Area
- SRE Sample Location

0 1.25 2.5 5 km

Scale: 1:200,000 @ A4

N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

- IMAGERY SOURCED FROM OPEN SOURCE

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PROJECT ID	DATE
Norseman Gold Project	7/10/2024

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 51

CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

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Figure 2

Norseman Gold Project Areas and SRE Sample Locations

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2.3 Habitat Assessment for Conservation Significant Butterflies

2.3.1 Arid Bronze Azure Butterfly

The Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) (referred to as ABAB) is listed as Critically endangered under BC and EPBC Act. The ABAB has an obligate association with the sugar ant *Camponotus sp. nr. terebrans*, with ABAB larvae living in the ants nest during development, large colonies of this ant are required to support ABAB presence (DBCA 2020a). The ABAB is listed due to its severely fragmented distribution with only two extant subpopulations being recorded in Western Australia. These subpopulations are at Barbalin Nature Reserve (BNR), and at a second site ~100km from Barbalin. This second site is small and its precise location is withheld for conservation reasons. A third subpopulation (the first discovered, in the 1980s) occurred near Lake Douglas, 12km SW of Kalgoorlie, but is now locally extinct and no ABAB have been recorded there since 1993.

At the two known extant sites where the ABAB occurs, the vegetation is mature mixed gimlet (*E. salubris)* and salmon gum (*E. salmonophloia*) woodlands on red-brown loam soils, with an open understorey. In addition to gimlet and salmon gum, other smooth-barked eucalyptus at these sites which have basal ant colonies include wandoo (*E. capilosa* subsp. *wandoo*), smooth-barked york gum (*E. loxophleba* subsp. *lissophloia*) and ribbon barked mallee (*E. sheathiana*) (DBCA, 2020).

Plate 2 The Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) listed as Critically Endangered under both WA State and Federal legislation.

The desktop assessment and field survey program were undertaken with regard to DBCA - Guidelines for the survey of arid bronze azure butterfly (ABAB) in Western Australia (2020a), and DBCA – Arid bronze azure butterfly (ABAB) survey in Western Australia additional information (2020b).

A field assessment of suitable vegetation combined with the presence of the sugar ant *Camponotus sp. nr. terebrans* was undertaken in May 2024 by Invertebrate Solutions whilst completing the SRE survey. This assessed potential habitat presence in Desirables and TSF5 and included the diurnal

excavation at the bases of 10 suitable trees at each SRE site (PANSRE31 – PANSRE42) to determine the presence or absence of the ABAB host ant *Camponotus sp. nr. terebrans*.

2.4 SRE Survey Methodology

The SRE surveys were undertaken using a combination of sampling techniques and employed both systematic (timed active searching) and opportunistic (litter collection and transect) sampling. Sites were chosen to maximise SRE habitat including south-facing slopes, gullies, rocky outcrops, dense patches of trees and permanent water bodies.

2.4.1 Active searching

Active searching was undertaken at 30 sites in 2020, and at another 12 sites in 2024, spread evenly between Desirables and TSF5, focusing on areas more likely to contain SRE fauna (Appendix 3). Active searching consisted of sifting of soil and/or leaf litter from suitable habitat areas within each site (millipedes and land snails); the raking of leaf litter (millipedes, land snails, centipedes, mygalomorph burrows); examination of vegetative material below logs and bark (pseudoscorpions, centipedes, millipedes), and an examination of (if present) areas of rock outcrops and associated rock piles.

A minimum of one hour of active searching per site was undertaken.

Plate 3 Burrow of mygalomorph spider found whilst undertaking an active search at site PANSRE39

2.4.2 Leaf Litter collection

Leaf litter was collected from each site surveyed and processed in Tullgren funnels for potential SRE fauna. Approximately 3L of leaf litter was collected from each site and stored in sealed plastic garbage bags.

2.4.3 Opportunistic collection

Various areas that may provide habitat for SRE invertebrates were also opportunistically sampled whilst undertaking other surveys in the survey area. This included searching for burrows of mygalomorph spiders and searching under tree bark and logs for potential SRE species.

Plate 4 Adult female of *Kwonkan silvestre*, whose burrow was opportunistically sited near site PANSRE35 in TSF5

2.5 Sorting and curation

Sorting for all SRE samples occurred in the Invertebrate Solutions laboratory using a Leica M125 100x dissecting microscope and was undertaken by Dr Timothy Moulds. In the laboratory, fauna was extracted from SRE leaf litter samples using Tullgren funnels and preserved in 70% ethanol. Each taxon was identified to the lowest practical taxonomic rank using published keys and descriptions, and the numbers of each taxon recorded. Each identified taxon was kept in a separate labelled vial and assigned a specimen tracking code. Specimen and site collection data were recorded in an Excel spreadsheet. At the conclusion of the study, all specimens will be lodged at the Western Australian Museum.

2.6 Taxonomy and Nomenclature

Identification of collected invertebrate material was undertaken by Dr Timothy Moulds. Invertebrate groups collected that have no SRE representatives such as ants and flying insects were not identified

or reported. The presence of winged adults in most insect groups suggests that they are more capable dispersers and, therefore, less likely to have a restricted range.

The level of specimen identification achievable is dependent on the level of taxonomic knowledge and expertise available. The majority of the taxonomic expertise relating to SRE taxa resides with the staff of the Western Australian Museum, while some groups are also worked on by researchers within other government departments and academic institutions. Taxonomic treatments are available for some invertebrate groups, but not all. The EPA expects that invertebrates collected for identification will be identified to the lowest taxonomic level possible. Ideally, this is to the species level, but there will be limits due to the nature of specimens and the availability of taxonomic keys.

Plate 5 Adult male specimens of *Antichiropus* millipedes such as this specimen of *Antichiropus exclamatus* can be confidently identified using male sexual organs

2.7 Short Range Endemic Status

Taxonomic groups known to contain SRE representatives were examined in more detail to determine if the specimens collected in this study are potentially restricted forms. SRE status will be assigned after comparison with the morphology of other close relatives in the group and current knowledge on their distribution and ecology, where known. Identifications of the isopod specimen was undertaken by Dr Simon Judd.

3. Results

3.1 SRE Invertebrates of the Goldfields region

Whilst there are limited systematic surveys for SRE species close to the Project Area there are several studies form the region for various resources projects. One of the closest projects to be completed recently is at the Mt Keith satellite mine expansion project (MWH 2016) south of Leinster. This comprised of multiple survey seasons and included the Mt Keith disturbance footprint as well the adjacent Wanjarri Nature Reserve. The surveys recorded over 1,500 specimens representing 49 taxa, however, only two species were considered by experts as Confirmed SRE species, four as Likely SRE species and 23 as Potential SRE species.

A comprehensive SRE survey was undertaken for the Tropicana Gold Project (Ecologia 2009) located approximately 330 km to the north east of Kalgoorlie between 2006 and 2008 using pitfall traps and active searching. The surveys recorded 46 potential SRE species from within the Tropicana Project area, with three confirmed SRE mygalomorph spiders being recorded only from within proposed impact areas (Ecologia 2009). The habitat for these species was found to be more widespread than the proposed impacts although a monitoring program was initiated to ensure these species were not significantly impacted (EPA 2010).

A baseline survey for SRE invertebrates in the Northern goldfields was undertaken on Cashmere Downs station for Cashmere Iron in 2010. This survey used a wide variety of different trapping techniques to record several likely SRE species including *Antichiropus* millipedes and mygalomorph trapdoor spiders (GHD 2010). No species were found to be restricted to proposed impact areas.

More widely within the greater Goldfields and Yilgarn areas comprehensive SRE surveys have been undertaken at the Gruyere Gold Project located approximately 100 km to the north east of Laverton. The survey recorded 20 taxa with the potential to contain SRE species, of which eight were determined to be Potential SRE species and the other 12 were found to be widespread (Harewood 2016, Framenau 2015, Volschenk 2015). The Potential SRE species included two species of scorpion, four species of spider, one species of isopod and one species of centipede (Harewood 2016).

Habitats within the wider Goldfields and Yilgarn area that are considered prospective for SRE invertebrates include creek and drainage lines, Banded Iron Formation (BIF) ridges, mesas, stony hills and breakaways. The majority of reported SRE species in the Goldfields and Yilgarn comprise of Camaenid land snails, Mygalomorph spiders, *Urodacus* scorpions, and *Antichiropus* and *Atelomastix* millipedes (Bamford 2006; Bamford and Bancroft 2006; Bennelongia 2012, Biota 2009; Biota 2011; Car et al. 2013; GHD 2012; Harewood 2016, Ninox 2009, Volschenck 2015).

3.1.1 Bennelongia (2013) Mount Henry SRE Survey

Bennelongia staff undertook a SRE pilot study in 2013 at the Mt Henry Mine site situated immediately to the west of the Maybell tenement. The survey sampled 13 sites in early December 2012 and used a combination of leaf litter samples, wet pitfall traps and hand foraging from the Mt Henry site but also included other tenement areas to the south including Selene and North Scotia situated along the edge of Lake Dundas between the Pantoro South areas of Scotia and Maybell (Bennelongia 2013). The survey recorded 61 species from seven potential SRE groups, of which 15

species were considered to be possible SRE species including six mygalomorph spiders from four families, one araneomorph spider, two pseudoscorpions, one centipede, one millipede and four slaters (Bennelongia 2013). The survey recorded no conservation significant species and the study concluded that due to the overall subdues topography of the area, combined with the widespread vegetation types that none of the species recorded represent true SRE species.

3.2 Conservation Significant and SRE Fauna in the Desktop Study Area

A list of conservation significant fauna for the Desktop Study Area was compiled from the DBCA Specially Protected Fauna Notice 2019 (DBCA 2019) and the DAWE's Protected Matters Search Tool (PMST). SRE species that are listed under the BC Act and/or the EPBC Act and are likely to occur or have known habitat within the Desktop Study Area are shown in Table 5 along with their conservation code. The PMST results listed no known SRE or conservation significant invertebrate fauna within 50 km of the Project area. A full description of the BC and DBCA conservation codes are shown in Appendix 1. The full list of species obtained from the PMST search is shown in Appendix 2.

A search of the WAM databases for potential SRE taxa occurring in the broader Desktop Study Area centred on the Project was undertaken (WAM 2020a, b, c). The results of these were filtered for SRE species as shown in Table 5. Definitions for SRE status are found in Table 1.

The records held by the WAM are not exhaustive and represent only specimens within the WAM collections that have been databased. The Entomology, Mollusc and Crustacean collections remain largely un-databased. Specimens identified to genus level only have been excluded from the analysis as it is impossible to determine if they represent a SRE taxa.

The Desktop Study Area contains three Confirmed SRE species, four Likely SRE species and 12 Possible SRE species (Table 5). The species are summarised below:

- Three Paradoxosomatid millipedes (*Antichiropus anconus, A. buchanorum* and *A. incomptus*) – Confirmed SRE species.
- Two isopods (*Troglarmadillo sp.'B35'* and *Philosciidae sp.'B28')* – Likely SRE species.
- Two Iulomorphid millipedes (*Atelomastix bamfordi*? and Iulomorphidae [*Atelomastix*] sp.'B03'*)* – Likely SRE species.
- Four trapdoor spiders, four land snails, two pseudoscorpions, two isopods, and one millipede – Possible SRE species.

The remaining species identified from desktop resources were found to be widespread.

An additional five conservation significant invertebrates (widespread, non-SRE species) were identified in the desktop assessment:

- A fairy shrimp - *Branchinella simplex* – DBCA Priority 1
- A fairy shrimp - *Branchinella denticulata*– DBCA Priority 3
- A mygalomorph spider – *Idiosoma intermedium* - DBCA Priority 3
- A butterfly – The Inland Hairstreak (*Jalmenus aridus*) – DBCA Priority 1

- A butterfly – The Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – BC Act Critically Endangered / EPBC Act Critically Endangered

Of these five conservation significant species only the Arid Bronze Azure Butterfly is considered as possibly having potential habitat within the Project area.

Table 5 SRE Invertebrates in WAM databases and Conservation Significant invertebrates recorded from or with potential habitat within the Project area.

Higher Classification	Genus and Species	SRE status	DBCA / BC Act Conservation Status	EPBC Conservation Status	Likely habitat present in Project area	Desktop likelihood of species within the Project Area
Gastropoda:						
Camaenidae	*Sinumelon cf. jimberlanensis*	Possible (A)	-	-	Present	High
	Sinumelon lennum mutuum	Possible (A)	-	-	Present	Moderate
Planorbidae	*cf. Isidorella sp.*	Possible (A)	-	-	Not Present	Low
Pomatiopsidae	*Coxiella pyrrhostoma*	Possible (A)	-	-	Not Present	Low
Crustacea:						
Anostraca						
Thamnocephalidae	*Branchinella denticulata*	Widespread	Priority 3	-	Not present	Very Low
	Branchinella simplex	Widespread	Priority 1	-	Not Present	Very Low
Isopoda						
Armadillidae	*Buddelundia sp.'B40'*	Possible (A)	-	-	Present	High
	Troglarmadillo sp.'B35'	Likely	-	-	Present	High
Philosciidae	*sp.'B28'*	Likely	-	-	Present	High
Arachnida:						
Araneae: Mygalomorphae						
Actinopodidae	*Missulena pinguipes*	Possible (A)	-	-	Present	High
	Missulena sp. 'B04'	Possible (A)	-	-	Present	High
Barychelidae	*Synothele near sp. 'B03'*	Possible (A)	-	-	Present	High
	Synothele sp. 'B06'	Possible (A)	-	-	Present	High
Idiopidae	*Idiosoma intermedium*	Widespread	Priority 3	-	Present	Moderate
Pseudoscorpiones						
Olpiidae	*Beierolpium spp.*	Possible (A)	-	-	Present	High
	Indolpium spp.	Possible (A)	-	-	Present	High
Diplopoda						
Polydesmida						
Paradoxosomatidae	*Antichiropus anconus*	Confirmed	-	-	Not present	Low

Higher Classification	Genus and Species	SRE status	DBCA / BC Act Conservation Status	EPBC Conservation Status	Likely habitat present in Project area	Desktop likelihood of species within the Project Area
	Antichiropus buchanorum	Confirmed	-	-	Not present	Low
	Antichiropus incomptus	Confirmed	-	-	Not present	Low
Polyzoniida						
Siphonotidae	*Sp.*	Possible (A)	-	-	Present	High
Spirostreptida						
Iulomorphidae	*Atelomastix bamfordi*	Likely	-	-	Present	Moderate
	Iulomorphidae sp.'B03'	Likely	-	-	Present	High
Insecta						
Lepidoptera	*Jalmenus aridus*	Widespread	Priority 1	-	present	Low
	Ogyris subterrestris petrina	Widespread	Critically Endangered	Critically Endangered	Present	Low

3.3 SRE Habitat in Project Area

The vegetation units and condition mapping identified in the biological assessments Mattiske (2020) were used to assess the Project area for potential SRE habitat (Table 6). The majority of the habitats identified (Eucalyptus woodlands) are widespread across the region and are unlikely to provide habitat isolates which may give rise to SRE invertebrates (EPA 2016, Harvey 2002). The only area likely to provide greater than 'Low' potential for SRE species was the slopes on the eastern edges of the Maybell and Scotia that were considered to be 'Moderate' SRE habitat suitability (Figure 3a-g).

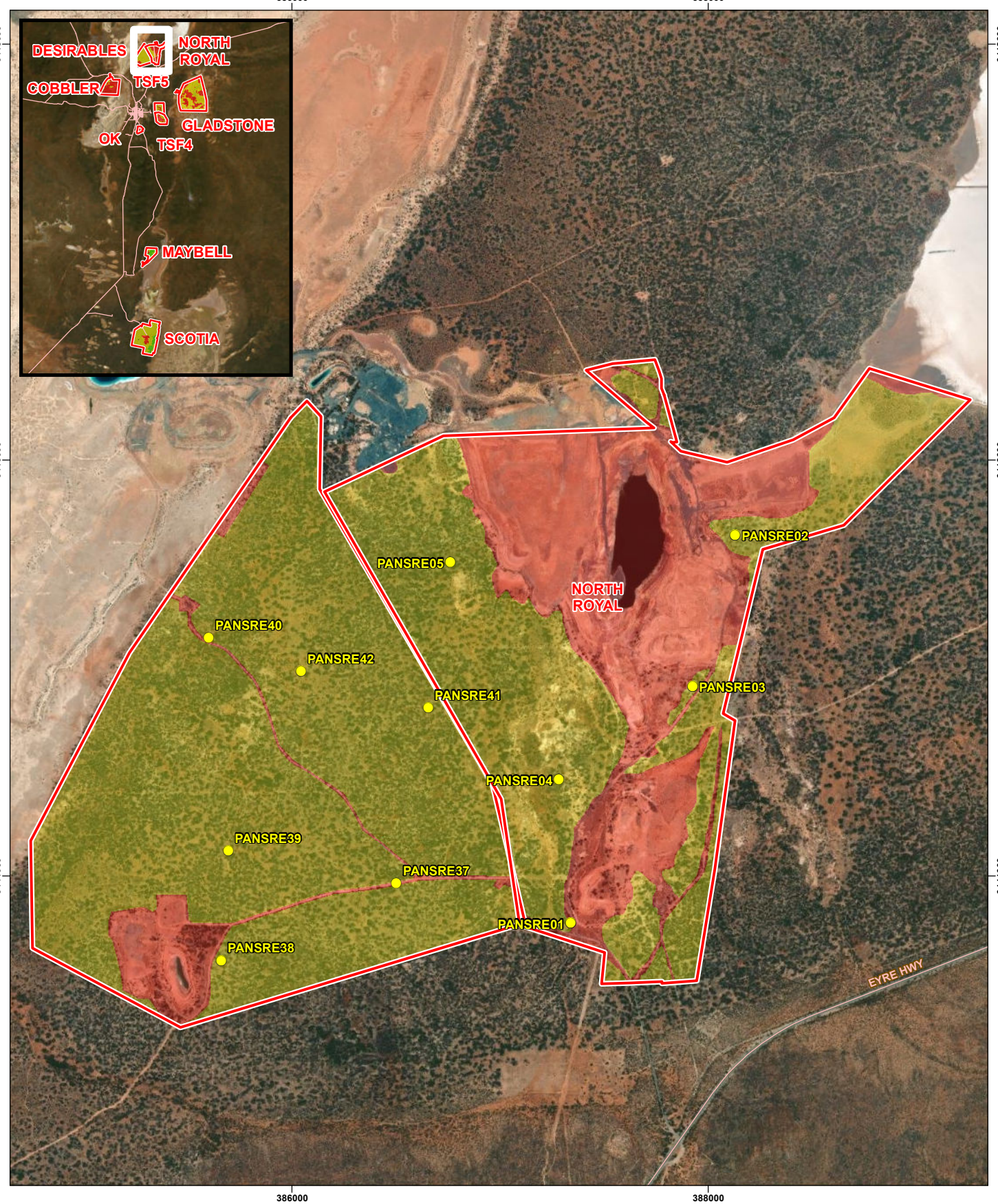
Vegetation mapping by Mattiske (2020) included the North Royal, Desirables, Gladstone and Scotia Project areas and this mapping was used by Invertebrate Solutions as a basis for SRE habitat mapping in the remaining Project areas assessed for SRE invertebrates.

The salt lake habitat at Cobbler and on the edges of other tenements was examined during the survey, however, it was deemed not to provide habitat for potential SRE species that would be restricted, rather any species found would be widespread across the extensive salt lake habitat of Lake Cowan and Dundas and other smaller salt lakes in the region.

