# Yindjibarndi Renewable Energy Project
# Fauna Assessment Report

Gorge at top of pool in project area. (Photo: Mike Bamford)

Prepared for: Yindjibarndi Energy Corporation

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18th January 2024

# Executive Summary


**Introduction**

Bamford Consulting Ecologists (BCE) has been commissioned by the Yindjibarndi Energy Corporation, to conduct a level 1 (Basic) fauna assessment of a proposed Green Energy development (the Jinbi Project) in the Pilbara region. This involves a desktop review and site inspection. This report presents results of this fauna assessment; specifically a summary of the expected fauna assemblage, information on species of conservation significance and their expected occurrence in the project area, and field observations.

**Project area description**

The project area is located in the Pilbara region of WA, approximately 60 km south of Karratha, on traditional lands of the Yindjibarndi people. The project area is largely undisturbed except for a transmission station near the centre and two transmission lines. Within 40 km of the project area, there are several recognized sensitive sites, including Millstream Chichester National Park, Millstream Pools, and several areas of Priority Ecological Communities. The Harding Dam and Lake Poongkaliyarra are c. 15 km north-east of the project area. These locations will be used by waterbirds and shorebirds and proximity to these locations may influence the likelihood of these species using the project area and thus being impacted by the proposed development.

**Fauna values**

Landscape and Vegetation Types. The project area encompasses rocky hills to undulating stony plains with a major watercourse in the centre starting at a spring, and a second major watercourse in the west, with both running north and uniting just outside the northern boundary. A distinctive feature of the landscape is that it has two broad geological components:

- Rocky basaltic hills in the south and west, dissected by valleys with minor watercourses.
- Undulating granitic plains. These are extensive and cover about two thirds of the area.

Prior to a recent fire in the project area, botanists from Mattiske Consulting visited the project area and described four main vegetation types (summarised briefly here):

- Rugged sandstone (?basalt) hills with *Acacia* shrubland over *Triodia* grassland
- Granite stony plains with isolated trees over *Acacia* shrubland over *Triodia* and *Aristida* grassland
- Ephemeral drainage channels with associated vegetation.
- Permanent pools surrounded by sedgeland and shrubland.

Fauna assemblage. The desktop assessment identified 224 vertebrate fauna species as potentially occurring in the project area: two fish, six frogs, 62 reptiles, 119 birds, 32 native mammals (including the Dingo, considered 'naturalised') and 3 introduced mammals. This does not include domesticated species that may be present in the project area. Six native mammal species that would have once been present in the project area are now locally extinct. The presence of at least 26 expected fauna species (one fish, at least two frogs, five reptiles, 16 birds and three native mammals) was confirmed during the December 2023 site inspection by either direct observation or due to the presence of evidence such as tracks, shed skin and scats. The fauna assemblage is typical of that expected in this region of Western Australia and is likely to be represented elsewhere in the region. The assemblage

is likely to be relatively complete for reptiles and birds, and incomplete for mammals. The expected assemblage is likely to be somewhat poor in a regional context, due to the harsh nature of the environments present, the lack of sandy soils and the limited amount of complex structures such as caves, overhangs, etc., that provide shelter for a variety of fauna.

Species of conservation significance. Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts.
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts.
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

Twenty-eight vertebrate species of conservation significance are expected to occur in the project area; 16 CS1, seven CS2, and five CS3 species. Key vertebrate species of conservation significance are the Yirriwardu (Northern Quoll) and Bargunyji (Pilbara Olive Python); both CS1 and expected as residents in the project area. Four invertebrates of conservation significance may be present in the project area.

Patterns of biodiversity. General information regarding the landscape and environments present allow some comment regarding significant areas for fauna within the project area. The spring is considered locally significant with regard to fauna, as it provides habitat for a variety of fauna species, including fish, frogs, birds and reptiles. Drainage lines and associated temporary pools are also expected to provide valuable habitat for a variety of fauna. The limited extent of sandy substrates will limit the number of reptiles expected to be present in the project area. The recent fire may have adversely affected the assemblage, but the relationship between fire and fauna assemblage composition is complex.

**Conclusions**

Several recommendations are made with respect to any proposed development in order to protect the fauna assemblage. These include protecting a buffer around the spring and gorge system, and along drainage lines; the spring and gorge are identified as denning habitat for the Yirriwardu (Northern Quoll). Buffers would be beneficial to much of the fauna assemblage due to the importance to fauna of the spring, gorge and drainage lines. Understanding the hydrology that maintains the spring is essential to protect this feature. Fire management and management of introduced species are also recommended. Some future studies are suggested; these are all focussed on gathering information relevant to the assessment of risk posed by the proposed development.

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# 1 Introduction

Bamford Consulting Ecologists (BCE) has been commissioned by the Yindjibarndi Energy Corporation to conduct a level 1 (Basic) fauna assessment of a proposed Green Energy development (the Jinbi Project) in the Pilbara region. This involves a desktop review and site inspection. This interim report presents preliminary results of this fauna assessment; specifically a summary of the expected fauna assemblage, information on species of conservation significance and their expected occurrence in the project area, and field observations. Fauna values (as described in Appendix 1) are discussed.

## 1.1 Description of project area and background environmental information

The project area is located approximately 60 km south of Karratha in the north-western portion of the Pilbara management region (DBCA, 2023c), on traditional lands of the Yindjibarndi people. The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia which are further divided into subregions (DCCEEW, 2023d). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway & Cresswell, 1995). The project area is in the Chichester subregion (PIL01) of the Pilbara bioregion. The Chichester subregion was described by Kendrick and McKenzie (2001) and a summary of their work follows here. This subregion comprises Archaean granite and basalt plains and significant areas of basaltic ranges. A shrub steppe of *Acacia* over *Triodia* hummock grassland is supported by the plains, with *Eucalyptus* occurring on the ranges. The climate of the subregion is semi-desert tropical, with highly variable rainfall that falls mostly in summer, and significant cyclonic activity (Kendrick & McKenzie, 2001).

The initial site inspection was conducted over a project area ofca. 1,600ha, which corresponds to a section 88 Option to Lease under the *Land Administration Act 1997*. This area is less than 2 km from the Millstream Chichester National Park, a protected terrestrial area (DCCEEW, 2020) and Environmentally Sensitive Area (DWER, 2023b, 2023a). Other sensitive sites of note include the following:

- Millstream Pools, c. 35 km south, which is an Important Wetland (DBCA, 2023d) and Proposed Ramsar Site (DBCA, 2023f).
- Priority Ecological Communities (PECs) c. 20 km north-east and north-west. These correspond to areas of the Horseflat land system (DPIRD, 2023) and are therefore likely to be clay pans of the Horseflat land system of the Roebourne plains, which is a priority 3 PEC (DBCA, 2023a).
- Priority Ecological Communities c. 15 km south. These correspond to areas of the Wona land system (DPIRD, 2023) which is associated with four plant assemblages which are Priority Ecological Communities (two are Priority 1 and two are Priority 3) (DBCA, 2023a).

Although not officially recognised as a sensitive site, the Harding Dam and Lake Poongkaliyarra are c. 15 km north-east of the project area. These locations will be used by waterbirds and shorebirds and proximity to these locations may influence the likelihood of these species using the project area and thus being impacted by the proposed development.

The dominant land uses within the Chichester subregion (PIL01) are grazing (native pastures), Aboriginal lands and Reserves, UCL and Crown Reserves, conservation and mining (Kendrick & McKenzie, 2001). At the local scale, the project area is surrounded predominantly by remnant native

vegetation and a network of sealed and unsealed roads. The area visited during the initial site inspection had recently been subject to a bushfire and appears to have been burnt on a regular basis. This is of relevance to several fauna species for which unburnt environments are important.

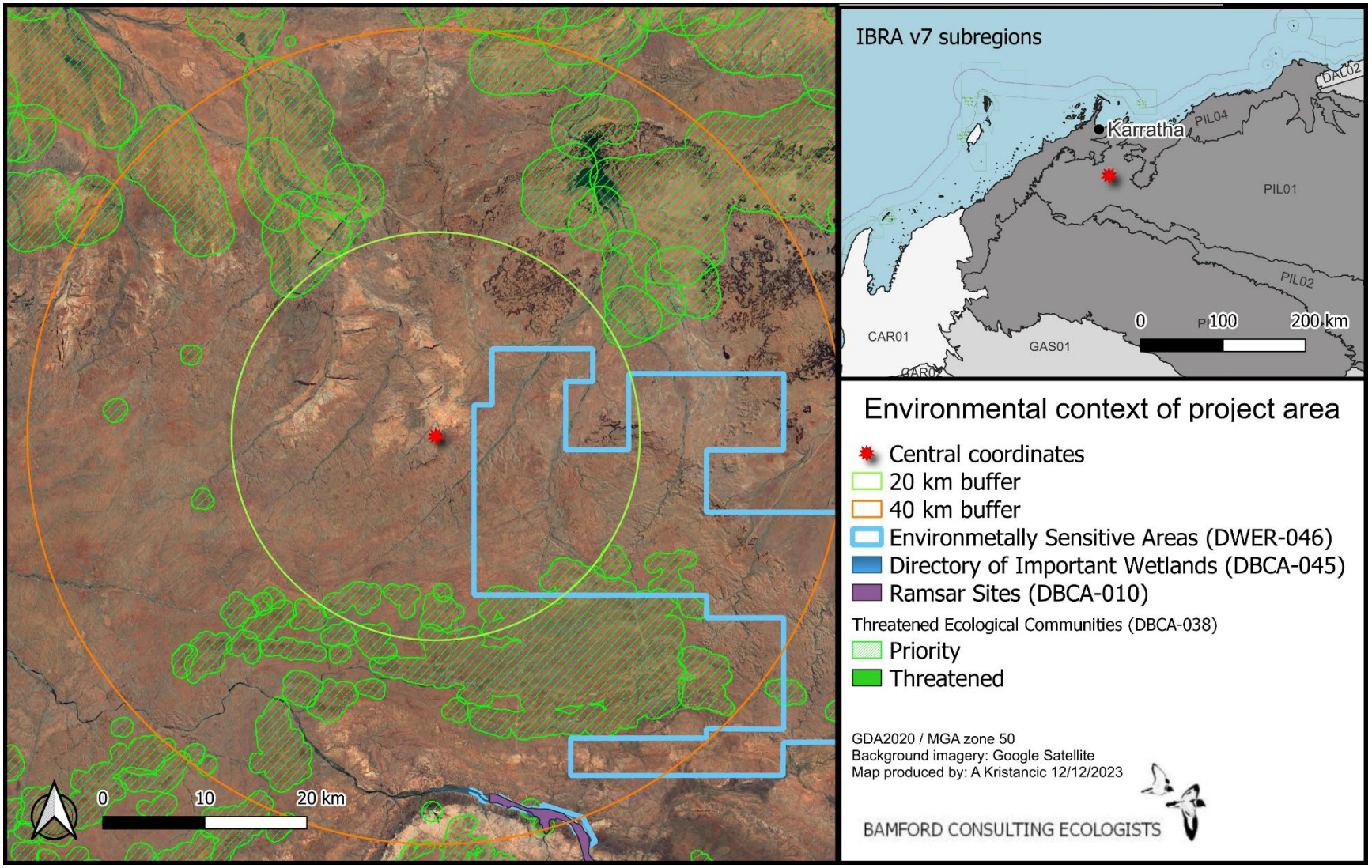


**Figure 1-1. Location and environmental context of the project area.**

# 2 Methods

## 2.1 Overview

BCE has been commissioned to conduct a level 1 (Basic) fauna assessment for the proposed development. This involves a desktop review and site inspection. This report provides results concerning the expected species assemblage, with a focus on species of conservation significance, and field observations from a site inspection.

The level of assessment recommended by the EPA (2020) is determined by geographic position, with a generic statement that detailed surveys are expected across all of the state except the south-west, but also recommending that site and project characteristics be considered, such as the survey objectives, existing available data, information required, the scale and nature of the potential impacts of the proposal and the sensitivity of the surrounding environment in which the disturbance is planned. These aspects should be considered in the context of the information acquired by the desktop study. When determining the type of survey required, the EPA (2020) suggested that the following be considered:

- level of existing regional knowledge;
- type and comprehensiveness of recent local surveys;
- degree of existing disturbance or fragmentation at the regional scale;
- extent, distribution and significance of habitats;
- significance of species likely to be present;
- sensitivity of the environment to the proposed activities; and
- scale and nature of impact.

The EPA (2020) recommends three levels of investigation that differ in their approach for field investigations:

- Basic – a low-intensity survey, conducted at the local scale to gather broad fauna and habitat information (formerly referred to as 'Level 1'). The primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats. A basic survey can also be used to identify future survey site locations and determine site logistics and access. The results from the basic survey are used to determine whether a detailed and/or targeted survey is required. During a basic survey, opportunistic fauna observations should be made and low-intensity sampling can be used to gather data on the general faunal assemblages present. While referred to as 'basic', this level of survey is involved and powerful, and should be considered the primary level of assessment. Other levels of assessment (where deemed necessary) add information to inform this primary level.
- Detailed – a detailed survey to gather quantitative data on species, assemblages and habitats in an area (formerly referred to as 'Level 2'). A detailed survey requires comprehensive survey design and should include at least two survey phases appropriate to the biogeographic region (bioregion). Surveys should be undertaken during the seasons of maximum activity of the relevant fauna and techniques should be selected to maximise the likelihood that the survey will detect most of the species that occur, and to provide data to enable some community analyses to be carried out.
- Targeted – to gather information on significant fauna and/or habitats, or to collect data where a desktop study or field survey has identified knowledge gaps. Because impacts must be placed

into context, targeted surveys are not necessarily confined to potential impact areas. A targeted survey usually requires one or more site visits to detect and record significant fauna and habitats. For areas with multiple significant species there may not be a single time of year suitable to detect all species. In these cases, multiple visits, each targeting different species or groups, should be conducted.

## 2.2 Identification of vegetation and substrate associations (VSAs)

Vegetation and substrate associations (VSAs) combine vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. Further discussion is provided in Appendix 1.

The initial site visit summarised in this interim report allowed identification of broad environments present in the project area, while the vegetation types identified by Mattiske (2023) were interpreted to describe VSAs.

## 2.3 Desktop assessment of expected species

### *2.3.1 Sources of information*

As per the recommendations of EPA (2020), information on the fauna assemblage of the project area was drawn from a range of sources including databases (as listed in Table 2-1). Information from these sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns are listed in Table 2-3.

### *2.3.2 Previous fauna surveys*

Two previous fauna studies were identified within 20 km of the centre point of the project area. These are listed in Table 2-2, and include one Basic fauna survey and one Targeted survey for Ghost Bats. Fauna observations from these previous studies were included in the compilation of the expected fauna assemblage (presented in Appendix 3).

**Table 2-1. Databases searched for the desktop review; accessed October 2023. Central coordinates used for database searches: 50 K 496422E 7651345N**

| Database | Type of records held in database | Area searched |
|---|---|---|
| Previous studies | Fauna recorded by the literature and previous studies in the vicinity of the project area. | 20 km buffer around the centre point of the project area. |
| Atlas of Living Australia (ALA, 2023) | Fauna records from Australian museums and conservation/research bodies, including records from BirdLife Australia's Atlas (Birdata) Database. | 20 km buffer around the centre point of the project area. |

| | | |
|---|---|---|
| NatureMap (DBCA, 2023e) (via request to DBCA) | Records from the Western Australian Museum (WAM) and Department of Biodiversity, Conservation and Attractions (DBCA) databases, including historical data and Threatened and Priority species in WA. | 20 km buffer around the centre point of the project area. |
| EPBC Protected Matters Search Tool (DCCEEW, 2023h) | Records on Matters of National Environmental Significance (MNES) protected under the EPBC Act. | 20 km buffer around the centre point of the project area. |
| Birdata (BirdLife Australia, 2023) | Bird records held by Birdlife Australia. | 20 km buffer around the centre point of the project area. |
| DBCA Threatened and Priority Fauna search (DBCA, 2023b) | DBCA records of threatened fauna. | 40 km buffer around the centre point of the project area. |
| DBCA Threatened Fauna List (DBCA, 2023b) | DBCA list of threatened fauna species | All invertebrate species of Pilbara region |

**Table 2-2. Previous terrestrial fauna survey within a 20 km buffer around the central coordinates.**

| Author | Title | Distance to site |
|---|---|---|
| Astron (2013) | Millstream Transmission Corridor Level 1 Vegetation, Flora and Fauna Survey. Unpublished report for Rio Tinto. | |
| Biologic (2012) | Targeted Ghost Bat Survey at Karijini National Park. Unpublished survey for BHP Billiton Iron Ore Pty Ltd. | |

**Table 2-3. Sources of information used for general patterns of fauna distribution.**

| Taxa | Sources |
|---|---|
| Fish | Morgan *et al.* (1998), Allen *et al.* (2003), Morgan *et al.* (2014), DoF (2023). |
| Frogs | Tyler and Doughty (2009), Anstis (2017). |
| Reptiles | Storr *et al*. (1983, 1990, 1999, 2002) , Bush *et al.* (2010), Wilson and Swan (2021). |
| Birds | Johnstone and Storr (1998, 2005), Menkhorst *et al*. (2017). |
| Mammals | Van Dyck and Strahan (2008), Churchill (2009), Menkhorst and Knight (2011). |

### *2.3.3 Nomenclature and taxonomy*

As per the recommendations of the EPA (2020), the nomenclature and taxonomic order presented in this report are generally based on the Western Australian Museum's (WAM) Checklist of the Fauna of Western Australia 2020. The authorities used for each vertebrate group were: fish (Morgan et al., 2014), frogs (Doughty, 2022a), reptiles (Doughty, 2022b), birds (Gill et al., 2023), and mammals (Travouillon, 2022). In some cases, more widely-recognised names and naming conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds (BirdLife Australia, 2022), and the International Ornithological Congress' 'World Bird List'). Similarly, the group name 'black-cockatoo' is consistently used for all three taxa in the South-West. English common names (as proper nouns consistent with most guidance) of species, where available, are used throughout the text; Latin names are presented with corresponding English names in tables in the appendices. Where available, Yindjibarndi names are given. The use of subspecies is limited to situations where there is an important (and relevant) geographically distinct population, or where the taxonomic distinction has direct relevance to the conservation status or listing of a taxon.

