

# Desktop assessment and targeted survey for SRE and Conservation Significant Invertebrate Fauna for the Moora Rail Outloading Project, Western Australia.



Report by Invertebrate Solutions Pty Ltd for Eco Logical Australia Pty Ltd on behalf of Co-operative Bulk Handling Group Ltd

**February 2021**

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Frontispiece: Native vegetation within the survey area .

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# Executive Summary

Co-operative Bulk Handling Group Ltd (CBH Group) has undertaken biological assessments to support State and Federal approvals for the clearing of native to allow for additional road and rail access for the Moora Rail Outloading Project (the Project). The Project is located approximately three kilometres (km) south of Moora in the Wheatbelt region of Western Australia.

Invertebrate Solutions was requested by Eco Logical Australia Pty Ltd (ELA) on behalf of CBH Group to undertake a desktop assessment of short range endemic (SRE) and conservation significant invertebrates for the Project.

The Desktop Study Area contains four Confirmed SRE species and two Likely SRE species:

- Two Confirmed SRE trapdoor spiders (*Idiosoma dandaragan* and *Kwonkan wonganensis*)
- A Confirmed SRE land snail *Bothriembryon `moora` n.sp.*
- A Confirmed SRE brine shrimp *Paralimnadia hyposalina*
- A Likely SRE land snail *Bothriembryon `walebing` n.sp.*
- A Likely SRE slater *Buddelundia sp.`88`*

The Desktop Study Area also contains one Possible SRE species (one ophiid pseudoscorpion) that is due to data deficiencies and taxonomic uncertainty. The remainder of the species were found to be widespread.

The Confirmed species *Idiosoma dandaragan* is also conservation significant and an additional three non SRE, but conservation significant species possibly occur, or have habitat within the Desktop Study Area:

- Two brine shrimp (*Branchinella denticulate* [P3] and *Branchinella simplex* [P1])
- One water flea *Daphnia jollyi* (P1)
- One trapdoor spider *Idiosoma dandaragan* (P2)

The mygalomorph spider *Idiosoma nigrum*, although shown as having the potential habitat within the Project Area based upon bioclimatic modelling does not occur here following a taxonomic 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 surrounding Wongan Hills from where it was first described. Instead the Moora region is known to contain the mygalomorph spider *Idiosoma dandaragan*.

A targeted survey for SRE and conservation significant invertebrates with a High likelihood of occurrence within the Project Area was undertaken in December 2020. Specifically, this survey targeted the mygalomorph spider *Idiosoma dandaragan* and the land snails *Bothriembryon `moora` n.sp.* and *Bothriembryon `walebing` n.sp.* The targeted survey recorded no SRE or conservation significant invertebrates within the Project Area.

No additional surveys for SRE or conservation significant invertebrates are required for the Project in order to meet Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

# 1. Introduction

Co-operative Bulk Handling Group Ltd (CBH Group) has undertaken biological assessments to support State and Federal approvals for the clearing of native vegetation to allow for additional road and rail access for the Moora Rail Outloading Project (the Project). The Project is located approximately three kilometres (km) south of Moora in the Wheatbelt region of Western Australia.

Invertebrate Solutions has been requested by Eco Logical Australia Pty Ltd (ELA) on behalf of CBH Group to undertake a desktop assessment of short range endemic (SRE) and conservation significant invertebrates followed by a targeted survey for these species for the Project.

## 1.1 Purpose of this report

Eco Logical Australia has requested Invertebrate Solutions to undertake the following scope of works for the Project Area, Western Australia:

- Carry out a desktop review to inform the survey planning and report preparation, including identification of all SRE species likely to occur within the Project Area;
- Undertake a SRE invertebrate survey to identify significant species in accordance with EPA Technical Guidance Sampling of short range endemic invertebrate fauna (EPA 2016);
- Identify to the lowest practical taxonomic unit all potential SRE specimens recorded during the field survey;
- Provide recommendations and any suggested requirements for further work to comply with relevant legislation; and
- Provide a written report containing the above items.

## 1.2 Project Area

The Project is located approximately three kilometres (km) south of Moora in the Wheatbelt region of Western Australia and is shown in Figure 1. The Desktop Study Area comprised a rectangle of approximately 50 km sides bounded by the north west corner (30.419276°S, 115.734942°E) and the south east corner (-30.891950°S, 116.273525°E) centred on the Project.