All assessments for likelihood of occurrence of conservation significant and SRE invertebrate species were undertaken with regard to the Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

Table 6 Vegetation units (modified after Mattiske 2020), habitat suitability for SRE invertebrates and survey methods

SRE Habitat	Description (modified after Mattiske Consulting, 2020)	SRE Sites surveyed	Present in Project Areas	Survey Methods		SRE habitat suitability
				Active Searching	Tullgren funnels	
Mallee and Acacia Shrubland	*Eucalyptus prolixa / planipes / longissima /?oleosa subsp. oleosa open mallee over mixed Acacia, Grevillea and Eremophila sp. over sparse hummock grassland shrubland (Mattiske 2020 vegetation units NW1,NW2a and b, NW3)*	PANSRE09	Gladstone	+	+	Low
Open Low Woodland	*Open low woodland of Eucalyptus lesouefii/salubris/torquata over open shrubland of Melaleuca spp. Eremophila spp. over Dodonaea sp. and Atriplex sp. on brown clay to sandy loam (Mattiske 2020 vegetation units NW4,NW5, NW8, NW9, NW10, NW13,)*	PANSRE01, PANSRE02, PANSRE03, PANSRE04, PANSRE06, PANSRE07, PANSRE08, PANSRE18, PANSRE40, PANSRE42	North Royal, Desirables, Galdstone, OK	+	+	Low
Mid Woodland	*Mid woodland of Eucalyptus lesouefii/salubris over mid isolated shrubs of Eremophila of mixed species (Mattiske 2020 vegetation units NW6,NW7, NW11, NW13, NW14, NW15)*	PANSRE05, PANSRE10, PANSRE11, PANSRE12, PANSRE13, PANSRE14, PANSRE15, PANSRE16, PANSRE17, PANSRE31, PANSRE32, PANSRE33, PANSRE34, PANSRE35, PANSRE36, PANSRE37, PANSRE38, PANSRE39, PANSRE41	North Royal, Desirables, Gladstone, TSF4, TSF5	+	+	Low
She-oak woodland	*Open low woodland of Casuarina obesa / Allocasuarina campestris over Acacia sp, Rhagodia ?drummondii, Atriplex ?vesicaria and Tecticornia sp. chenopod shrubs and isolated tussock grassland of Poaceae sp. 3 on dry, powdery cream clay. (Mattiske 2020 vegetation units NW12, S2)*	-	Gladstone, Scotia	-	-	Low
Shrubland near salt lakes	*Open shrubland of Callitris preissii, ?Geijera linearifolia over Senna artemisioides ?subsp. filifolia, Pittosporum angustifolium, Santalum acuminatum and Eremophila scoparia over?Westringia rigida, Scaevola spinescens and Rhagodia ?drummondii over mixed low chenopod shrubs on red sandy clay on flats near salt lakes. (Mattiske 2020 vegetation units NS1, NS2, NS3, NS4, S3, W1)*	PANSRE19, PANSRE20, PANSRE21, PANSRE22	Maybell, Scotia	+	+	Low
Woodland over shrubs	*Woodland to open woodland of Eucalyptus dundasii, Eucalyptus lesouefii and Eucalyptus dundasii over sparse shrubland of Melaleuca sheathiana, Scaevola spinescens, Beyeria sulcata and Exocarpos aphyllus over isolated shrubs of Olearia muelleri on orange-red to brown clayey loam on flats and slopes. (Mattiske 2020 vegetation units W2 W3)*	PANSRE25, PANSRE27, PANSRE28, PANSRE29, PANSRE30	Maybell, Scotia	+	+	Low
Woodland/ Shrubland on slopes	*Open woodland of Eucalyptus longicornis/gracilis/flocktoniae/ ?salicola over open shrubland of Melaleuca sheathiana, Cratystylis conocephala over mixed sparse chenopod shrubland on pale brown clayey loam flats. (Mattiske 2020 vegetation units W4, S1, S4)*	PANSRE23, PANSRE24, PANSRE26	Maybell, Scotia	+	+	Moderate
Cleared / Degraded	*Cleared or degraded land*	-	All	-	-	Nil
Salt Lake	*Salt lake or non-vegetated lake bed.*	-	All	-	-	Nil



Legend

- Norseman Gold Project Area
- SRE Sample Location

SRE Habitat Suitability

- Moderate
- Low
- Nil

- IMAGERY SOURCED FROM OPEN SOURCE

0 150 300 600 m

Scale: 1:25,000 @ A4

N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

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Figure 3a

Norseman Gold Project Areas and SRE Habitat Suitability

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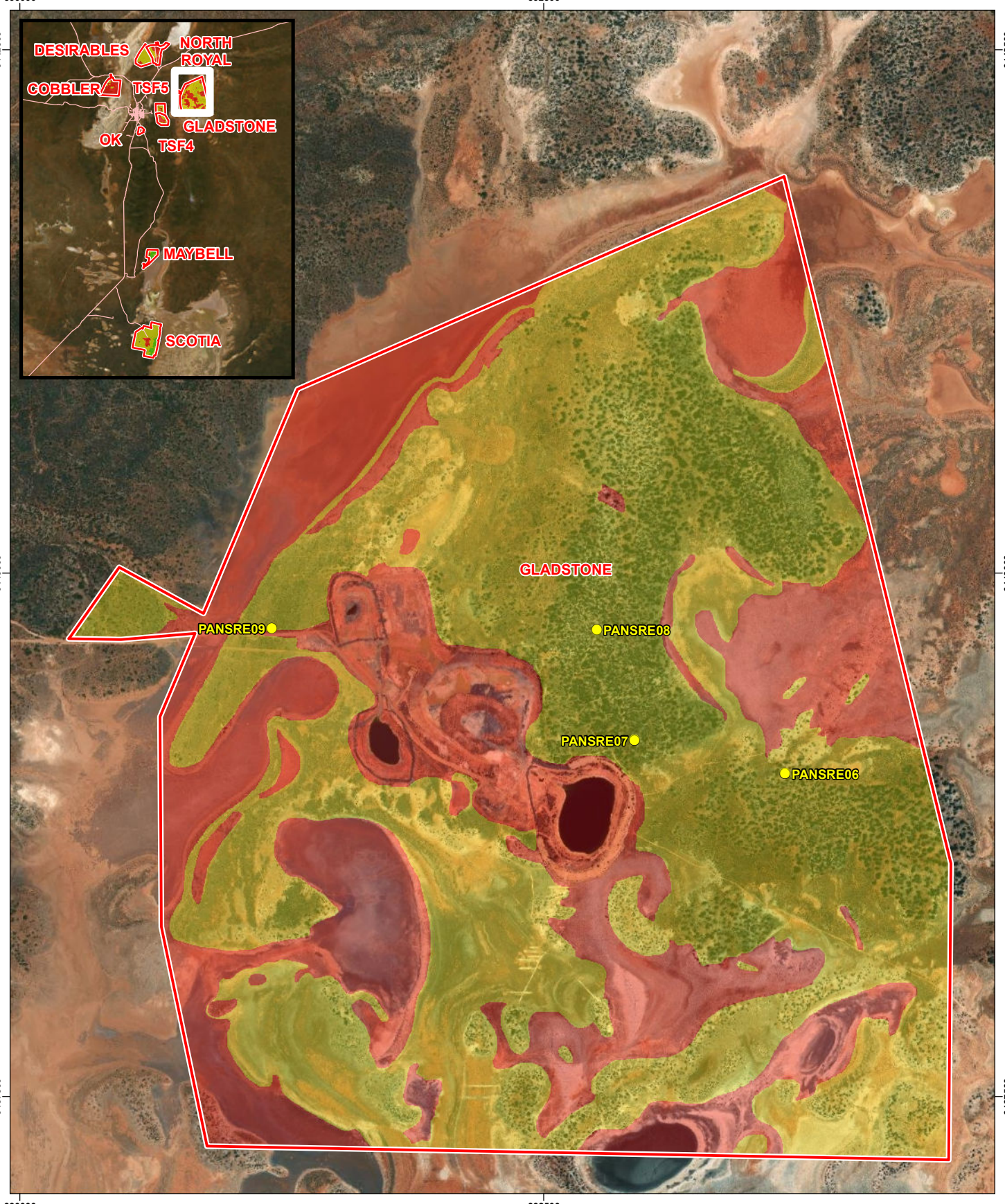

Legend

- Norseman Gold Project Area
- SRE Sample Location

SRE Habitat Suitability

- Moderate
- Low
- Nil

0 175 350 700 N

m

Scale: 1:25,000 @ A4

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Figure 3b

Norseman Gold Project Areas and SRE Habitat Suitability

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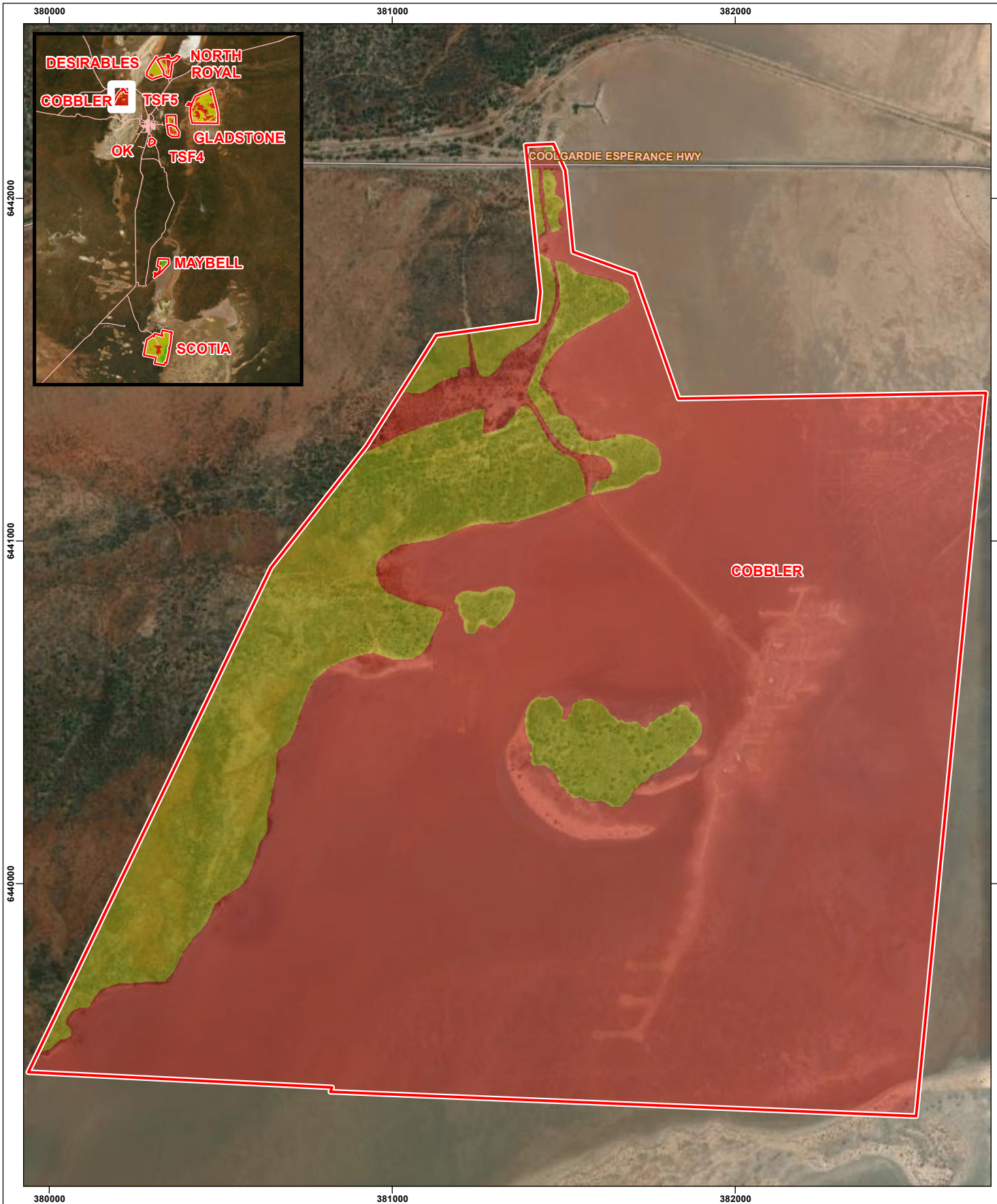

Legend

- Norseman Gold Project Area
- SRE Sample Location

SRE Habitat Suitability

- Moderate
- Low
- Nil

0 100 200 400 m

Scale: 1:15,000 @ A4

N

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Figure 3c

Norseman Gold Project Areas and SRE Habitat Suitability

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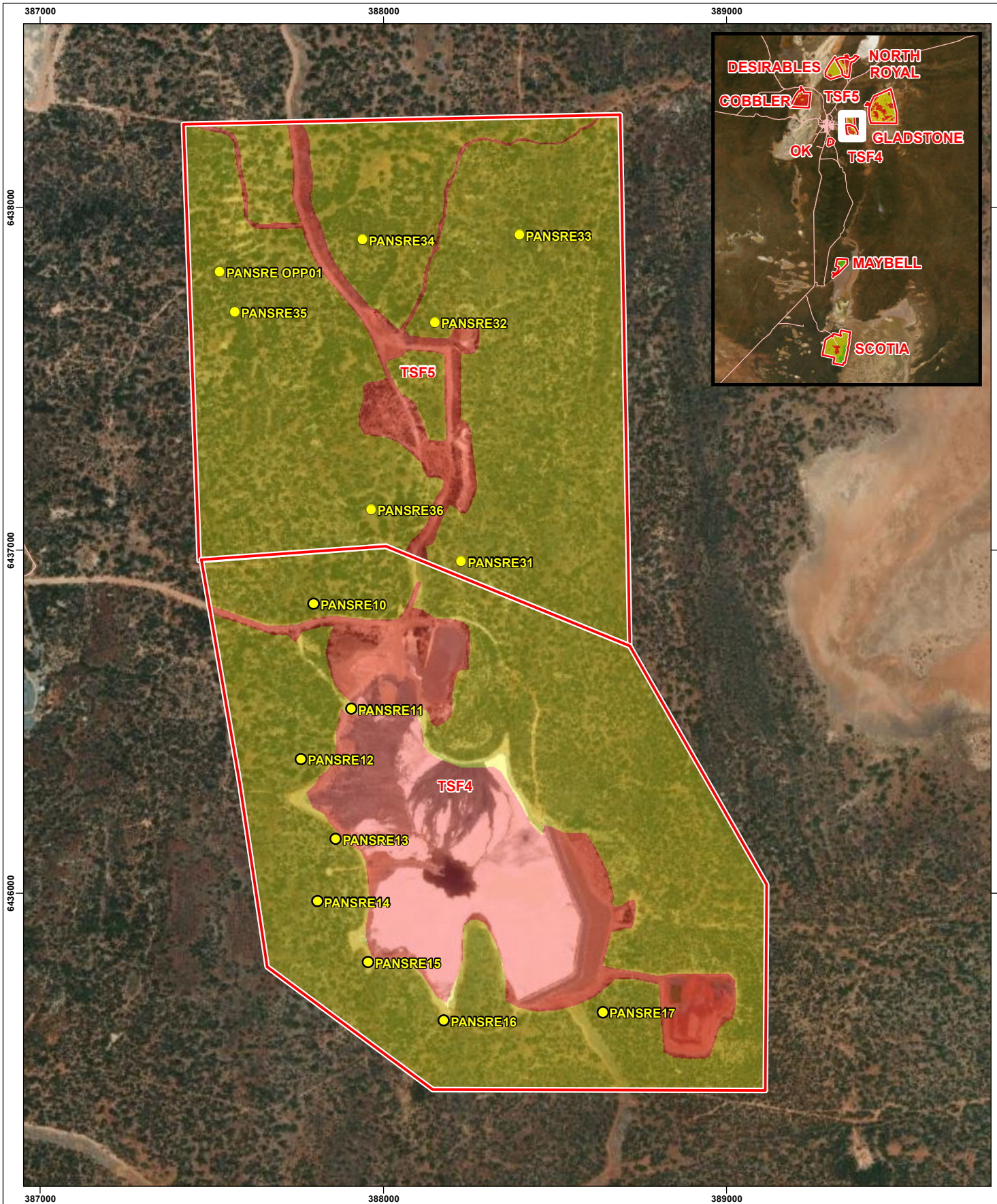

Legend

- Norseman Gold Project Area
- SRE Sample Location

SRE Habitat Suitability

- Moderate
- Low
- Nil

- IMAGERY SOURCED FROM OPEN SOURCE

0 125 250 500 m

Scale: 1:15,000 @ A4

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Figure 3d

Norseman Gold Project Areas and SRE Habitat Suitability

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Legend

- Norseman Gold Project Area
- SRE Sample Location

SRE Habitat Suitability

- Moderate
- Low
- Nil

0 25 50 100 m

Scale: 1:5,000 @ A4

N

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Figure 3e

Norseman Gold Project Areas and SRE Habitat Suitability

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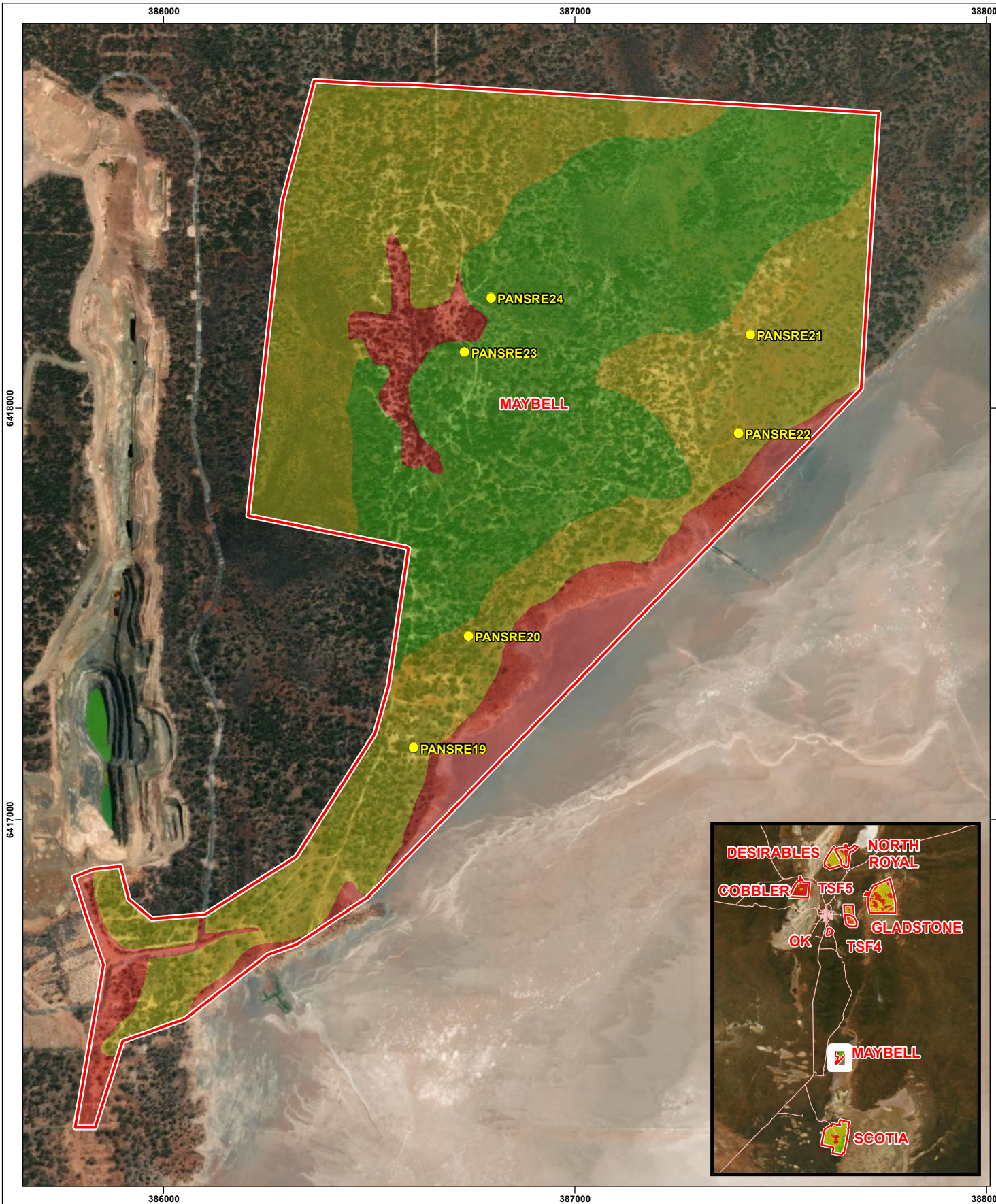