### *2.3.4 Interpretation of species lists*

#### *2.3.4.1 Expected occurrence*

Species lists generated from the review of sources of information are generous as they include records drawn from a large region (the study area; a 20 km buffer around the centre point of the project area) and possibly from environments not represented in the project area. Therefore, some species that were returned by one or more of the database and literature searches have been excluded because their ecology, or the environment within the project area, determined that it is highly unlikely that these species will be present. Such species can include, for example, seabirds that might occur as extremely rare vagrants at a terrestrial, inland site, but for which the site is of no importance. Species returned from the databases and not excluded on the basis of ecology or environment are therefore considered potentially present or expected to be present in the project area at least occasionally, whether or not they were recorded during field surveys, and whether or not the project area is likely to be important for them. This list of expected species is therefore subject to interpretation by assigning each a predicted status, the expected occurrence, in the project area. The status categories used are:

- **Resident:** species with a population permanently present in the project area.
- **Regular visitor:** species that occur within the project area regularly in at least moderate numbers, such as part of an annual cycle (thus includes migrants).
- **Irregular Visitor:** species that occur within the project area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the project area in at least moderate numbers and for some time.
- **Vagrant:** species that occur within the project area unpredictably, in small numbers and/or for very brief periods. Therefore, the project area is unlikely to be of importance for the species.
- **Locally extinct:** a species that would have been present historically but has not been recently recorded in the local area and therefore is almost certainly no longer present in the project area.

These status categories make it possible to distinguish between vagrant species, which may be recorded at any time but for which the project area is not important in a conservation sense, and species which use the project area in other ways but for which the site is important at least occasionally. This is particularly useful for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive, and further recognises that even the most detailed field survey can fail to record species which will be present at times. The status categories are assigned conservatively based on the precautionary principle. For example, a lizard known from the general area is assumed to be a resident unless there is very good evidence the project area will not support it, and even then, it may be classed as a vagrant rather than assumed to be absent if the site might support dispersing individuals. It must be stressed that these status categories are predictions only and that often very intensive sampling would be required to confirm a species' status. It should be noted that the aim of the desktop assessment and field investigations is not to confirm the presence or absence of species in the project area. By using a precautionary approach, the expected species assemblage represents a conservative estimate of the species assemblage that may use the project area, with errors of inclusion rather than exclusion.

The results of the database searches were reviewed and Interpreted, and obvious errors and out of date taxonomic names were deleted.

#### *2.3.4.2 Conservation significance*

All expected species were assessed for conservation significance as detailed in Appendix 1. Three broad levels of conservation significance are used in this report:

- Conservation Significance 1 (CS1) – species listed under State or Commonwealth Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act);
- Conservation Significance 2 (CS2) – species listed as Priority by DBCA but not listed under State or Commonwealth Acts; and
- Conservation Significance 3 (CS3) – species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution. In the Perenjori region, a large proportion of what might otherwise be considered common species are of local significance as they are reliant on the very small areas of remnant native vegetation. In a different context, this principle was used by Dell and Banyard (2000) to recognise species of conservation significance in urban landscapes.

See Appendix 1 for an expanded discussion of these categories and Appendix 2 for a description of the categories used in the legislation (EPBC and BC Acts) and by the DBCA.

## 2.4 Field investigations

### *2.4.1 Overview*

Preliminary results were obtained from an initial site inspection from 6-7th December 2023 by Dr Mike Bamford (BCE) and Mr Will Oversby (Coterra). This involved personnel travelling around the project area by car and on foot, as well as an approximately 3 hour information sharing session with Lorraine Coppin of Juluwarlu Aboriginal corporation held at Ngurrawaana. The session involved discussions on the history of the land, local fauna records and observations, and Yindjibarndi creation myths and uses for specific fauna. Within the project area, field investigations that were conducted included:

- a general description of the environments present;
- opportunistic fauna observations (birds and other fauna, including signs such as diggings, scats and tracks).

GPS tracks are indicated on Figure 2-1.

Personnel involved in the field investigations and interim report preparation (including desktop review) are listed in Table 2-4.

**Table 2-4. Personnel involved in the field investigations and report preparation.**

| Personnel | EIA/Wildlife Survey Experience | Field Investigations | Report Preparation |
|---|---|---|---|
| Dr Mike Bamford *BSc (Biology), Hons (Biology), PhD (Biology)* | 40 years | + | + |
| Mr Will Oversby *BSc (Environmental Biology), Hons (Zoology)* | 7 years | + | |
| Dr Amanda Kristancic *BSc (Zoology/Biochemistry), Hons (Zoology), PhD (Parasitology)* | 2 years | | + |

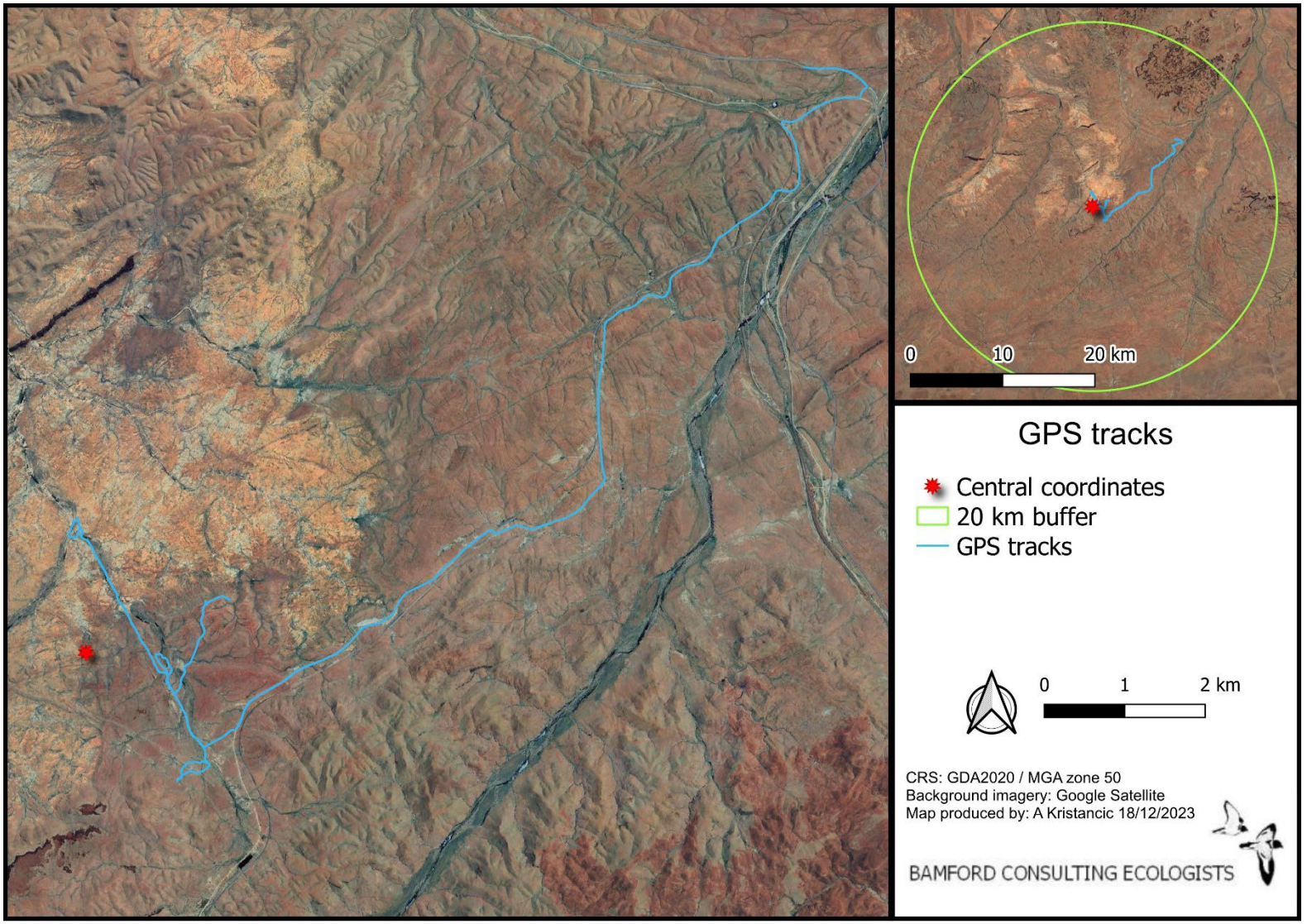


**Figure 2-1. GPS tracks of personnel during the field investigations.**

# 3 Fauna values

This section presents the results of the desktop and field investigations in terms of key fauna values (described in detail in Appendix 1) and includes:

- Preliminary information regarding environments and VSAs in the areas visited;
- Fauna assemblage characteristics (uniqueness, completeness and richness);
- Species of conservation significance;
- Patterns of biodiversity across the landscape; and
- Ecological processes affecting fauna.

## 3.1 Landscape and Vegetation and Vegetation and Substrate Associations (VSAs)

The project area encompasses rocky hills to undulating stony plains with a major watercourse in the centre starting at a spring, and a second major watercourse in the west, with both running north and uniting just outside the northern boundary. Vegetation was almost entirely burnt only a month to six weeks before the site inspection (see Plate 1 to Plate 3), but broadly a tall shrubland variable in density (often open, but mid-dense and forming thickets close to drainage lines) over spinifex. Scattered eucalypts in loam flats adjacent to watercourses and along drainage lines. A distinctive feature of the landscape is that it has two broad geological components:

- Rocky basaltic hills in the south and west, dissected by valleys with minor watercourses. Rocky and very shallow soil and hills and slopes. Some valleys have flats with loam/cobbles soil and the largest drainage lines with coarse sand beds. Vegetation on hills and slopes spinifex with scattered and occasional patches of tall shrubs. Valley flats of loam/cobbles soils support mid-dense to dense tall shrubland with scattered eucalypts (Corymbia). Shrubs form thickets along drainage lines with occasional Corymbia and probably Eucalyptus victrix. One watercourse starts at a spring is in an incised valley/gorge with near-permanent pools in the gorge; water present at time of visit (Plate 4 and Plate 5). A few Cadjeput and beds of Typha present. The watercourse then flows out across the granitic plain with a lot of water-exposed granite and sand.
- Undulating granitic plains. These extensive and cover about two thirds of the area. Granite exposed along watercourses but geology is complex, with small rises of a grey conglomerate and layers of alluvial loam/cobbles over decomposed granite across much of the undulating plains. A linear feature in the south-west appears to be two lines of basalt crumbling into boulders; possibly an intrusion through the granite. Vegetation across the plains mid-dense tall shrubland over spinifex. Scattered eucalypts in slightly low-lying areas of best loam soil. Major watercourses on the granitic plain are not deeply incised but have a broad sandy bed with exposed granite (Plate 6). Much evidence of seasonal pools but all dry at the time of the site visit. Some dense shrub-thickets along watercourses and occasional eucalypts. The largest watercourse in the west could not be accessed due to conditions (a 5km round walk and temperature around 40C).

The project area is largely undisturbed except for a transmission station near the centre and two transmission lines. Disturbance associated with these is very limited; for example the track under the powerlines is minor to almost non-existent, and disturbance around the transmission station is very restricted.

Botanists from Mattiske Consulting visited the project area before the fire and described four main vegetation types (Mattiske 2023):

- Rugged sandstone (?basalt) hills: *Acacia ancistrocarpa, Acacia pyrifolia* var. *pyrifolia, Acacia bivenosa* mid sparse shrubland over KRT267 *Triodia* 12 paid ID, *Triodia epactia* low hummock grassland.
- Granite stony plains: *Corymbia hamersleyana, Terminalia circumalata* low isolated trees over *Acacia ancistrocarpa, Acacia pyrifolia* var. *pyrifolia, Acacia inaequilatera* mid sparse shrubland over *Triodia epactia, Aristida contorta* low hummock grassland.
- *Eucalyptus victrix* low open woodland over *Melaleuca linophylla, Melaleuca glomerata, Acacia bivenosa* mid sparse shrubland over *Stemodia grossa, Cyperus vaginatus* low sparse shrubland along ephemeral drainage channels.
- *Melaleuca argentea, Eucalyptus ?camaldulensis* mid woodland over *Acacia ampliceps, Acacia coriacea* subsp. *pendens, Acacia pyrifolia* var. *pyrifoli*a mid open shrubland over *Typha domingensis, Cyperus vaginatus, Schoenoplectus subulatus* open sedgeland surrounding permanent pools.

The site inspection and descriptions of vegetation types allow for the recognition of VSAs (fauna 'habitats'). These are mapped on Figure 3-1 and described below. Photographs are provided but the vegetation is almost entirely burnt.

- VSA 1. Acacia Open Shrubland over Spinifex Hummock Grassland on undulating rocky hills (Plate 1 and Plate 2). Shallow loam soil and very rocky. Corresponds to 'rugged sandstone hills' (Mattiske 2023).
- VSA 2. Very Open Low Woodland to scattered trees over Acacia Open Shrubland and Spinifex Hummock Grassland with occasional acacia thickets and mixed grasses close to drainage lines (Plate 3). Loam soil, occasionally rocky, becoming sandy close to drainage lines. Corresponds to 'granite stony plains' (Mattiske 2023).
- VSA 3. Ephemeral drainage lines crossing VSA 2. Vegetation includes patches of *Eucalyptus victrix* Open Woodland, Melaleuca and Acacia Thickets to Open Shrubland, and areas of Sedgeland. Granite sheets often exposed and soils sandy in watercourse but sandy-loam to loam adjacent (Plate 4).
- VSA 4. Permanent and near-permanent pools with associated riparian vegetation of Cadjeput (*Melaleuca argentea*) and River Gum (*Eucalyptus ?camaldulensis*) Woodland over dense rushes and sedges, including beds of Bulrush *Typha domingensis*). Acacia Shrublands and Thickets adjacent. Pools are fed by a spring above the gorge (Plate 5 and Plate 6). The gorge is a prominent feature with boulders, crevices and rocky ledges (Plate 7). Soils sandy with extensive exposed rock, but loam soils around the spring where water movement is slow.

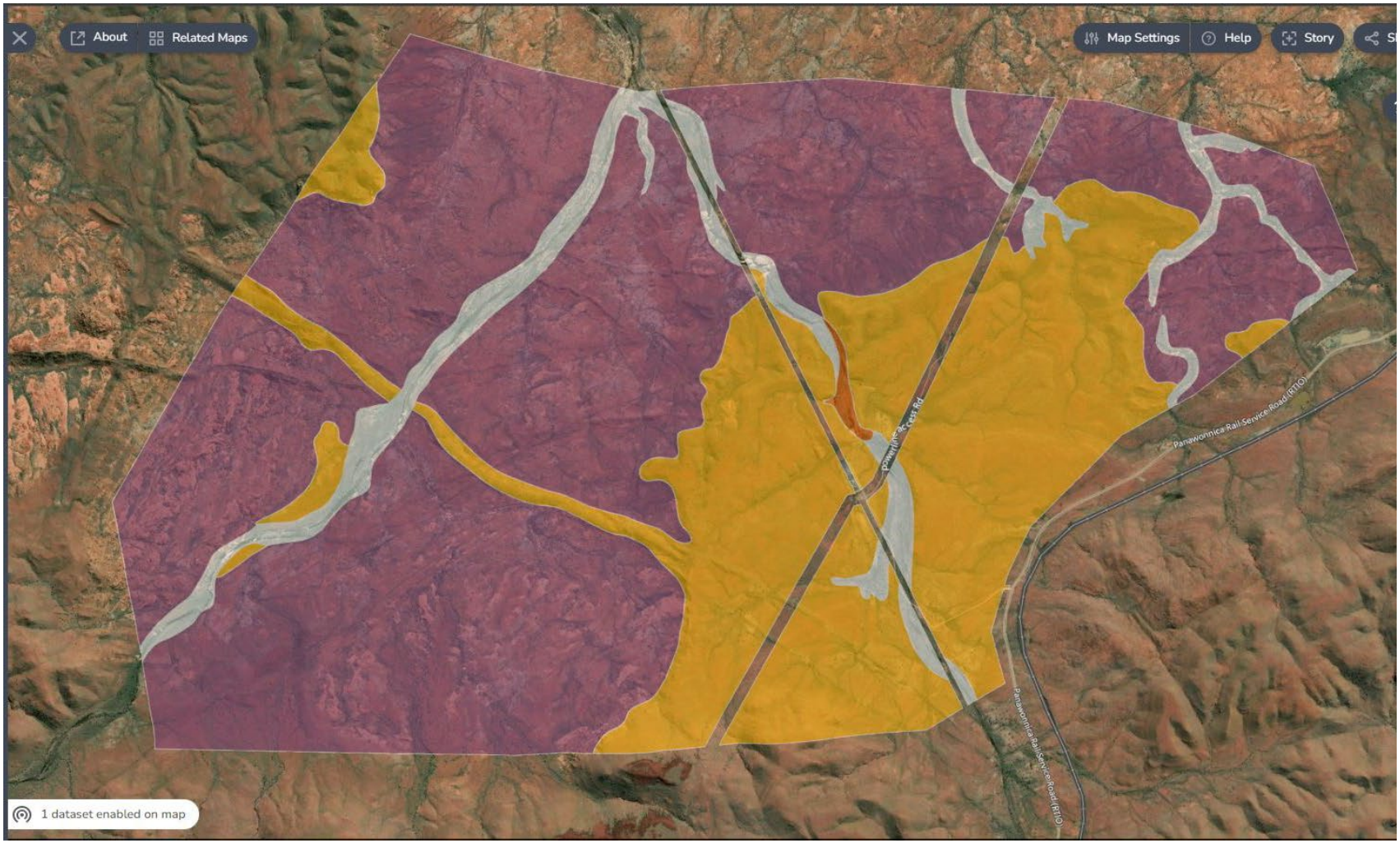


**Figure 3-1. Vegetation types (Mattiske 2023) and VSAs across the project area. Orange = VSA 1; purple = VSA 2; grey = VSA 3; brown = VSA 4.**