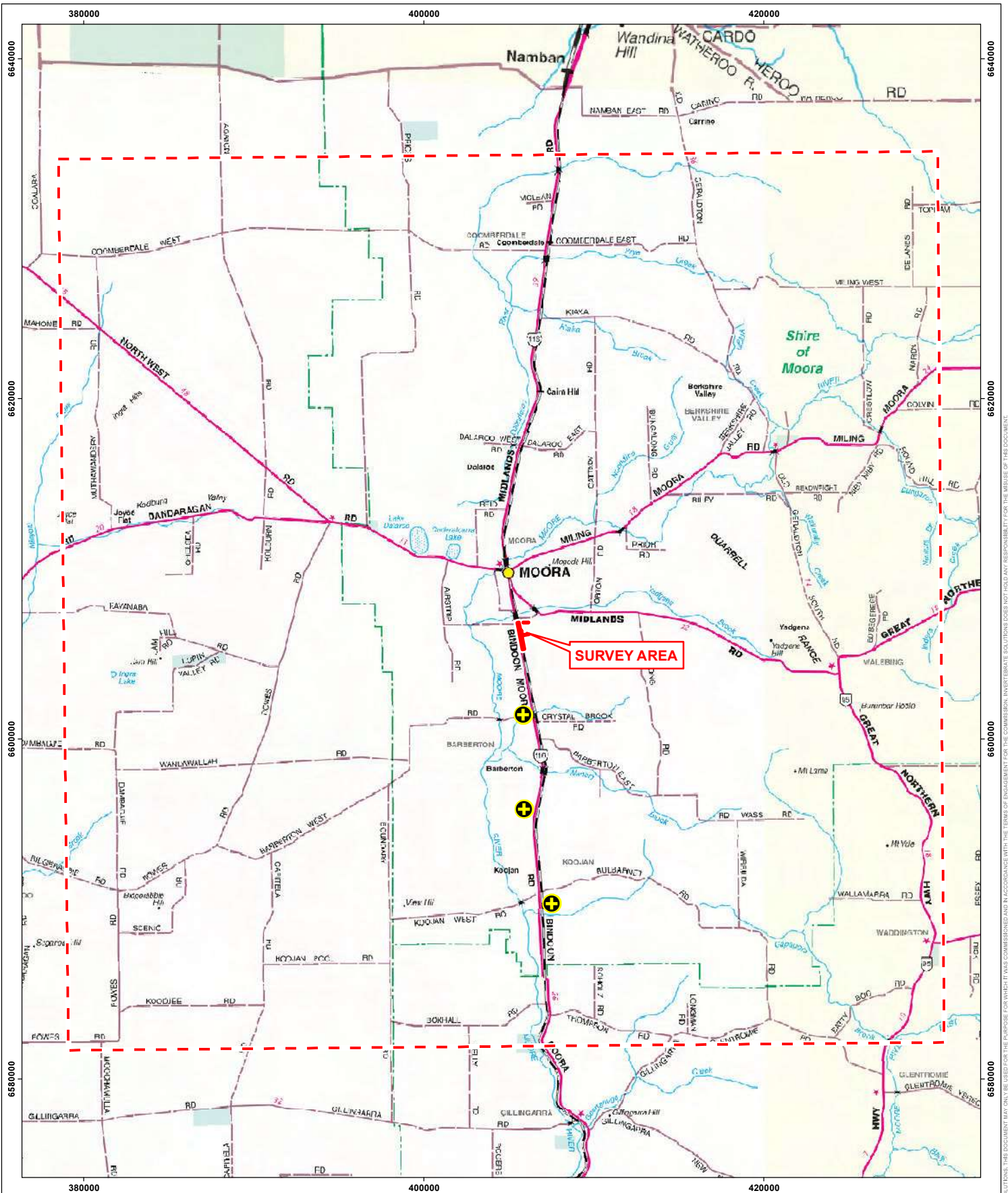
## 1.3 Survey Effort and Timing

Invertebrate Solutions completed a targeted survey for SRE and conservation significant invertebrates on 21<sup>st</sup> December 2020. This involved grid searching the entire site by an experienced ecologist:

- Dr Timothy Moulds *BSc (Hons) Geol., PhD. Invert. Ecol.* (Invertebrate Solutions); and

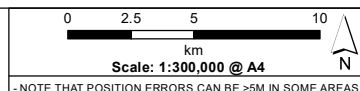
Survey work was undertaken under the collection licences issued by the Department of Biodiversity, Conservation and Attractions (DBCA):

- BA27000335; Licensee Timothy Moulds (Invertebrate Solutions); Valid 20/12/2021.

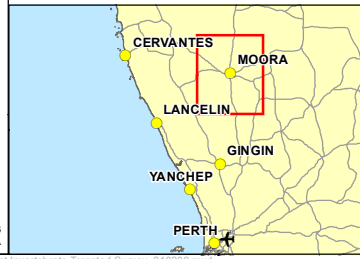


**Legend**

- Survey Area
- Desktop Study Area
- ⊕ Mygalomorphae: Idiopidae: *Idiosoma dandaragan* Location



**LOCALITY MAP**



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PROJECT ID MROP	DATE 9/02/2021
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HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
CREATED ENVIROMAPS	CHECKED TM	APPROVED TM	REVISION 0

**Figure 1**  
**Moora Rail Outloading Project Site SRE and Conservation Significant Invertebrate Targeted Survey**

- LOCALITY MAP SOURCED FROM LANDGATE 2006  
 - STREET DIRECTORY MAP OPEN SOURCE DATA

## 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<sup>2</sup> (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 on 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
<b>Confirmed</b>	A confirmed SRE species. A known distribution of < 10,000 km <sup>2</sup> (after Harvey 2002). Taxonomy of the group is well known. The group is well represented in collections, or via comprehensive sampling.
<b>Likely</b>	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.
<b>Possible</b>	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: <ul style="list-style-type: none"> <li>A. Data deficient i.e. new species, lack of distribution, taxonomic or collecting knowledge, juvenile specimens, wrong sex for identification</li> <li>B. Habitat indicators</li> <li>C. Morphology indicators</li> <li>D. Molecular evidence</li> <li>E. Research and expertise of WAM staff/taxonomic specialists</li> </ul>
<b>Widespread</b>	Not a SRE, a wide ranging distribution of > 10,000 km <sup>2</sup>

## 1.5 Conservation Legislation and Guidance Statements

Terrestrial SRE species are protected under state legislation via the newly enacted *Biodiversity Conservation (BC) Act* (2016) which came into force on 1<sup>st</sup> January 2019, replacing the outdated *Wildlife Conservation (WC) Act* (1950). The BC Act is aligned with the federal *Environment Protection and Biodiversity Conservation (EPBC) Act* (1999). 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 species that have special protection as species listed under Part 2 of the BC Act. This notice is updated periodically by the DBCA (formerly the Department of Parks and Wildlife (DPaW)) and the current list (January 2019) includes numerous SRE species from the Goldfields, 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” (Appendix 1). 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. The Priority fauna list is irregularly updated by DBCA and is now part of the BC Act.

The BC Act provides the ability for the state government of Western Australia to formally list Threatened Ecological Communities (TECs), along with threatening processes.

The EPBC Act protects both species, and ecological communities. The most relevant listing for SRE fauna in Western Australia is the mygalomorph spider *Idiosoma nigrum* that occurs in the Wheatbelt region and is listed as Vulnerable.

## 1.6 Report Limitations and Exclusions

This study was limited to the written scope provided to the client by Invertebrate Solutions (25<sup>th</sup> November 2020) 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 CBH Group.

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 CBH Group, Eco Logical Australia 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 season 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.

### 1.6.1 Survey Specific Limitations

The following specific comments are made with regard to project specific limitations for the Project:

- **Sampling effort** – The single-phase survey included a detailed grid search of the entire site by an experienced ecologist for burrows of mygalomorph spiders and searching under

vegetation and organic debris for land snails. The very detailed nature of the survey provides a high degree of certainty that the majority of potential SRE invertebrates present at the time of survey were recorded from the Survey Area.

- **Timing** – The survey was undertaken in December, which is suitable for targeted surveys for mygalomorph spiders and land snails that can be observed throughout the year.
- **Methods** – A wide variety of collecting techniques were used including active searching (raking and leaf litter searching) providing a high degree of certainty that the majority of targeted potential SRE invertebrates present at the time of the survey were recorded from the Survey Area.
- **Habitats sampled** – All significant potential SRE habitats within the Survey Area were sampled using a combination of techniques.
- **Access to areas** – No access within 3 m of the rail line was possible, however these areas were largely devoid of vegetation and highly disturbed and highly unlikely to contain SRE or conservation significant invertebrates. No other access issues were encountered, and all remaining vegetated parts of the site were able to be comprehensively surveyed.

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## 2. Desktop Methods

Invertebrate Solutions undertook the following tasks for the desktop SRE and Conservation Significant Invertebrate assessment of the Project:

- SRE desktop assessment based upon the WAM Records;
- An assessment of the likelihood that SRE invertebrate species are present in the habitats located within the Project Area; and
- An assessment of potential conservation significant invertebrates that may occur in the region based upon DBCA and EPBC conservation listings.

The desktop assessment 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 Moora region. In addition, other published reports including Invertebrate Solutions (2019), were examined. The desktop analysis was used to identify any potential SRE species that may occur in the Moora region and target those taxa during the subsequent field survey of the Project Area.