Legend

- Norseman Gold Project Area
- SRE Sample Location

SRE Habitat Suitability

- Moderate
- Low
- Nil

0 75 150 300 m

Scale: 1:12,500 @ A4

N

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Figure 3f

Norseman Gold Project Areas and SRE Habitat Suitability

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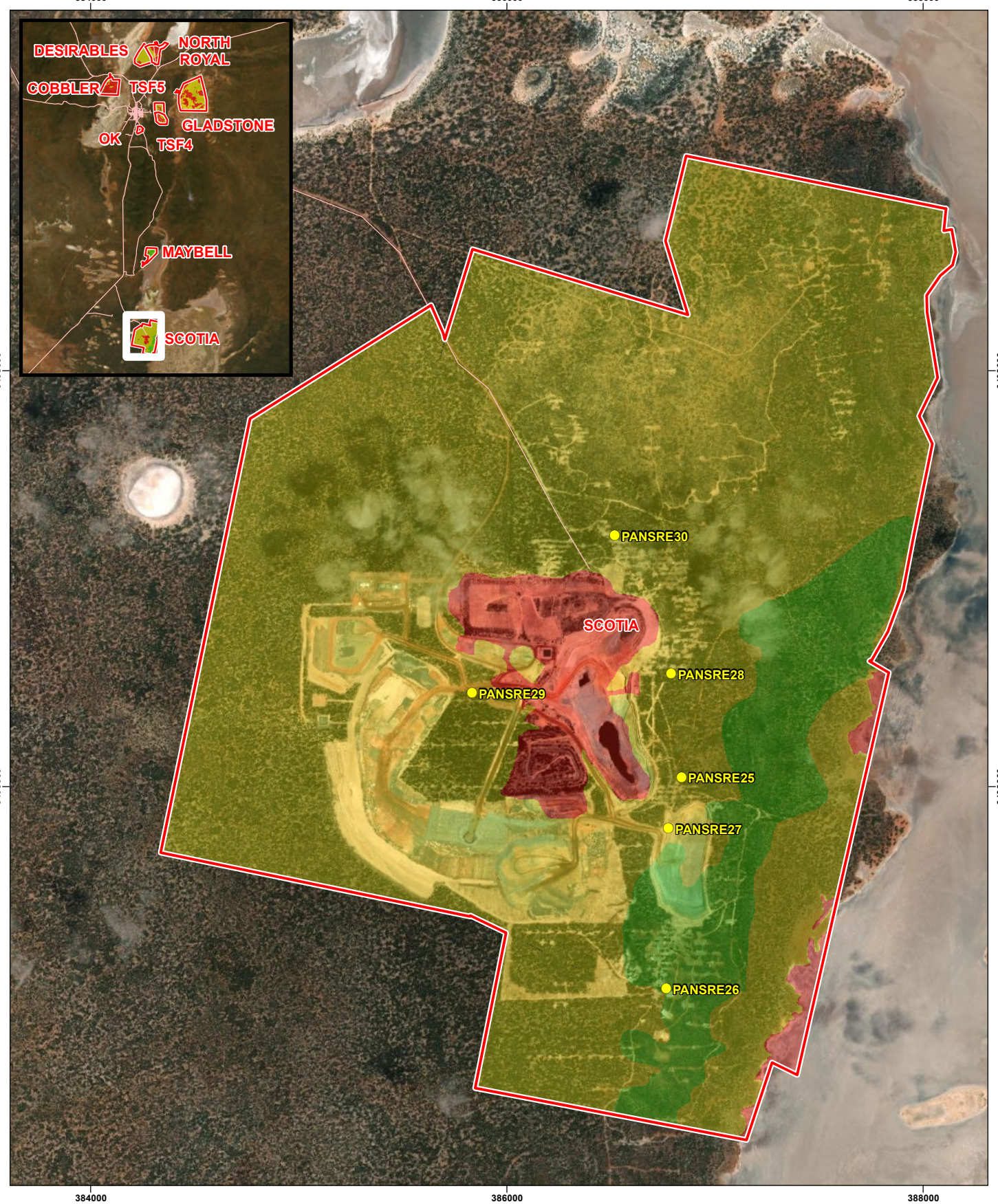

Legend

- Norseman Gold Project Area
- SRE Sample Location

SRE Habitat Suitability

- Moderate
- Low
- Nil

0 150 300 600 m

Scale: 1:25,000 @ A4

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Figure 3g

Norseman Gold Project Areas and SRE Habitat Suitability

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3.5 SRE Field Survey

3.5.1 2020 Field survey

The SRE field survey in 2020, recorded 204 individual specimens representing 22 taxa of invertebrates from five classes, 12 orders and 21 families that have the potential to contain SRE taxa (Appendix 4). Species that are considered to be SRE are summarised in Table 7.

No Confirmed SRE species or conservation significant species were recorded during the field survey.

One species were identified as a Likely SRE species:

- the millipede *Atelomastix sp. 'B03'*

Three Possible SRE species were recorded primarily due to the groups being considered data deficient:

- One geophilid centipedes *Mecistocephalus sp.'47 legs'*
- One isopod Philosciidae *sp. indet*. (damaged)
- Pseudoscorpions from the family Olpiidae

The taxonomy of the Pseudoscorpion family Olpiidae is poorly known and, until further taxonomic resolution has been obtained, all species are considered to be Possible SRE species in Western Australia due to a deficiency in data. Molecular sequencing of Pilbara and other Western Australian specimens is currently being undertaken by the Western Australian Museum and these data will be used in the future to determine if species are widespread or restricted in distribution. It must be stated, however, there is considerable difference between molecular and morphological data, with generic and species boundaries highly uncertain making meaningful results unlikely, except in the medium to long term. Due to the unreliable existing taxonomic framework olpiid specimens are not identified beyond family level.

3.5.1 2024 Field survey

The SRE field survey in 2024, recorded 48 individual specimens representing 12 taxa of invertebrates from four classes, eight orders and 12 families that have the potential to contain SRE taxa (Appendix 4). Species that are considered to be SRE are summarised in Table 7.

No Confirmed SRE species or conservation significant species were recorded during the field survey.

One species were identified as a Likely SRE species:

- the millipede *Atelomastix sp. 'B03'*

Five Possible SRE species were recorded primarily due to the groups being considered data deficient:

- Two mygalomorph spiders (*Kwonkan silvestre* and *Synothele pectinata*)
- A geophilid centipede *Mecistocephalus sp.'47 legs'*
- One Polyzonid millipede *Siphonotidae sp.'Norseman IS01'*)
- Pseudoscorpions from the family Olpiidae

Plate 6 The widespread mygalomorph spider *Gaius austini* excavated from her burrow at site PANSRE24

Plate 7 Burrow lid of the widespread mygalomorph spider *Gaius austini* from the Maybell Project area

The potential SRE taxa identified in Table 7 are discussed further in Sections 4.1 – 4.2. The majority of species recorded are widespread across the Great Western Woodland region of Western Australia and beyond.

The details of all specimens recorded during the survey including identification, abundance data and individual specimen tracking numbers is shown in Appendix 4.

Table 7 SRE invertebrates recorded during the field survey.

Higher Order	Genus and species	Sites recorded	SRE Status
Crustacea: Isopoda:			
Philosciidae	Philosciidae *sp. indet.* (damaged)	PANSRE19	Possible (A)
Arachnida			
Mygalomorphae:			
Anamidae	*Kwonkan silvestre*	PANSRE35	Possible (A)
Barychelidae	*Synothele pectinata*	PANSRE34, PANSRE39	Possible (A)
Pseudoscorpiones:			
Olpiidae	*sp.*	PANSRE05, PANSRE12, PANSRE23, PANSRE33, PANSRE36, PANSRE37, PANSRE39, PANSRE41, PANSRE42,	Possible (A)
Chilopoda:			
Geophilomorpha			
Mecistocephalidae	*Mescitocephalus sp.'47 legs'*	PANSRE20, PANSRE21, PANSRE039	Possible (A)
Diplopoda:			
Spirostreptida			
Iulomorphidae	*Atelomastix sp. 'B03'*	PANSRE07, PANSRE09, PANSRE21, PANSRE23, PANSRE24, PANSRE40	Likely
Polyzoniida:			
Siphonotidae	*"Norseman sp IS01"*	PANSRE07, PANSRE18, PANSRE19, PANSRE21, PANSRE22, PANSRE23, PANSRE27, PANSRE40, PANSRE42	Possible (A)

Plate 8 The millipede *Antichiropus exclamatus* at PANSRE20 in the Maybell area.

Plate 9 The Possible SRE mygalomorph spider *Kwonkan silvestre* from PANSRE35 in the TSF5 area.

3.6 Habitat Assessment for Arid Bronze Azure Butterfly

Whilst vegetated areas in both Desirables and TSF5 were dominated by smooth barked *Eucalyptus* (Plate 10), no individuals, or nests of *Camponotus sp. nr. terebrans* were recorded during the active SRE searches from either Desirables or TSF5 survey areas, hence the likelihood of ABAB being present is Very Low.

No further assessment for ABAB was considered necessary based upon the initial habitat assessment.

Plate 10 Smooth barked Eucalyptus woodland in the Desirables survey area.

4. Discussion

4.1 SRE Invertebrate Assessment

The SRE field surveys in 2020 and 2024 recorded seven potential SRE invertebrate species from within the nine SRE Survey Areas. These seven taxa included no Confirmed SRE species, one Likely SRE species and six Possible SRE species (Figure 4, Table 8, Appendix 4). The majority of the species determined to be Possible SRE taxa is due to incomplete taxonomy and unknown species distributions. All the Possible SRE species are known to occur more widely in the region or were often recorded at multiple locations during the survey indicating that their distributions are wider than the current survey could determine.

The desktop assessment of the Desktop Study Area recorded three Confirmed SRE species that have a Low Likelihood of occurrence within the SRE Survey area. None of the Confirmed SRE species were recorded during the SRE survey or during the survey undertaken by Bennelongia (2013). A further four Likely SRE species are known to occur within the Desktop Study Area; two isopods with a High Likelihood of occurrence are known from the Mt Henry area (Bennelongia 2013), along with two Iulomorphid millipedes, one of which has a Moderate Likelihood of occurrence and the other Iulomorphidae sp.'B03', now identified as *Atelomastix* sp. 'B03', was recorded at Maybell and Gladstone Project areas in 2020, and at Desirables in 2024 (Table 8).

The Likely SRE millipede species *Atelomastix* sp. 'B03' recorded within the project areas was collected from both leaf litter extracted in a Tullgren funnel but most records were a result of active searching and leaf litter sifting (Appendix 4). Two of the Possible SRE species were recorded solely from leaf litter extracted in a Tullgren funnel, whilst one was from active searching and the remaining species was from a mixture of both methods.

The millipede *Antichiropus exclamatus* (Plate 5 and Plate 8) is one of only a handful of *Antichiropus* millipede species that is widespread and not considered to be a SRE species (Car et al. 2013, Car and Harvey 2014). The species was recorded at several sites across multiple Project areas (Gladstone, TSF4, Maybell and Scotia, Appendix 4) with adult male specimens allowing confident identification of the specimens to species level.

The mygalomorph spider *Gaius austini* (Plate 6) recorded at various Project areas (North Royal, Gladstone, TSF4 and Maybell, Appendix 4) was recently described from the Goldfields region (Rix et. al. 2018a) with specimens dug from burrows at each location to confirm their identification as the external burrow morphology (Plate 7) shows superficial similarity to other Idiopid genera including some species of *Idiosoma* that contain SRE and conservation significant t representatives (refer Section 4.3.2).

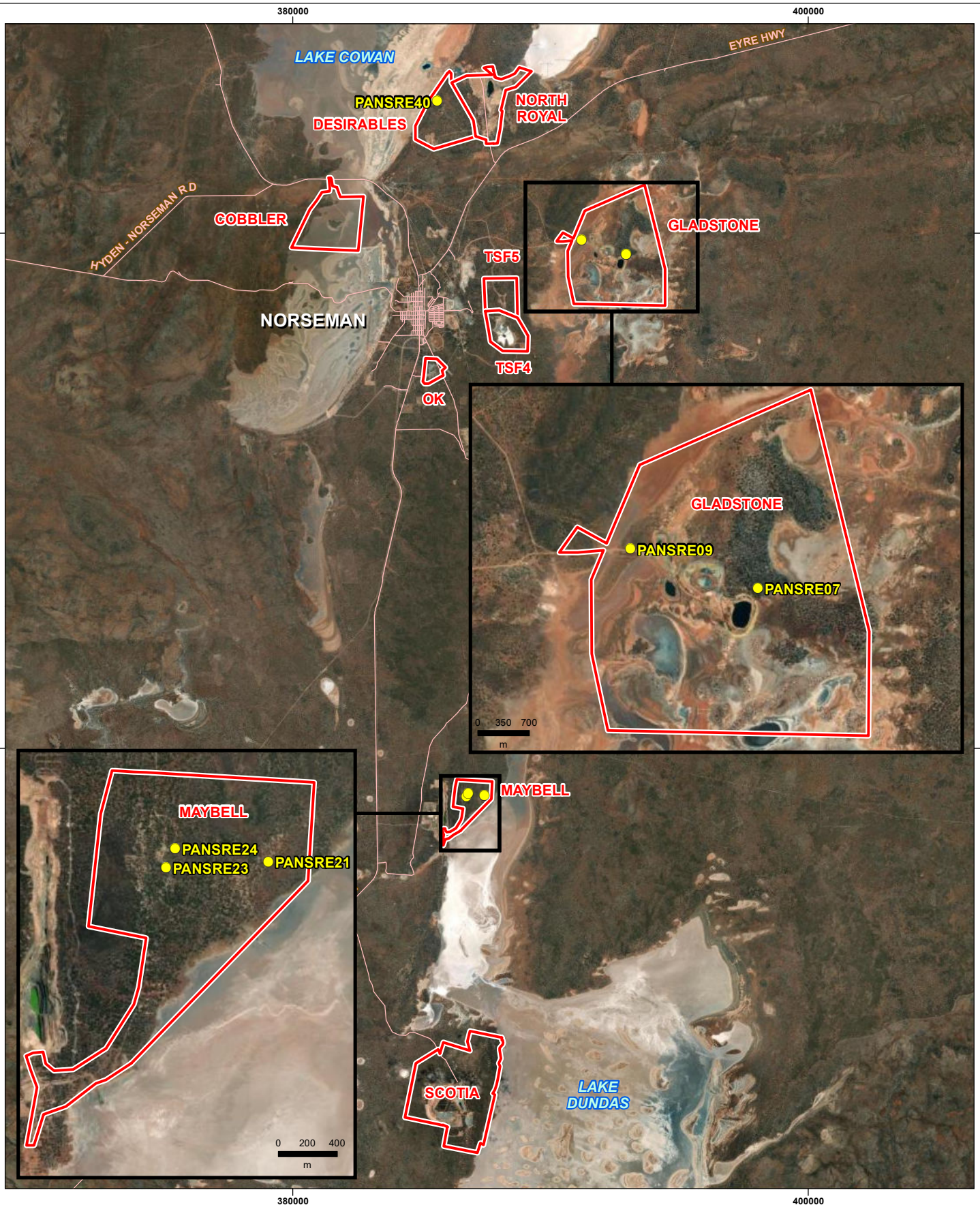
All Confirmed and Likely SRE and conservation significant species with a Moderate or higher likelihood of occurrence within the Project area, are considered in depth in Section 4.2 – 4.3 respectively.

Table 8 Potential SRE invertebrates Likelihood of occurrence in the Pantoro SRE Survey Area

Higher Order	Genus and species	Recorded during current surveys	SRE Status	Likelihood of species within the Survey area	Occurrence in Norseman Gold Project Areas
Gastropoda					
Camaenidae	*Sinumelon cf. jimberlanensis*	No	Possible (A)	Moderate	
	Sinumelon lennum mutuum	No	Possible (A)	Low	
Planorbidae	*cf. Isidorella sp.*	No	Possible (A)	Very Low	
Pomatiopsidae	*Coxiella pyrrhostoma*	No	Possible (A)	Very Low	
Isopoda					
Armadillidae	*Buddelundia sp.'B40'*	No	Possible (A)	High	
	Troglarmadillo sp.'B35'	No	Likely	High	
Philosciidae	*sp.'B28'*	No	Likely	High	
	Philosciidae *sp. indet.* (damaged)	2020 Survey	Possible (A)	Present	Maybell
Arachnida:					
Mygalomorphae					
Actinopodidae	*Missulena pinguipes*	No	Possible (A)	Moderate	
	Missulena sp. 'B04'	No	Possible (A)	High	
Anamidae	*Kwonkan silvestre*	2024 Survey	Possible (A)	Present	TSF5
Barychelidae	*Synothele pectinata*	2024 Survey	Possible (A)	Present	Desirables and TSF5
	Synothele near sp. 'B03'	No	Possible (A)	High	
	Synothele sp. 'B06'	No	Possible (A)	High	
Idiopidae	*Idiosoma intermedium*	No	Priority 3 / Widespread	Moderate	
Pseudoscorpiones:					
Olpiidae	*spp.*	2020 and 2024 Surveys*	Possible (A)	Present	Desirables, North Royal, TSF4, TSF5, and Maybell
Diplopoda:					
Polydesmida:					
Paradoxosomatidae	*Antichiropus anconus*	No	Confirmed	Low	
	Antichiropus buchanorum	No	Confirmed	Low	
	Antichiropus incomptus	No	Confirmed	Low	

Higher Order	Genus and species	Recorded during current surveys	SRE Status	Likelihood of species within the Survey area	Occurrence in Norseman Gold Project Areas
Polyzoniida					
Siphonotidae	*sp.*	No	Possible (A)	High	
Spirostreptida					
Iulomorphidae	*Atelomastix bamfordi*	No	Likely	Moderate	
	Iulomorphidae sp.'B03' / Atelomastix sp. 'B03'	2020 and 2024 Surveys	Likely	Present	Desirables, Gladstone and Maybell

* Due to the incomplete taxonomy of the Olpiid pseudoscorpions it is unknown if these are the same or different species, however, as explained in Section 3.5 all Olpiid pseudoscorpions are considered Possible (A) SRE species.



Legend

Norseman Gold Project Area

Likely SRE Species Distribution

- Diplopoda: Iulomorphidae: *Atelomastix* sp. 'B03'

0 1.25 2.5 5
km
Scale: 1:200,000 @ A4

N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

- IMAGERY SOURCED FROM OPEN SOURCE

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PROJECT ID	DATE
Norseman Gold Project	7/10/2024

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 51

CREATED	CHECKED	APPROVED	REVISION
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Figure 4
Likely SRE Species Distribution

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4.2 Likely SRE species recorded within the SRE Survey Area

4.2.1 Myriapoda: Diplopoda

Spirostreptida: Iulomorphidae: *Atelomastix sp. 'B03'* – Likely SRE

Millipedes from the genus *Atelomastix* all have limited powers of dispersal and conservative ecological requirements (Edward and Harvey 2010). In addition, the above-ground activity of most *Atelomastix* species is limited to a very small window of opportunity when there is sufficient moisture for them to forage and mate during wetter winter months (Edward and Harvey 2010). *Atelomastix* species are, consequently, most often short range endemics with very small distributions *sensu* Harvey 2002.

The Likely SRE millipede species *Atelomastix* sp. 'B03' was recorded from four different habitats (Table 6, Figure 3) that are largely laterally continuous *Eucalyptus* Woodland habitats along with Woodland over shrubs and from Woodland on slopes and from multiple Project Areas (Desirables, Gladstone and Maybell). This would indicate that the species is widespread throughout multiple habitats in the region and not restricted to Project areas.

4.3 Likelihood of Occurrence of Likely SRE and Conservation Significant SRE species within the SRE Survey Area

4.3.1 Crustacea: Isopoda

Armadillidae: *Troglarmadillo sp.'B35'* – Likely SRE

This undescribed species of isopod was recorded during the Mt Henry SRE survey (Bennelongia 2013) from drainage lines in rocky hills. Only a single specimen was collected and it is considered a Likely SRE species based upon the distribution of other members of this genus that are known to contain confirmed SRE species (Dr Simon Judd, pers. comm. August 2020).