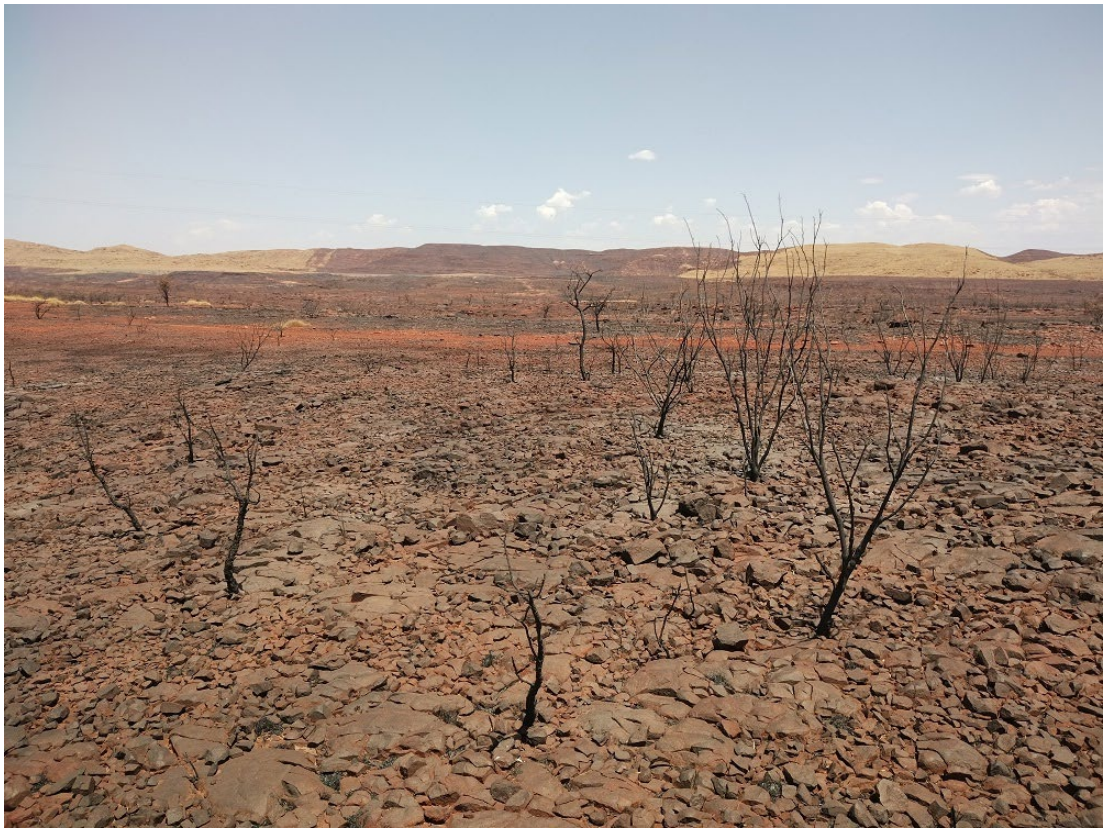

**Plate 1. Top of basalt plateau in east of the area visited during the initial site inspection. VSA 1.**

**Plate 2. Edge of basalt plateau in the east of the area visited during the initial site inspection. VSA 1 with VSA 2 on plain to right.**

**Plate 3. Burnt landscape near transmission station. VSA 2.**

**Plate 4. Granite along creek near north boundary of the area visited during the initial site inspection.**

**Plate 5. Pools at top of spring with patch of Typha burnt by fire.**

**Plate 6. Gorge just below spring. Near-permanent pools present in gorge.**

**Plate 7. Near-permanent pool in gorge with Cadjeput and acacia thicket (burnt).**

## 3.2 Fauna assemblage

### *3.2.1 Overview of vertebrate fauna assemblage*

The desktop assessment identified 224 vertebrate fauna species as potentially occurring in the project area: two fish, six frogs, 62 reptiles, 119 birds, 32 native mammals (including the Mujira (Dingo), considered 'naturalised') and 3 introduced mammals. These species are listed in Appendix 3. The presence of at least 26 expected fauna species (one fish, at least two frogs, five reptiles, 16 birds, and three native mammals) was confirmed during the December 2023 site inspection by either direct observation or due to the presence of evidence such as tracks, shed skin, and scats. An annotated list of these species is presented in Appendix 4 and indicated in Appendix 3. Note that European Cattle are present in the project area (and evidence of this species was observed along major drainage lines) but as this is a domesticated species, it is excluded from the expected species assemblage and instead listed in Appendix 6. The composition of the expected vertebrate fauna assemblage is summarised in Table 3-1.

Six mammal species that would historically have been present in the project area have been omitted from the expected species list because they are considered locally extinct. These species are listed in Appendix 5 and summarised in Table 3-1.

Fifty-seven species returned from databases were omitted due to habitat or range limitations, or because they are domesticated species. These are listed in Appendix 6.

**Table 3-1. Composition of expected vertebrate fauna assemblage of the project area.**

| Taxon | Number of species in each status category | | | | | |
|---|---|---|---|---|---|---|
| | **Total*** | **Resident** | **Regular visitor** | **Irregular visitor** | **Vagrant** | *Extinct or locally extinct* |
| Fish | **2** | 0 | 2 | 0 | 0 | *0* |
| Frogs | **6** | 6 | 0 | 0 | 0 | *0* |
| Reptiles | **62** | 62 | 0 | 0 | 0 | *0* |
| Birds | **119** | 47 | 44 | 20 | 8 | *0* |
| Native mammals[+] | **32** | 21 | 8[+] | 3 | 0 | *6* |
| Introduced mammals | **3** | 2 | 0 | 1 | 0 | *0* |
| **Total** | **224** | **138** | **54** | **24** | **8** | *6* |

[+] Includes the Dingo, considered 'naturalised'

* Extinct or locally extinct species are not included in the number of expected vertebrate fauna species.

### *3.2.2 Expected vertebrate fauna*

Fish

The two fish species are freshwater fishes common in waterways in the region, and both are expected as regular visitors. The Western Rainbowfish was observed during the initial site inspection, in pools at the top of the spring. None of the fish species is of conservation significance. Note that other freshwater fish species known from rivers in the western Pilbara may occasionally be present as distributions are uncertain.

Frogs

The six frog species are all expected to be resident to the project area. During the site inspection, the Jarrarna (Little Red Tree-Frog) and Douglas's Toadlet were heard calling from dense emergent vegetation around pools at the spring. Most of the frog species are likely to disperse widely away from the spring and other drainage systems for part of the year, but will rely on seasonal pools for breeding. Permanent or near-permanent pools that may contain fish are likely to be less important for breeding due to predation risk posed by the fish. For example tadpoles of at least two frogs species were present in pools at the top of the spring (Plate 4), but tadpoles were not present in the larger and probably permanent pools in the gorge (Plate 5). None of the frog species is of conservation significance.

Reptiles

The 62 reptile species include 48 lizards and 14 snakes, and all are expected to be residents. Note that this is effectively a precautionary assessment and means that if a reptile species is considered potentially present in the area, it is likely to be a resident. This is only a moderately rich assemblage

as the lack of sandy soils means that a number of additional species known from the broader region are not likely to be present. During the site inspection, the Marndangatha (Ring-tailed Dragon) was common even in areas that had been burnt intensely, and Garlirrinygaa (Long-nosed Water Dragons) were common around pools at the spring. Three of the expected reptile species are of conservation significance: Bargunyji (Pilbara Olive Python) (CS1), Lined Soil-crevice Skink (CS2) and Gane's Blind Snake (CS2). These species are discussed in more detail in Section 3.2.6.

Birds

The expected bird assemblage of 119 species is moderately rich, with over a third (47 species) expected as residents. The remainder are expected as regular visitors (44 species), irregular visitors (20 species) and vagrants (8 species). The spring and associated vegetation provides habitat for a variety of birds that would otherwise not be expected to use the area, including some waterbirds, and a single Jinbirdiny (Black-fronted Dotterel) was present during the site inspection. During the initial site inspection, sixteen bird species were observed and a large number of all bird observations were made at the spring. Fresh tracks of a Wilumarra (Bush Stone-curlew) were found (Plate 7) indicating that this ground-dwelling species had remained despite the recent fire. Sixteen bird species are of conservation significance: 12 CS1, one CS2 and three CS3. Only two of these (both CS3) are expected as residents, with the majority expected as vagrants (six species) and visitors (six irregular visitors and two regular visitors). Conservation significant birds are discussed in Section 3.2.6.

**Plate 8. Willumarra (Bush Stone-curlew) track observed during initial site inspection.**

Mammals

The mammal assemblage is somewhat incomplete, with six species considered locally extinct, but still relatively rich with a total of 32 native mammals expected, and 21 of these expected as residents. The remaining native species are expected as visitors (eight regular and three irregular). The Mujira (Dingo), expected as a regular visitor, has been included in the native mammals, as it is considered naturalised rather than introduced. Scats of the Yirriwardu (Northern Quoll), Marndanyungu (Euro) and Mujira (Dingo) were observed in the project area during the initial site inspection. Nine native mammals are of conservation significance (three CS1, four CS2 and two CS3) and are discussed in Section 3.2.6.

Three introduced mammals are expected in the project area; two as residents (House Mouse and Feral Cat) and one as an irregular visitor (Red Fox). Evidence of European Cattle was observed along major drainage lines in the project area during the initial site inspection but as this species is domesticated it is not included in the expected vertebrate fauna assemblage which is limited to species present as free-living and wild populations. Despite this, domestic livestock can have an impact on the fauna assemblage. The introduced species may negatively impact native species via predation (particularly the Feral Cat and Red Fox), competition for food and nesting resources, and degradation of habitat via grazing and trampling of vegetation.

Summary

The key features of the fauna assemblage expected in the project area are:

- **Uniqueness:** The fauna assemblage is typical of that expected in this region of Western Australia. The assemblage is likely to be represented elsewhere in the region.
- **Completeness:** The assemblage is likely to be relatively complete for reptiles and birds, and incomplete for mammals, with six mammal species locally extinct. Over a third (38%) of the expected vertebrate fauna assemblage are expected as regular visitors, irregular visitors or vagrants, so will not be present at all times. This is typical of the variability of the fauna assemblage in the region.
- **Richness:** The expected assemblage is likely to be somewhat poor in a regional context, due to the harsh nature of the environments present, the lack of sandy soils and the limited amount of complex structures such as caves, overhangs, etc., that provide shelter for a variety of fauna. The recent fire may have adversely affected the assemblage, but the relationship between fire and fauna assemblage composition is complex.

### *3.2.3 Locally extinct vertebrate fauna*

There are six mammal species that would be expected to be present in the project area but are considered locally extinct (Appendix 6). For these species, the likely causes of local extinction are introduced species (e.g. cats, foxes and possibly domestic livestock) and altered fire regimes.

### *3.2.4 Invertebrate fauna of conservation significance*

The project area sits within DBCA's Pilbara management region (DBCA, 2023c), within which DBCA (2023a) has listed 49 threatened or priority invertebrate fauna. Forty-five species were considered unlikely to be present in the project area based on distance from known populations and/or lack of suitable habitat in the project area and were therefore excluded. These species are shown in Appendix 7. Two of these species, the Garlawirrura (Pilbara Dragonfly (*Antipodogomphus hodgkini*)) and Pilbara Threadtail (Damselfly) (*Nososticta pilbara*), have been recorded within 40 km of the central coordinates used for the database search area; they occur around the Millstream area nearly 40km to the south. Given the presence of a near-permanent stream and seasonal drainage lines, both may be present at least occasionally. The remaining two species are both millipedes: Antichiropus sp. 'DIP007' (Bond's Antichiropus Millipede) and Antichiropus sp. 'DIP008' (Flinder's Antichiropus Millipede). There is limited information on the distribution and habitat preferences of these species, so either one or both may be present, and are likely to favour mesic locations. The spring and surrounding moist soils may be suitable for them. Known records of CS invertebrates within 40 km of the project area (from the DBCA threatened fauna database) are shown on Figure 3-1.

In addition to these listed species, there are records of three isopods that are possible short-range endemic (SRE) invertebrates within 20 km of the central coordinates used for database searches. These are Buddelundia '13', Buddelundia '18' and Buddelundia '20'. Any or all of these could be present, possibly favouring mesic locations such as around the spring.

It should be noted that the ecology and distribution of short-range endemic invertebrates is often poorly understood or documented. Thus there may be undetected SRE species present.

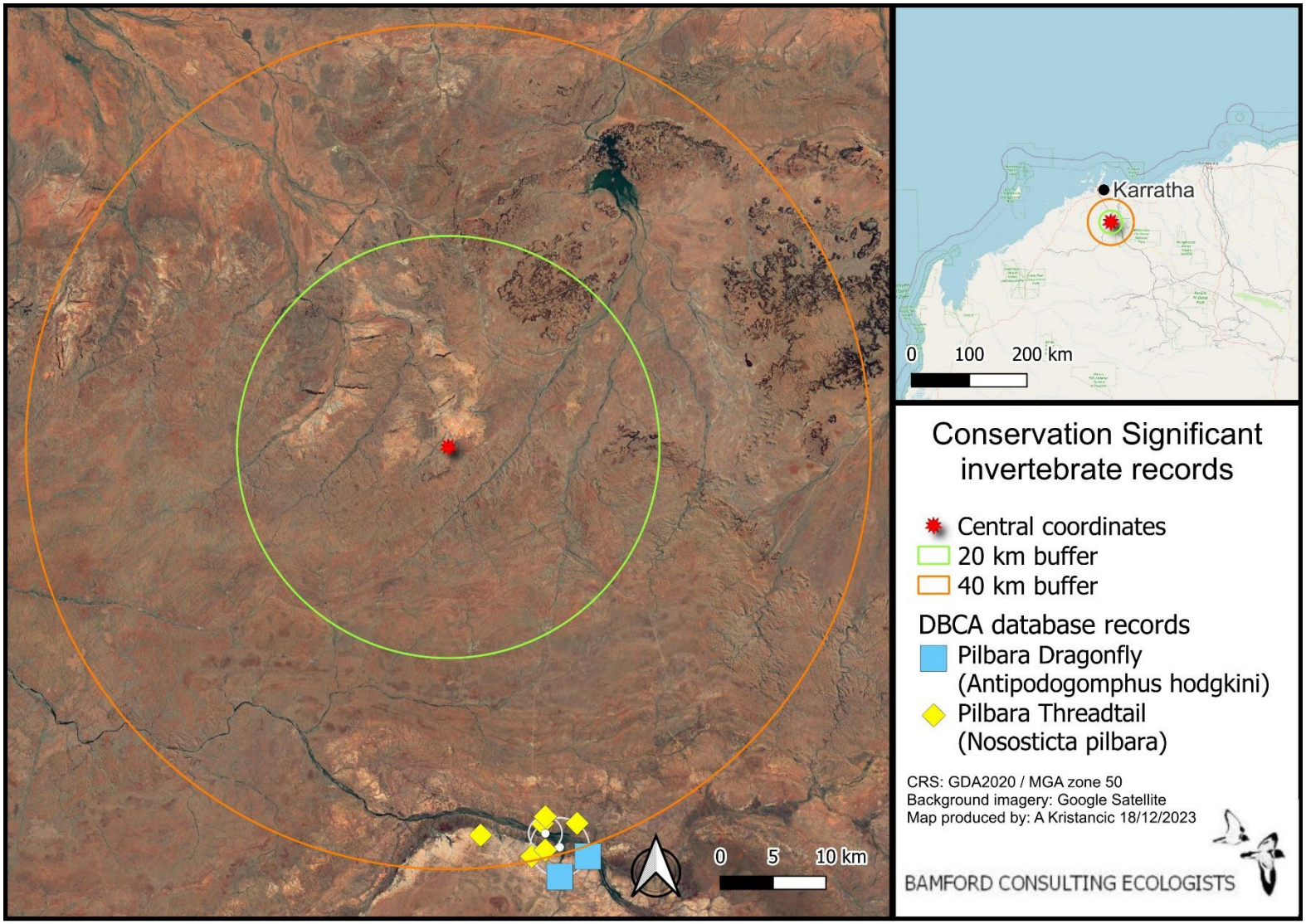


**Figure 3-2. Records of conservation significant invertebrates, from the DBCA threatened and priority fauna database. Point displacement (around a central white dot) has been used to display overlapping records. Records are from DBCA (2023b).**

### *3.2.5 Vertebrate fauna of conservation significance*

Of the 224 species of vertebrate fauna expected to occur in the project area, 28 are considered to be of conservation significance: 16 CS1, seven CS2, and five CS3. A summary of the numbers in each vertebrate class is presented in Table 3-2. These species of conservation significance are indicated in the complete species list (Appendix 3) but are also listed with details of their conservation significance in Table 3-3. The CS1 and CS2 species include three reptiles, 13 birds and seven mammals. Six are expected as residents, four as regular visitors, seven as irregular visitors and six as vagrants. The CS3 species include three birds (two expected as residents and one as an irregular visitor) and two mammals (one expected as a regular visitor and one as an irregular visitor). More details regarding CS species are given under conservation significant species accounts in Section 3.2.5.

Locations of expected CS1 and CS2 species records within 40 km of the central coordinates used for the database search (from the DBCA threatened and priority fauna database) are illustrated in Figure 3-2. In the search area used for the DBCA database, there are records of several CS1 and CS2 species that have been omitted from the expected fauna assemblage; these are shown in Figure 3-3, and reasons for omission are detailed in Appendix 6.