#### 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;
- Botanical and vegetation mapping and other information available for the Project Area;
- Results of a Protected Matters Search from the Federal Government’s Department of the Environment and Energy (DEE) website; and
- Records of fauna held by the WAM.

Based on the analysis of all available information within the Project Area and from the broader Desktop Study Area, each SRE and Conservation Significant invertebrate species was assigned a level of likelihood to occur within the Project Area of either ‘Very Low’, ‘Low’, ‘Moderate’, ‘High’, or ‘Definite’.

**Table 2 SRE species likelihood of occurrence definitions**

SRE Species Likelihood of occurrence	Definition
<b>Definite</b>	The species is confirmed to occur within the Project Area
<b>High</b>	Habitat for the species is known to occur within the Project Area and known current records of the species are within 20 km
<b>Moderate</b>	Habitat for the species is known to occur within the Project Area and known current records of the species are within 50 km
<b>Low</b>	The species has been recorded from within 50 km, however, no habitat is present for the species within the Project Area or the records are historical.
<b>Very low</b>	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 SRE Survey Methodology

The SRE survey was 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.

### 2.2.1 Active searching

Active searching was undertaken across the entire site, and consisted of searching soil and/or leaf litter from suitable habitat areas within each site (land snails); the raking of leaf litter (land snails, mygalomorph burrows); examination of vegetative material below logs and bark (land snails), and an examination of areas of rock outcrops and associated rock piles.

## 2.3 Sorting and curation

Sorting for all SRE samples occurred in the Invertebrate Solutions laboratory using an Leica M125 100x dissecting microscope and was undertaken by Dr Timothy Moulds. Each taxon was identified to the lowest practical taxonomic rank using published keys and descriptions, and the number 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.

## 2.4 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 are 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 WAM, 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 for 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, however there will be limits due to the nature of specimens and the availability of taxonomic keys.

## 2.5 Short Range Endemic Status

Taxonomic groups known to contain SRE representatives were examined in more detail to determine if the records in this study are potentially restricted forms. SRE status was assigned after comparison with other close relatives in the group and current knowledge on their distribution and ecology, where known.

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## 3. Results

### 3.1 SRE Invertebrates of the Wheatbelt region

Whilst there are few systematic surveys for SRE species within the Wheatbelt region of Western Australia, the area has been the subject of numerous invertebrate collections by researchers from the WAM and Universities over the past 80 years or more. This has resulted in a reasonable understanding of the regions fauna within a highly fragmented agricultural landscape. The highly conservation significant *Idiosoma nigrum* (Vulnerable EPBC Act) is now known to be restricted to the central northern Wheatbelt (Rix et al. 2018), along with several other conservation significant mygalomorph spiders from various portions of the Wheatbelt including *Idiosoma dandaragan*, that are known to occur within the Desktop Study Area.

There are few SRE surveys in the vicinity of Moora or the Project Area. The previous studies in the region are almost exclusively related to ad hoc surveys of remnant vegetation, usually nature reserves with little in the way of broad scale systematic data available. Although, the recent work on the mygalomorph spider fauna of Western Australia has greatly increased our knowledge of some specific families and genera, compared with the general SRE fauna. Many species remain to be properly documented and the taxonomy of many groups remains unresolved.

A single baseline survey for SRE invertebrates was undertaken at the North Kiaka Mine, approximately 20km north of Moora in 2018 (Invertebrate Solutions 2019). The SRE survey recorded two Confirmed SRE species; the mygalomorph spider *Kwonkan wonganensis?* and the millipede *Antichiropus sp. 'Moora'*. As well as the land snail *Bothriembryon sp. 'moora'* and the slater *Buddelundia sp. '88'*, that are considered to be Likely SRE species. Whilst another four species are considered to be Possible SRE species, no conservation significant invertebrates were recorded during the field survey at the North Kiaka site (Invertebrate Solutions 2019).

### 3.2 Conservation Significant Fauna in the Desktop Study Area

A list of conservation significant fauna for the Desktop Study Area was compiled from the DBCA Wildlife Conservation (Specially Protected Fauna) Notice 2019 (DBCA 2019) and the 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 3 with their conservation code. The PMST results listed a single invertebrate, the mygalomorph spider *Idiosoma nigrum* as having the potential for habitat based upon bioclimatic modelling to occur within the Project Area. The species was once considered wide ranging throughout much of the Western Australian Wheatbelt and into the arid zone prior to 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 including Wongan Hills from where it was first described (Main 1952). The species is now known to occur roughly within a polygon bounded by Bolgart, New Norcia, Walebing, and Bindi Bindi along its western margin, east to Koorda along its northern margin, south to Durokoppin and Kellerberrin along its eastern margin, and from Kellerberrin to Bolgart along its southern margin (Rix et al. 2018, Plate 5).

A full description of the DBCA and EPBC conservation codes are shown in Appendix 1 and Appendix 2 respectively. The full list of species obtained from the PMST search is shown in Appendix 2.

Whilst 21 conservation listed invertebrate species occur within the entire Wheatbelt region, within the Moora area only five of these species have any potential habitat in the local region (Table 3), with the remaining species found several hundreds of kilometres away in the broader region. Of these five species, the mygalomorph spider *Idiosoma dandaragan* (Priority 2) is known to be present within the Desktop Study Area and the tree cricket *Throscodectes xederoides* (Priority 3) has a Moderate likelihood of occurrence. The remaining three species are considered to have a Low or Very Low likelihood of occurrence within the Desktop Study Area.

**Table 3 Conservation significant terrestrial invertebrates potentially within the Desktop Study Area.**

Higher Classification	Genus and Species	DBCA/ BC Status	EPBC status	Habitat/Distribution within Desktop Study Area
<b>Bivalvia</b>	<i>Westralunio carteri</i>	Vulnerable	Vulnerable	Not Present
<b>Crustacea</b>	<i>Branchinella denticulata</i>	P3	-	Low
	<i>Branchinella simplex</i>	P1	-	Very Low
	<i>Daphnia jollyi</i>	P1	-	Very Low
<b>Arachnida</b>	<i>Idiosoma castellum</i>	P2	-	Not Present
	<i>Idiosoma dandaragan</i>	P2	-	Present
	<i>Idiosoma mccllementsorum</i>	P2	-	Not Present
	<i>Idiosoma nigrum</i>	Endangered	Vulnerable	Not Present
<b>Insecta</b>	<i>Throscodectes xederoides</i>	P3	-	Not Present

### 3.3 SRE Habitat in Project Area

The vegetation units and condition mapping identified in the flora and vegetation assessment (Eco Logical Australia 2020) were used to assess the Project Area for potential SRE habitat. The vegetation condition is Excellent to Completely Degraded, with several unsealed vehicle access tracks through the vegetated area. The vegetation mapping undertaken by Eco Logical Australia (2020) show that the Project Area is situated within three vegetation types; *Eucalyptus salmonophloia* mid woodland, *Eucalyptus wandoo* mid woodland and *Eucalyptus camaldulensis* mid woodland (Eco Logical Australia 2020, Figure 5) with the former two part of the Eucalypt Woodlands of the Australian Wheatbelt Threatened Ecological Community (TEC). This habitat, once widespread and continuous in the region is now largely cleared due to agricultural use and remaining areas are highly fragmented. All three the vegetation units provide limited potential SRE habitat due to the historical ground disturbance observed throughout during the field assessment (refer Section 3.5).