Philosciidae: *Philosciidae sp.'B28'* – Likely SRE

This undescribed species of isopod was recorded during the Mt Henry SRE survey (Bennelongia 2013) from drainage lines in rocky hills. Only a single specimen was collected and it is considered a Likely SRE species based upon the distribution of other members of this genus that are known to contain confirmed SRE species (Dr Simon Judd, pers. comm. July 2020). A highly damaged individual specimen that could be identified only to the family Philosciidae was recorded from site PANSRE19 in the Maybell Project area and it is possible that this is the same species, however, three species of Philosciidae were recorded at the Mt Henry site (Bennelongia 2013) and it is impossible to match this damaged specimen to any known morphospecies (Dr Simon Judd, pers. comm. August 2020).

4.3.2 Arachnida: Mygalomorphae

Idiopidae*: Idiosoma intermedium* – Priority 3 (DBCA)

Idiosoma intermedium commonly known as the 'Coolgardie shield-backed trapdoor spider' is a recently described species of *Idiosoma* following a revision by Rix et al. (2018) that split *I. nigrum* into 15 species and restricts true *I. nigrum* to a small portion of the northern Wheatbelt centred on Wongan Hills from where it was first described (Main 1952).

Idiosoma intermedium occurs throughout the eastern Wheatbelt and western Coolgardie bioregions although its distribution, especially on the eastern and northern margins is poorly known (Rix et al. 2018b, Plate 11). It is for this reason that, although no records of *I. intermedium* are known within 50 km of the Project area, the species is still considered to have a Moderate Likelihood of occurrence due to the uncertainty in its true distribution and the suitability of habitat within Eucalyptus and Mallee woodland areas that are present throughout much of the Project area. It should, however, be noted that much of the Project area has been the subject of historical mining activities and disturbance has been significant historically throughout the local region that may have previously impacted on the distribution of *I. intermedium*.

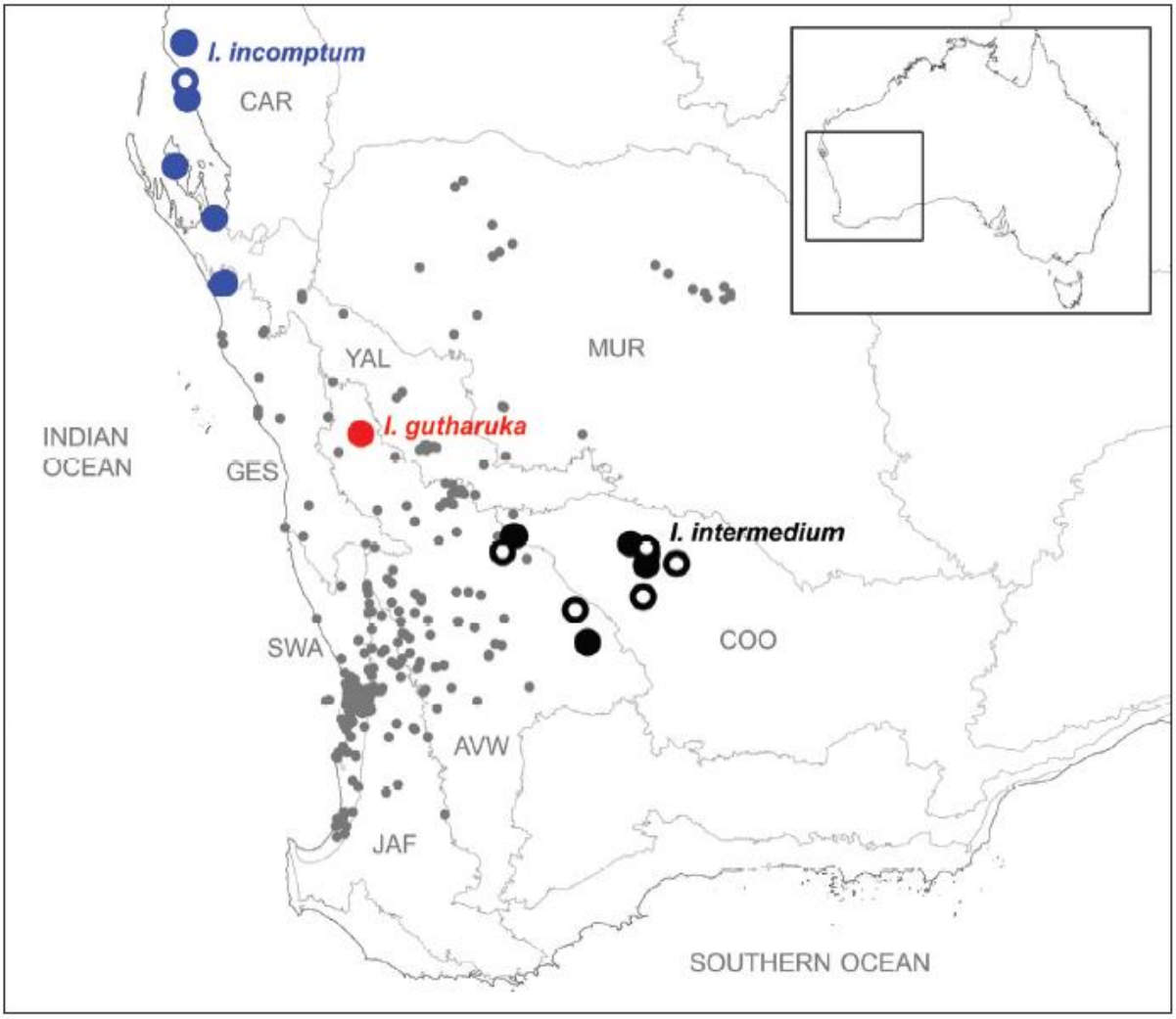

Plate 11 Distribution of *Idiosoma intermedium* (black circles) in the eastern Wheatbelt and Coolgardie bioregions (after Rix et al. 2018b, Figure 376).

4.3.3 Myriapoda: Diplopoda:

Spirostreptida: Iulomorphidae: *Atelomastix bamfordi* – Likely SRE

This species of *Atelomastix* millipede has been previously recorded to the south west of the Scotia Project area towards Salmon Gums (WAM 2020a) and is known to occur throughout the eastern extremity of the Wheatbelt including Koolyanobbing, Marvel Loch and Mt Jackson (Edwards and Harvey 2010). The *Eucalyptus* woodland habitat present throughout the Norseman region is suitable for this species to occur.

5. Conclusions and Recommendations

The Desktop Study Area contains three Confirmed SRE species, four Likely SRE species and 12 Possible SRE species. Of these 19 species identified in the Desktop Study Area, one of these was recorded in the field survey; the Likely SRE millipede *Atelomastix sp.'B03'*. The remaining three Confirmed, three Likely and 12 Possible SRE species (four mygalomorph spiders, four land snails, two pseudoscorpions, two isopods, and one millipede) were not recorded.

An additional five conservation significant invertebrates (widespread, non-SRE species) were identified in the desktop assessment, however, of these five conservation significant species only the Arid Bronze Azure Butterfly is considered as possibly having potential habitat within the Project area.

A field habitat assessment for ABAB including both presence of suitable vegetation combined with the presence of the sugar ant *Camponotus sp. nr. terebrans* was undertaken. This assessed potential habitat presence in Desirables and TSF5 to determine the presence or absence of the ABAB host ant *Camponotus sp. nr. terebrans*. Whilst vegetated areas were dominated by smooth barked eucalyptus, no individuals, or nests of *Camponotus sp. nr. terebrans* were recorded from either Desirables or TSF5 survey areas, hence the likelihood of ABAB being present is Very Low.

The SRE field surveys in 2020 and 2024 recorded seven potential SRE invertebrate species from within the nine SRE Survey Areas. These seven taxa included no Confirmed SRE species, one Likely SRE species and six Possible SRE species.

One species were identified as a Likely SRE species:

- the millipede *Atelomastix sp. 'B03'*

Six Possible SRE species were recorded primarily due to the groups being considered data deficient:

- Two mygalomorph spiders (*Kwonkan silvestre* and *Synothele pectinata*)
- Two geophilid centipedes *Mecistocephalus sp.'47 legs'* and *Sepedenophilus cf. antipodus*
- One isopod Philosciidae *sp. indet*. (damaged)
- Pseudoscorpions from the family Olpiidae

The Likely SRE millipede species *Atelomastix* sp. 'B03' was recorded from four different habitats that are largely laterally continuous *Eucalyptus* Woodland habitats along with Woodland over shrubs and from Woodland on slopes and from multiple Project Areas (Desirables, Gladstone and Maybell). This would indicate that the species is widespread throughout multiple habitats in the region and not restricted solely to Project areas.

The majority of species recorded are widespread throughout the Great Western Woodland region of Western Australia.

No further invertebrate surveys for SRE or conservation significant invertebrate are required for the nine project areas assessed in this report.

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Appendix 1

Conservation Codes from Department of Biodiversity, Conservation and Attractions

CONSERVATION CATEGORY DEFINITIONS

For Western Australian Fauna and Flora

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] 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.

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened species

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 the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species.

Threatened flora is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species.

The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline Number 1 and Ministerial Guideline Number 2 that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria[3], and is based on the national distribution of the species.

CR Critically endangered species

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.

Examples of use:

- The western ringtail possum (*Pseudocheirus occidentalis*) is listed as a critically endangered threatened species under the *Biodiversity Conservation Act 2016.*
- Western ringtail possum is listed as critically endangered under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: CR.

EN Endangered species

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.

Examples of use:

- *Caladenia hopperiana* is listed as an endangered threatened species under the *Biodiversity Conservation Act 2016.*
- *Caladenia hopperiana* is listed as endangered under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: EN.

VU Vulnerable species

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.

Examples of use:

- The forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) is listed as a vulnerable threatened species under the *Biodiversity Conservation Act 2016.*
- Forest red-tailed black cockatoo is listed as vulnerable under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: VU.

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.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Examples of use:

- *Acacia kingiana* is listed as an extinct species under the *Biodiversity Conservation Act 2016.*
- *Acacia kingiana* is listed as extinct under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: EX.

EW Extinct in the wild species

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 fauna or flora species listed as extinct in the wild.

SP 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.

MI Migratory species

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).

Migratory species include birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA)[4], China (CAMBA)[5] or The Republic of Korea (ROKAMBA)[6], and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)[7], 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.

Examples of use:

- The wedge-tailed shearwater (*Ardenna pacifica*) is listed as a specially protected migratory species under the *Biodiversity Conservation Act 2016.*
- Wedge-tailed shearwater is listed as migratory under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: MI.

CD **Species of special conservation interest (conservation dependent)**

Species of special conservation need that are 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).

Currently only fauna are listed as species of special conservation interest.

Examples of use:

- The wambenger, south-western brush-tailed phascogale (*Phascogale tapoatafa wambenger*) is listed as a specially protected species of special conservation interest under the *Biodiversity Conservation Act 2016.*
- Wambenger, south-western brush-tailed phascogale, is listed as conservation dependent under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: CD.

OS **Species otherwise in need of special protection (other specially protected)**

Species 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).

Currently only fauna are listed as species otherwise in need of special protection.

Examples of use:

- The dugong (*Dugong dugon*) is listed as a specially protected species otherwise in need of special protection under the *Biodiversity Conservation Act 2016.*
- Dugon is listed as other specially protected fauna under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: OS.

P **Priority species**

Priority is not a listing category under the BC Act. The Priority Flora and Fauna lists are maintained by the department and are published on the department's website.

All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land).

Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey 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 prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened.

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

Assessment of priority status 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.

1 **Priority 1: Poorly-known species - known from few locations, none on conservation lands**

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, for example, 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 for threatened listing and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.

Examples of use:

- *Borya stenophylla* is listed as a Priority 1 species by the Department of Biodiversity, Conservation and Attractions.
- *Borya stenophylla* is listed as Priority 1 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P1.

2 Priority 2: Poorly-known species - known from few locations, some on conservation lands

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, for example, 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 for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.

Examples of use:

- *Caladenia nivalis* is listed as a Priority 2 species by the Department of Biodiversity, Conservation and Attractions.
- *Caladenia nivalis* is listed as Priority 2 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P2.

3 Priority 3: Poorly-known species - known from several locations

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. These species need further survey.

Examples of use:

- *Acacia nitidula* is listed as a Priority 3 species by the Department of Biodiversity, Conservation and Attractions.
- *Acacia nitidula* is listed as Priority 3 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P3.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as a conservation dependent specially protected species.

(c) Species that have been removed from the list of threatened species or lists of conservation dependent or other specially protected species, during the past five years for reasons other than taxonomy.

(d) Other species in need of monitoring.

Examples of use:

- *Banksia aculeata* is listed as a Priority 4 species by the Department of Biodiversity, Conservation and Attractions.
- *Banksia aculeata* is listed as Priority 4 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P4.

[1] The definition of flora includes algae, fungi, and lichens.

[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

[3] Western Australia has assigned species to threat categories using the *IUCN Red List of Threatened Species Categories and Criteria* since 1996 (referencing all criteria).

[4] JAMBA - first included in the WA migratory species list in 1980.

[5] CAMBA - first included in the WA migratory species list in 2010.

[6] ROKAMBA - first included in the WA migratory species list in 2010.

[7] Bonn Convention (Birds) - first included in the WA migratory species list in 2015.

Appendix 2

Protected Matters Search Tool Results

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. Please see the caveat for interpretation of information provided here.

Report created: 24-Sep-2024

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	10
Listed Migratory Species:	6

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	9
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	4
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis			
Southern Whiteface [529]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos			
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leipoa ocellata			
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Pezoporus occidentalis](#) Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area	In buffer area only
PLANT			
[Daviesia microcarpa](#) Norseman Pea [56766]	Endangered	Species or species habitat known to occur within area	In feature area
[Eucalyptus platydisca](#) Jimberlana Mallee [64575]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Tecticornia flabelliformis](#) Bead Glasswort, Bead Samphire [82664]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [51802]	WA	In buffer area only
Commonwealth Land - [51800]	WA	In buffer area only
Commonwealth Land - [50330]	WA	In buffer area only
Commonwealth Land - [52247]	WA	In buffer area only
Commonwealth Land - [51801]	WA	In buffer area only
Commonwealth Land - [52187]	WA	In buffer area only
Commonwealth Land - [52243]	WA	In buffer area only
Commonwealth Land - [52246]	WA	In buffer area only
Commonwealth Land - [52188]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Binaronca	Nature Reserve	WA	In buffer area only
Dordie Rocks	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Dundas	Nature Reserve	WA	In buffer area only
Ngadju	Indigenous Protected Area	WA	In buffer area only
Unnamed WA06043	Nature Reserve	WA	In buffer area only
Unnamed WA08029	Nature Reserve	WA	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Gold Mining Developments on Lake Lefroy	2010/5402	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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 3

SRE Site locations and habitats

PANSRE01 Open Low Woodland	
PANSRE02 Open Low Woodland	

PANSRE03 Open Low Woodland	
PANSRE04 Open Low Woodland	

PANSRE05 Mid Woodland	
PANSRE06 Open Low Woodland	

PANSRE07 Open Low Woodland	
PANSRE08 Open Low Woodland	

PANSRE09 Mallee and Acacia shrubland	
PANSRE10 Mid Woodland	

PANSRE11 Mid Woodland	
PANSRE12 Mid Woodland	

PANSRE13 Mid Woodland	
PANSRE14 Mid Woodland	

PANSRE15 Mid Woodland	
PANSRE16 Mid Woodland	

PANSRE17 Mid Woodland	
PANSRE18 Open Low Woodland	

PANSRE19 Shrubland near salt lakes	
PANSRE20 Shrubland near salt lakes	

PANSRE21 Shrubland near salt lakes	
PANSRE22 Shrubland near salt lakes	

PANSRE23 Woodland/ Shrubland on slopes.	
PANSRE24 Woodland/ Shrubland on slopes	

PANSRE25 Woodland over shrubs	
PANSRE26 Woodland/ Shrubland on slopes	

PANSRE27 Woodland over shrubs.	
PANSRE28 Woodland over shrubs.	

PANSRE29 Woodland over shrubs	
PANSRE30 Woodland over shrubs	

PANSRE31 Mid Woodland	
PANSRE32 Mid Woodland	

PANSRE33 Woodland over shrubs.	
PANSRE34 Woodland over shrubs.	

PANSRE35 Woodland over shrubs.	
PANSRE36 Mid Woodland	

PANSRE37 Mid Woodland	
PANSRE38 Mid Woodland	

PANSRE39 Mid Woodland	
PANSRE40 Woodland over shrubs.	

PANSRE41 Mid Woodland	
PANSRE42 Mid Woodland	

Appendix 4

Specimen abundance and tracking codes

Phylum/ Subphylum	Class	Order	Family	Genus and sp	SRE Status	Abundance	Site	Date	Collection Method	Tracking number	Identified by
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE02	12/05/2020	Active searching and leaf litter sifting	ISTN2040	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE04	12/05/2020	Active searching and leaf litter sifting	ISTN2046	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE05	12/05/2020	Active searching and leaf litter sifting	ISTN1912	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE07	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1974	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE07	12/05/2020	Active searching and leaf litter sifting	ISTN2044	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE10	13/05/2020	Active searching and leaf litter sifting	ISTN1918	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE12	13/05/2020	Active searching and leaf litter sifting	ISTN1919	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE13	13/05/2020	Active searching and leaf litter sifting	ISTN2029	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE17	13/05/2020	Active searching and leaf litter sifting	ISTN2034	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE18	14/05/2020	Active searching and leaf litter sifting	ISTN2063	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE20	14/05/2020	Active searching and leaf litter sifting	ISTN2064	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	5	PANSRE21	14/05/2020	Active searching and leaf litter sifting	ISTN2053	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE22	14/05/2020	Active searching and leaf litter sifting	ISTN2060	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE26	15/05/2020	Active searching and leaf litter sifting	ISTN1934	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	2	PANSRE27	15/05/2020	Active searching and leaf litter sifting	ISTN1935	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE28	15/05/2020	Active searching and leaf litter sifting	ISTN1936	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE32	16/05/2024	Active searching and leaf litter sifting	ISTN4854	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE33	14/05/2024	Active searching and leaf litter sifting	ISTN4857	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	4	PANSRE34	15/05/2024	Active searching and leaf litter sifting	ISTN4413	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE35	14/05/2024	Active searching and leaf litter sifting	ISTN4852	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE37	16/05/2024	Active searching and leaf litter sifting	ISTN4423	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE41	17/05/2024	Active searching and leaf litter sifting	ISTN4855	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Bothriembryontidae	*Bothriembryon cf. sedgwicki*	Widespread	1	PANSRE42	17/05/2024	Active searching and leaf litter sifting	ISTN4853	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	2	PANSRE06	12/05/2020	Active searching and leaf litter sifting	ISTN2039	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	1	PANSRE12	13/05/2020	Active searching and leaf litter sifting	ISTN2033	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	2	PANSRE13	13/05/2020	Active searching and leaf litter sifting	ISTN2030	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	5	PANSRE17	13/05/2020	Active searching and leaf litter sifting	ISTN1924	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	2	PANSRE18	14/05/2020	Active searching and leaf litter sifting	ISTN1925	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	1	PANSRE21	14/05/2020	Active searching and leaf litter sifting	ISTN2054	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	1	PANSRE22	14/05/2020	Active searching and leaf litter sifting	ISTN2059	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	2	PANSRE23	14/05/2020	Active searching and leaf litter sifting	ISTN1930	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	1	PANSRE24	14/05/2020	Active searching and leaf litter sifting	ISTN2055	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon jimberlanensis*	Widespread	1	PANSRE34	15/05/2024	Leaf litter extracted from tullgren funnel	ISTN3874	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon nullarboricum*	Widespread	2	PANSRE32	16/05/2024	Active searching and leaf litter sifting	ISTN4419	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon nullarboricum*	Widespread	1	PANSRE33	14/05/2024	Active searching and leaf litter sifting	ISTN4415	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Camaenidae	*Siumelon nullarboricum*	Widespread	2	PANSRE41	17/05/2024	Active searching and leaf litter sifting	ISTN4425	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	3	PANSRE02	12/05/2020	Active searching and leaf litter sifting	ISTN1909	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE06	12/05/2020	Active searching and leaf litter sifting	ISTN2036	T Moulds