**Table 3-2. The number of conservation significant species in each vertebrate class expected to occur within the project area.**

See Appendix 1 for full explanation of Conservation Significance (CS) levels: CS1 = listed under WA State and/or Commonwealth legislation; CS2 = listed as Priority by DBCA; CS3 = considered locally significant. Locally extinct species not included.

| | | CONSERVATION SIGNIFICANCE | | |
|---|---|---|---|---|
| **CLASS** | **Total** | **CS1** | **CS2** | **CS3** |
| **Fish** | **0** | 0 | 0 | 0 |
| **Frogs** | **0** | 0 | 0 | 0 |
| **Reptiles** | **3** | 1 | 2 | 0 |
| **Birds** | **16** | 12 | 1 | 3 |
| **Mammals** | **9** | 3 | 4 | 2 |
| **Total** | **28** | **16** | **7** | **5** |

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**Table 3-3. Conservation significant fauna species expected to occur within the project area.**

Species are listed in taxonomic order.
CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.
EPBC Act listings: CR = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory (see Appendix 2).
Biodiversity Conservation Act 2016 listings: S1 to S3 = Schedules 1 to 3, D1 to D3 = Divisions 1 to 3 (see Appendix 2).
DBCA Priority species: P1 to P4 = Priority 1 to 4 (see Appendix 2).

| Yindjibarndi Name | Latin Name | Common Name | Status | Expected Occurrence |
|---|---|---|---|---|
| | **REPTILES** | | | |
| Bargunyji | *Liasis olivaceus barroni* | Pilbara Olive Python | CS1 (V, S2D3) | Resident |
| | *Notoscincus butleri* | Lined Soil-Crevice Skink | CS2 (P4) | Resident |
| | *Anilios ganei* | Gane's Blind Snake | CS2 (P1) | Resident |
| | **BIRDS** | | | |
| | *Elanus scriptus* | Letter-winged Kite | CS2 (P4) | Vagrant |
| | *Erythrotriorchis radiatus* | Red Goshawk | CS1 (E, S2D3) | Vagrant |
| | *Apus pacificus* | Fork-tailed Swift | CS1 (M, S1D2) | Irregular visitor |
| | *Cuculus optatus* | Oriental Cuckoo | CS1 (M, S1D2) | Vagrant |
| | *Neochmia ruficauda* | Star Finch | CS3 | Irregular visitor |
| | *Falco hypoleucos* | Grey Falcon | CS1 (V, S2D3) | Regular visitor |
| | *Falco peregrinus* | Peregrine Falcon | CS1 (S1D3) | Regular visitor |
| | *Glareola maldivarum* | Oriental Pratincole | CS1 (M, S1D2) | Irregular visitor |
| | *Hirundo rustica* | Barn Swallow | CS1 (M, S1D2) | Irregular visitor |
| | *Amytornis whitei* | Rufous Grasswren | CS3 | Resident |
| | *Stipiturus ruficeps* | Rufous-crowned Emu-wren | CS3 | Resident |
| | *Motacilla cinerea* | Grey Wagtail | CS1 (M, S1D2) | Vagrant |
| | *Motacilla flava* | Yellow Wagtail | CS1 (M, S1D2) | Vagrant |
| | *Pezoporus occidentalis* | Night Parrot | CS1 (E, S2D1) | Vagrant |
| | *Actitis hypoleucos* | Common Sandpiper | CS1 (M, S1D2) | Irregular visitor |
| | *Tringa glareola* | Wood Sandpiper | CS1 (M, S1D2) | Irregular visitor |
| | **MAMMALS** | | | |
| | Dasycercus blythi | Brush-tailed Mulgara | CS2 (P4) | Irregular visitor |
| Yirriwardu | Dasyurus hallucatus | Northern Quoll | CS1 (E, S2D2) | Resident |
| Wayuwarra | Petrogale rothschildi | Rothschild's Rock-Wallaby | CS3 | Regular visitor |
| | Macroderma gigas | Ghost Bat | CS1 (V, S2D3) | Regular visitor |
| | Hydromys chrysogaster | Water-rat, Rakali | CS2 (P4) | Irregular visitor |
| | Leggadina lakedownensis | Short-tailed Mouse | CS2 (P4) | Resident |
| Gurdi | Pseudomys chapmani | Ngadji or Western Pebble-mound Mouse | CS2 (P4) | Resident |
| Warrgi | Trichosurus vulpecula | Brushtail Possum | CS3 | Irregular visitor |
| | Rhinonicteris aurantia (Pilbara form) | Pilbara Leaf-nosed bat | CS1 (V, S2D3) | Regular visitor |

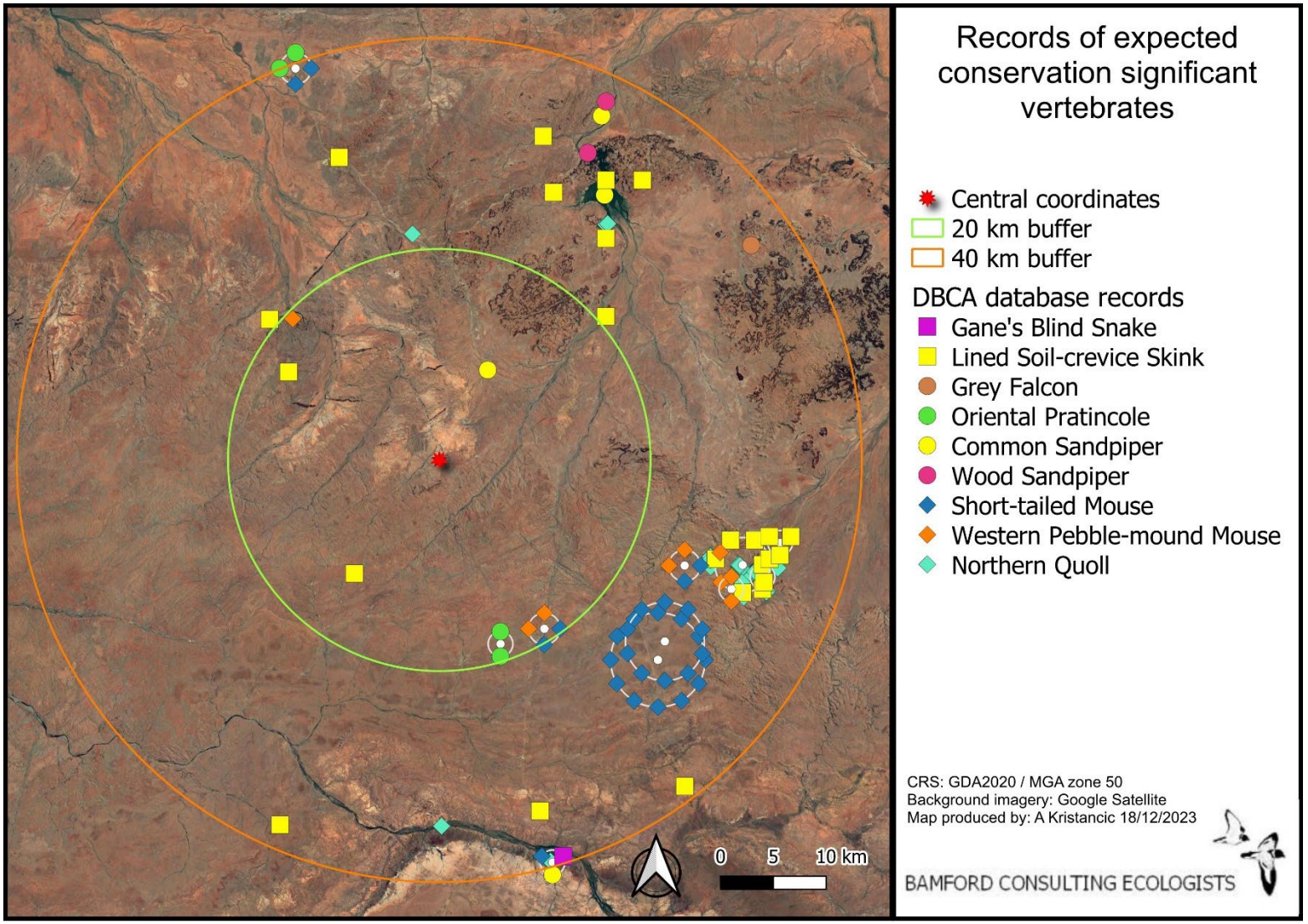


**Figure 3-3. Location of records of expected conservation significant species within the 40 km radius used for the DBCA database search. Point displacement (around a central white dot) has been used to display overlapping records. Records are from DBCA (2023b).**

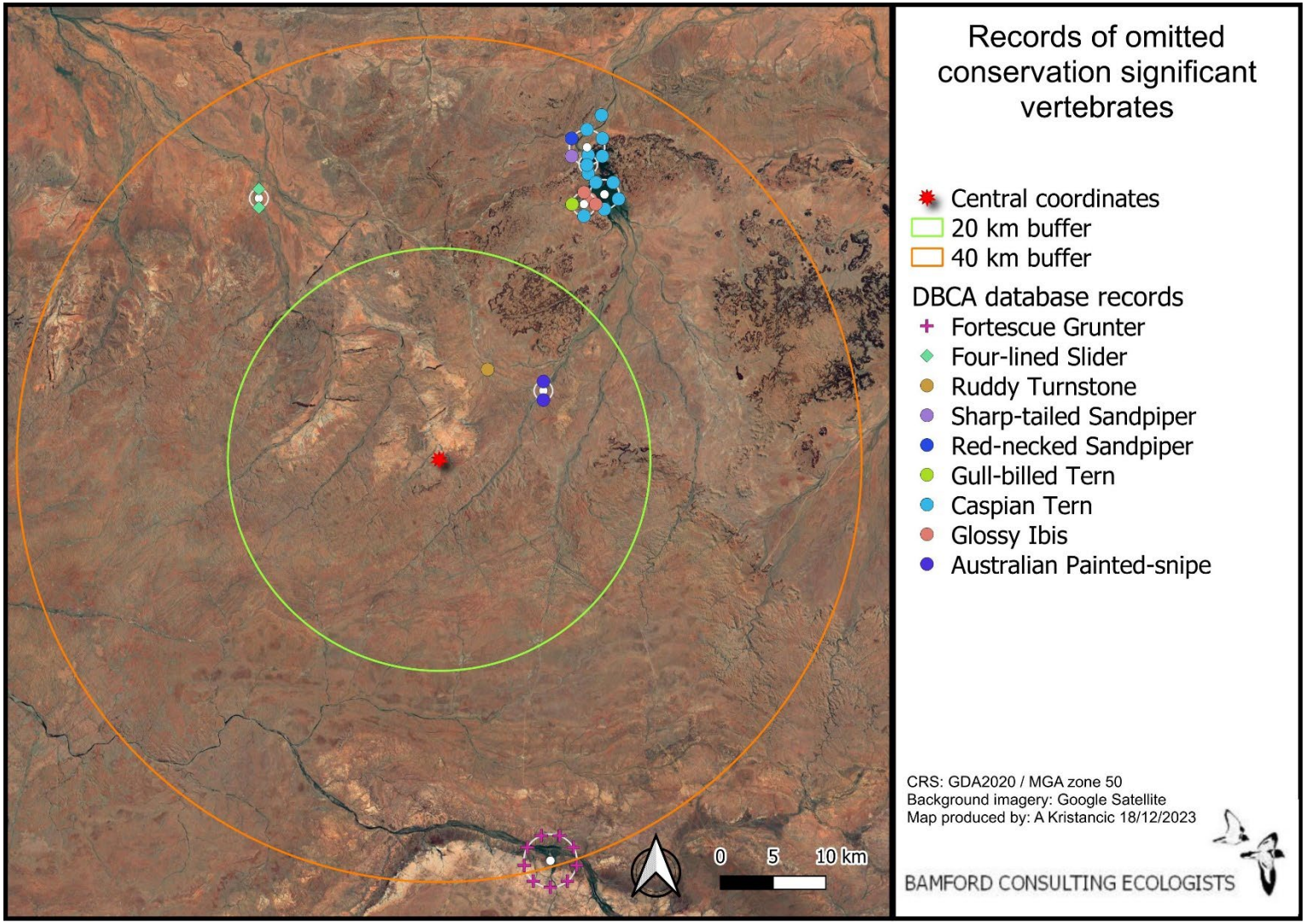


**Figure 3-4. Location of records of omitted conservation significant species within the 40 km radius used for the DBCA database search. Point displacement (around a central white dot) has been used to display overlapping records. Records are from DBCA (2023b).**

### *3.2.6 Conservation significant species accounts*

A list of all conservation significant species expected within the project area is provided in Table 3-3; these comprise three reptiles, 16 birds and nine mammals (see Section 3.2.5). Information on the conservation status, distribution and habitat, salient ecology and expected occurrence within the project area is provided below for all species.

#### *3.2.6.1 Conservation Significance 1*

**Bargunyji (**Pilbara Olive Python) (*Liasis olivaceus barroni*) CS1 (V, S2D3)

Conservation status: Vulnerable under the EBPC Act and Schedule 2 Division 3 under the BC Act.

Distribution and habitat: This subspecies is restricted to ranges within the Pilbara region and Mount Augustus in the Gascoyne and is often recorded near waterholes (Wilson & Swan, 2021). Usually associated with rocky landscapes (Burbidge, 2004; Wilson & Swan, 2021).

Ecology: Usually found in proximity to water, although breeding males and juveniles may disperse widely (Burbidge, 2004). An ambush predator that feeds predominately on mammals and birds (Burbidge, 2004). Probably cathemeral.

Expected occurrence: **Resident.** There are no records within the 40 km radius used for the DBCA database search; this is surprising as there are anecdotal accounts of the species in the Millstream area (<40km to the south). The project area contains suitable habitat in the form of rocky area around the spring and along major drainage lines.

Red Goshawk (*Erythrotriorchis radiatus*) CS1 (EN, S2D3)

Conservation status: Endangered under the EBPC Act and Schedule 2 Division 3 under the BC Act.

Distribution and habitat: A sparsely distributed species that occurs in well-wooded areas (generally not dense or very open habitats) in northern Australia (DCCEEW, 2023e; DERM, 2012; Menkhorst et al., 2017). Birds are usually located adjacent to areas of permanent water (DCCEEW, 2023e; DERM, 2012). In Western Australia the Red Goshawk is restricted to the Kimberley, south to Broome, Gieke Gorge and Carlton Gorge (Johnstone & Storr, 1998), although with a recent record from the Pilbara (Atlas of Living Australia). In the Kimberley, Red Goshawks are most often found in "extensive open forest, open woodlands and riparian vegetation dominated by mature *Eucalyptus tetrodonta*, woollybutt *E. miniata*, and Cadjeputs *Melaleuca leucadendron*" (DERM, 2012). Habitat needs to be open enough for fast attack and manoeuvring in flight, but provide cover for ambushing of prey (DCCEEW, 2023e).

Ecology: A diurnal predator (most active early morning and late afternoon) that predominantly feeds on birds, usually by ambushing prey from concealed perches (DCCEEW, 2023e; Johnstone & Storr, 1998). Mammals, reptiles and insects are occasionally taken (DCCEEW, 2023e; Johnstone & Storr, 1998). Typical of bird-eating raptors, Red Goshawks have large home ranges (up to 200 $km^2$). This species nests in tall stands of trees that are within one kilometre of permanent water, with the nest usually in the tallest and most massive trees (DERM, 2012).

Expected occurrence: **Vagrant.** There are no records within the 40 km radius used for the DBCA database search. The project area is well south of the documented breeding range of the species. It is possible that individual birds may be present very occasionally during juvenile dispersal or non-breeding migration (DCCEEW, 2023a).

Fork-tailed Swift (*Apus pacificus*) CS1 (M, S1D2)

Conservation status: Migratory under the EPBC Act and Schedule 1 Division 2 under the BC Act.

Distribution and habitat: The swift is a largely aerial species of unpredictable occurrence in Western Australia. There are scattered records from the south coast, widespread in coastal and subcoastal areas between Augusta and Carnarvon, scattered along the coast from south-west Pilbara to the north and east Kimberley region. Sparsely scattered inland records, especially in the Wheatbelt, but more common in the north and north-west Gascoyne Region, north through much of the Pilbara Region, and the south and east Kimberley (DCCEEW, 2023c; Higgins, 1999). Aerial, usually flying from as low as one metre to more than 300 m above the ground.

Ecology: A diurnal, aerial insectivore, this species often forages along the edge of low pressure systems in flocks of ten to 1000 birds (DCCEEW, 2023c; Higgins, 1999). Breeds in Siberia (April to July) and spends the non-breeding season (October to mid-April) in Australia. Being aerial, it is effectively independent of terrestrial ecosystems when in Australia.

Expected occurrence: **Irregular visitor.** There are no records within the 40 km radius used for the DBCA database search. Individuals may fly over the project area but are unlikely to utilise it.

Oriental Cuckoo (*Cuculus optatus*) CS1 (M, S1D2)

Conservation status: Migratory under the EPBC Act and Schedule 1 Division 2 under the BC Act.

Distribution and habitat: A migrant to northern and east-coast Australia, the Oriental Cuckoo favours areas of dense vegetation including riverside forests, rainforests, vine thickets and mangroves (Johnstone & Storr, 1998) but will also inhabit open woodlands and gardens (Menkhorst et al., 2017). In Western Australia its occurrence is scarce and largely limited to the Kimberley region (Johnstone & Storr, 1998).

Ecology: A diurnal insectivore, this species has a preference for caterpillars (Menkhorst *et al.*, 2017). Oriental Cuckoos are non-breeding migrants (from northern Asia) to Australia between September and May, although most birds are observed from November to March (Menkhorst *et al*., 2017).

Expected occurrence: **Vagrant.** There are no records within the 40 km radius used for the DBCA database search. The project area is south of the expected distribution, and does not provide the species' favoured habitats of riverside forests, rainforests, vine thickets and mangroves (Johnstone & Storr, 1998). It is broadly considered a vagrant in the Pilbara.

Grey Falcon (*Falco hypoleucos*) CS1 (V, S2D3)

Conservation status: Vulnerable under the EPBC Act and Schedule 2 Division 3 under the BC Act.

Distribution and habitat: Sparsely distributed through central, northern and north-western Australia, this species appears to have a distribution that is centred around wooded ephemeral or permanent drainage lines (Shoenjahn, 2013).

Ecology: An aerial, diurnal predator that predominantly forages on pigeons and parrots, although may also take invertebrates, reptiles and small mammals (Debus, 2019). Resident when seasonal conditions are favourable, nomadic in times of drought (Debus, 2019).

Expected occurrence: **Regular visitor.** There is one record within the 40 km radius used for DBCA database search. The species is expected to visit the project area regularly, particularly in environments associated with drainage lines. However, the drainage lines lack the sort of very large trees with which the species is often associated, particularly for breeding.

Peregrine Falcon (*Falco peregrinus*) CS1 (S1D3)

Conservation status: Schedule 1 Division 3 under the BC Act.

Distribution and habitat: More or less cosmopolitan throughout Australia (Menkhorst *et al.* 2017). This species occurs in a variety of habitats but is usually reliant on cliff faces or tall trees for nesting (Debus, 2019).

Ecology: A highly adept aerial predator that predominantly forages on birds, although will also occasionally take invertebrates, fish, reptiles and mammals (Debus, 2019). Mostly diurnal or crepuscular.

Expected occurrence: **Regular visitor.** There are no records within the 40 km radius used for the DBCA database search, likely due to the fact that this species is not common (but is widespread) (Western Australian Museum, 2019). The project area is likely to be within the home range of a pair but does not contain suitable nesting sites (such as tall trees or cliff faces).

Oriental Pratincole (*Glareola maldivarum*) CS1 (M,S1D2)

Conservation status: Migratory under the EPBC Act and Schedule 1 Division 2 under the BC Act.

Distribution and habitat: A non-breeding visitor to Australia, present largely from October to April, and most common on northern dry floodplains and grasslands. Not associated with wetlands or coastlines except sometimes for roosting. Occasionally roosts in very large flocks on plains and coastlines (Marchant & Higgins, 1993). The birds that visit Australia are from the east Asian breeding population and only two sites of international importance are identified in Australia, with both on the coast in the western Kimberley (Bamford et al., 2008).

Ecology: Feeds terrestrially on insects and seeds, usually across dry grasslands; will occasionally hawk for flying insects. Aerial foraging can occur over any vegetation type (Marchant and Higgins 1993).

Expected occurrence: **Irregular visitor.** There are two records within the 40 km radius used for the DBCA database search. Likely to occur only occasionally and in small numbers as there is limited extent of open grasslands within the project area or nearby. As noted above, however, aerial feeding aggregations can occur over any vegetation type when food is available. Areas degraded by cattle may be attractive to the species.

Barn Swallow (*Hirundo rustica*) CS1 (M, S1D2)

Conservation status: Migratory under the EPBC Act and Schedule 1 Division 2 under the BC Act.

Distribution and habitat: A northern hemisphere species that reaches northern Australia in small numbers in summer each year, and often seems to congregate around towns (M. Bamford pers. obs.).

Ecology: An aerial insectivore that forages over a range of environments but is often seen close to water and built structures.

Expected occurrence: **Irregular visitor.** There are no records within the 40 km radius used for the DBCA database search. Most Pilbara observations appear to be in towns, particularly Onslow (M. Bamford pers. obs.)

Yellow Wagtail (*Motacilla flava*) and Grey Wagtail (*Motacilla cinerea*) CS1 (M, S1D2)

Conservation status: Migratory under the EPBC Act and Schedule 1 Division 2 under the BC Act.