### 3.4 Potential occurrence of SRE Invertebrates within the Desktop Study Area

A search of the WAM databases for potential SRE taxa occurring in the Desktop Study Area centred on the Project Area to the south of Moora was undertaken (Figure 1, WAM 2020a, b, c). The results of these were filtered for groups that potentially contain SRE species as shown in Table 4. Definitions for SRE status are found in Table 1. Results of the SRE survey of the North Kiaka mine site (Invertebrate Solutions 2019) were also included.



The Desktop Study Area contains four Confirmed SRE species; two trapdoor spiders, a brine shrimp and a land snail, and two Likely SRE species; a *Bothriembryon* land snail and a *Buddelundia* slater, and one Possible SRE species (one olpiid pseudoscorpion). The remainder of the species were found to be widespread.

**Table 4 Desktop records from WAM of potential SRE Invertebrates in the Project Area**

Higher Order	Genus and species	SRE Status and notes	Likelihood of occurrence within the Project Area
<b>Gastropoda</b>			
<b>Heterobranchia:</b>			
<b>Bothriembryontidae</b>	<i>Bothriembryon 'walebing' n.sp.</i>	Likely	High
	<i>Bothriembryon 'moora' n.sp.</i>	Confirmed	High
<b>Crustacea:</b>			
<b>Diplostraca: Limnadiidae</b>	<i>Paralimnadia hyposalina</i>	Confirmed	Very Low
<b>Isopoda</b>	<i>Buddelundia sp. '88'</i>	Likely	Low
<b>Arachnida:</b>			
<b>Mygalomorphae</b>			
<b>Actinopodidae</b>	<i>Missulena granulosa</i>	Widespread	-
	<i>Missulena hoggi</i>	Widespread	-
	<i>Missulena occatoria</i>	Widespread	-
<b>Idiopidae</b>	<i>Idiosoma dandaragan</i>	Confirmed/P2	Very High
<b>Nemesiidae</b>	<i>Aname mainae</i>	Widespread	-
	<i>Kwonkan wonganensis</i>	Confirmed	Low
<b>Pseudoscorpiones:</b>			
<b>Chernetidae</b>	<i>Troglochernes dewae</i>	Widespread	-
<b>Olpiidae</b>	<i>Genus indet.</i>	Possible (A)	- <sup>1</sup>
<b>Scorpiones</b>			
<b>Buthidae</b>	<i>Lychas 'splendens'</i>	Widespread	-
<b>Urodacidae</b>	<i>Urodacus armatus</i>	Widespread	-
	<i>Urodacus novaehollandiae</i>	Widespread	-
<b>Chilopoda:</b>			
<b>Scolopendridae</b>	<i>Cormocephalus aurantiipes</i>	Widespread	-
	<i>Cormocephalus turneri</i>	Widespread	-
	<i>Ethmostigmus rubripes</i>	Widespread	-
	<i>Scolopendra morsitans</i>	Widespread	-
<b>Geophilida:</b>			
<b>Oryidae</b>	<i>Orphnaeus brevilabiatus</i>	Widespread	-
<b>Diplopoda:</b>			
<b>Paradoxosomatidae</b>	<i>Antichiropus sp. 'moora'</i>	Confirmed	Moderate

<sup>1</sup>All olpiid pseudoscorpions are considered Possible SRE species due to an incomplete taxonomic framework (refer section 4.1 for full details).

### 3.5 SRE Field Survey Results

The targeted field survey recorded no SRE or conservation significant invertebrates from the Project Area.

The Project Area was found to be disturbed from historical minor earth works in most areas (Plate 1, Plate 2, and Plate 3) and further disturbed by vehicle tracks and off road driving, by both light and heavy vehicle (Plate 4) that have degraded the potential habitat for SRE and conservation significant invertebrate species. Most areas contain little or limited undergrowth and mid-storey vegetation that limits the potential for SRE or conservation significant invertebrates.



**Plate 1 Previous ground disturbance within the Project area**



**Plate 2 Previous ground disturbance within the Project area**



**Plate 3 Previous ground disturbance within the Project area**



**Plate 4 Previous ground disturbance and vehicle tracks within the Project area**

## 4. Discussion

### 4.1 SRE Invertebrate Assessment

The Desktop Study Area contains four Confirmed SRE species and two Likely SRE species:

- Two Confirmed SRE trapdoor spiders (*Idiosoma dandaragan* and *Kwonkan wonganensis*)
- A Confirmed SRE land snail *Bothriembryon 'moora' n.sp.*
- A Confirmed SRE brine shrimp *Paralimnadia hyposalina*
- A Likely SRE land snail *Bothriembryon 'walebing' n.sp.*
- A Likely SRE slater *Buddelundia sp.'88'*

The Desktop Study Area also contains one Possible SRE species (one ophiid pseudoscorpion) that is due to data deficiencies and taxonomic uncertainty. The remainder of the species were found to be widespread.

The Confirmed species *Idiosoma dandaragan* is also conservation significant and an additional three non SRE but conservation significant species possibly occur, or have habitat within the Desktop Study Area:

- Two brine shrimp (*Branchinella denticulate* [P3] and *Branchinella simplex* [P1])
- One water flea *Daphnia jollyi* (P1)
- One trapdoor spider *Idiosoma dandaragan* (P2)

These species are discussed in detail in section 4.1.1 – 4.1.4.

#### 4.1.1 Gastropoda: Bothriembryontidae

##### **Bothriembryon 'Moora' n. sp. – Confirmed SRE**

The land snail specimen is known to occur in the northern Wheatbelt (Invertebrate Solutions 2019, Corey Whisson, Western Australian Museum, pers comm. March 2019). The taxa is a Confirmed SRE species, primarily due to the highly fragmented nature of the remnant vegetation in the region reducing available habitat and area of occurrence for the species. The taxa most likely occurs throughout all vegetated areas in the Northern Wheatbelt but was not recorded from the Project Area during the targeted field survey in December 2020. Therefore it is not anticipated to be subject to significant impact from the Project development.

##### **Bothriembryon 'Walebing' n. sp. – Likely SRE**

The land snail *Bothriembryon 'Walebing' n. sp.* identified during the desktop assessment is known from a single record near the locality of Walebing, less than 20 km to the east of the Project Area. It differs from *Bothriembryon 'Moora' n. sp.* recorded at North Kiaka (Invertebrate Solutions 2019) by the radial whorls across the shell (Corey Whisson, Western Australian Museum, pers comm. March 2019). The taxa is considered a Likely SRE species, primarily due to the highly fragmented nature of the remnant vegetation in the region reducing available habitat and area of occurrence for the species. This species was not recorded from the Project Area during the targeted field survey in

December 2020 and therefore is not anticipated to be subject to significant impact from the Project development.