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Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE07	12/05/2020	Active searching and leaf litter sifting	ISTN2043	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	2	PANSRE08	12/05/2020	Active searching and leaf litter sifting	ISTN1915	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE09	13/05/2020	Active searching and leaf litter sifting	ISTN2032	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE10	13/05/2020	Active searching and leaf litter sifting	ISTN2035	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	8	PANSRE14	13/05/2020	Active searching and leaf litter sifting	ISTN1921	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE18	14/05/2020	Active searching and leaf litter sifting	ISTN2062	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE18	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1986	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	8	PANSRE19	14/05/2020	Active searching and leaf litter sifting	ISTN1926	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	4	PANSRE20	14/05/2020	Active searching and leaf litter sifting	ISTN1927	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE22	14/05/2020	Active searching and leaf litter sifting	ISTN1929	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE28	15/05/2020	Active searching and leaf litter sifting	ISTN2051	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE29	15/05/2020	Active searching and leaf litter sifting	ISTN1937	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE35	14/05/2024	Active searching and leaf litter sifting	ISTN4851	T Moulds
Mollusca	Gastropoda	Systellomatomorpha	Pupillidae	*Pupoides adelaidae*	Widespread	1	PANSRE42	17/05/2024	Active searching and leaf litter sifting	ISTN4424	T Moulds
Crustacea:	Malacostraca	Isopoda	Philosciidae	*indet. (damaged)*	Possible A	1	PANSRE19	14/05/2020	Active searching and leaf litter sifting	ISTN2067	S Judd
Chelicerata	Arachnida	Mygalomorphae	Anamidae	*Kwonkan silvestre*	Possible A	1	PANSRE35	14/05/2024	Dug from burrow	ISTN4417	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Anamidae	*Proshermacha tepperi?*	Widespread	1	PANSRE03	12/05/2020	Dug from burrow	ISTN1910	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Anamidae	*Proshermacha tepperi?*	Widespread	1	PANSRE06	12/05/2020	Dug from burrow	ISTN1913	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Barychelidae	*Synothele pectinata*	Possible A	1	PANSRE34	15/05/2024	Dug from burrow	ISTN4414	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Barychelidae	*Synothele pectinata*	Possible A	1	PANSRE39	16/05/2024	Dug from burrow	ISTN4422	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Idiopidae	*Gaius austini*	Widespread	1	PANSRE02	15/05/2020	Dug from burrow	ISTN1939	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Idiopidae	*Gaius austini*	Widespread	1	PANSRE09	13/05/2020	Dug from burrow	ISTN1917	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Idiopidae	*Gaius austini*	Widespread	1	PANSRE11	16/05/2020	Dug from burrow	ISTN1940	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Idiopidae	*Gaius austini*	Widespread	1	PANSRE15	13/05/2020	Dug from burrow	ISTN1922	T Moulds
Chelicerata	Arachnida	Mygalomorphae	Idiopidae	*Gaius austini*	Widespread	1	PANSRE24	14/05/2020	Dug from burrow	ISTN1932	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Atemnidae	*Oratemnus sp. (juvenile)*	Widespread	1	PANSRE16	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1983	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Cheiridiidae	*Cheiridiidae sp.'B01'?*	Widespread	1	PANSRE09	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1942	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Cheiridiidae	*Cheiridiidae sp.'B01'?*	Widespread	1	PANSRE26	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1955	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Chernitidae	*Haplochernes sp.*	Widespread	1	PANSRE06	12/05/2020	Active searching and leaf litter sifting	ISTN2038	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	5	PANSRE05	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1981	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	3	PANSRE06	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1945	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	2	PANSRE08	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1946	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	1	PANSRE10	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1947	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	1	PANSRE14	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1975	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	1	PANSRE15	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1957	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	1	PANSRE16	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1953	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	12	PANSRE20	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1987	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	1	PANSRE21	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1979	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypidae	*Synsphyronus lathrius*	Widespread	4	PANSRE38	16/05/2024	Leaf litter extracted from tullgren funnel	ISTN3871	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypinidae	*Amblyolpium sp.'WA1'?*	Widespread	1	PANSRE06	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1976	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypinidae	*Amblyolpium sp.'WA1'?*	Widespread	2	PANSRE16	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1984	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypinidae	*Amblyolpium sp.'WA1'?*	Widespread	2	PANSRE21	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1980	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Garypinidae	*Amblyolpium sp.'WA1'?*	Widespread	1	PANSRE24	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1970	T Moulds

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Chelicerata	Arachnida	Pseudoscorpionida	Garypinidae	*Amblyolpium sp.'WA1'?*	Widespread	1	PANSRE25	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1972	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*Beierolpium sp.*	Possible A	3	PANSRE05	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1966	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*Beierolpium sp.*	Possible A	1	PANSRE12	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1941	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*Beierolpium sp.*	Possible A	3	PANSRE23	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1952	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*sp.*	Possible A	2	PANSRE33	16/05/2024	Leaf litter extracted from tullgren funnel	ISTN4433	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*sp.*	Possible A	5	PANSRE36	16/05/2024	Leaf litter extracted from tullgren funnel	ISTN3876	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*sp.*	Possible A	1	PANSRE37	16/05/2024	Leaf litter extracted from tullgren funnel	ISTN4428	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*sp.*	Possible A	4	PANSRE39	16/05/2024	Active searching and leaf litter sifting	ISTN4848	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*sp.*	Possible A	1	PANSRE41	17/05/2024	Active searching and leaf litter sifting	ISTN4856	T Moulds
Chelicerata	Arachnida	Pseudoscorpionida	Olpiidae	*sp.*	Possible A	1	PANSRE42	17/05/2024	Leaf litter extracted from tullgren funnel	ISTN3872	T Moulds
Chelicerata	Arachnida	Scorpionida	Urodacidae	*Lychas sp.'austroccidentalis'*	Widespread	1	PANSRE15	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1977	T Moulds
Myriapoda	Arachnida	Scorpionida	Urodacidae	*Lychas sp.'austroccidentalis'*	Widespread	1	PANSRE16	13/05/2020	Active searching and leaf litter sifting	ISTN1923	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedenophilus cf. antipodus*	Widespread	1	PANSRE07	12/05/2020	Active searching and leaf litter sifting	ISTN2045	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedenophilus cf. antipodus*	Widespread	1	PANSRE19	14/05/2020	Active searching and leaf litter sifting	ISTN2066	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedenophilus cf. antipodus*	Widespread	1	PANSRE22	14/05/2020	Active searching and leaf litter sifting	ISTN2061	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedenophilus cf. antipodus*	Widespread	1	PANSRE25	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1969	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedenophilus cf. antipodus*	Widespread	1	PANSRE25	15/05/2020	Active searching and leaf litter sifting	ISTN1933	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedenophilus cf. antipodus*	Widespread	2	PANSRE27	15/05/2020	Active searching and leaf litter sifting	ISTN2048	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedenophilus cf. antipodus*	Widespread	2	PANSRE30	15/05/2020	Active searching and leaf litter sifting	ISTN1938	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Mecistocephalidae	*Mecistocephalus sp.'47 legs'*	Possible A	1	PANSRE20	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1950	T Moulds
Myriapoda	Chilopoda	Geophilomorpha	Mecistocephalidae	*Mecistocephalus sp.'47legs'*	Possible A	1	PANSRE39	16/05/2024	Active searching and leaf litter sifting	ISTN4421	T Moulds
Myriapoda	Chilopoda	Scolopendromorpha	Scolopendridae	*Cormocephalus turneri*	Widespread	1	PANSRE06	12/05/2020	Active searching and leaf litter sifting	ISTN2037	T Moulds
Myriapoda	Chilopoda	Scolopendromorpha	Scolopendridae	*Cormocephalus turneri*	Widespread	1	PANSRE13	13/05/2020	Active searching and leaf litter sifting	ISTN1920	T Moulds
Myriapoda	Chilopoda	Scolopendromorpha	Scolopendridae	*Cormocephalus turneri*	Widespread	1	PANSRE25	15/05/2020	Active searching and leaf litter sifting	ISTN2050	T Moulds
Myriapoda	Chilopoda	Scolopendromorpha	Scolopendridae	*Cormocephalus turneri*	Widespread	2	PANSRE30	15/05/2020	Active searching and leaf litter sifting	ISTN2049	T Moulds
Myriapoda	Chilopoda	Scolopendromorpha	Scolopendridae	*Cormocephalus turneri*	Widespread	1	PANSRE35	14/05/2024	Active searching and leaf litter sifting	ISTN4416	T Moulds
Myriapoda	Chilopoda	Scolopendromorpha	Scolopendridae	*Scolopendra laeta*	Widespread	1	PANSRE01	12/05/2020	Active searching and leaf litter sifting	ISTN1908	T Moulds
Myriapoda	Chilopoda	Scolopendromorpha	Scolopendridae	*Scolopendra laeta*	Widespread	1	PANSRE04	12/05/2020	Active searching and leaf litter sifting	ISTN1911	T Moulds
Myriapoda	Chilopoda	Scutigeromorpha	Scutigeridae	*Allothereua maculata?*	Widespread	1	PANSRE23	14/05/2020	Active searching and leaf litter sifting	ISTN2058	T Moulds
Myriapoda	Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus exclamatus*	Widespread	2	PANSRE08	12/05/2020	Active searching and leaf litter sifting	ISTN2047	T Moulds
Myriapoda	Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus exclamatus*	Widespread	3	PANSRE20	14/05/2020	Active searching and leaf litter sifting	ISTN2065	T Moulds
Myriapoda	Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus exclamatus*	Widespread	2	PANSRE28	15/05/2020	Active searching and leaf litter sifting	ISTN2052	T Moulds
Myriapoda	Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus exclamatus*	Widespread	3	PANSRE40	16/05/2024	Active searching and leaf litter sifting	ISTN4420	T Moulds
Myriapoda	Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus exclamatus?*	Widespread	1	PANSRE07	12/05/2020	Active searching and leaf litter sifting	ISTN1914	T Moulds
Myriapoda	Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus exclamatus?*	Widespread	1	PANSRE16	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1985	T Moulds
Myriapoda	Diplopoda	Polyxenida	Polyxenidae	*Unixenus*	Widespread	1	PANSRE11	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1948	T Moulds
Myriapoda	Diplopoda	Polyxenida	Polyxenidae	*Unixenus*	Widespread	1	PANSRE13	13/05/2020	Active searching and leaf litter sifting	ISTN2031	T Moulds
Myriapoda	Diplopoda	Polyxenida	Polyxenidae	*Unixenus*	Widespread	2	PANSRE14	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1965	T Moulds
Myriapoda	Diplopoda	Polyxenida	Polyxenidae	*Unixenus*	Widespread	7	PANSRE17	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1962	T Moulds
Myriapoda	Diplopoda	Polyxenida	Polyxenidae	*Unixenus*	Widespread	2	PANSRE21	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1978	T Moulds
Myriapoda	Diplopoda	Polyxenida	Polyxenidae	*Unixenus*	Widespread	2	PANSRE23	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1982	T Moulds
Myriapoda	Diplopoda	Polyxenida	Polyxenidae	*Unixenus*	Widespread	1	PANSRE25	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1971	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	4	PANSRE07	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1944	T Moulds

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Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	2	PANSRE07	12/05/2020	Active searching and leaf litter sifting	ISTN2042	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	1	PANSRE18	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1958	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	1	PANSRE19	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1951	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	1	PANSRE21	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1960	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	1	PANSRE22	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1949	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	2	PANSRE23	14/05/2020	Active searching and leaf litter sifting	ISTN2056	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	2	PANSRE27	15/05/2020	Leaf litter extracted from tullgren funnel	ISTN1959	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	1	PANSRE40	16/05/2024	Active searching and leaf litter sifting	ISTN4850	T Moulds
Myriapoda	Diplopoda	Polyzoniida	Siphonotidae	*"Norseman sp IS01"*	Possible A	1	PANSRE42	17/05/2024	Leaf litter extracted from tullgren funnel	ISTN3337	T Moulds
Myriapoda	Diplopoda	Spirostreptida	Iulomoprhidae	*Atelomastix sp. 'B03'*	Likely	1	PANSRE07	16/05/2020	Leaf litter extracted from tullgren funnel	ISTN1973	T Moulds
Myriapoda	Diplopoda	Spirostreptida	Iulomoprhidae	*Atelomastix sp. 'B03'*	Likely	2	PANSRE07	12/05/2020	Active searching and leaf litter sifting	ISTN2041	T Moulds
Myriapoda	Diplopoda	Spirostreptida	Iulomoprhidae	*Atelomastix sp. 'B03'*	Likely	4	PANSRE09	13/05/2020	Active searching and leaf litter sifting	ISTN1916	T Moulds
Myriapoda	Diplopoda	Spirostreptida	Iulomoprhidae	*Atelomastix sp. 'B03'*	Likely	1	PANSRE21	14/05/2020	Active searching and leaf litter sifting	ISTN1928	T Moulds
Myriapoda	Diplopoda	Spirostreptida	Iulomoprhidae	*Atelomastix sp. 'B03'*	Likely	2	PANSRE23	14/05/2020	Active searching and leaf litter sifting	ISTN2057	T Moulds
Myriapoda	Diplopoda	Spirostreptida	Iulomoprhidae	*Atelomastix sp. 'B03'*	Likely	1	PANSRE24	14/05/2020	Active searching and leaf litter sifting	ISTN1931	T Moulds
Myriapoda	Diplopoda	Spirostreptida	Iulomoprhidae	*Atelomastix sp. 'B03'*	Likely	2	PANSRE40	16/05/2024	Active searching and leaf litter sifting	ISTN4849	T Moulds

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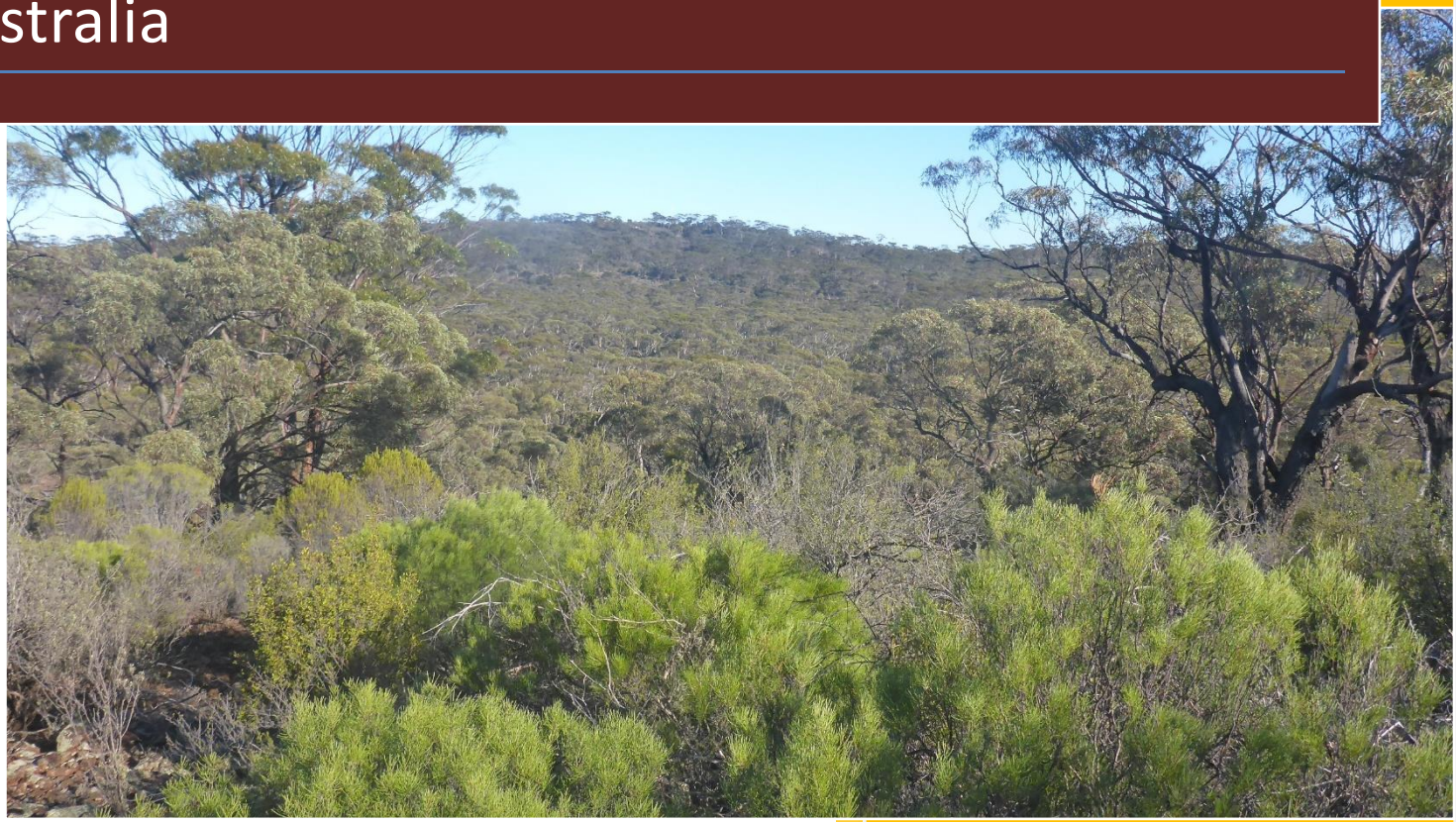
APPENDIX 6: INVERTEBRATE SOLUTIONS, 2024: DESKTOP ASSESSMENT OF SUBTERRANEAN FAUNA FOR THE NORSEMAN GOLD PROJECT, NORSEMAN, WESTERN AUSTRALIA

Desktop Assessment of Subterranean Fauna for the Norseman Gold Project, Norseman, Western Australia



PANTORO SOUTH

Report by *Invertebrate Solutions Pty Ltd*
for Pantoro South Pty Ltd

September 2024

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Desktop assessment for subterranean fauna for the Norseman Gold Project, Norseman, Western Australia. Unpublished report to Pantoro South Pty Ltd, September 2024.

Report Number 2024ISJ0401_F02_20240923

Prepared for: Pantoro South Pty Ltd

Frontispiece: View west from the eastern edge of TSF 5.

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Executive Summary

Pantoro South Pty Ltd (Pantoro) is currently in the process of developing the Norseman Gold Project (the Project), a series of open pit and underground gold mines located southern Goldfield region of Western Australia, near the Norseman townsite. The Norseman Gold Project consists of nine separate Project areas: North Royal, Desirables, Cobbler, Gladstone, TSF4, TSF5, Ok, Maybell and Scotia.

The Norseman Gold Project areas are located in the vicinity of the Norseman townsite, in the Goldfields region of Western Australia and is shown in Figure 1. The desktop study area comprised approximately 17,000 km^2 bounded by the north west corner (31.702523°S, 121.041734°E) and the south east corner (32.877950 °S, 122.449994°E) centred on the Norseman Gold Project (Figure 1).

Invertebrate Solutions undertook a desktop assessment for subterranean fauna (stygofauna and troglofauna) for the Norseman Gold Project areas. Searches of the Western Australian Museum databases for Crustaceans and Arachnids/Myriapods were undertaken for an area comprising of approximately 17,000 km^2 centred on the nine Norseman Gold Project areas. Core photos and hydrogeological information including water quality was also assessed.

No previous stygofauna records are held within WAM databases. This is due to both an absence of previous assessments for stygofauna within the Norseman region, but also reflects the general absence of stygofauna habitat within the local Norseman region. The groundwater in the Norseman area associated with the nine Project areas is mostly hypersaline, especially with depth and with proximity to the salt lakes in the immediate region. This precludes the presence of stygofauna in all the nine Project areas when combined with an absence of voids or fractures in examined core photos from all Project areas within saturated depth zones.