Distribution and habitat: Both species breed in Asia/Siberia and small numbers may migrate as far south as northern Australia in the non-breeding season, generally confined to coastal areas (Johnstone & Storr, 2005; Menkhorst et al., 2017). The Yellow Wagtail is considered to be the more common of the two in Australia (Menkhorst et al., 2017). Both species are associated with wetland habitats: the Yellow Wagtail being more diverse in its choice of habitats (open, moist grassy areas; sewage ponds; bare ground; beaches), and the Grey Wagtail being restricted to fast-flowing rocky waterways (Johnstone & Storr, 2005; Menkhorst et al., 2017).

Ecology: Diurnal insectivores (Johnstone & Storr, 2005; Menkhorst et al., 2017). These migrants may be present in Australia between October and April (Johnstone & Storr, 2005; Menkhorst et al., 2017).

Expected occurrence: **Vagrants.** There are no records of either species within the 40 km radius used for the DBCA database search and both are considered vagrants in the Pilbara. Both species are generally confined to near-coastal regions when in Australia and are closely associated with wetland habitats. The project area thus lacks habitat for species that are not expected to occur regularly within the greater region.

Night Parrot (*Pezoporus occidentalis*) CS1 (E, S2D1)

Conservation status: Endangered under the EBPC Act and Schedule 2 Division 1 under the BC Act.

Distribution and habitat: Highly elusive and known from only a very small number of records, it is difficult to ascertain the distribution and habitat of this species. DCCEEW (2023g) lists central Western Australia, north-eastern South Australia and south-western Queensland as 'core' areas, although the Night Parrot may occur throughout any part of inland Australia. Habitat associations are also tenuous but the species may occur in areas of spinifex grassland and/or chenopod shrublands, or in areas of shrubby samphire (TSSC, 2016b).

Ecology: The Night Parrot was recorded more or less regularly through the late 19$^{th}$ Century but appeared to decline early in the 20$^{th}$ Century, with a lack of reliable records from the 1930s to the end of the century leading to some speculation that it was extinct. In the early 20$^{th}$ Century, however, there have been multiple records including in the eastern Pilbara, northern Murchison and western deserts of Western Australia (Davis & Metcalf, 2008; Hamilton et al., 2017; Jackett et al., 2017), and a population has been studied in south-western Queensland since 2013 (DCCEEW, 2023g). The species has been mired in controversy due to the implications of records close to development proposals, and after researchers falsified recordings and subsequently retracted recent Night Parrot records from South Australia (A. Jones et al., 2019). It is likely to be predominantly nocturnal and granivorous.

Expected occurrence: **Vagrant.** There are no records within the 40 km radius used for the DBCA database search. The project area is within the medium priority area for Night Parrot survey (Department of Parks and Wildlife, 2017). Following the recent fire (spring 2023) it lacks dense old spinifex that provides shelter, and it also lacks the species rich grasslands and herbfields favoured for foraging (Department of Parks and Wildlife, 2017).

Yirriwardu (Northern Quoll) (*Dasyurus hallucatus*) CS1 (EN,S2D2)

Conservation status: Endangered under the EBPC Act and Schedule 2 Division 2 under the BC Act.

Distribution and habitat: Oten associated with rocky areas in the Pilbara (but also occurs along watercourses and beaches), and occurs through forests, savannahs and dissected rocky environments in the Kimberley (Van Dyck and Strahan 2008; DAWE 2020d). It also occurs, patchily, across northern Australia to Queensland (Van Dyck and Strahan 2008; DAWE 2020d). This species formerly occurred across much of northern Australia, from the Pilbara to south-east Queensland, but now only occurs in a number of fragmented populations across its former range, largely due to poisoning by Cane Toads.

Ecology: A predominantly nocturnal predator of invertebrates, amphibians, reptiles, birds and small mammals (Van Dyck and Strahan 2008). Northern Quoll are both terrestrial and arboreal (Van Dyck and Strahan 2008). This species undergoes a partial post-breeding male-die off (semelparity), with most individuals (including females) only surviving for one or two breeding seasons (Van Dyck and Strahan 2008).

Expected occurrence: **Resident.** The species is known from the region, with a large number of records (more than 200) within the 40 km radius used for the DBCA database search. The majority of these records are from an area about 30 km from the central coordinates used for the database searches. Most of the landscape within the area assessed during the initial site visit provides limited rocky shelter, but there is some in the form of overhangs around the spring, and amongst granite boulders along drainage lines. During the initial site visit in December 2023, Northern Quoll scats were observed at several locations along major drainage lines, including at the spring. Locations were: 50K,497386mE,7651177mN and 50K,496773mE,7651954mN. The species is likely to be resident, but the recent fire may cause a temporary decline in population size and even short-term disappearance until vegetation regenerates post-fire.

Ghost Bat (*Macroderma gigas*) CS1 (VU, S2D3)

Conservation status: Vulnerable under the EBPC Act and Schedule 2 Division 3 under the BC Act.

Distribution and habitat: The species' current range is discontinuous, with distinct colonies in the Pilbara and the Kimberley (including several islands) of Western Australia, as well as in other locations across the north of Australia (TSSC, 2016a). Colonies are geographically isolated and genetically distinct; with the Kimberley bats being considered distinct from all other Australian populations of Ghost Bats (TSSC, 2016a). Gene flow within regions is primarily due to movement of male Ghost Bats. Permanent roost sites are usually deep natural caves or disused mines with a stable temperature between 23-28°C and moderate to high humidity (50-100%) (TSSC, 2016a).

Ecology: A nocturnal carnivore with a broad diet encompassing small mammals, birds, reptiles, frogs and large insects (TSSC, 2016a). The main threat to Ghost Bats is habitat loss and degradation due to mining activities, and the geographic and genetic isolation of each subpopulation suggests that an area will not be recolonised if a population becomes locally extinct (TSSC, 2016a). Genetic studies indicate that females remain in or return to their place of birth, and significant impacts to sites containing breeding females are of particular concern as loss of these sites may significantly reduce the population size (TSSC, 2016a).

Expected occurrence: **Regular visitor.** There are no records within the 40 km radius used for the DBCA database search, but this lack of records most likely reflects lack of survey effort in this area. There is very limited shelter habitat (caves) in the project area, but during travel to the Ngarrawaana Community, it was noted that the landscape consisted of abrupt rocky hills with a high likelihood of caves. Therefore, the species may be resident towards Ngarrawaana and individuals could visit the project for foraging on a regular basis.

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* (Pilbara)) CS1 (V, S2D3)

Conservation status: Vulnerable under the EBPC Act and Schedule 2 Division 3 under the BC Act.

Distribution and habitat: The Pilbara Leaf-nosed Bat occurs within the Pilbara where it is limited by the availability of very hot (28-32 °C) and very humid (96-100%) roost sites in caves and/or abandoned mine voids (Armstrong, 2001; Van Dyck & Strahan, 2008). There are also populations of the non-Pilbara form of the Orange Leaf-nosed Bat (*R. aurantia*) in the Kimberley and Northern Territory (Van Dyck & Strahan, 2008).

Ecology: A nocturnal, aerial insectivore (DCCEEW, 2023b).

Expected occurrence: **Regular visitor.** There are no records within the 40 km radius used for the DBCA database search, but this lack of records most likely reflects lack of survey effort in this area. There is very limited shelter habitat (caves) in the project area, but during travel to the Ngarrawaana Community, it was noted that the landscape consisted of abrupt rocky hills with a high likelihood of caves. Therefore, the species may be resident towards Ngarrawaana and individuals could visit the project for foraging on a regular basis.

#### *3.2.6.2 Conservation Significance 2*

Lined Soil-crevice Skink *(Notoscincus butleri)* CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA. It has a somewhat limited distribution and is believed to be threatened by altered fire regimes and invasive Buffel grass.

Distribution and habitat: Once thought to be restricted to coastal areas between Karratha and Port Hedland, it is more widespread than originally thought, encompassing most of the western Pilbara from Dampier Peninsula, Pannawonica and Karijini National Park. This species is associated with spinifex-dominated areas near creek and river margins in arid, rocky areas (Wilson & Swan, 2021).

Ecology: A species that forages in leaf litter and feeds on invertebrates.

Expected occurrence: **Resident.** This species is known from the region, with 24 records within the 40 km radius used for the DBCA database search, and is therefore assumed to be resident in the project area on a precautionary basis. Areas of sandy soils close to drainage lines on the plains may provide suitable habitat.

Gane's Blind-Snake (Pilbara) *(Anilios ganei)* CS2 (P1)

Conservation status: Listed as Priority 1 by DBCA.

Distribution and habitat: A fossorial snake with a patchy and poorly documented distribution from Newman to Pannawonica, and thought to be associated with moist soils of gorges and gullies (Wilson & Swan, 2021).

Ecology: Burrows in soil and leaf mould and probably feeds mainly on ant larvae and pupae (like most blind-snakes).

Expected occurrence: **Resident.** There is one record about 40 km from the central coordinates used for database searches. This species is presumed to be resident on a precautionary basis. If present, it is probably restricted to the major drainage lines.

Letter-winged Kite (*Elanus scriptus*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: This species' core range is arid inland and northern Australia but it may be a casual occupier of other parts when suitable seasonal conditions prevail (Johnstone & Storr, 1998; Menkhorst et al., 2017). Prefers open country and grasslands (Menkhorst et al., 2017).

Ecology: A crepuscular or nocturnal predator, mostly targeting smaller mammals such as rodents(Johnstone & Storr, 1998; Menkhorst et al., 2017). It is a boom-bust species that will move and breed opportunistically in response to rainfall events, and coincident prey-population increases(Menkhorst et al., 2017). The Letter-winged Kite roosts communally, during the day, in leafy trees (Menkhorst et al., 2017).

Expected occurrence: **Vagrant.** There are no records within the 40 km radius used for the DBCA database search.

Brush-tailed Mulgara (*Dasycercus blythi*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: Pilbara and inland, central Western Australia, as well as central Australia (southern Northern Territory and northern South Australia). This species is often compared with its congener, the Crest-tailed Mulgara (*D. cristicauda*), as the two are sympatric over parts of their range (Van Dyck & Strahan, 2008). In general, the Brush-tailed Mulgara is less closely associated with the dune fields than the Crest-tailed Mulgara (Woolley et al., 2013). Where the two co-occur, the Crest-tailed Mulgara is restricted to sandridges with an understorey dominated by spinifex (*Triodia*), whereas the Brush-tailed Mulgara occupies sand plain and gibber plain (Pavey et al., 2011).

Ecology: A nocturnal predator, the Brush-tailed Mulgara is among the largest native predatory mammals remaining in Australia's deserts (Pavey et al., 2011). Its main prey include rodents, other dasyurid marsupials, reptiles, small birds and a wide range of invertebrate taxa (Pavey et al., 2011). Generally solitary (Van Dyck & Strahan, 2008). This species constructs characteristic burrows for shelter (Triggs, 1996; Van Dyck & Strahan, 2008).

Expected occurrence: **Irregular visitor.** There are no records within the 40 km radius used for the DBCA database search, probably due to lack of survey effort in this region. However, suitable habitat (extensive sandy soils supporting spinifex) may be limiting. Assuming that the species does occur in the region, it can be expected to be an irregular visitor in the project area that provides limited suitable habitat.

Water-rat, Rakali (*Hydromys chrysogaster*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: Generally occurs in the vicinity of permanent fresh or brackish water sources (including lakes, rivers, swamps, mangroves and beaches) throughout much of Australia, with the exception of inland/central Western Australia, Northern Territory, South Australia and New South Wales (Van Dyck & Strahan, 2008). In the south of Western Australia Water-rats preferentially use wetland habitats characterised by dense, low-lying vegetation, low-density canopy cover and shallow, narrow water bodies (Speldewinde et al., 2013). Within the greater Perth area, Water-rats occurred in association with high value habitat quality characteristics such as high bank stability, habitat diversity, stream cover and foreshore vegetation (Smart et al., 2011).

Ecology: While most active around sunset (crepuscular), Water-rats are also known to forage during the day (Van Dyck & Strahan, 2008). They are generally carnivorous, feeding on aquatic invertebrates, fish and also terrestrial mammals, including birds but may also browse on plant material (Van Dyck & Strahan, 2008).

Expected occurrence: **Irregular visitor.** There are no records within the 40 km radius used for the DBCA database search. Despite this, the drainage systems do provide suitable habitat, although a status of 'Vagrant' may be more suited.

Short-tailed Mouse, Lakeland Downs Mouse (*Leggadina lakedownensis*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: Northern Pilbara through the Kimberley and into northern Australia (Van Dyck & Strahan, 2008), inhabiting a range of environments including spinifex and tussock grasslands, samphire and sedgelands, *Acacia* shrublands, tropical *Eucalyptus* and *Melaleuca* woodlands, and stony ranges(Van Dyck & Strahan, 2008). Usually associated with areas that are seasonally inundated on red or white sandy-clay soils (Van Dyck & Strahan, 2008).

Ecology: Nocturnal and solitary, the Short-tailed Mouse feeds predominately on invertebrates but may supplement its diet with plant material (Van Dyck & Strahan, 2008). Populations of the Short-tailed Mouse appear to fluctuate dramatically, probably in response to environmental conditions and food availability.

Expected occurrence: **Resident.** There are 29 records within the 40 km radius used for the DBCA database search. The majority of these records are from an area c. 28 km from the central coordinates used for the database searches. There may be suitable habitat associated with heavy soils along drainage lines. Extreme population fluctuations mean that the species can be undetectable for long periods even when present.

**Gurdi;** Ngadji or Western Pebble-mound Mouse (*Pseudomys chapmani*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: This species is found through much of the Pilbara and prefers rocky soils in grassland and *Acacia* woodland.

Ecology: The Western Pebble-mound Mouse lives in groups in burrows surrounded by mounds of pebbles. Mounds are typically found on low gravelly and stony rises.

Expected occurrence: **Resident.** There are 9 records within c. 30 km of the central coordinates used for the DBCA database search. Some of the landscape appeared suitable (low, gravelly rises) but no mounds were found during the site inspection. More extensive ground-surveys would be required to confirm the presence of the species, or to be confident that it is absent.

#### *3.2.6.3 Conservation Significance 3*

Star Finch (*Neochmia ruficauda*) CS3 (LS)

Conservation status: This species is patchily distributed and was formerly listed as priority by DBCA.

Distribution and habitat: Distributed patchily from the Pilbara to north-eastern Queensland. Its preferred habitat is grasslands associated with drainage systems. Usually seen in flocks close to dense vegetation and even rushes.

Ecology: A granivore that often feeds on the ground along the margins of riparian grasslands and shrublands.

Expected occurrence: **Irregular visitor**. Some suitable habitat appeared to be present along drainage lines, but all had been recently-burnt.

Rufous Grasswren (*Amytornis whitei*)* and Rufous-crowned Emu-wren (*Stipiturus ruficeps*) CS3 (LS)

* formerly a sub-species of Striated Grasswren (*Amytornis striatus whitei*)

Conservation status: These species are patchily distributed in the Pilbara and often associated with long-unburnt spinifex.

Distribution and habitat: Both species prefer tall, dense unburnt spinifex on plains and rocky hills.

Ecology: Insectivorous and granivorous, both species are secretive and stay close to cover.

Expected occurrence: **Residents**. The recent fire may have displaced birds that would normally be present in the project area, but they are expected to persist nearby with unburnt landscapes just to the south.

Wayuwarru (Rothschild's Rock-Wallaby) (*Petrogale rothschildi*) CS3 (LS)

Conservation status: This species is considered locally significant due to its restricted distribution.

Distribution and habitat: Distributed patchily in the Pilbara region. Its preferred habitat is rocky hills.

Ecology: A nocturnal herbivore which prefers to shelter in caves and rocky outcrops during the day but may forage away from rocky hills at night.

Expected occurrence: **Regular visitor.** There is limited suitable habitat but individuals may regularly disperse through the area as suitable habitat occurs particularly to the south.

**Warrgi;** Brush-tailed Possum (*Trichosurus vulpecula*) CS3 (LS)

Conservation status: This species is considered locally significant as it is recorded infrequently in the Pilbara (Anderson et al., in prep). It has declined throughout its range in Western Australia. The taxonomic affinities of Brush-tailed Possums in the Pilbara are uncertain; the northern sub-species (*T. vulpecula arnhemensis*) of the Kimberley is considered Vulnerable (EPBC Act) and Schedule 3 (BC Act).

Distribution and habitat: Formerly distributed across almost the whole of Australia, the Brush-tailed Possum's range has now been reduced in Western Australia to the south-west, the Kimberley and an isolated population within the north-western Pilbara, including offshore islands (Van Dyck & Strahan, 2008). There may be other outlying Pilbara records (M. Bamford, pers. obs). It occurs in a wide variety of environments that usually encompass trees, including forests, woodlands, riparian zones and urban areas, but it also persists in treeless landscapes such as Barrow Island (Van Dyck & Strahan, 2008) (Van Dyck and Strahan 2008). The Robe Valley area (south of Pannawonica) appears to be a possible stronghold for the Pilbara population (Anderson et al., in prep).

Ecology: A nocturnal herbivore, its preferred diet is predominantly leaves, flowers and fruits (Van Dyck & Strahan, 2008).

Expected occurrence: **Irregular visitor.** The project area has limited suitable habitat (such as drainage systems lined with trees and thickets) but the species is known from the broader region.

## 3.3 Patterns of biodiversity

While patterns of biodiversity have not been studied in detail, and indeed are beyond the reach even of detailed surveys, some patterns can be interpreted based on the landscape and VSAs. Drainage lines, the spring and the small rocky gorge around the spring are likely to support species that would not otherwise be present, and a permanent water source can affect the abundance and movement pattern of a range of fauna species. The structure of the spring even meant that while fish were present in the lower pools, they were absent from the upper pools and thus tadpoles were present in these. The majority of bird observations made during the site inspection were around the spring and the gorge, emphasising the value of this area as a refugium during hot conditions, and following the fire. The very shallow, rocky soils across much of the landscape may also affect patterns of biodiversity, with rocky slopes providing micro-habitat and shelter.

## 3.4 Ecological processes

The landscape in the project area is continuous with very little degradation or weed invasion. The current fauna assemblage is likely to be affected by:

- Fire regime. Almost entire area recently burnt, and fires are likely to be too frequent and too extensive, resulting in the decline in abundance and possible disappearance of some sensitive species.
- Landscape patterns, with strong linear features in the form of drainage lines and some geological features affecting landscape permeability for some species. For example, areas of loose rock tend to be found along the upper slopes of valleys within VSA 1, and these may facilitate movement of fauna across the landscape.
- The presence of feral species. Cattle may be causing some damage as they forage along drainage lines and some trampling was observed around the spring. The Feral Cat is likely to be present.
- Hydrology, with a small spring an important feature for the fauna assemblage.