#### **4.1.2 Crustacea**

##### **Diplostracea: Limnadiidae: *Paralimnadia hyposalina* – Confirmed SRE**

This is a species of clam shrimp that occurs in salt and clay pans to the west of Comberdale (Timms 2016), that is located approximately 25 km to the north of the Project Area. This species is known only from a series of salt pans in this area, however, these will not to be the subject of any impacts from the development of the Project and thus no impacts are anticipated to occur to the endemic clam shrimp.

##### **Isopoda: Armadillidae: *Buddelundia* sp. '88' – Likely SRE**

The taxonomic framework of slaters in Australia is extremely poor, making assessment of SRE status for this fauna difficult. The armadillid isopods from the Australian genus *Buddelundia* are extremely diverse in arid Australia, with over 150 putative species identified in collections. These are primarily from Western Australia, but require taxonomic revision at a family level making the proper identification of species difficult (Dalens 1992; Judd and Perina 2013).

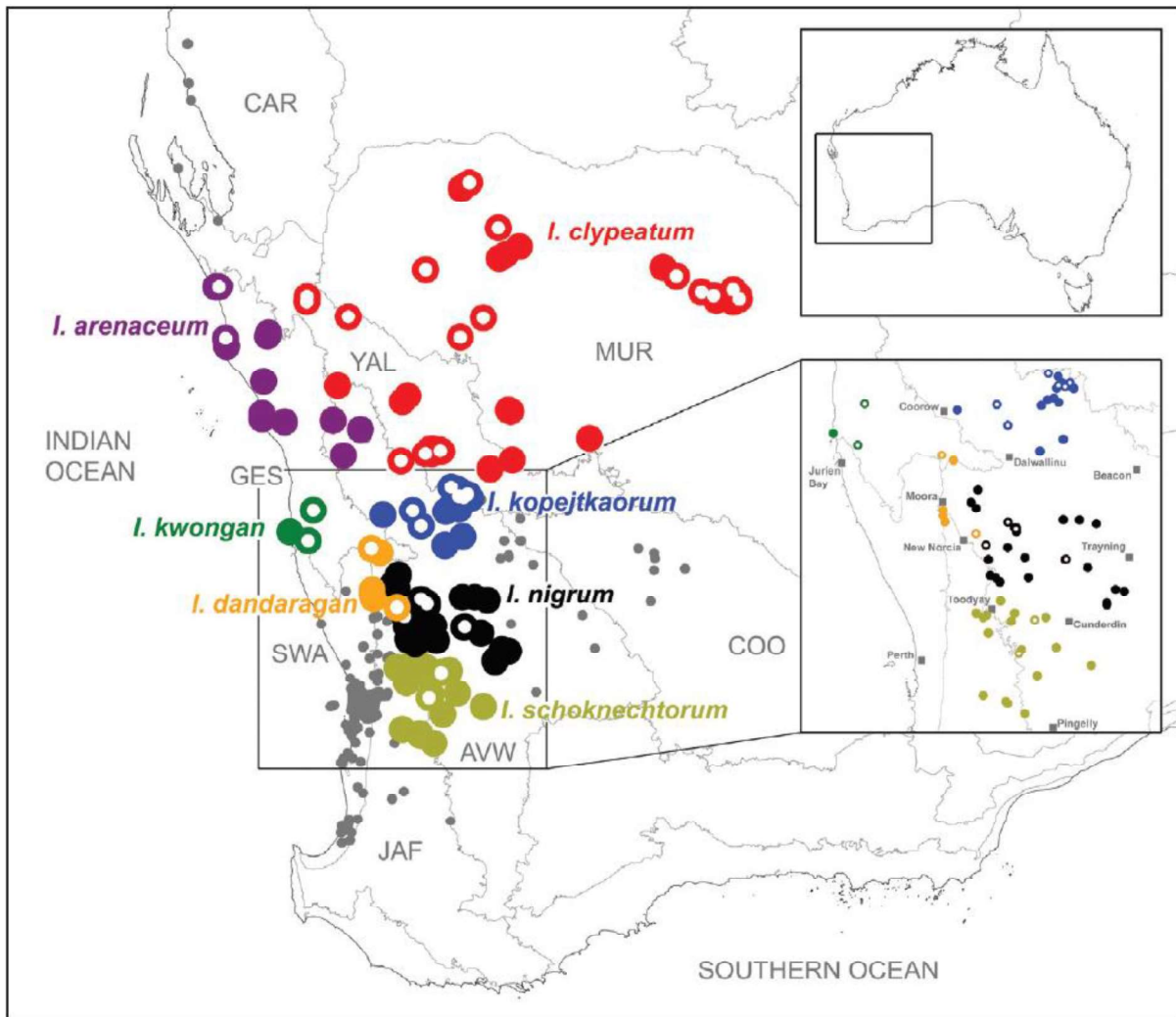
This species was collected from five sites at North Kiaka and match a single specimen collected approximately 150 km north of Moora at Koolanooka (Invertebrate Solutions 2019). These are the only records for *Buddelundia* sp. '88' and it is considered a Likely SRE, however, it is noted that due to a lack of collecting in the Wheatbelt it is likely that the taxon occurs elsewhere in remnant vegetation within the region (Invertebrate Solutions 2019). The species is considered to have a Low likelihood of occurrence when considering the disturbance to the site observed during the targeted field survey in December 2020, and therefore is not anticipated to be subject to significant impact from the Project development.

#### **4.1.3 Arachnida: Mygalomorphae**

##### **Idiopidae: *Idiosoma dandaragan* – Confirmed SRE / Priority 2**

*Idiosoma dandaragan* was formerly known by WAM code 'MYG477' is a member of the sigillate complex and has a restricted distribution along the eastern margin of the Dandaragan Plateau, from near New Norcia in the south, and north to at least the Watheroo National Park (Figure 1, Plate 3, Rix et al. 2018). *Idiosoma dandaragan* has a known extent of occurrence of approximately 1,230 km<sup>2</sup>, however, the area of occupancy within that range is less than 500 km<sup>2</sup> at less than 10 severely fragmented sites (Rix et al. 2018, Plate 5). The distribution of *I. dandaragan* is closely adjacent to the north-western extent of the range of *I. nigrum* near New Norcia and Carani (Rix et al. 2018). Both *I. dandaragan* and *I. nigrum* have a strongly sclerotised abdomens, although they are easily separated by morphology and molecular data (Rix et al. 2018).

This species was not recorded from the Project Area during the targeted field survey in December 2020 and therefore is not anticipated to be subject to significant impact from the Project development.