Only two troglofauna records for the Norseman region are held by WAM, although another five species are recorded from the Mt Henry mine site, hosted in mineralised BIF that is known in other parts of Western Australia and internationally to provide troglofauna habitat. The geology within the Norseman region excluding the minor BIF ridge is dominated by saprolitic clays and salt lake sediments that are both unsuitable for troglofauna as they contain no interconnected pore spaces. Troglofauna outside of BIF geologies in the Norseman region have a Nil or Low likelihood of occurrence.

The construction and operation of underground and open cut mining operations, including tailings storage facilities and associated infrastructure are expected to pose a low risk to potential stygofauna and troglofauna due to the general low likelihood of subterranean fauna presence and the small areas proposed to be developed as part of the Norseman Gold Project.

1. Introduction

Pantoro South Pty Ltd (Pantoro) is developing the Norseman Gold Project (the Project), a series of open pit and underground gold mines located in the southern Goldfield region of Western Australia, near the Norseman townsite (Figure 1).

The Proposed Project areas are:

- Gladstone - Daisy and associated dewatering pipeline and access/haul road -Potential additional Open Pits, WRD extensions and Open Pit Cutbacks.
- Desirables - Potential additional Open Pits
- North Royal-Slippers - Potential additional Open Pits, WRD extensions, Open Pit Cutbacks and extensions of existing underground.
- Scotia and associated dewatering pipeline and access/haul road. Open Pits, WRD extensions, Open Pit Cutbacks and extensions of existing underground.
- OK - Potential existing Underground expansion and WRD expansion.
- TSF 4 and associated pipeline- TSF expansion-reapplication of expired CPS area
- TSF 5 – additional tailings storage facility immediately to the north of TSF 4
- Maybell and associated access track- Open Pits, WRD and extensions of existing small underground
- Cobbler (some additional areas for access/haul roads to be determined)-Lake based pit and WRD. Potential Open pit and Underground.

Invertebrate Solutions has been requested by Pantoro to undertake a desktop assessment for subterranean fauna (stygofauna and troglofauna) for the Norseman Gold Project areas.

Subterranean fauna is comprised of stygofauna (aquatic subterranean dependent species) and troglofauna (air breathing subterranean dependent species) which are known to form a subterranean faunal biodiversity hotspot on a worldwide scale in the Pilbara and Yilgarn cratons of Western Australia (Guzik et al. 2010). Over 4,000 species of subterranean fauna species are likely to occur in Western Australia (Guzik et al. 2010) with an estimate that over 80% of these taxa remain unknown to science. Subterranean fauna is also known to play an important role in ecosystem function (Humphreys 2006). Many species of subterranean fauna have highly restricted ranges, and can be considered short range endemics (*sensu* Harvey 2002), with sometimes highly restricted ranges due to habitat connectivity issues and evolutionary history. Stygofauna and troglofauna are known to occur widely in much of Western Australia with many locally endemic species present.

The high degrees of local endemism and lack of habitat connectivity make subterranean fauna susceptible to impacts from sometimes localised projects and impacts (Ponder & Colgan 2002), with species' extinction a real possibility if they are not adequately considered during project planning phases.

Legend

- Dekstop Study Area
- Norseman Gold Project Area

0 5 10 20 km

Scale: 1:750,000 @ A4

N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

- IMAGERY SOURCED FROM OPEN SOURCE

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PROJECT ID	DATE
Norseman Gold Project	8/10/2024

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 51

CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

Pantoro South Pty Ltd

Figure 1

Norseman Gold Project Location and Subterranean Fauna Desktop Assessment

ENVIRONMAPS t: 0406 590 006 Environmental Mapping Solutions www.environmaps.com.au

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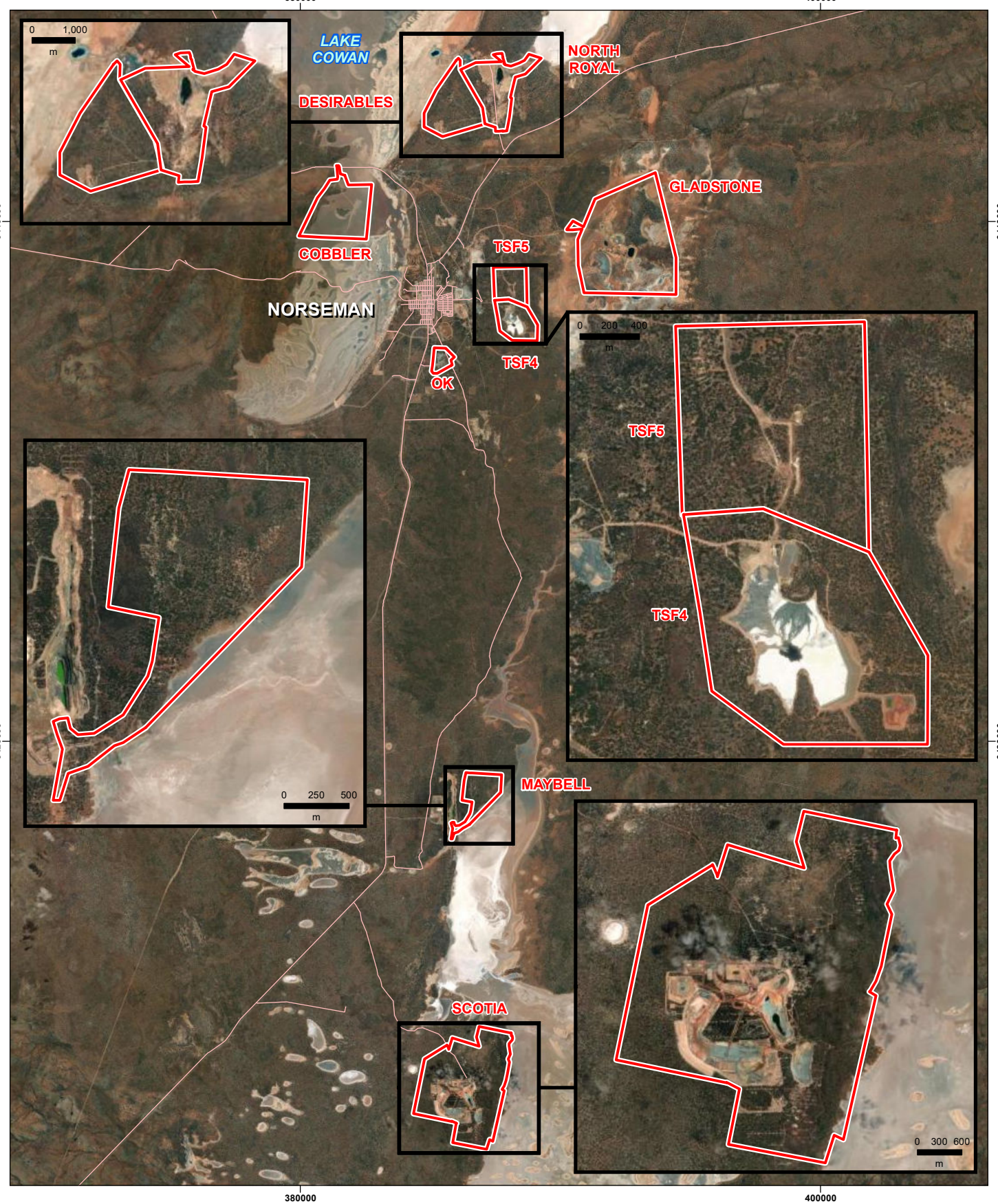

Legend

Norseman Gold Project Area

0 1.25 2.5 5 km

Scale: 1:200,000 @ A4

N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

- IMAGERY SOURCED FROM OPEN SOURCE

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Norseman Gold Project	8/10/2024

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 51

CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

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Figure 2
Norseman Gold Project Areas

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1.1. Purpose of this report

Pantoro has requested Invertebrate Solutions to undertake the following scope of works for the Norseman Gold Project, Norseman, Western Australia:

- Undertake a desktop review for stygofauna and troglofauna presence at each of the nine separate project areas (North Royal-Slippers, Desirables Cobbler, Gladstone-Daisy, TSF4, TSF 5, Ok, Maybell and Scotia).
- Undertake a risk assessment for potential impacts to stygofauna and troglofauna from the proposed development at each of the nine separate project areas.
- Provide recommendations to minimise potential impacts and any suggested requirements for further work to comply with relevant legislation.
- Provide a written report containing the above items.

1.2. Study Area and Background Environmental Information

The proposed Norseman Gold Project areas are located in the vicinity of the Norseman townsite, in the Goldfields region of Western Australia and is shown in Figure 1. The desktop study area comprised approximately 17,000 km^2 bounded by the north west corner (31.702523°S, 121.041734°E) and the south east corner (32.877950 °S, 122.449994°E) centred on the Project.

The Norseman Gold Project consists of nine separate Project areas: North Royal-Slippers, Desirables, Cobbler, Gladstone-Daisy, TSF4, TSF5, Ok, Maybell and Scotia Figure 2.

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation, and species information (DCCEEW 2022). The Project is located within the Coolgardie bioregion. The Coolgardie region is comprised of the granite strata of the Yilgarn Craton with archaean greenstone intrusions in parallel belts. Drainage is occluded, generally ending in salt lakes. Mallees and scrubs are present on sandplains associated with lateritised uplands, playas and granite outcrops. Diverse woodlands rich in endemic eucalypts are present on low greenstone hills, valley alluvials and broad plains of calcareous earth. The climate is arid to semi-arid Warm Mediterranean. (Environment Australia 2000).

The land tenure for the Project area is a mix of unallocated crown land, mining tenement and pastoral lease. The localised climate is classified as semi-Arid with an average annual rainfall of 288 mm recorded at the Bureau of Meteorology (BoM) Station 012065 at Norseman (BoM, 2024), located in the centre of the Project area. Annual rainfall shows minor seasonality with most rainfall occurring during the winter months, linked to low pressure systems in the Southern Ocean (May to August) (Plate 1).

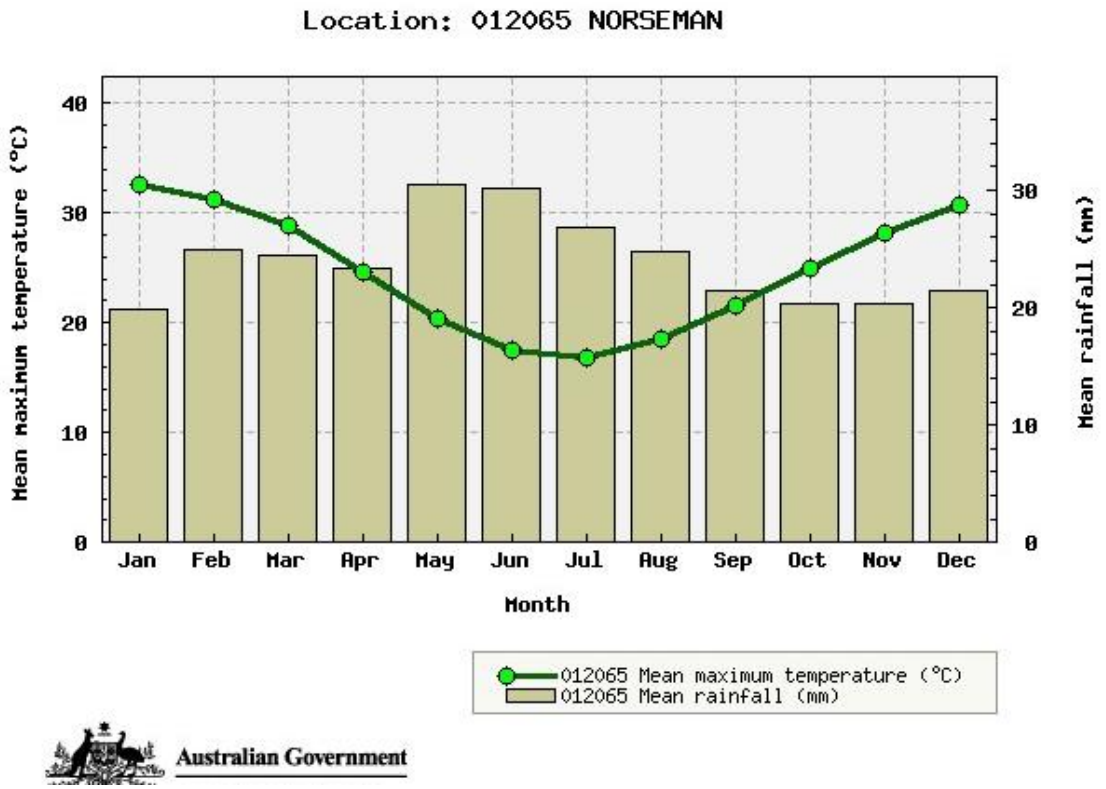


Plate 1 Norseman long term climate data (After BOM.gov.au).

1.3. Document Review

The following documents have been examined in the compilation of this report, along with other referenced scientific papers used to provide general background:

- Doepel, J.J., Newton-Smith, J. and Koehn, P.R. (1972). Norseman 1:250,000 1st Edition. Sheet SI 51-2 Geological Map, Australian Geological Survey, Canberra.
- Norseman Gold (2007). Mining Proposal (Notice of Intent), Central Norseman Operations Tailings Management – Valley Dam (TSF4), Norseman, Western Australia. 17p.
- Bennelongia (2013). Mt Henry Gold Project, Troglofauna Desktop Assessment and Pilot Survey. Unpublished report to Panoramic Resources Ltd. Draft, April 2013, 22p.
- Umwelt (2016). Mining Proposal, Maybell Open Pit Mine, Tenements M63/204, M63/138 and L63/56. Prepared by Umwelt on Behalf of Central Norseman Gold Corporation Pty Ltd, 96p.
- Pantoro (2020). Groundwater conditions summary at the NGP mining centers. Memo to Invertebrate Solutions April 2020, 1p.

This report has been prepared with regard to the Technical guidance subterranean fauna survey for environmental impact assessment. EPA (2021).

1.4. Conservation Legislation and Guidance Statements

Subterranean fauna is protected under state legislation via the *Biodiversity Conservation* (BC) *Act 2016* which came into force on 1st January 2019, replacing the *Wildlife Conservation Act 1950*. The BC Act is aligned with the Federal *Environment Protection and Biodiversity Conservation* (EPBC) Act

(1999). The assessment of subterranean fauna for environmental impact assessment (EIA) is undertaken in Western Australia with regard to the Technical Guidance – Subterranean Fauna Surveys for Environmental Impact Assessment (EPA 2021). A summary flowchart of the assessment process for subterranean fauna is shown in .

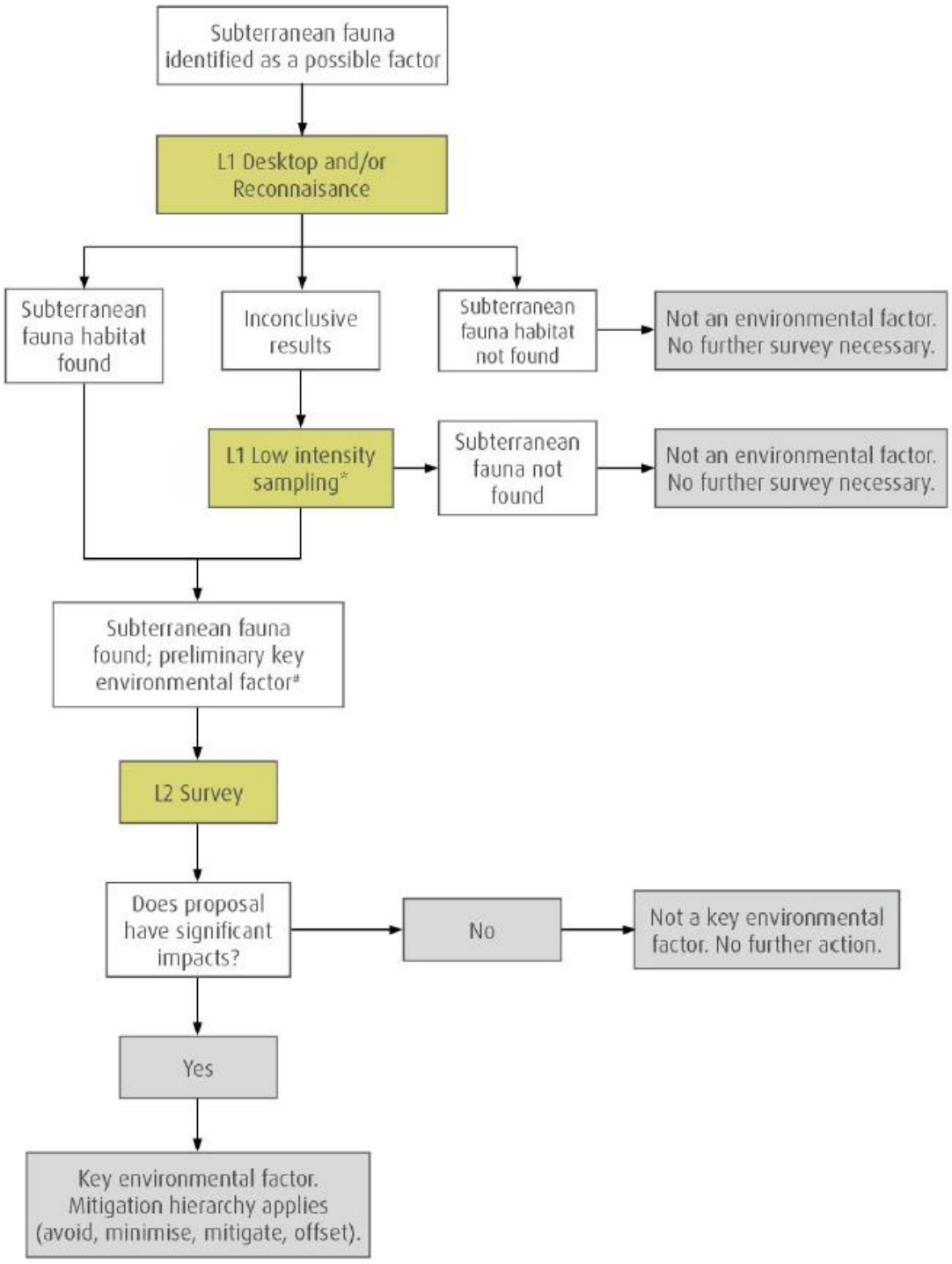


Plate 2 Flowchart of the process for undertaking subterranean fauna assessments for impact assessment in Western Australia (EPA 2016).

Part 2 of the BC Act provides for the listings of species that have special protection under Act. Updates to the species list are gazetted periodically by the Minister for Environment. The current Threatened fauna list (October 2023) includes numerous subterranean species, primarily from the Cape Range and Pilbara regions. Included in the list are crustaceans, arachnids and myriapods that are considered to be "rare or likely to become extinct, as critically endangered fauna, or are declared to be fauna that is in need of special protection" (DBCA 2023). In addition to the specially protected fauna, DBCA also maintains a list of Priority fauna considered to be of conservation significance but do not meet the criteria for formal listing under the BC Act. The Priority fauna list is irregularly updated by DBCA and, although it offers no formal legislative protection, these species are generally considered in the EIA process.

The state BC Act also provides for the Minister for Environment to formally list Threatened Ecological Communities (TECs), along with relevant threatening processes. Several subterranean ecological communities are recognised as Threatened including stygal root mat communities in both the Yanchep and Margaret River regions, Bundera Cenote Anchialine community on Cape Range, Cameron's Cave near the townsite of Exmouth on Cape Range, and stygobionts (aquatic subterranean organisms) in the Ethel Gorge aquifer in the Pilbara.

The EPBC Act (1999) provides federal protection to both species and ecological communities. Listings for subterranean fauna in WA include the Bundera Cenote on the western side of the Cape Range (>1000 km from the Project area), which contains a unique anchialine ecosystem including the stygal Cape Range Remipede *Kumonga exleyi* (Yager and Humphreys 1996), listed as Vulnerable. The Cape Range Gudgeon *Milyeringa veritas* and the Cape Range Blind Cave Eel *Ophisternon candidum* (Humphreys 2008) are also listed as Vulnerable species.