These ecological processes help identify some of the vulnerabilities of the fauna assemblage to impacts and change wrought be development.

## 3.5 Summary of fauna values

Landscape and VSAs. The project area encompasses rocky hills to undulating stony plains with a major watercourse in the centre starting at a permanent or near-permanent spring, and a second major watercourse in the west, with both running north and uniting just outside the northern boundary. Vegetation is broadly low, open to sparse woodland over sparse shrubland with occasional thickets, over spinifex hummock grassland, but was difficult to define due to a recent fire. However, vegetation types had been described by Mattiske (2023) before the fire. Four VSAs were identified:

- VSA 1. Acacia Open Shrubland over Spinifex Hummock Grassland on undulating rocky hills. Shallow loam soil and very rocky.
- VSA 2. Very Open Low Woodland to scattered trees over Acacia Open Shrubland and Spinifex Hummock Grassland with occasional acacia thickets and mixed grasses close to drainage lines. Loam soil, occasionally rocky, becoming sandy close to drainage lines.
- VSA 3. Ephemeral drainage lines crossing VSA 2. Vegetation includes patches of *Eucalyptus victrix* Open Woodland, Melaleuca and Acacia Thickets to Open Shrubland, and areas of Sedgeland. Granite sheets often exposed and soils sandy in watercourse but sandy-loam to loam adjacent.
- VSA 4. Permanent and near-permanent pools with associated riparian vegetation of Cadjeput (*Melaleuca argentea*) and River Gum (*Eucalyptus ?camaldulensis*) Woodland over dense rushes and sedges, including beds of Bulrush *Typha domingensis*). Acacia Shrublands and Thickets adjacent. Pools lie within a distinctive rocky gorge.

Fauna assemblage. The desktop assessment identified 224 vertebrate fauna species as potentially occurring in the project area: two fish, six frogs, 62 reptiles, 119 birds, 32 native mammals (including the Dingo, considered 'naturalised') and 3 introduced mammals. Six mammal species that would historically have been present in the project area have been omitted from the expected species list because they are considered locally extinct.

The fauna assemblage is typical of that expected in this region of Western Australia and is likely to be represented elsewhere in similar landscapes nearby. It is only moderately rich in a regional context due to the virtual absence of sandplains and strongly rocky landscapes which provide habitat for a number of species not expected to be present. The assemblage is expected to be intact except for some extinct mammal species. Over a third (38%) of the expected vertebrate fauna assemblage are expected as regular visitors, irregular visitors or vagrants, so will not be present at all times.

Species of conservation significance. Twenty-eight vertebrate species that are listed under state or federal *Acts* or publications are expected to occur in the project area: 16 CS1, seven CS2, and five CS3 species. Nearly half the conservation significant species are expected only as irregular visitors or vagrants, and just six species are expected as residents. Of particular interest as being likely to be residents are the Yirriwardu (Northern Quoll) (recorded near the spring during the site inspection) and the Bargunyji (Pilbara Olive Python) (not recorded but the spring and nearby drainage line provide suitable habitat). Several conservation significant invertebrate species may also be present, with the spring potentially providing habitat for the Garlawirrura (Pilbara Dragonfly) and Pilbara Threadtail (Damselfly), and the spring area also possibly providing the sort of mesic environment favoured by several potential SRE invertebrates.

Patterns of biodiversity. Patterns of biodiversity have not been studied in detail, but can be interpreted from the landscape. The spring and associated gorge is a distinctive feature likely to support many species that would not otherwise be present, and also affecting the abundance of a range of species not wholly reliant on these features. The spring, gorge and associated vegetation are therefore a locally significant feature for fauna. Across the broader landscape, small areas of rocks may provide shelter.

Ecological processes. Important ecological processes affecting the fauna assemblage include the fire regime, the presence of strong linear landscape features, the presence of feral species and the presence of a permanent or near-permanent spring, a feature of the local hydrology. These ecological processes help identify some of the vulnerabilities of the fauna assemblage to impacts and change wrought be development.

# 4 Conclusions

The preliminary fauna assessment has identified several fauna species of significance in the area, and several features of the landscape that are important for the fauna assemblage.

The Northern Quoll is present and may be resident, although the recent fire may result in a decline and even short-term disappearance from the site. It is likely to rely heavily on the gorge around the spring and on the rocky landscapes along watercourses in general for shelter/denning, but to forage across adjacent landscapes. Other drainage systems and slightly rocky areas such as on the upper slopes of valleys in VSA 1 may provide some denning habitat and may be important for dispersal. Protecting denning areas and providing protected buffers of adjacent landscapes would allow the Northern Quoll to persist and would also protecting other important features and functions, such as connectivity for a range of fauna species.

The Pilbara Olive Python is likely to be present and would favour the spring and gorge, with dispersal along other drainage lines and possibly more broadly across the landscape. Protection of the spring and associated gorge, and of drainage lines and a buffer, would be important for retaining this species in the landscape.

The spring is an important feature of the landscape for fauna and its hydrology needs to be understood. There may be significant SRE invertebrates, the spring is a water source for fauna and it is likely to be locally important for frogs and freshwater fish. The spring itself appears to be located above the actual gorge in a broad seepage area, but there may also be upwellings within the gorge.

Fires in the area are likely to have been too frequent and too extensive. Reduction in the frequency and extent of fires (but not fire exclusion except possibly around the spring) is likely to benefit the fauna assemblage.

There are likely to be some impacts from introduced species. Removal of Cattle and an assessment of the abundance of the Feral Cat (with subsequent control if necessary) may benefit the fauna assemblage.

Particularly due to the severely burnt nature of the landscape, there is little if any value in conducting a detailed survey in the project area. Mammal populations will be low and many birds will have moved out of the area, and therefore results would not be representative. Reptile populations may also be low, or reptiles may simply have low levels of activity until some regeneration occurs. Studies that may be worth carrying out are:

- Survey for the Yirriwardu (Northern Quoll) to determine the extent to which it is using the landscape (although abundance and activity levels may be low due to the recent fire). This

survey would be based on motion-sensitive cameras as conventional cage trapping is less effective, more stressful for animals and requires a much greater commitment of time and personnel (Moore *et al.* 2020).

- Searching for mounds of the Gurdi (Ngadju or Pebble-mound Mouse).

These studies are all related to predicting risk associated with the proposed development.

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# 6 Appendices

## Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

**Assemblage characteristics**

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

**Vegetation and substrate associations (VSAs)**

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver et al., 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of

even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

VSA assessment was made with reference to the key attributes provided by (EPA, 2020):

- soil type and characteristics
- extent and type of ground surfaces and landforms
- height, cover and dominant flora within each vegetation stratum
- presence of specific flora or vegetation of known importance to fauna
- evidence of fire history including, where possible, estimates of time since fire
- evidence and degree of other disturbance or threats, e.g. feral species
- presence of microhabitats and significant habitat features, such as coarse woody debris, rocky
- outcrops, tree hollows, water sources and caves
- evidence of potential to support significant fauna
- function of the habitat as a fauna refuge or part of an ecological linkage.

**Patterns of biodiversity across the landscape**

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

**Species of conservation significance**

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 2.

<u>Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts</u>.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN, 2012), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The *Biodiversity Conservation Act 2016* uses a series of divisions within three Schedules to classify conservation status that largely reflect the IUCN categories (IUCN, 2012).

Conservation Significance (CS) 2: Species listed as Priority by DBCA but not listed under State or Commonwealth Acts.

In Western Australia, DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the *Biodiversity Conservation Act 2016* but for which DBCA feels there is cause for concern.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA, 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (Dell & Banyard, 2000).

Marine-listed species

Some conservation significant species may also be listed as 'Marine' under the EPBC Act. This listing protects these species in 'Commonwealth areas' which include "marine areas beyond the coastal waters of each State and the Northern Territory, and includes all of Australia's Exclusive Economic Zone (EEZ)" (DEH, 2006). The EEZ extends to 200 nautical miles (approximately 350 kilometres) from the coast (DEH, 2006). This may mean that the 'Marine' listing does not apply to the project/project area (depending on its location). Therefore, when a species is otherwise protected (under the EPBC Act or BC Act) or priority-listed (by the DBCA) then the Marine listing is also noted but it does not have site-specific relevance. In cases where a species is solely Marine-listed (for a list see DEH, 2000) and a project/project area is not within a Commonwealth area then it is treated like all other fauna.

Invertebrates

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey, 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

**Ecological processes upon which the fauna depend**

These are the processes and conditions that apply to the existing environment and that affect and maintain fauna populations in an area. As such they are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project area may be affected and effectively determined by processes such as:

- fire regime.
- landscape patterns (such as extent of existing habitat, fragmentation and/or linkage).
- the presence of feral species.
- hydrology.

# Appendix 2. Categories used in the assessment of conservation status.

IUCN (International Union for the Conservation of Nature) categories, as outlined by IUCN (2012), and as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Biodiversity Conservation Act 2016*.

| | |
|---|---|
| Extinct | Taxa not definitely located in the wild during the past 50 years. |
| Extinct in the Wild (Ex) | 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 (E) | Taxa facing a very high risk of extinction in the wild in the near future. |
| Vulnerable (V) | Taxa facing a high risk of extinction in the wild in the medium-term future. |
| Near Threatened | Taxa that risk becoming Vulnerable in the wild. |
| Conservation Dependent | Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened. |
| Data Deficient (Insufficiently Known) | Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information. |
| Least Concern. | Taxa that are not Threatened. |

Schedules used in the WA *Biodiversity Conservation Act 2016, updated 2023*

| | |
|---|---|
| Schedule 1 | Specially protected fauna<br>Division 1 – Species of special conservation interest (S1D1)<br>Division 2 – Migratory species (S1D2)<br>Division 3 – Species otherwise in need of special protection (S1D3) |
| Schedule 2 | Threatened species<br>Division 1 – Critically endangered species (S2D1)<br>Division 2 – Endangered species (S2D2)<br>Division 3 – Vulnerable species (S2D3) |
| Schedule 3 | Extinct species (S3) |

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

| | |
|---|---|
| Priority 1 (P1) | Taxa with few, poorly known populations on threatened lands. |
| Priority 2 (P2) | Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands. |
| Priority 3 (P3) | Taxa with several, poorly known populations, some on conservation lands. |
| Priority 4. (P4) | Taxa in need of monitoring.<br>Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. |
| Priority 5 (P5) | Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent). |

## Appendix 3. Expected fauna assemblage of the project area.

Status codes:

CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.

EPBC Act listings: CR = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Mar = Marine (see Appendix 2).

Biodiversity Conservation Act 2016 listings: S1 to S3 = Schedules 1 to 3, D1 to D3 = Divisions 1 to 3 (see Appendix 2).

DBCA Priority species: P1 to P4 = Priority 1 to 4 (see Appendix 2).

CS3 = considered to be of local significance by Bamford Consulting Ecologists (see Appendix 1).

Int = introduced species.

See Section 2.3.4 for explanation of expected occurrence categories.

Sources: 1 = Previous studies, 2 = Atlas of Living Australia, 3 = Naturemap, 4 = Protected Matters Search Tool, 5 = Birdata, 6 = DBCA threatened and priority fauna search, Lit = general literature