**Plate 5** Distribution of *Idiosoma* spp in the Wheatbelt and pastoral regions of Western Australia (After Rix et al. 2018, Figure 374)

### **Nemesiidae: *Kwonkan wonganensis* – Confirmed SRE**

This mygalomorph spider is known from the Wongan Hills Nature Reserve, some 60 km to the east of the Project Area (Main 1977, Invertebrate Solutions 2019). The species was described from adult female specimens only, whilst adult male specimens were recorded from North Kiaka. The specimens from Wongan Hills were dug from their distinctive burrows, made of small pebbles. Female mygalomorph spiders can only live in remnant vegetation that has limited fire regimes and are protected from grazing, so it is likely to be restricted to the vegetated rocky outcrop areas in the local region. This species was not recorded from the Project Area during the targeted field survey in December 2020 and therefore is not anticipated to be subject to significant impact from the Project development.

#### 4.1.4 Diplopoda: Paradoxosomatidae

##### ***Antichiropus*. 'Moora' n. sp.**

Millipedes from the genus *Antichiropus* all have limited powers of dispersal and conservative ecological requirements (Car et al. 2013). In addition, the above-ground activity of most *Antichiropus* species are limited to a very small window of opportunity when there is sufficient moisture for them to forage and mate during wetter winter months (Car et al. 2013). *Antichiropus* species are, consequently, short range endemics with very small distributions *sensu* Harvey 2002.

The millipede *Antichiropus* sp. 'Moora' was collected as dead specimens from two sites near the centre of the North Kiaka Project Area north of Moora (Invertebrate Solutions 2019) and was recorded from rocky vegetated areas. The precise habitat requirements for the species are unknown. This species was not recorded from the Project Area during the targeted field survey in December 2020 and therefore is not anticipated to be subject to significant impact from the Project development.



## 5. Conclusions and Recommendations

The Desktop Study Area contains four Confirmed SRE species and two Likely SRE species:

- Two Confirmed SRE trapdoor spiders (*Idiosoma dandaragan* and *Kwonkan wonganensis*)
- A Confirmed SRE land snail *Bothriembryon `moora` n.sp.*
- A Confirmed SRE brine shrimp *Paralimnadia hyposalina*
- A Likely SRE land snail *Bothriembryon `walebing` n.sp.*
- A Likely SRE slater *Buddelundia sp.`88`*

The remainder of the species were found to be widespread. The Confirmed species *Idiosoma dandaragan* is also conservation significant and an additional three non SRE, but conservation significant species possibly occur, or have habitat within the Desktop Study Area:

- Two brine shrimp (*Branchinella denticulate* [P3] and *Branchinella simplex* [P1])
- One water flea *Daphnia jollyi* (P1)
- One trapdoor spider *Idiosoma dandaragan* (P2)

The targeted SRE and conservation significant invertebrate survey undertaken on the entire Project Area on 21<sup>st</sup> December 2020 recorded no SRE or conservation significant invertebrates. The Project Area was found to be disturbed from minor earth works in most areas, and further disturbed by vehicle tracks that have degraded the potential habitat for SRE and conservation significant invertebrate species. No significant impacts to SRE or conservation significant invertebrates are anticipated to occur from the Project development and no further surveys are required to be undertaken to meet Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

## 6. References

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- Car, C.A., Wojcieszek, J.M. and Harvey, M.S. (2013). The millipede genus *Antichiropus* (Diplopoda: Polydesmida: Paradoxosomatidae), part 1: redefinition of the genus and redescrptions of existing species. *Records of the Western Australian Museum*, 28: 83-118. DOI: 10.18195/issn.0312-3162.28(2).2013.083-118
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- Western Australian Museum (WAM). (2020a). Arachnida and Myriapoda database search December 2020.
- Western Australian Museum (WAM). (2020b). Crustacea database search December 2020.
- Western Australian Museum (WAM). (2020c). Mollusc database search December 2020.

# Appendix 1

## DBCA Conservation Categories



# CONSERVATION CODES

## For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora<sup>1</sup> are species<sup>2</sup> 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.

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

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

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

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

### **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. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

### **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. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

### **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. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

## **Extinct species**

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

### **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).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

### **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 threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

## **Specially protected species**

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

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

### **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).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

### **CD Species of special conservation interest (conservation dependent fauna)**

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

### **OS Other specially protected species**

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

**P** **Priority species**

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

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

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

**1** **Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

**2** **Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

**3** **Priority 3: Poorly-known species**

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

**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 Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

<sup>1</sup> The definition of flora includes algae, fungi and lichens

<sup>2</sup> 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).

# 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.

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 09/02/21 13:45:07

[Summary](#)

[Details](#)

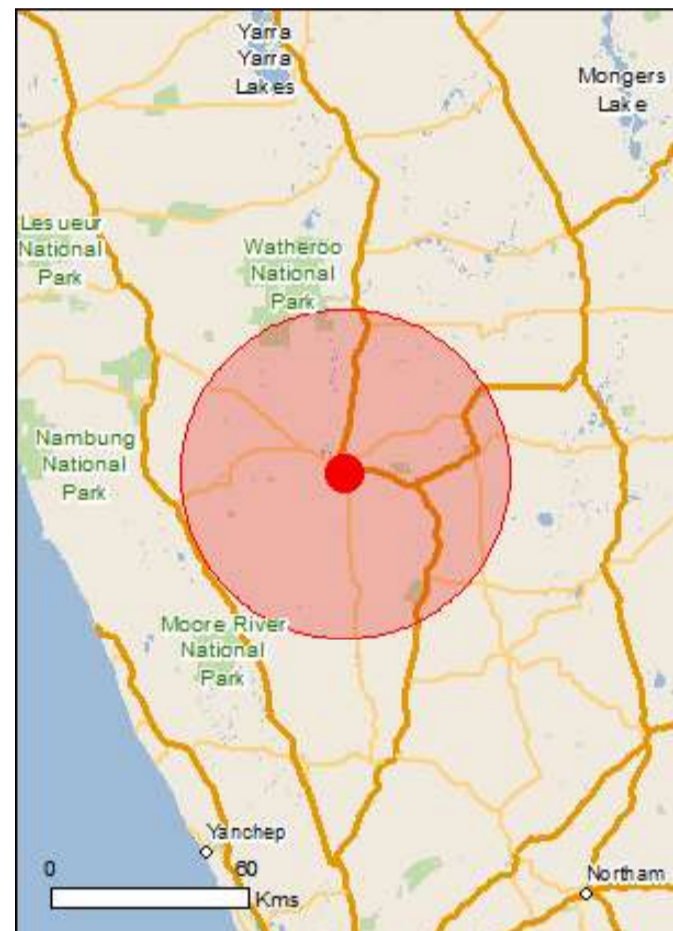
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

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[Coordinates](#)

[Buffer: 50.0Km](#)





# Summary

## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	4
<a href="#">Listed Threatened Species:</a>	79
<a href="#">Listed Migratory Species:</a>	9

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	1
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	16
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	34
<a href="#">Regional Forest Agreements:</a>	1
<a href="#">Invasive Species:</a>	23
<a href="#">Nationally Important Wetlands:</a>	1
<a href="#">Key Ecological Features (Marine)</a>	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.