1.5. Classifications of subterranean dependence

Subterranean fauna is a collective term that refers to both troglofauna (terrestrial subterranean fauna inhabiting air voids) and stygofauna (aquatic subterranean fauna) (Humphreys 2000). Extensive amounts of jargon have historically been associated with subterranean fauna and multiple forms of classification have been used through time (Sket 2008). The most accepted classifications divide troglofauna into categories that describe a particular species' degree of dependence upon the subterranean environment. Due to the reliance upon ecological information to determine if a species is a troglobite, the concept of troglomorphy (Christiansen 1962), specific morphological adaptations to the subterranean environment, is used to define obligate subterranean species. The term troglomorphy, initially confined to morphology, has since been used to describe both morphological or behavioural adaptations (Howarth 1973). This combination provides a practical system, easily applied in the field and requires minimal detailed ecological studies (Sket 2008). The level of subterranean dependency for different ecological groupings is described below:

- Troglobiont: animals that are obligate subterranean species, and mostly show morphological adaptation to subterranean habitats (troglomorphisms) including depigmentation, loss or reduction of eyes, elongation of appendages, flightlessness or wing reduction, and extra sensory hairs.
- Troglophiles: animals that can complete their entire lifecycle within a cave but possess no specific adaptations to the cave environment. These species are capable of living outside caves in suitably dark and moist epigean habitats.

- Trogloxenes: animals that use the subterranean environment but require surface environments to complete part of their lifecycle (generally either feeding or breeding). Common trogloxenes are cave dwelling bats, cave swiftlets and cave crickets that leave subterranean habitats to feed.

The terms above refer to stygofauna when the prefix is altered to 'stygo' (Humphreys 2000).

Species which inhabit the deep soil habitat (Edaphophiles) often exhibit convergent morphological adaptations to those animals found exclusively within caves, such as loss/reduction of eyes, body flattening, loss of pigmentation etc. Soil dwelling species typically lack restrictions in distribution, as these organisms have experienced relatively minimal isolation in evolutionary timeframes, thus, only true troglobitic animals are studied in subterranean fauna surveys. Taxa discussed in this study were assessed upon their combination of loss/reduction of eyes, and reduction in pigmentation, wing development, and elongation of appendages to assess if a taxon was an edaphophile or truly reliant upon the subterranean habitat (Troglobiont).

1.6. Report Limitations and Exclusions

This study was limited to the proposal provided by Invertebrate Solutions Pty Ltd (20th March 2024) and in Section 1.1. This study was limited to the extent of information made available to Invertebrate Solutions at the time of undertaking the work. Information not made available to this study, or which subsequently becomes available may alter the conclusions made herein.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Invertebrate Solutions has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by Invertebrate Solutions described in this report (this section and throughout this report). Invertebrate Solutions disclaims liability arising from any of the assumptions being incorrect.

Invertebrate Solutions has prepared this report on the basis of information provided by Pantoro South Pty Ltd and others (including Government authorities), which Invertebrate Solutions has not independently verified or checked beyond the agreed scope of work. Invertebrate Solutions does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.7. Assumptions and Limitations

Invertebrate Solutions has made the following assumptions in the writing of this report and its subsequent conclusions:

- Existing borefield(s), dewatering rates, and/or water allocations will be sufficient for construction and process water.

2. Methods

2.1. Desktop Methods

The subterranean fauna desktop review comprises:

- An assessment of the likelihood that subterranean species are present in the habitats located within the broader Desktop study area and the Project area within the Desktop Study area.

The likelihood of stygofauna and troglofauna species occurring in the study area was assessed using a combination of regional information, geological, hydrogeological and database searches including:

- Analysis of published and unpublished reports concerning subterranean fauna from the region.
- Available geological maps.
- Geological, geotechnical, and hydrogeological information available for the Study area.
- Results of a Protected Matters Search from the Australian Government's Department of Climate Change, Energy, Environment, and Water (DCCEEW) website.
- Records of fauna held by the Western Australian Museum.

Based on the analysis of all available information, the study area was assigned a level of likelihood to support subterranean fauna of either 'Low', 'Moderate', 'High', or 'Definite'.

3. Desktop Subterranean Fauna Review

3.1 Subterranean fauna in the Yilgarn

A wide variety of differing geologies within the Yilgarn provide numerous opportunities for subterranean fauna to be present. The most likely habitat for both stygofauna and troglofauna are the sometimes extensive and numerous calcrete outcrops, many of which are listed as Priority Ecological Communities (PECs) for their endemic stygofauna assemblages (Cooper et al. 2002; Cooper et al. 2007; Watts and Humphreys 2003; Watts and Humphreys 2004; Guzik et al. 2011). The upper unsaturated portions of Yilgarn calcretes contain troglofauna including pseudoscorpions, spiders, palpigrades and isopods (Barranco & Harvey 2008, Baehr et al. 2012, Cooper et al. 2008, Edward & Harvey 2008 and Platnick 2008). The diversity of troglofauna in calcrete can be exceptionally high with 45 species of troglofauna recorded from the Yeelirrie calcrete (Bennelongia 2015) and 20 species at Lake Maitland (Outback Ecology 2011).

The presence of subterranean fauna in other lithologies is mixed with palaeochannel aquifers often being host to stygofaunal assemblages, but not as diverse as surfical calcrete aquifers (GHD 2012). This is due to lower hydraulic conductivity in palaeochannel aquifers compared with highly transmissive calcrete aquifers. Smaller and less well connected pore spaces limits the infiltration and dispersion of oxygen and carbon into subterranean habitats (Hose et al. 2015).

The lithologies associated with gold deposits tend to have smaller voids with less connectivity that makes them less preferable to host subterranean fauna unless the rocks are highly fractured. Intense weathering profiles of many gold bearing lithologies also reduce the likelihood of subterranean fauna with available pore spaces clogged with clay weathering products from the saprolitic zone. Troglofauna surveys at the Tropicana project recorded only four troglofauna species (Ecologia 2009a), compared with more vuggy Banded Iron Formation (BIF) habitats such as those surveyed at Weld Range, Koolyanobbing and Mt Jackson that have yielded moderately rich troglofauna communities (Ecologia 2009b, Bennelongia 2008a; Bennelongia 2008b).

Analysis has shown that there is little correlation between water quality and geology for predicting the presence of stygofauna, however, the non-random siting of groundwater wells in highly transmissive locations within various geologies has undoubtedly created a bias in the data (Halse et al. 2014). When stygofauna are present it does, however, show high levels of endemism with 98% of the stygobites and 83% of the other groundwater species recorded in the Pilbara being endemic (Halse et al. 2014). The presence of virtually entirely endemic stygofauna communities in every calcrete in the Yilgarn that has been sampled in any systematic way shows that this trend is not unique to the Pilbara. The large degree of endemism in Yilgarn calcrete is the reason why so many are listed as PECs by DBCA under the BC Act (2016).

3.1.1 Mt Henry Gold Project

The Mt Henry Gold Project is located approximately 20 km south of Norseman and immediately to the west of the Maybell Project area (Figure 2). The Mt Henry gold deposit is held within mineralized Banded Iron Formation (BIF) ridges that are prospective for troglofauna due to the vuggy interconnected nature of BIF mineralisation although troglofauna diversity and abundance is lower in the Yilgarn than compared to the Pilbara region of Western Australia.

The site was subject to a troglofauna pilot survey in 2013 (Bennelongia 2013) that recorded five troglofauna species, two pseudoscorpions, a thysanuran, an isopod and a symphylan, two of which (*Tyrannochthonius* sp. B25 and Armadillidae sp. B08) were only recorded from within the proposed mine pits, although their entire distributions are invariably much larger.

3.2 Conservation Significant Fauna and Habitats

A list of conservation significant fauna subterranean invertebrate fauna for the Desktop Study Area was compiled from the DBCA Wildlife Conservation (Specially Protected Fauna) Notice 2024 (DBCA 2024) and DCCEEW's Protected Matters Search Tool (PMST). Subterranean species that are listed under the BC Act and/or the EPBC Act and are likely to occur or have known habitat within the region are shown in Table 1 along with their conservation code. The PMST results listed no known subterranean fauna within the Desktop Study Area. A full description of the DBCA and EPBC conservation codes are shown in Appendix 1 and 2 respectively. The full list of species obtained from the PMST search is shown in Appendix 2.

Table 1 Conservation significant invertebrates potentially within the Desktop Study area.

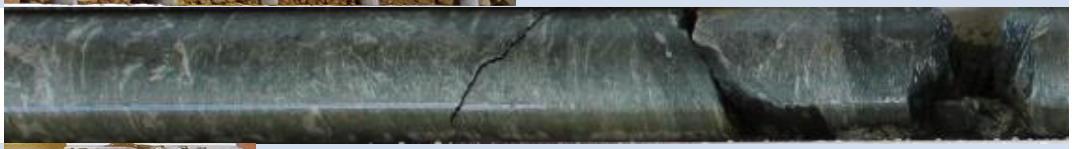
Higher Classification	Genus and Species	DBCA/ BC Status	EPBC status	Habitat/Distribution within Desktop Study Area
Crustacea: Isopoda:				
Paraplatyarthridae	*Paraplatyarthrus subterraneus*	P1	-	Not Present (Laverton)
Arachnida				
Araneomorphae				
Stiphidiidae	*Tartarus mullamullangensis*	Vu	-	Not Present (Nullarbor)
	Tartarus murdochensis	Vu	-	Not Present (Nullarbor)
	Tartarus nurinensis	Vu	-	Not Present (Nullarbor)
	Tartarus thampannensis	Vu	-	Not Present (Nullarbor)
Mygalomorphae:				
Anamidae	*Troglodiplura lowryi*	Vu	-	Not Present (Nullarbor)

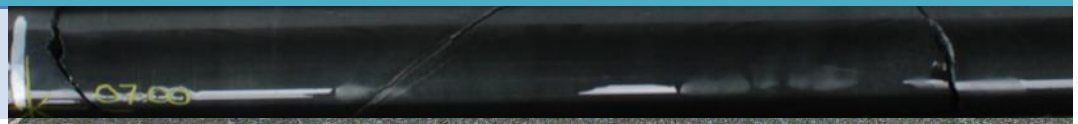
3.3 Subterranean Fauna Habitat in the Project Areas

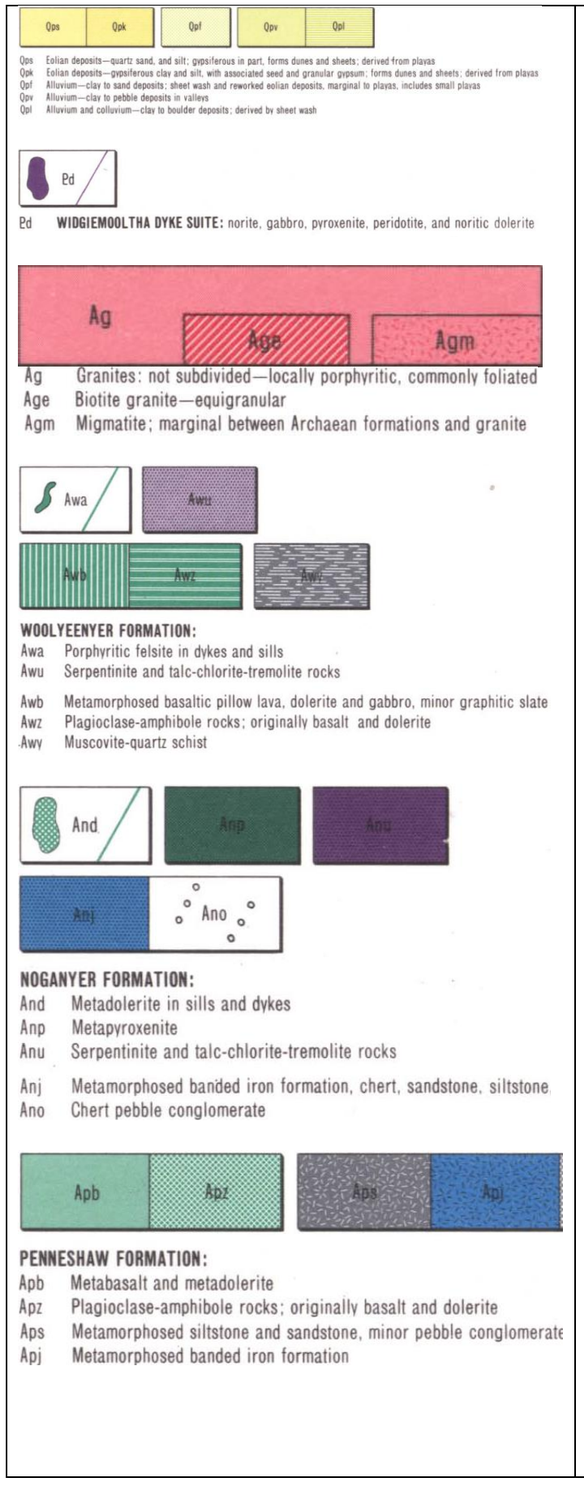
The Norseman Gold Project is situated on the southern extremity of the Wiluna – Norseman Greenstone Belt, a series of mafic to ultramafic successions within the Yilgarn Craton of Western Australia (Hope 2004) and is largely covered in shallow colluvium and alluvium (Plate 2).

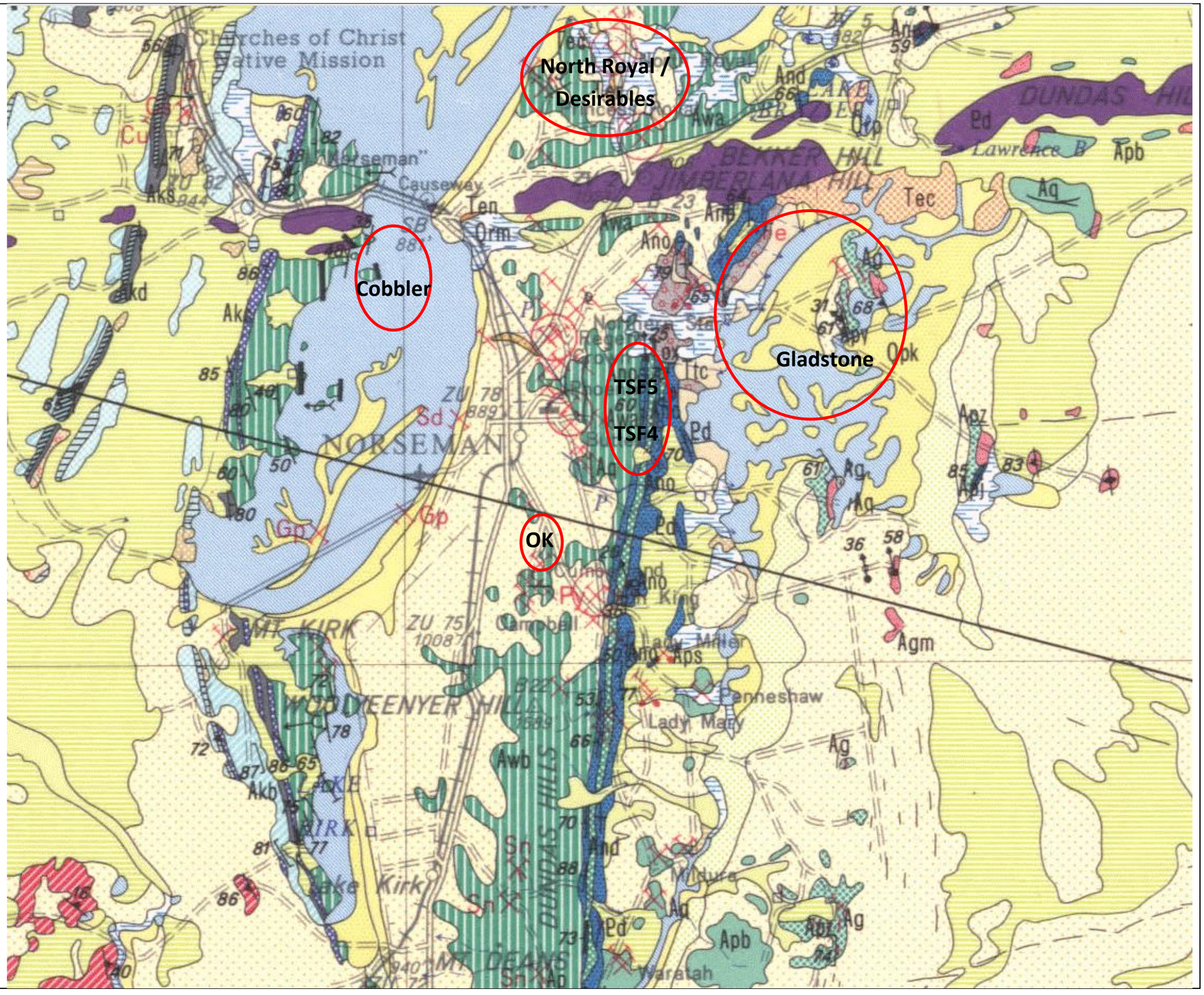
The alluvium and colluvium deposits surrounding and within much of the nine Project areas have a low suitability for both troglofauna and stygofauna habitat due to the fine silty nature of the alluvium (Table 2). The upper saprolite of the weathered basement rocks is often laterised at the surface, although these exhibit low permeability due to the clay infilling voids (Norseman Hold 2007). The portions of the Project area that extend over the salt lakes of Lake Cowan and Lake Dundas or are immediately adjacent to them (Figure 2) provide no habitat for subterranean fauna due to the fine silty nature of the overlying sediments and the hypersaline conditions present below the regional water table that commonly exceed 200,000 TDS, with salinities of up to 360,000 TDS (Umwelt 2016, Pantoro 2020).

Table 2 Norseman Gold Project areas and representative core samples showing potential subterranean fauna habitat.