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| **Tetrapontidae** | | | | | |
| | *Leiopotherapon unicolor* | Spangled Grunter | | Lit | Regular visitor |
| **Melanotaenidae** | | | | | |
| | *Melanotaenia australis* | Western Rainbowfish | | Lit | Regular visitor |
| **Hylidae (Tree frogs)** | | | | | |
| | *Cyclorana maini* | Main's Frog | | 2 3 | Resident |
| | *Litoria rubella* | Little Red Tree Frog | | 2 3 | Resident |
| **Myobatrachidae (Ground frogs)** | | | | | |
| | *Platyplectrum spenceri* | Spencer's Frog | | 2 3 | Resident |
| | *Pseudophryne douglasi* | Douglas's Toadlet | | 2 3 | Resident |
| | *Uperoleia russelli* | Russells Toadlet | | 3 | Resident |
| | *Uperoleia saxatilis* | Pilbara Toadlet | | 2 3 | Resident |
| **Carphodactylidae (Carphodactylid geckoes)** | | | | | |
| | *Nephrurus cinctus* | Northern Banded Knobtail Gecko | | 3 | Resident |
| **Diplodactylidae (Diplodactylid geckoes)** | | | | | |
| | *Diplodactylus bilybara* | Western Fat-tailed Gecko | | 2 | Resident |
| | *Diplodactylus galaxias* | Northern Pilbara Beak-faced Gecko | | 2 3 | Resident |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Diplodactylus mitchelli* | Pilbara Stone Gecko | | 3 | Resident |
| | *Lucasium stenodactylum* | Crowned Gecko | | 3 | Resident |
| | *Lucasium wombeyi* | Pilbara Ground Gecko | | 2 3 | Resident |
| | *Lucasium woodwardi* | | | 3 | Resident |
| | *Oedura fimbria* | Western Marbled Velvet Gecko | | 2 | Resident |
| | *Strophurus elderi* | Jewelled Gecko | | 2 3 | Resident |
| **Gekkonidae (Gekkonid geckos)** | | | | | |
| | *Gehyra crypta* | Western Cryptic Gehyra | | 2 | Resident |
| | *Gehyra incognita* | Northern Pilbara Cryptic Gehyra | | Lit | Resident |
| | *Gehyra punctata* | Spotted Dtella | | 2 3 | Resident |
| | *Gehyra variegata* | Variegated Dtella | | 3 | Resident |
| | *Heteronotia binoei* | Bynoe's Gecko | | 2 3 | Resident |
| | *Heteronotia spelea* | Pilbara Cave Gecko | | 3 | Resident |
| **Pygopodidae (Legless lizards)** | | | | | |
| | *Delma elegans* | Pilbara Delma | | 2 3 | Resident |
| | *Delma nasuta* | Sharp-snouted Delma | | 3 | Resident |
| | *Delma pax* | Peace Delma | | 2 3 | Resident |
| | *Lialis burtonis* | Burton's Snake-lizard | | 3 | Resident |
| | *Pygopus nigriceps* | Western Hooded Scaly-foot | | 3 | Resident |
| **Agamidae (Dragons)** | | | | | |
| | *Ctenophorus caudicinctus* | Ring-tailed Dragon | | 1 2 3 | Resident |
| | *Ctenophorus isolepis* | Central Military Dragon | | 1 3 | Resident |
| | *Diporiphora valens* | Southern Pilbara Tree Dragon | | 2 3 | Resident |
| | *Gowidon longirostris* | Long-nosed Dragon | | 2 3 | Resident |
| | *Pogona minor* | Dwarf Bearded Dragon | | 2 3 | Resident |
| **Scincidae (Skinks)** | | | | | |
| | *Carlia munda* | Shaded-litter Rainbow-Skink | | 2 3 | Resident |
| | *Cryptoblepharus buchananii* | Buchanan's Snake-eyed Skink | | Lit | Resident |
| | *Ctenotus grandis* | | | 2 3 | Resident |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Ctenotus helenae* | Clay-soil Ctenotus | | 2 3 | Resident |
| | *Ctenotus inornatus* | Bar-shouldered Ctenotus | | 2 | Resident |
| | *Ctenotus pantherinus* | Leopard Ctenotus | | 2 3 | Resident |
| | *Ctenotus rubicundus* | Ruddy Ctenotus | | 2 3 | Resident |
| | *Ctenotus saxatilis* | Rock Ctenotus | | 3 | Resident |
| | *Cyclodomorphus melanops* | Northern Slender Blue-Tongue | | 2 3 | Resident |
| | *Egernia cygnitos* | Western Pilbara Spiny-tailed Skink | | Lit | Resident |
| | *Glaphyromorphus pallidus* | Western Narrow-banded Skink | | Lit | Resident |
| | *Lerista muelleri* | | | 2 3 | Resident |
| | *Lerista verhmens* | Powerful Lerista | | 2 3 | Resident |
| | *Menetia greyii* | Common Dwarf Skink | | 3 | Resident |
| | *Morethia ruficauda* | | | 2 3 | Resident |
| | *Notoscincus butleri* | Lined Soil-Crevice Skink | CS2 (P4) | 2 3 6 | Resident |
| | *Tiliqua multifasciata* | Central Blue-tongue | | 3 | Resident |
| **Varanidae (Monitors and goannas)** | | | | | |
| | *Varanus acanthurus* | Spiny-tailed Monitor | | 2 3 | Resident |
| | *Varanus brevicauda* | Short-tailed Pygmy Monitor | | 2 3 | Resident |
| | *Varanus giganteus* | | | Lit | Resident |
| | *Varanus panoptes* | | | Lit | Resident |
| | *Varanus pilbarensis* | Pilbara Rock Monitor | | 2 3 | Resident |
| | *Varanus tristis* | Racehorse Monitor | | 3 | Resident |
| **Typhlopidae (Blind snakes)** | | | | | |
| | *Anilios ammodytes* | | | 2 3 | Resident |
| | *Anilios ganei* | Gane's Blind Snake | CS2 (P1) | 6 | Resident |
| **Pythonidae (Pythons)** | | | | | |
| | *Antaresia childreni* | Children's Python | | Lit | Resident |
| | *Antaresia perthensis* | Pygmy Python | | 2 3 | Resident |
| | *Aspidites melanocephalus* | | | Lit | Resident |
| | *Liasis olivaceus barroni* | Pilbara Olive Python | CS1 (V, S2D3) | 4 | Resident |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| **Elapidae (Venomous land snakes)** | | | | | |
| | *Acanthophis wellsei* | Pilbara Death Adder | | 2 3 | Resident |
| | *Brachyurophis approximans* | North-western Shovel-nosed Snake | | 3 | Resident |
| | *Demansia psammophis* | Yellow-faced Whipsnake | | 3 | Resident |
| | *Furina ornata* | Orange-naped Snake | | 2 3 | Resident |
| | *Pseudechis australis* | Mulga Snake | | 3 | Resident |
| | *Pseudonaja mengdeni* | Western Brown Snake | | 3 | Resident |
| | *Suta fasciata* | Rosen's Snake | | 3 | Resident |
| | *Vermicella snelli* | Pilbara Bandy-bandy | | 3 | Resident |
| **Casuariidae (Emus and Cassowaries)** | | | | | |
| | *Dromaius novaehollandiae* | Emu | | Lit | Regular visitor |
| **Podicipedidae (Grebes)** | | | | | |
| | *Tachybaptus novaehollandiae* | Australasian Grebe | | 2 3 5 | Irregular visitor |
| **Phasianidae (Pheasants and Quail)** | | | | | |
| | *Coturnix ypsilophora* | Brown Quail | | 2 3 5 | Regular visitor |
| **Turnicidae (Button-quails)** | | | | | |
| | *Turnix velox* | Little Button-quail | | 2 3 5 | Resident |
| **Columbidae (Pigeons and Doves)** | | | | | |
| | *Geopelia cuneata* | Diamond Dove | | 1 2 3 5 | Resident |
| | *Geopelia placida* | Peaceful Dove | | 2 3 5 | Resident |
| | *Geophaps plumifera* | Spinifex Pigeon | | 2 3 5 | Resident |
| | *Ocyphaps lophotes* | Crested Pigeon | | 1 2 3 5 | Resident |
| | *Phaps chalcoptera* | Common Bronzewing | | 1 2 3 5 | Resident |
| | *Phaps histrionica* | Flock Bronzewing | | 2 3 5 | Irregular visitor |
| **Cuculidae (Cuckoos)** | | | | | |
| | *Cacomantis pallidus* | Pallid Cuckoo | | 2 3 5 | Regular visitor |
| | *Centropus phasianinus* | Pheasant Coucal | | 2 3 5 | Regular visitor |
| | *Chrysococcyx basalis* | Horsfield's Bronze-Cuckoo | | 2 3 5 | Regular visitor |
| | *Chrysococcyx osculans* | Black-eared Cuckoo | | 4 | Regular visitor |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Cuculus optatus* | Oriental Cuckoo | CS1 (M, S1D2) | Lit | Vagrant |
| **Ardeidae (Herons, Bitterns and Egrets)** | | | | | |
| | *Ardea novaehollandiae* | White-faced Heron | | 2 3 5 | Irregular visitor |
| | *Ardea pacifica* | White-necked Heron | | 2 5 | Irregular visitor |
| | *Nycticorax caledonicus* | Nankeen Night Heron | | 2 3 5 | Irregular visitor |
| **Accipitridae (Kites, Eagles, Goshawks)** | | | | | |
| | *Accipiter cirrocephalus* | Collared Sparrowhawk | | 2 3 5 | Resident |
| | *Accipiter fasciatus* | Brown Goshawk | | 5 | Resident |
| | *Aquila audax* | Wedge-tailed Eagle | | 2 3 5 | Regular visitor |
| | *Circus approximans* | Swamp Harrier | | 5 | Vagrant |
| | *Circus assimilis* | Spotted Harrier | | 2 3 5 | Regular visitor |
| | *Elanus caeruleus* | Black-shouldered Kite | | 3 5 | Regular visitor |
| | *Elanus scriptus* | Letter-winged Kite | CS2 (P4) | Lit | Vagrant |
| | *Erythrotriorchis radiatus* | Red Goshawk | CS1 (E, S2D3) | 4 | Vagrant |
| | *Haliastur sphenurus* | Whistling Kite | | 1 2 3 5 | Regular visitor |
| | *Hamirostra melanosternon* | Black-breasted Buzzard | | 2 3 5 | Regular visitor |
| | *Hieraaetus morphnoides* | Little Eagle | | 2 3 5 | Regular visitor |
| | *Lophoictinia isura* | Square-tailed Kite | | 3 5 | Irregular visitor |
| | *Milvus migrans* | Black Kite | | 2 3 5 | Regular visitor |
| **Otididae (Bustards)** | | | | | |
| | *Ardeotis australis* | Australian Bustard | | 1 3 5 | Regular visitor |
| **Rallidae (Rails, Crakes, Coots)** | | | | | |
| | *Fulica atra* | Eurasian Coot | | 5 | Irregular visitor |
| | *Hypotaenidia philippensis* | Buff-banded Rail | | 3 5 | Irregular visitor |
| | *Porphyrio porphyrio* | Purple Swamphen | | 5 | Vagrant |
| | *Tribonyx ventralis* | Black-tailed Native-hen | | 5 | Irregular visitor |
| **Burhinidae (Stone-curlews)** | | | | | |
| | *Burhinus grallarius* | Bush Stone-curlew | | 2 3 5 | Resident |
| **Charadriidae (Dotterals)** | | | | | |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Elseyornis melanops* | Black-fronted Dotterel | | 2 3 5 | Regular visitor |
| | *Vanellus tricolor* | Banded Lapwing | | 5 | Irregular visitor |
| **Scolopacidae (Sandpipers and Stints)** | | | | | |
| | *Actitis hypoleucos* | Common Sandpiper | CS1 (M, S1D2) | 3 4 5 6 | Irregular visitor |
| | *Tringa glareola* | Wood Sandpiper | CS1 (M, S1D2) | 5 6 | Irregular visitor |
| **Glareolidae (Pratincoles)** | | | | | |
| | *Glareola maldivarum* | Oriental Pratincole | CS1 (M, S1D2) | 2 3 4 5 6 | Irregular visitor |
| | *Stiltia isabella* | Australian Pratincole | | 5 | Irregular visitor |
| **Strigidae (Hawk Owls)** | | | | | |
| | *Ninox boobook* | Southern Boobook | | 2 3 5 | Resident |
| **Caprimulgidae (Nightjars)** | | | | | |
| | *Eurostopodus argus* | Spotted Nightjar | | 3 5 | Regular visitor |
| **Podargidae (Frogmouths)** | | | | | |
| | *Podargus strigoides* | Tawny Frogmouth | | 5 | Resident |
| **Aegothelidae (Owlet-nightjars)** | | | | | |
| | *Aegotheles cristatus* | Australian Owlet-nightjar | | 3 5 | Resident |
| **Apodidae (Swifts)** | | | | | |
| | *Apus pacificus* | Fork-tailed Swift | CS1 (M, S1D2) | 4 | Irregular visitor |
| **Alcedinidae (Kingfishers)** | | | | | |
| | *Dacelo leachii* | Blue-winged Kookaburra | | 2 3 5 | Regular visitor |
| | *Todiramphus pyrrhopygius* | Red-backed Kingfisher | | 2 3 5 | Resident |
| | *Todiramphus sanctus* | Sacred Kingfisher | | 2 3 5 | Regular visitor |
| **Meropidae (Bee-eaters)** | | | | | |
| | *Merops ornatus* | Rainbow Bee-eater | | 2 3 4 5 | Regular visitor |
| **Falconidae (Falcons)** | | | | | |
| | *Falco berigora* | Brown Falcon | | 2 3 5 | Resident |
| | *Falco cenchroides* | Nankeen Kestrel | | 1 2 3 5 | Resident |
| | *Falco hypoleucos* | Grey Falcon | CS1 (V, S2D3) | 4 6 | Regular visitor |
| | *Falco longipennis* | Australian Hobby | | 3 5 | Regular visitor |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Falco peregrinus* | Peregrine Falcon | CS1 (S1D3) | Lit | Regular visitor |
| **Cacatuidae (Cockatoos)** | | | | | |
| | *Cacatua roseicapilla* | Galah | | 1 2 3 5 | Resident |
| | *Cacatua sanguinea* | Little Corella | | 2 3 5 | Resident |
| | *Nymphicus hollandicus* | Cockatiel | | 2 3 5 | Regular visitor |
| **Psittacidae (Parrots)** | | | | | |
| | *Melopsittacus undulatus* | Budgerigar | | 1 2 3 5 | Regular visitor |
| | *Neopsephotus bourkii* | Bourke's Parrot | | Lit | Irregular visitor |
| | *Pezoporus occidentalis* | Night Parrot | CS1 (E, S2D1) | 4 | Vagrant |
| | *Platycercus varius* | Mulga Parrot | | 1 | Irregular visitor |
| | *Platycercus zonarius* | Australian Ringneck | | 2 3 5 | Resident |
| **Ptilonorhynchidae (Bowerbirds)** | | | | | |
| | *Ptilonorhynchus maculatus* | Western Bowerbird | | 2 3 5 | Resident |
| **Maluridae (Wrens)** | | | | | |
| | *Amytornis whitei* | Rufous Grasswren | CS3 | 2 3 5 | Resident |
| | *Malurus lamberti* | Purple-backed Fairy-wren | | 2 3 5 | Resident |
| | *Malurus leucopterus* | White-winged Fairy-wren | | 2 3 5 | Resident |
| | *Stipiturus ruficeps* | Rufous-crowned Emu-wren | CS3 | 3 | Resident |
| **Meliphagidae (Honeyeaters)** | | | | | |
| | *Acanthagenys rufogularis* | Spiny-cheeked Honeyeater | | 1 | Regular visitor |
| | *Certhionyx variegatus* | Pied Honeyeater | | 3 5 | Regular visitor |
| | *Epthianura tricolor* | Crimson Chat | | 1 2 3 5 | Regular visitor |
| | *Gavicalis virescens* | Singing Honeyeater | | 1 2 3 5 | Resident |
| | *Lichmera indistincta* | Brown Honeyeater | | 1 2 3 5 | Resident |
| | *Manorina flavigula* | Yellow-throated Miner | | 2 3 5 | Resident |
| | *Melithreptus gularis* | Black-chinned Honeyeater | | 3 5 | Resident |
| | *Ptilotula keartlandi* | Grey-headed Honeyeater | | 2 3 5 | Resident |
| | *Ptilotula penicillata* | White-plumed Honeyeater | | 2 3 5 | Resident |
| | *Ptilotula plumula* | Grey-fronted Honeyeater | | 3 | Regular visitor |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Sugomel nigrum* | Black Honeyeater | | 2 3 5 | Regular visitor |
| **Pardalotidae (Pardalotes)** | | | | | |
| | *Pardalotus rubricatus* | Red-browed Pardalote | | 2 3 5 | Resident |
| | *Pardalotus striatus* | Striated Pardalote | | 2 3 5 | Resident |
| **Acanthizidae (Gerygones)** | | | | | |
| | *Smicrornis brevirostris* | Weebill | | 1 2 3 5 | Resident |
| **Pomatostomidae (Babblers)** | | | | | |
| | *Pomatostomus temporalis* | Grey-crowned Babbler | | 2 3 5 | Resident |
| **Campephagidae (Cuckoo-shrikes and Trillers)** | | | | | |
| | *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | | 1 2 3 5 | Regular visitor |
| | *Lalage tricolor* | White-winged Triller | | 2 3 5 | Regular visitor |
| **Oreoididae (Bellbirds)** | | | | | |
| | *Oreoica gutturalis* | Crested Bellbird | | 1 2 3 5 | Resident |
| **Pachycephalidae (Whistlers)** | | | | | |
| | *Colluricincla harmonica* | Grey Shrike-thrush | | 1 2 3 5 | Resident |
| | *Pachycephala rufiventris* | Rufous Whistler | | 1 3 5 | Resident |
| **Artamidae (Woodswallows)** | | | | | |
| | *Artamus cinereus* | Black-faced Woodswallow | | 2 3 5 | Resident |
| | *Artamus leucorynchus* | White-breasted Woodswallow | | 5 | Regular visitor |
| | *Artamus minor* | Little Woodswallow | | 2 3 5 | Resident |
| | *Artamus personatus* | Masked Woodswallow | | 1 3 5 | Irregular visitor |
| **Cracticidae (Butcherbirds and Magpie)** | | | | | |
| | *Cracticus nigrogularis* | Pied Butcherbird | | 1 2 3 5 | Resident |
| | *Cracticus tibicen* | Australian Magpie | | 2 3 5 | Resident |
| | *Cracticus torquatus* | Grey Butcherbird | | 1 5 | Resident |
| **Rhipiduridae (Fantails)** | | | | | |
| | *Rhipidura leucophrys* | Willie Wagtail | | 1 2 3 5 | Resident |
| **Monarchidae (Monarchs)** | | | | | |
| | *Grallina cyanoleuca* | Magpie-Lark | | 2 3 5 | Resident |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| **Corvidae (Crows and Ravens)** | | | | | |
| | *Corvus bennetti* | Little Crow | | 5 | Regular visitor |
| | *Corvus orru* | Torresian Crow | | 1 2 3 5 | Resident |
| **Hirundinidae (Swallows and Martins)** | | | | | |
| | *Cheramoeca leucosterna* | White-backed Swallow | | 2 3 5 | Regular visitor |
| | *Hirundo neoxena* | Welcome Swallow | | 5 | Regular visitor |
| | *Hirundo rustica* | Barn Swallow | CS1 (M, S1D2) | 4 | Irregular visitor |
| | *Petrochelidon ariel* | Fairy Martin | | 2 3 5 | Regular visitor |
| | *Petrochelidon nigricans* | Tree Martin | | 2 3 5 | Regular visitor |
| **Acrocephalidae (Reed-warblers)** | | | | | |
| | *Acrocephalus australis* | Australian Reed-Warbler | | 2 3 5 | Regular visitor |
| **Alaudidae (Larks)** | | | | | |
| | *Mirafra javanica* | Horsfield's Bushlark | | 2 3 5 | Resident |
| **Locustellidae (Songlarks and Grassbirds)** | | | | | |
| | *Cincloramphus cruralis* | Brown Songlark | | 2 3 5 | Regular visitor |
| | *Cincloramphus mathewsi* | Rufous Songlark | | 2 3 5 | Regular visitor |
| | *Poodytes carteri* | Spinifexbird | | 2 3 5 | Resident |
| | *Poodytes gramineus* | Little Grassbird | | 3 5 | Regular visitor |
| **Dicaeidae (Mistletoebirds)** | | | | | |
| | *Dicaeum hirundinaceum* | Mistletoebird | | 2 3 5 | Regular visitor |
| **Estrildidae (Finches and Mannikins)** | | | | | |
| | *Emblema pictum* | Painted Finch | | 2 3 5 | Regular visitor |
| | *Neochmia ruficauda* | Star Finch | CS3 | 2 3 5 | Irregular visitor |
| | *Taeniopygia guttata* | Zebra Finch | | 1 2 3 5 | Regular visitor |
| **Motacillidae (Pipits)** | | | | | |
| | *Anthus australis* | Australian Pipit | | 3 5 | Resident |
| | *Motacilla cinerea* | Grey Wagtail | CS1 (M, S1D2) | 4 | Vagrant |
| | *Motacilla flava* | Yellow Wagtail | CS1 (M, S1D2) | 4 | Vagrant |
| **Tachyglossidae (Echidna)** | | | | | |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Tachyglossus aculeatus* | Short-beaked Echidna | | Lit | Resident |
| **Dasyuridae (Carnivorous Marsupials)** | | | | | |
| | *Dasycercus blythi* | Brush-tailed Mulgara | CS2 (P4) | Lit | Irregular visitor |
| | *Dasykaluta rosamondae* | Kaluta | | 2 3 | Resident |
| | *Dasyurus hallucatus* | Northern Quoll | CS1 (E, S2D2) | 4 6 | Resident |
| | *Ningaui timealeyi* | Pilbara Ningaui | | 2 3 | Resident |
| | *Planigale sp. 't'* | | | Lit | Resident |
| | *Planigale tealei* | Cracking-clay Pilbara Planigale | | Lit | Resident |
| | *Pseudantechinus macdonnelensis* | | | Lit | Resident |
| | *Sminthopsis macroura* | Stripe-faced Dunnart | | 2 3 | Resident |
| **Phalangeridae (Possums)** | | | | | |
| | *Trichosurus vulpecula* | Brushtail Possum | CS3 | Lit | Irregular visitor |
| **Macropodidae (Kangaroos and Wallabies)** | | | | | |
| | *Osphranter robustus* | Euro | | 1 3 | Resident |
| | *Petrogale rothschildi* | Rothschild's Rock-Wallaby | CS3 | 2 | Regular visitor |
| **Muridae (Rats and Mice)** | | | | | |
| | *Hydromys chrysogaster* | Water-rat, Rakali | CS2 (P4) | Lit | Irregular visitor |
| | *Leggadina lakedownensis* | Short-tailed Mouse | CS2 (P4) | 2 3 6 | Resident |
| | *Mus musculus* | House Mouse | Int | 3 | Resident |
| | *Pseudomys chapmani* | Ngadji or Western Pebble-mound Mouse | CS2 (P4) | 2 3 6 | Resident |
| | *Pseudomys delicatulus* | Delicate Mouse | | 2 3 | Resident |
| | *Pseudomys desertor* | Desert Mouse | | 3 | Resident |
| | *Pseudomys hermannsburgensis* | Sandy Inland Mouse | | 2 3 | Resident |
| | *Zyzomys argurus* | Common Rock-Rat | | 2 3 | Resident |
| **Rhinonycteridae (Leaf-nosed Bats)** | | | | | |
| | *Rhinonicteris aurantia (Pilbara form)* | Pilbara Leaf-nosed bat | CS1 (V, S2D3) | 4 | Regular visitor |
| **Megadermatidae (Ghost Bat)** | | | | | |
| | *Macroderma gigas* | Ghost Bat | CS1 (V, S2D3) | 1 4 | Regular visitor |
| **Emballonuridae (Shreath-tail Bats)** | | | | | |

| Family | Latin Name | Common Name | Status | Source | Expected Occurrence |
|---|---|---|---|---|---|
| | *Saccolaimus flaviventris* | Yellow-bellied Sheath-tail Bat | | Lit | Regular visitor |
| | *Taphozous georgianus* | Common Sheath-tail Bat | | Lit | Resident |
| **Molossidae (Free-tail Bats)** | | | | | |
| | *Austronomus australis* | White-striped Free-tail Bat | | Lit | Regular visitor |
| | *Chaerephon jobensis* | Greater Northern Free-tail Bat | | Lit | Regular visitor |
| | *Ozimops lumsdenae* | Northern Free-tail Bat | | Lit | Resident |
| **Vespertilionidae (Vespertilionid Bats)** | | | | | |
| | *Chalinolobus gouldii* | Gould's Wattled Bat | | Lit | Resident |
| | *Nyctophilus daedalus* | Pallid Long-Eared Bat | | Lit | Regular visitor |
| | *Nyctophilus geoffroyi* | Lesser Long-eared Bat | | Lit | Resident |
| | *Scotorepens greyii* | Little Broad-nosed Bat | | Lit | Resident |
| | *Vespadelus finlaysoni* | Finlayson's Cave Bat | | Lit | Resident |
| **Canidae (Dogs and Foxes)** | | | | | |
| | *Canis lupus dingo* | Dingo | | 1 | Regular visitor |
| | *Vulpes vulpes* | Red Fox | Int | Lit | Irregular visitor |
| **Felidae (Cats)** | | | | | |
| | *Felis catus* | Cat | Int | 1 2 | Resident |