Name	Status	Type of Presence
<a href="#">Banksia Woodlands of the Swan Coastal Plain ecological community</a>	Endangered	Community likely to occur within area
<a href="#">Clay Pans of the Swan Coastal Plain</a>	Critically Endangered	Community likely to occur within area
<a href="#">Eucalypt Woodlands of the Western Australian Wheatbelt</a>	Critically Endangered	Community likely to occur within area
<a href="#">Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community</a>	Critically Endangered	Community may occur within area

### Listed Threatened Species

[\[ Resource Information \]](#)

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding known to occur within area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
<b>Fish</b>		
<a href="#">Nannatherina balstoni</a> Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
<b>Mammals</b>		
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
<a href="#">Parantechinus apicalis</a> Dibbler [313]	Endangered	Species or species habitat may occur within area
<a href="#">Phascogale calura</a> Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor [316]	Vulnerable	Species or species habitat likely to occur within area
<b>Other</b>		
<a href="#">Idiosoma nigrum</a> Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat known to occur within area
<b>Plants</b>		
<a href="#">Acacia aprica</a> Blunt Wattle [64821]	Endangered	Species or species habitat likely to occur within area
<a href="#">Acacia aristulata</a> Watheroo Wattle [64822]	Endangered	Species or species habitat known to occur within area
<a href="#">Acacia ataxiphylla subsp. magna</a> Large-fruited Tammin Wattle [64823]	Endangered	Species or species habitat may occur within area
<a href="#">Acacia cochlocarpa subsp. cochlocarpa</a> Spiral-fruited Wattle [23877]	Endangered	Species or species habitat known to occur within area
<a href="#">Acacia cochlocarpa subsp. velutinos</a> Velvety Spiral Pod Wattle [65112]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Acacia forrestiana</a> Forest's Wattle [17235]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Acacia splendens</a> Splendid Wattle, Dandaragan Wattle [81510]	Endangered	Species or species habitat known to occur within area
<a href="#">Acacia vassalii</a> Vassal's Wattle [6144]	Endangered	Species or species habitat known to occur within area
<a href="#">Andersonia gracilis</a> Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
<a href="#">Anigozanthos viridis subsp. terraspectans</a> Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Asterolasia nivea</a> Bindoon Starbush [8225]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Banksia fuscobracte</a> Dark-bract Banksia [83059]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Banksia mimica</a> Summer Honey-pot [82765]	Endangered	Species or species habitat likely to occur within area
<a href="#">Banksia serratuloides subsp. perissa</a> Northern Serrate Dryandra [82767]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Banksia serratuloides subsp. serratuloides</a> Southern Serrate Dryandra [82768]	Vulnerable	Species or species

Name	Status	Type of Presence
<a href="#">Caladenia drakeoides</a> Hinged Dragon Orchid [68687]	Endangered	habitat known to occur within area Species or species habitat known to occur within area
<a href="#">Chamelaucium sp. Cataby (G.J.Keighery 11009)</a> Griffin's Waxflower [82509]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Chamelaucium sp. Gingin (N.G.Marchant 6)</a> Gingin Wax [88881]	Endangered	Species or species habitat likely to occur within area
<a href="#">Chorizema humile</a> Prostrate Flame Pea [32573]	Endangered	Species or species habitat known to occur within area
<a href="#">Conospermum densiflorum subsp. unicephalatum</a> One-headed Smokebush [64871]	Endangered	Species or species habitat known to occur within area
<a href="#">Darwinia acerosa</a> Fine-leaved Darwinia [9004]	Endangered	Species or species habitat known to occur within area
<a href="#">Darwinia carnea</a> Mogumber Bell, Narrogin Bell [9736]	Endangered	Species or species habitat known to occur within area
<a href="#">Dasymalla axillaris</a> Native Foxglove [38829]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Daviesia dielsii</a> Diels' Daviesia [19617]	Endangered	Species or species habitat known to occur within area
<a href="#">Daviesia euphorbioides</a> Wongan Cactus [3477]	Endangered	Species or species habitat may occur within area
<a href="#">Diplolaena andrewsii</a> [6601]	Endangered	Species or species habitat may occur within area
<a href="#">Drakaea elastica</a> Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
<a href="#">Eleocharis keigheryi</a> Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Eremophila glabra subsp. chlorella</a> [84927]	Endangered	Species or species habitat known to occur within area
<a href="#">Eremophila pinnatifida</a> Pinnate-leaf Eremophila [64894]	Endangered	Species or species habitat likely to occur within area
<a href="#">Eremophila scaberula</a> Rough Emu Bush [16729]	Endangered	Species or species habitat known to occur within area
<a href="#">Eucalyptus absita</a> Badgingarra Box [24260]	Endangered	Species or species habitat known to occur within area
<a href="#">Eucalyptus crispata</a> Yandanooka Mallee [24268]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence area
<a href="#">Eucalyptus dolorosa</a> Dandaragan Mallee, Mount Misery Mallee [56709]	Endangered	Species or species habitat known to occur within area
<a href="#">Eucalyptus impensa</a> Eneabba Mallee [56711]	Endangered	Species or species habitat may occur within area
<a href="#">Eucalyptus leprophloia</a> Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat may occur within area
<a href="#">Eucalyptus pruiniramis</a> Midlands Gum, Jingymia Gum [56403]	Endangered	Species or species habitat known to occur within area
<a href="#">Eucalyptus recta</a> Silver Mallet [56430]	Endangered	Species or species habitat known to occur within area
<a href="#">Eucalyptus rhodantha</a> Rose Mallee [9362]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Frankenia conferta</a> Silky Frankenia [6074]	Endangered	Species or species habitat may occur within area
<a href="#">Gastrolobium appressum</a> Scale-leaf Poison [7358]	Vulnerable	Species or species habitat may occur within area
<a href="#">Gastrolobium hamulosum</a> Hook-point Poison [9212]	Endangered	Species or species habitat known to occur within area
<a href="#">Glyceria drummondii</a> Nangetty Grass [14008]	Endangered	Species or species habitat known to occur within area
<a href="#">Goodenia arthrotricha</a> [12448]	Endangered	Species or species habitat known to occur within area
<a href="#">Grevillea calliantha</a> Foote's Grevillea, Cataby Grevillea, Black Magic Grevillea [56339]	Endangered	Species or species habitat known to occur within area
<a href="#">Grevillea christineae</a> Christine's Grevillea [64520]	Endangered	Species or species habitat known to occur within area
<a href="#">Grevillea curviloba subsp. incurva</a> Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
<a href="#">Grevillea dryandroides subsp. hirsuta</a> Hairy Phalanx Grevillea [64577]	Endangered	Species or species habitat may occur within area
<a href="#">Grevillea pythara</a> Pythara Grevillea [64525]	Endangered	Species or species habitat may occur within area
<a href="#">Grevillea sp. Gillingarra (R.J.Cranfield 4087)</a> [86383]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Hakea megalosperma</a> Lesueur Hakea [10505]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
<a href="#">Haloragis platycarpa</a> Broad-fruited Haloragis [15371]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Hemiandra gardneri</a> Red Snakebush [7945]	Endangered	Species or species habitat known to occur within area
<a href="#">Hemiandra rutilans</a> Sargents Snakebush, Colourful Snakebush [17932]	Endangered	Species or species habitat likely to occur within area
<a href="#">Jacksonia pungens</a> Pungent Jacksonia [64920]	Endangered	Species or species habitat may occur within area
<a href="#">Leucopogon obtectus</a> Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
<a href="#">Melaleuca sciotostyla</a> Wongan Melaleuca [24324]	Endangered	Species or species habitat known to occur within area
<a href="#">Paracaleana dixonii</a> Sandplain Duck Orchid [86882]	Endangered	Species or species habitat likely to occur within area
<a href="#">Ptychosema pusillum</a> Dwarf Pea [11268]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Roycea pycnophylloides</a> Saltmat [21161]	Endangered	Species or species habitat likely to occur within area
<a href="#">Spirogardnera rubescens</a> Spiral Bush [15667]	Endangered	Species or species habitat may occur within area
<a href="#">Synaphea quartzitica</a> Quartz-loving Synaphea [64978]	Endangered	Species or species habitat known to occur within area
<a href="#">Thelymitra dedmaniarum</a> Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
<a href="#">Thelymitra stellata</a> Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area
<a href="#">Thomasia sp. Green Hill (S.Paust 1322)</a> Green Hill Thomasia [64542]	Endangered	Species or species habitat likely to occur within area
<a href="#">Verticordia staminosa subsp. staminosa</a> Wongan Featherflower [55825]	Endangered	Species or species habitat may occur within area