Deposit	Dominant geology	Subterranean Fauna Suitability	Example Core Photo
North Royal and Desirables (unsaturated)	Laterite and saprolitic clay	Nil for troglofauna (fine sediments – no void space)	
North Royal (saturated)	Basalt	Nil for stygofauna (hypersaline and no void space)	
Cobbler (unsaturated)	Salt lake sediments	Nil for troglofauna (fine sediments – no void space)	
Cobbler (saturated)	Ultramfic volcanics	Nil for stygofauna (hypersaline and no void space)	
Gladstone (unsaturated)	Clay and saprolite	Nil for troglofauna (fine sediments – no void space)	
Gladstone (saturated)	Dolerite	Nil for stygofauna (hypersaline and no void space)	
TSF4 / TSF5 (unsaturated)	Gravels and clay	Nil for troglofauna (fine sediments – no void space)	
TSF4 / TSF5 (saturated)	Dolerite/ Basalt	Nil for stygofauna (hypersaline and no void space)	

Deposit	Dominant geology	Subterranean Fauna Suitability	Example Core Photo
OK (unsaturated)	Basalt	Nil for troglofauna (no void space)	
OK (saturated)	Gabbro	Nil for stygofauna (hypersaline and no void space)	
Maybell (unsaturated)	Ferruginous Upper Saprolite	Low for troglofauna (no void space)	
Maybell (saturated)	Basalt	Nil for stygofauna (hypersaline)	
Scotia (unsaturated)	Laterite and fine clays	Low for troglofauna (void spaces filled with clay)	
Scotia (saturated)	Gabbro	Nil for stygofauna (hypersaline and no void space)	


Qps
Qpk
Qpf
Qpv
Qpl
Qps Eolian deposits—quartz sand, and silt; gypsiferous in part, forms dunes and sheets; derived from playas
Qpk Eolian deposits—gypsiferous clay and silt, with associated seed and granular gypsum; forms dunes and sheets; derived from playas
Qpf Alluvium—clay to sand deposits; sheet wash and reworked eolian deposits, marginal to playas; includes small playas
Qpv Alluvium—clay to pebble deposits in valleys
Qpl Alluvium and colluvium—clay to boulder deposits; derived by sheet wash
Pd
Pd WIDGIEMOOLTHA DYKE SUITE: norite, gabbro, pyroxenite, peridotite, and noritic dolerite
Ag
Age
Agm
Ag Granites: not subdivided—locally porphyritic, commonly foliated
Age Biotite granite—equigranular
Agm Migmatite; marginal between Archaean formations and granite
Awa
Awu
Awb
Awz
Awy
WOOLYEENYER FORMATION:
Awa Porphyritic felsite in dykes and sills
Awu Serpentinite and talc-chlorite-tremolite rocks
Awb Metamorphosed basaltic pillow lava, dolerite and gabbro, minor graphitic slate
Awz Plagioclase-amphibole rocks; originally basalt and dolerite
Awy Muscovite-quartz schist
And
Anp
Anu
Anj
Ano
NOGANYER FORMATION:
And Metadolerite in sills and dykes
Anp Metapyroxenite
Anu Serpentinite and talc-chlorite-tremolite rocks
Anj Metamorphosed banded iron formation, chert, sandstone, siltstone
Ano Chert pebble conglomerate
Apb
Apz
Aps
Apj
PENNESHAW FORMATION:
Apb Metabasalt and metadolerite
Apz Plagioclase-amphibole rocks; originally basalt and dolerite
Aps Metamorphosed siltstone and sandstone, minor pebble conglomerate
Apj Metamorphosed banded iron formation


North Royal / Desirables
Cobbler
Gladstone
TSF5
TSF4
OK
Churches of Christ Native Mission
Causeway
NORSEMAN
MT KIRK
WOOLYEENYER HILLS
Lake Kirk
MT DEANS
Penneshaw
Lady Mary
Mildura
Waratah
Lawrence
DUNDAS
BEKKER HILL
Tec
Agm
Awa
Awb
Ag
Apb
Apz
Aps
Apj
Pd
And
Ano
Akd
Akb
Gp
Sn

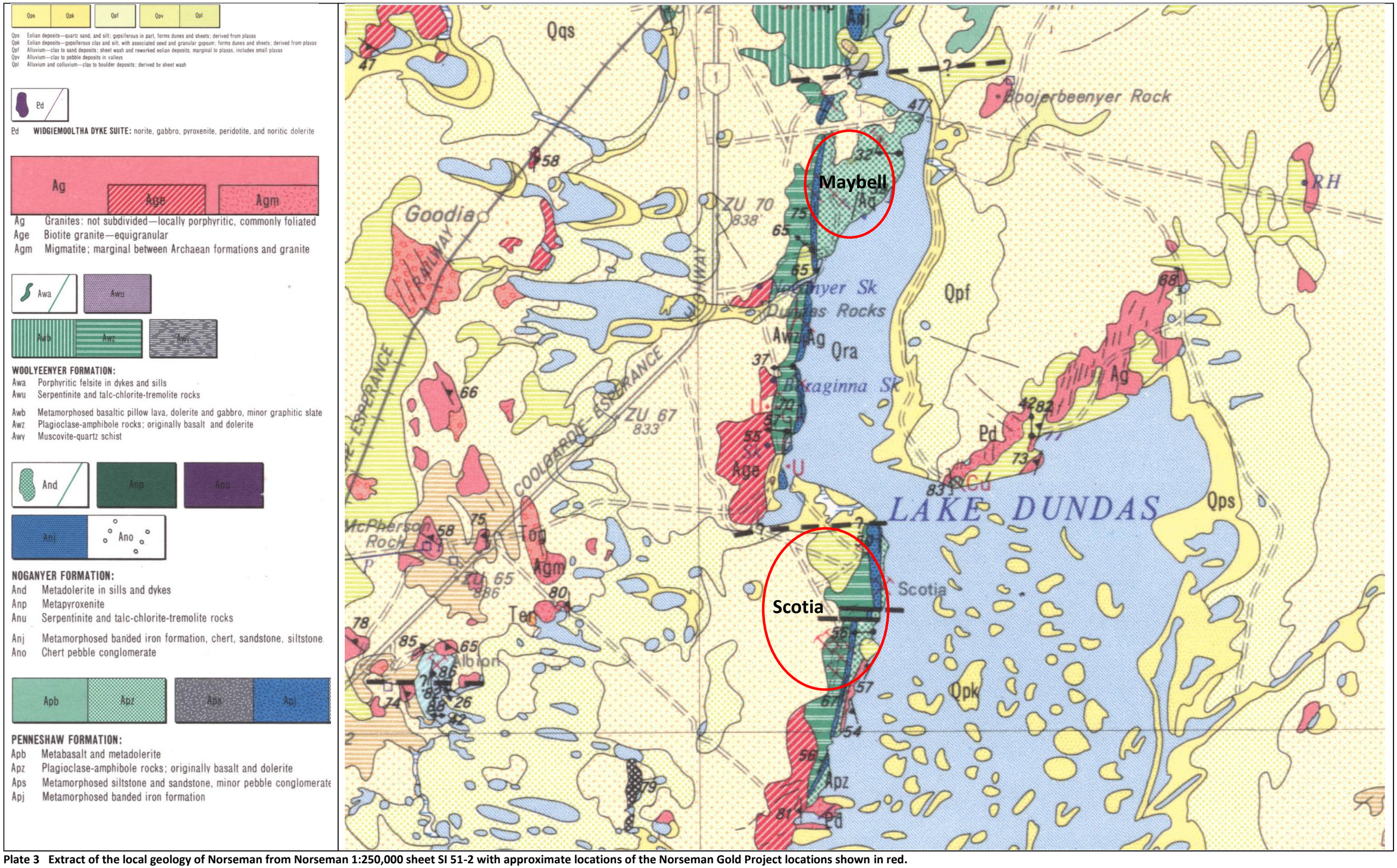


Plate 3 Extract of the local geology of Norseman from Norseman 1:250,000 sheet SI 51-2 with approximate locations of the Norseman Gold Project locations shown in red.

The geological units below the alluvium and colluvium are generally metamorphosed tholeiitic basalts, dolerite and komatiite throughout much of the Project area, situated within the Woolyeenyer Formation. The southern Project areas of Maybell and Scotia also encompass the Noganyer Formation characterised by a north south trending BIF ridge and associated conglomerate and gabbro units. To the east of the BIF is the Penneshaw Formation, comprised of mafic volcanics and sediments which sits along the western shore of Lake Dundas within the Maybell and Scotia Project areas (Hope 2004).

The ultramafics and other volcanics are generally considered to be poor habitat for troglofauna or stygofauna unless they are highly fractured locally. Examination of diamond drill core from the nine Norseman Gold Project areas has shown fracturing, to be absent in the most part, or minor and provides little opportunity for subterranean fauna (Table 2), and the upper unsaturated weathered zones areas are generally filled with fine grained clays and weathering products that fill any minor voids or fractures if present (Table 2).

Granitoid units surround the ultramafic to mafic units on both the east and west. The intrusive granitoids are massive in nature with minor foliation and a general absence of interconnected voids and hence are considered to have a low likelihood of forming the high permeability and interconnected voids required for high value subterranean fauna habitat.

Palaeochannel aquifers are present in the region, primarily within the Cowan Palaeovalley (Magee 2009) that may provide some stygofauna habitat regionally, however, these are 10's of kilometres away from the Project area, well beyond any impact to groundwater aquifers caused by localised dewatering activities associated with underground and surface mining at Norseman.

Table 3 Geological units in the Norseman Gold Project and Subterranean fauna habitat potential.

Unit	Description / Remarks	Subterranean Fauna Suitability
Colluvium and alluvium	Quartz sand and soil	Low for stygofauna and troglofauna.
Playa and salt lake sediments	Fine silt and evaporites	Nil for stygofauna (hypersaline) Nil for troglofauna (no void space)
Cowan Palaeochannel	Sand confined by clay and silts	Moderate for stygofauna Nil for troglofauna (saturated)
Jimberlana Dyke	Basaltic dyke (norite, basalt, pyroxenite)	Low for stygofauna (hypersaline) Low for troglofauna
Granitoids	Intrusive undifferentiated granites, locally porphyritic	Low for stygofauna Low for troglofauna
Banded Iron Formation	North south trending metamorphosed BIF, chert, sandstone and siltstone	Low for stygofauna (hypersaline) Moderate for troglofauna
Archean basement greenstones	Partially remelted Archean metamorphic Komatiites, Mafic and Ultramafic rock	Nil for stygofauna (hypersaline groundwater) Low for troglofauna (unless highly fractured and unsaturated)

3.4 Likelihood of stygofauna presence

A search was undertaken of the Western Australian Museum databases for Crustaceans (WAM 2020a) and Arachnids/Myriapods (WAM 2020b) over the Desktop Study Area. No stygofauna have previously been recorded form within the Desktop search area. It should be noted that only WAM records from the Arachnida/Myriapoda, and Crustacean databases are available to determine subterranean species and does not include records of Insects (i.e. stygobiontic diving beetles) as the WAM Insect database is unavailable for database searches. Stygobiontic diving beetles are, however, only known to occur within surficial calcrete aquifers, which are not present within the Norseman region.

The absence of stygofauna records in the Norseman area supports the habitat assessment that found no suitable stygofauna habitat due to hypersaline groundwater and an absence of interconnected void spaces. It should be noted, however, that little if any sampling for stygofauna has been undertaken in the Norseman area but desktop information suggests that there is a very low likelihood of stygofauna being present within the local Norseman region.

3.5 Likelihood of troglofauna presence

A search was undertaken of the Western Australian Museum databases for Crustaceans (WAM 2020a) and Arachnids/Myriapods (WAM 2020b) within the Desktop Study Area (Figure 1). The results of these filtered for subterranean troglofauna species are shown in Table 4.

Table 4 Troglofauna recorded from the Desktop Study Area.

Higher Classification	Family	Genus and Species	Notes
Crustacea:			
Isopoda:	Armadillidae	Armadillidae sp. B08	Mt Henry Mine (Bennelongia 2013)
	Philosciidae	Philosciidae sp. B26	Mt Henry Mine
		Philosciidae sp. B26/27	Mt Henry Mine
Arachnida:			
Pseudoscorpiones	Chthoniidae	*Austrochthonius* sp.	Mt Henry Mine (Bennelongia 2013) – Not in WAM records
		Tyrannochthonius sp. B25	Mt Henry Mine (Bennelongia 2013) – Not in WAM records
Myriapoda:			
Symphyla	Cephalostigmata	*Scutigerella sp. B05*	Mt Henry Mine (Bennelongia 2013)
Insecta:			
Zygentoma	Nicoletiidae	*Trinemura sp. B23*	Mt Henry Mine (Bennelongia 2013)

All the troglofauna that is recorded in WAM databases is from the troglofauna pilot survey of the Mt Henry mine, located adjacent to the Maybell deposit area (Figure 2), although Bennelongia (2013) report five troglobiont species, and 27 individuals only two records (of different species) are held by the WAM. These species were recorded from bores intersecting the mineralised north south trending BIF units as well as the immediately adjacent mafic dolerite, gabbro and siltstone units. The

bores where troglofauna were collected intersected numerous geological facies so it is unknown the exact geology that was the primary habitat for the troglofauna species recorded (Bennelongia 2013). It is, however, most likely that the troglofauna are inhabiting the vuggy interconnected weather BIF units, where troglofauna are most commonly recorded (Invertebrate Solutions 2020a), rather than the gabbro and dolerite units that far less commonly host troglofauna, although it is not unknown (Invertebrate Solutions 2020b).

The presence of a small troglofauna community within the Mt Henry mine tenements suggests that some troglofauna are present within at least some geological units in the Norseman region. Drilling results from the Norseman Gold project areas, including Maybell, show the unsaturated upper sediments to be dominated by clay and saprolite that has infilled any potential troglofauna habitat within lateritic horizons (Norseman Gold 2007), lowering the likelihood that troglofauna are common or abundant outside of the BIF formation sampled by Bennelongia (2013). The Maybell deposit does not include the higher value BIF troglofauna habitat and so overall has a Low likelihood of troglofauna being present.

The remaining eight Project areas (Cobbler, North Royal, Desirables, Gladstone, TSF 4, TSF 5, OK and Scotia) are all dominated by either fine silt-like salt lake sediments or clay and/or clay filled laterite facies in the upper unsaturated zone that is unsuitable for troglofauna as no interconnected void spaces are present. These Project areas have Nil to Low likelihood of any troglofauna being present.

4. Conclusions and Recommendations

The Norseman Gold Project is situated on the southern extremity of the Wiluna – Norseman Greenstone Belt, a series of mafic to ultramafic successions within the Yilgarn Craton of Western Australia and is largely covered in shallow colluvium and alluvium. The colluvium and alluvium lithologies surrounding and within much of the Project area have a low suitability for both troglofauna and stygofauna habitat due to the absence of interconnected voids in these fine grained units. The ultramafics and other volcanics are generally considered to be poor habitat for troglofauna or stygofauna unless they are highly fractured locally. The intrusive granitoids are also considered to have poor subterranean fauna suitability due to a general absence of interconnected voids. Examination of diamond drill core from the nine Norseman Gold Survey areas has shown fracturing, to be absent in the most part, or minor and provides little opportunity for subterranean fauna.

No previous stygofauna records are held within WAM databases. This is due to both an absence of previous assessments for stygofauna within the Norseman region, but also reflects the general absence of stygofauna habitat within the local Norseman region. The groundwater in the Norseman area associated with the nine Project areas is mostly hypersaline, especially with depth and with proximity to the salt lakes in the immediate region. This precludes the presence of stygofauna in all nine Project areas when combined with an absence of voids or fractures in examined core photos from all Project areas within saturated depth zones.

Only two troglofauna records for the Norseman region are held by WAM, although another five species are recorded from the Mt Henry mine site, hosted in mineralised BIF that is known in other parts of Western Australia and internationally to provide troglofauna habitat. The geology within the Norseman region excluding the minor BIF ridge is dominated by saprolitic clays and salt lake sediments that are both unsuitable for troglofauna as they contain no interconnected pore spaces. Troglofauna outside of BIF geologies in the Norseman region have a Nil or Low likelihood of occurrence.

The construction and operation of underground and open cut mining operations, including tailings storage facilities and associated infrastructure are expected to pose a low risk to potential stygofauna and troglofauna due to the general low likelihood of subterranean fauna presence and the small areas proposed to be developed as part of the Norseman Gold Project.

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Appendix 1

Department of Biodiversity, Conservation and Attractions Conservation Codes (2023)

CONSERVATION CATEGORY DEFINITIONS

For Western Australian Fauna and Flora

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] 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.

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened species

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 the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species.

Threatened flora is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species.

The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline Number 1 and Ministerial Guideline Number 2 that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria[3], and is based on the national distribution of the species.

CR Critically endangered species

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.

Examples of use:

- The western ringtail possum (*Pseudocheirus occidentalis*) is listed as a critically endangered threatened species under the *Biodiversity Conservation Act 2016.*
- Western ringtail possum is listed as critically endangered under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: CR.

EN Endangered species

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.

Examples of use:

- *Caladenia hopperiana* is listed as an endangered threatened species under the *Biodiversity Conservation Act 2016.*
- *Caladenia hopperiana* is listed as endangered under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: EN.

VU Vulnerable species

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.

Examples of use:

- The forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) is listed as a vulnerable threatened species under the *Biodiversity Conservation Act 2016.*
- Forest red-tailed black cockatoo is listed as vulnerable under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: VU.

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.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Examples of use:

- *Acacia kingiana* is listed as an extinct species under the *Biodiversity Conservation Act 2016.*
- *Acacia kingiana* is listed as extinct under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: EX.

EW Extinct in the wild species

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 fauna or flora species listed as extinct in the wild.

SP 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.

MI Migratory species

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).

Migratory species include birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA)[4], China (CAMBA)[5] or The Republic of Korea (ROKAMBA)[6], and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)[7], 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.

Examples of use:

- The wedge-tailed shearwater (*Ardenna pacifica*) is listed as a specially protected migratory species under the *Biodiversity Conservation Act 2016.*
- Wedge-tailed shearwater is listed as migratory under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: MI.

CD **Species of special conservation interest (conservation dependent)**

Species of special conservation need that are 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).

Currently only fauna are listed as species of special conservation interest.

Examples of use:

- The wambenger, south-western brush-tailed phascogale (*Phascogale tapoatafa wambenger*) is listed as a specially protected species of special conservation interest under the *Biodiversity Conservation Act 2016.*
- Wambenger, south-western brush-tailed phascogale, is listed as conservation dependent under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: CD.

OS **Species otherwise in need of special protection (other specially protected)**

Species 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).

Currently only fauna are listed as species otherwise in need of special protection.

Examples of use:

- The dugong (*Dugong dugon*) is listed as a specially protected species otherwise in need of special protection under the *Biodiversity Conservation Act 2016.*
- Dugon is listed as other specially protected fauna under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: OS.

P **Priority species**

Priority is not a listing category under the BC Act. The Priority Flora and Fauna lists are maintained by the department and are published on the department's website.

All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land).

Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey 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 prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened.

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

Assessment of priority status 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.

1 **Priority 1: Poorly-known species - known from few locations, none on conservation lands**

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, for example, 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 for threatened listing and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.

Examples of use:

- *Borya stenophylla* is listed as a Priority 1 species by the Department of Biodiversity, Conservation and Attractions.
- *Borya stenophylla* is listed as Priority 1 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P1.

2 Priority 2: Poorly-known species - known from few locations, some on conservation lands

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, for example, 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 for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.

Examples of use:

- *Caladenia nivalis* is listed as a Priority 2 species by the Department of Biodiversity, Conservation and Attractions.
- *Caladenia nivalis* is listed as Priority 2 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P2.

3 Priority 3: Poorly-known species - known from several locations

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. These species need further survey.

Examples of use:

- *Acacia nitidula* is listed as a Priority 3 species by the Department of Biodiversity, Conservation and Attractions.
- *Acacia nitidula* is listed as Priority 3 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P3.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as a conservation dependent specially protected species.

(c) Species that have been removed from the list of threatened species or lists of conservation dependent or other specially protected species, during the past five years for reasons other than taxonomy.

(d) Other species in need of monitoring.

Examples of use:

- *Banksia aculeata* is listed as a Priority 4 species by the Department of Biodiversity, Conservation and Attractions.
- *Banksia aculeata* is listed as Priority 4 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P4.

[1] The definition of flora includes algae, fungi, and lichens.

[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

[3] Western Australia has assigned species to threat categories using the *IUCN Red List of Threatened Species Categories and Criteria* since 1996 (referencing all criteria).

[4] JAMBA - first included in the WA migratory species list in 1980.

[5] CAMBA - first included in the WA migratory species list in 2010.

[6] ROKAMBA - first included in the WA migratory species list in 2010.

[7] Bonn Convention (Birds) - first included in the WA migratory species list in 2015.

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. Please see the caveat for interpretation of information provided here.

Report created: 24-Sep-2024

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	10
Listed Migratory Species:	6

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	9
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	4
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis			
Southern Whiteface [529]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos			
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leipoa ocellata			
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Pezoporus occidentalis](#) Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area	In buffer area only
PLANT			
[Daviesia microcarpa](#) Norseman Pea [56766]	Endangered	Species or species habitat known to occur within area	In feature area
[Eucalyptus platydisca](#) Jimberlana Mallee [64575]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Tecticornia flabelliformis](#) Bead Glasswort, Bead Samphire [82664]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [51802]	WA	In buffer area only
Commonwealth Land - [51800]	WA	In buffer area only
Commonwealth Land - [50330]	WA	In buffer area only
Commonwealth Land - [52247]	WA	In buffer area only
Commonwealth Land - [51801]	WA	In buffer area only
Commonwealth Land - [52187]	WA	In buffer area only
Commonwealth Land - [52243]	WA	In buffer area only
Commonwealth Land - [52246]	WA	In buffer area only
Commonwealth Land - [52188]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Binaronca	Nature Reserve	WA	In buffer area only
Dordie Rocks	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Dundas	Nature Reserve	WA	In buffer area only
Ngadju	Indigenous Protected Area	WA	In buffer area only
Unnamed WA06043	Nature Reserve	WA	In buffer area only
Unnamed WA08029	Nature Reserve	WA	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Gold Mining Developments on Lake Lefroy	2010/5402	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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Invertebrate Solutions

Appendix 2

Protected Matters Search Results

www.invertebratesolutions.com