#### Reptiles

<a href="#">Egernia stokesii badia</a> Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
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#### Listed Migratory Species

[ [Resource Information](#) ]

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

Name	Threatened	Type of Presence
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#### Migratory Marine Birds

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

## Other Matters Protected by the EPBC Act

### Commonwealth Land [\[ Resource Information \]](#)

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

Name
Commonwealth Land -

### Listed Marine Species [\[ Resource Information \]](#)

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

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Chrysococcyx osculans</a> Black-eared Cuckoo [705]		Species or species habitat known to occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Extra Information

State and Territory Reserves	[ Resource Information ]
Name	State
Bundarra	WA
Dandarangan	WA
Gillingarra	WA
Jam Hill	WA
Karamarra	WA
Koodjee	WA
Lake Wannamal	WA
Long Pool	WA
Manaling	WA
Merewana	WA
Minyulo	WA
Mogumber	WA
Mogumber West	WA



Name	State
Moochamulla	WA
NTWA Bushland covenant (0048)	WA
NTWA Bushland covenant (0057)	WA
NTWA Bushland covenant (0115)	WA
Namban	WA
Namming	WA
Quins Hill	WA
Sevenmile Well	WA
Unnamed WA23179	WA
Unnamed WA25591	WA
Unnamed WA28710	WA
Unnamed WA39322	WA
Unnamed WA39571	WA
Unnamed WA41042	WA
Unnamed WA43811	WA
Unnamed WA44081	WA
Unnamed WA45337	WA
Unnamed WA46899	WA
Unnamed WA47694	WA
Unnamed WA47808	WA
Watheroo	WA

### Regional Forest Agreements [\[ Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
<a href="#">South West WA RFA</a>	Western Australia

### Invasive Species [\[ Resource Information \]](#)

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

Name	Status	Type of Presence
<b>Birds</b>		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

## Plants

Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

## Nationally Important Wetlands

Name	State
<a href="#">Wannamal Lake System</a>	WA

[ [Resource Information](#) ]

# Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

## Coordinates

-30.66975 116.01319

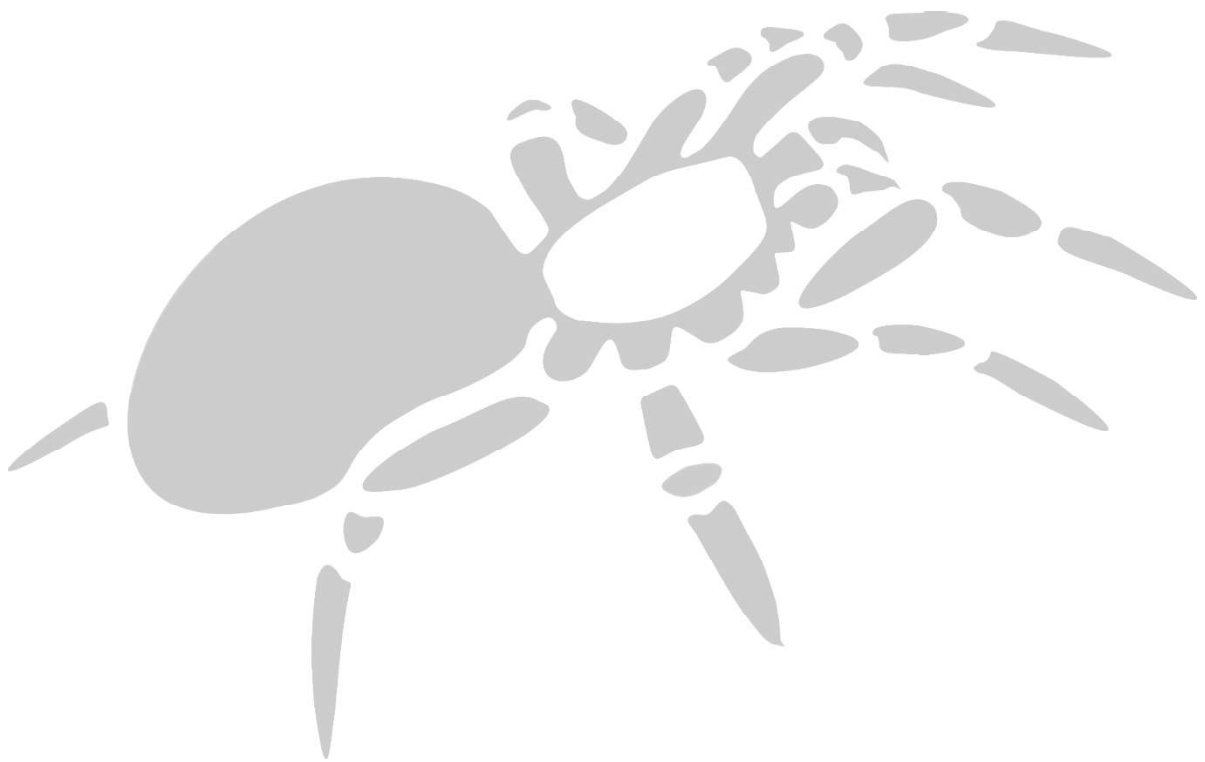
# Acknowledgements

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](#)
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- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
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- [-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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