## Appendix 4. Species recorded in the site inspection in December 2023.

| Yindjibarndi Name | Latin Name | Common Name | Status | Expected Occurrence | Comment |
|---|---|---|---|---|---|
| | **FISH** | | | | |
| | *Melanotaenia splendida* | Western Rainbowfish | | Regular visitor | Several seen in largest pools of spring. |
| | **FROGS** | | | | |
| Jarrarna | *Litoria rubella* | Little Red Tree Frog | | Resident | Heard in spring on 7/12. |
| | *Pseudophryne douglasi* | Douglas's Toadlet | | Resident | A typical Pseudophryne call heard in spring |
| | **REPTILES** | | | | |
| Thawu | *Diplodactylus bilybara* | Western Fat-tailed Gecko | | Resident | Skin found in south |
| Marndangatha | *Ctenophorus caudicinctus* | Ring-tailed Dragon | | Resident | Several seen even in completely burnt areas. Some were panting due to heat. |
| Garlirrinygaa | *Gowidon longirostris* | Long-nosed Dragon | | Resident | Several seen on rocks and even in the water at the spring. |
| Yujurli | *Ctenotus saxatilis* | Rock Ctenotus | | Resident | Dead specimen found on rocks near spring |
| Barnka | *Varanus panoptes* | | | Resident | Burrow complex in south in area of loam soil close to large drainage line. |
| | **BIRDS** | | | | |
| Jurlawurdu | *Geophaps plumifera* | Spinifex Pigeon | | Resident | Seen frequently near spring and elsewhere, in groups of 2-10 birds. |
| Garranyga | *Haliastur sphenurus* | Whistling Kite | | Regular visitor | One in tall trees along spring. |
| Wilumarra | *Burhinus grallarius* | Bush Stone-curlew | | Resident | Fresh tracks just south of transmission station. See Plate 7. |
| Jinbirdiny | *Elseyornis melanops* | Black-fronted Dotterel | | Regular visitor | One on edge of pool of spring (7/12). |
| Wirndiwirndi | *Falco berigora* | Brown Falcon | | Resident | One in tall trees along spring |

| | | | | | |
|---|---|---|---|---|---|
| Minybirrirrii | *Falco cenchroides* | Nankeen Kestrel | | Resident | Three in the east, along the edge of the basalt hills dropping down to the granitic plains. |
| Buyiyirri | *Malurus lamberti* | Purple-backed Fairy-wren | | Resident | Several parties with coloured males in remnant unburnt vegetation along drainage lines. |
| Juudi | *Gavicalis virescens* | Singing Honeyeater | | Resident | Few seen in eucalypts. |
| Wirnmirdbula | *Manorina flavigula* | Yellow-throated Miner | | Resident | Two at spring on 7/12. |
| Juudi | *Ptilotula keartlandi* | Grey-headed Honeyeater | | Resident | Few seen and heard in eucalypts. Several around spring on 7/12. |
| Julgira | *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | | Regular visitor | One in trees near spring on 6/12; two present on 7/12 |
| Yilimbirraa | *Grallina cyanoleuca* | Magpie-Lark | | Resident | Pair near spring on both days. |
| Jarrbinyjarra | *Artamus cinereus* | Black-faced Woodswallow | | Resident | Three on powerlines near transmission station. |
| Guruwarru | *Cracticus nigrogularis* | Pied Butcherbird | | Resident | Two at spring on 7/12. |
| Warndurla | *Cracticus tibicen* | Australian Magpie | | Resident | Party along powerline near northern boundary (6/12) and party at spring on 7/12. Sheltering from heat in a shallow cave with two butcherbirds, two Magpie-larks and two miners. |
| Wangangga | *Corvus orru* | Torresian Crow | | Resident | Two in trees at spring |
| | **MAMMALS** | | | | |
| Yirriwardu | *Dasyurus hallucatus* | Northern Quoll | CS1 (E, S2D2) | Resident | Scats at several location long major drainage lines. |
| Marndanyungu | *Osphranter robustus* | Euro | | Resident | Scats along major drainage lines and around spring |
| Mujira | *Canis lupus dingo* | Dingo | | Regular visitor | Scats found. |
| | *Bos taurus* | European Cattle | Int | Domestic | Abundant evidence along major drainage lines |

# Appendix 5. Vertebrate species returned from the literature review and database search that have been omitted from the expected species list because they are considered locally extinct.

Status codes: CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.
EPBC Act listings: CR = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Mar = Marine (see Appendix 2).
Biodiversity Conservation Act 2016 listings: S1 to S3 = Schedules 1 to 3, D1 to D3 = Divisions 1 to 3 (see Appendix 2).
DBCA Priority species: P1 to P4 = Priority 1 to 4 (see Appendix 2).
See Section 2.3.4 for explanation of expected occurrence categories.
Sources: 1 = Previous studies, 2 = Atlas of Living Australia, 3 = Naturemap, 4 = Protected Matters Search Tool, 5 = Birdata, 6 = DBCA threatened and priority fauna search, Lit = general literature

| Latin Name | Common Name | Source | Status |
|---|---|---|---|
| **Peramelidae (Bandicoots)** | | | |
| *Isoodon auratus* | Golden Bandicoot | Lit | CS1 (V, S2D3) |
| **Thylacomyidae (Bilbies)** | | | |
| *Macrotis lagotis* | Greater Bilby | 4 | CS1 (V, S2D3) |
| **Macropodidae (Kangaroos and Wallabies)** | | | |
| *Lagorchestes conspicillatus* | Spectacled Hare-Wallaby | Lit | CS2 (P4) |
| **Muridae (Rats and Mice)** | | | |
| *Leporillus conditor* | Greater Stick-nest Rat | Lit | CS1 (V, S1D1) |
| *Pseudomys nanus* | Chestnut Mouse | Lit | |
| *Rattus tunneyi* | Pale Field Rat | Lit | |

# Appendix 6. Species returned from the literature review that have been omitted from the expected species list because of habitat or range limitations, or because they are domesticated species.

Note that some birds could still occur as extremely rare vagrants.

Sources: 1 = Previous studies, 2 = Atlas of Living Australia, 3 = Naturemap, 4 = Protected Matters Search Tool, 5 = Birdata, 6 = DBCA threatened and priority fauna search, Lit = general literature

| Family | Latin Name | Common Name | Status | Source | Reason for omitting |
|---|---|---|---|---|---|
| **Tetrapontidae** | | | | | |
| | *Leiopotherapon aheneus* | Fortescue Grunter | CS2 (P4) | 6 | out of range |
| **Gekkonidae (Gekkonid geckos)** | | | | | |
| | *Gehyra media* | Medium Pilbara Spotted Rock Gehyra | | 2 | out of range |
| | *Gehyra micra* | Small Pilbara Spotted Rock Gehyra | | 2 | out of range |
| **Scincidae (Skinks)** | | | | | |
| | *Ctenotus duricola* | Pilbara Ctenotus | | 3 | out of range |
| | *Ctenotus pallasotus* | Pilbara Lined Ctenotus | | 2 | out of range |
| | *Egernia formosa* | Goldfields Crevice-skink | | 2 3 | out of range |
| | *Glaphyromorphus isolepis* | Northern Bar-lipped Skink | | 3 | out of range |
| | *Lerista flammicauda* | Pilbara Flame-tailed Slider | | 2 3 | out of range |
| | *Lerista quadrivincula* | Four-lined Slider | CS2 (P1) | 6 | out of range |
| **Anatidae (Ducks, Swans and Geese)** | | | | | |
| | *Anas gracilis* | Grey Teal | | 2 3 5 | no habitat |
| | *Anas superciliosa* | Pacific Black Duck | | 2 3 5 | no habitat |
| | *Aythya australis* | Hardhead | | 2 3 5 | no habitat |
| | *Chenonetta jubata* | Australian Wood Duck | | 3 5 | no habitat |
| | *Cygnus atratus* | Black Swan | | 2 3 5 | no habitat |
| | *Dendrocygna arcuata* | Wandering Whistling-Duck | | 5 | no habitat |
| | *Dendrocygna eytoni* | Plumed Whistling-Duck | | 3 5 | no habitat |
| | *Malacorhynchus membranaceus* | Pink-eared Duck | | 5 | no habitat |
| **Podicipedidae (Grebes)** | | | | | |
| | *Podiceps cristatus* | Great Crested Grebe | | 5 | no habitat |

| Family | Latin Name | Common Name | Status | Source | Reason for omitting |
|---|---|---|---|---|---|
| **Threskiornithidae (Ibis and Spoonbills)** | | | | | |
| | *Platalea flavipes* | Yellow-billed Spoonbill | | 5 | no habitat |
| | *Platalea regia* | Royal Spoonbill | | 2 5 | no habitat |
| | *Plegadis falcinellus* | Glossy ibis | CS1 (M, S1D2) | 5 6 | no habitat |
| | *Threskiornis moluccus* | Australian White Ibis | | 5 | no habitat |
| | *Threskiornis spinicollis* | Straw-necked Ibis | | 2 3 5 | no habitat |
| **Ardeidae (Herons, Bitterns and Egrets)** | | | | | |
| | *Ardea garzetta* | Little Egret | | 2 3 5 | no habitat |
| | *Ardea ibis* | Cattle Egret | | 4 | no habitat |
| | *Ardea intermedia* | Intermediate Egret | | 2 3 5 | no habitat |
| | *Ardea modesta* | Eastern Great Egret | | 2 3 5 | no habitat |
| **Ciconiidae (Storks)** | | | | | |
| | *Ephippiorhynchus asiaticus* | Black-Necked Stork | | 2 5 | no habitat |
| **Pelecanidae (Pelicans)** | | | | | |
| | *Pelecanus conspicillatus* | Australian Pelican | | 2 5 | no habitat |
| **Phalacrocoracidae (Cormorants)** | | | | | |
| | *Phalacrocorax melanoleucos* | Little Pied Cormorant | | 2 3 5 | no habitat |
| | *Phalacrocorax sulcirostris* | Little Black Cormorant | | 2 3 5 | no habitat |
| | *Phalacrocorax varius* | Pied Cormorant | | 5 | no habitat |
| **Anhingidae (Darters)** | | | | | |
| | *Anhinga novaehollandiae* | Australasian Darter | | 3 5 | no habitat |
| **Accipitridae (Kites, Eagles, Goshawks)** | | | | | |
| | *Haliaeetus leucogaster* | White-Bellied Sea-Eagle | | 4 5 | no habitat |
| | *Haliastur indus* | Brahminy Kite | | 3 | no habitat |
| | *Pandion cristatus* | Eastern Osprey | CS1 (M, S1D2) | 4 | no habitat |
| **Recurvirostridae (Stilts)** | | | | | |
| | *Himantopus himantopus* | Black-winged Stilt | | 5 | no habitat |
| **Charadriidae (Dotterals)** | | | | | |
| | *Charadrius leschenaultii* | Greater Sand Plover | CS1 (V & M, S2D3) | 5 | no habitat |

| Family | Latin Name | Common Name | Status | Source | Reason for omitting |
|---|---|---|---|---|---|
| | *Charadrius ruficapillus* | Red-Capped Plover | | 5 | no habitat |
| | *Charadrius veredus* | Oriental Plover | CS1 (M, S1D2) | 4 5 | no habitat |
| | *Erythrogonys cinctus* | Red-kneed Dotterel | | 5 | no habitat |
| | *Vanellus miles* | Masked Lapwing | | 5 | no habitat |
| **Rostratulidae (Snipes)** | | | | | |
| | *Rostratula australis* | Australian Painted-snipe | CS1 (E, S2D2) | 3 4 5 6 | no habitat |
| **Scolopacidae (Sandpipers and Stints** | | | | | |
| | *Arenaria interpres* | Ruddy Turnstone | CS1 (M, S1D2) | 3 6 | no habitat |
| | *Calidris acuminata* | Sharp-tailed Sandpiper | CS1 (M, S1D2) | 4 5 6 | no habitat |
| | *Calidris ferruginea* | Curlew Sandpiper | CS1 (CR & M, S2D1) | 4 | no habitat |
| | *Calidris melanotos* | Pectoral Sandpiper | CS1 (M, S1D2) | 4 | no habitat |
| | *Calidris ruficollis* | Red-necked Stint | CS1 (M, S1D2) | 5 6 | no habitat |
| | *Numenius madagascariensis* | Eastern Curlew | CS1 (CR & M, S2D1) | 4 | no habitat |
| | *Tringa nebularia* | Common Greenshank | CS1 (M, S1D2) | 5 | no habitat |
| **Laridae (Gulls and Terns)** | | | | | |
| | *Chlidonias hybrida* | Whiskered Tern | | 5 | no habitat |
| | *Gelochelidon macrotarsa* | Australian Gull-billed Tern | | 5 6 | no habitat |
| | *Hydroprogne caspia* | Caspian Tern | CS1 (M, S1D2) | 5 6 | no habitat |
| **Procellariidae (Shearwaters)** | | | | | |
| | *Ardenna pacifica* | Wedge-tailed Shearwater | CS1 (M, S1D2) | 4 | no habitat |
| **Campephagidae (Cuckoo-shrikes and Trillers)** | | | | | |
| | *Lalage leucomela* | Varied Triller | | 3 | out of range |
| **Zosteropidae (Silvereyes)** | | | | | |
| | *Zosterops luteus* | Yellow White-eye | | 2 5 | no habitat |
| **Bovidae (Horned ruminants)** | | | | | |
| | *Bos taurus* | European Cattle | Int | 1 | domestic |

## Appendix 7. Excluded conservation significant invertebrate fauna species.

Status codes:

CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.

EPBC Act listings: CR = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Mar = Marine (see Appendix 2).

Biodiversity Conservation Act 2016 listings: S1 to S3 = Schedules 1 to 3, D1 to D3 = Divisions 1 to 3 (see Appendix 2). EX = extinct

DBCA Priority species: P1 to P4 = Priority 1 to 4 (see Appendix 2).

Sources: 7 = DBCA threatened species list for Pilbara region

| | Latin Name | Common Name | Source | Status | Reason for excluding |
|---|---|---|---|---|---|
| **Arachnida** | | | | | |
| | *Bamazomus subsolanus* | eastern Cape Range bamazomus | 7 | CS1 (E S2) | Out of range |
| | *Bamazomus vespertinus* | western Cape Range bamazomus | 7 | CS1 (E S2) | Out of range |
| | *Draculoides bramstokeri* | Barrow Island draculoides | 7 | CS1 (V S2) | Out of range |
| | *Draculoides brooksi* | northern Cape Range draculoides | 7 | CS1 (E S2) | Out of range |
| | *Draculoides julianneae* | western Cape Range draculoides | 7 | CS1 (E S2) | Out of range |
| | *Draculoides mesozeirus* | Middle Robe draculoides | 7 | CS1 (V S2) | Out of range |
| | *Ideoblothrus linnaei* | Linnaeus' pseudoscorpion (Mesa A) | 7 | CS2 (P1) | Out of range |
| | *Ideoblothrus sp. 'Mesa A' (WAM T81374)* | an Ideoblothrus pseudoscorpion (Mesa A) | 7 | CS2 (P1) | Out of range |
| | *Indohya damocles* | Cameron's Cave pseudoscorpion | 7 | CS1 (CR S2) | Out of range |
| | *Lagynochthonius asema* | Mesa A Lagynochthonius pseudoscorpion | 7 | CS2 (P1) | Out of range |
| | *Paradraculoides anachoretus* | Mesa A paradraculoides | 7 | CS1 (V S2) | Out of range |
| | *Paradraculoides bythius* | Mesa B/C paradraculoides | 7 | CS1 (V S2) | Out of range |
| | *Paradraculoides gnophicola* | Mesa G paradraculoides | 7 | CS1 (V S2) | Out of range |
| | *Paradraculoides kryptus* | Mesa K paradraculoides | 7 | CS1 (V S2) | Out of range |
| | *Tyrannochthonius sp. 'Mesa A' (WAM T81480)* | a Tyrannochtonius pseudoscorpion (Mesa A) | 7 | CS2 (P1) | Out of range |
| **Diplopoda** | | | | | |
| | *Antichiropus sp. 'DIP004'* | Roy Hill Antichiropus millipede | 7 | CS2 (P1) | Out of range |
| | *Antichiropus sp. 'DIP005'* | Abydos Antichiropus millipede | 7 | CS2 (P1) | Out of range |
| | *Antichiropus sp. 'DIP006'* | Area C Antichiropus millipede | 7 | CS2 (P1) | Out of range |
| | *Antichiropus sp. 'DIP013'* | Cloudbreak Antichiropus millipede | 7 | CS2 (P1) | Out of range |

| | Latin Name | Common Name | Source | Status | Reason for excluding |
|---|---|---|---|---|---|
| | *Antichiropus sp. 'DIP029'* | Mt Bruce Antichiropus millipede | 7 | CS2 (P1) | Out of range |
| | *Speleostrophus nesiotes* | Barrow Island millipede | 7 | CS1 (V S2) | Out of range |
| | *Stygiochiropus isolatus* | a stygiochiropus millipede (Cape Range) | 7 | CS1 (V S2) | Out of range |
| | *Stygiochiropus peculiaris* | Cameron's Cave millipede | 7 | CS1 (Cr S2) | Out of range |
| | *Stygiochiropus sympatricus* | a stygiochiropus millipede (Cape Range) | 7 | CS1 (V S2) | Out of range |
| **Insecta** | | | | | |
| | *Nocticola flabella* | Cape Range blind cockroach | 7 | CS2 (P4) | Out of range |
| **Amphipoda** | | | | | |
| | *Bogidomma australis* | Barrow Island bogidomma amphipod | 7 | CS1 (V S2) | Out of range |
| | *Liagoceradocus branchialis* | Cape Range liagoceradocus amphipod | 7 | CS1 (E S2) | Out of range |
| | *Liagoceradocus subthalassicus* | Barrow Island liagoceradocus amphipod | 7 | CS1 (V S2) | Out of range |
| | *Nedsia chevronia* | Chevron's freshwater amphipod (Barrow Island) | 7 | CS2 (P2) | Out of range |
| | *Nedsia fragilis* | a freshwater amphipod | 7 | CS1 (V S2) | Out of range |
| | *Nedsia humphreysi* | a freshwater amphipod | 7 | CS1 (V S2) | Out of range |
| | *Nedsia hurlberti* | a freshwater amphipod | 7 | CS1 (V S2) | Out of range |
| | *Nedsia macrosculptilis* | a freshwater amphipod | 7 | CS1 (V S2) | Out of range |
| | *Nedsia sculptilis* | a freshwater amphipod | 7 | CS1 (V S2) | Out of range |
| | *Nedsia straskraba* | a freshwater amphipod | 7 | CS1 (V S2) | Out of range |
| | *Nedsia urifimbriata* | a freshwater amphipod | 7 | CS1 (V S2) | Out of range |
| **Copepoda** | | | | | |
| | *Bunderia misophaga* | a copepod (Bundera Sinkhole) | 7 | CS1 (CR S2) | Out of range |
| | *Speleophria bunderae* | a copepod (Bundera Sinkhole) | 7 | CS1 (CR S2) | Out of range |
| | *Stygocyclopia australis* | a copepod (Bundera Sinkhole) | 7 | CS1 (CR S2) | Out of range |
| **Ostracoda** | | | | | |
| | *Welesina kornickeri* | Kornicker's Bundera Sinkhole ostracod | 7 | CS1 (CR S2) | Out of range |
| **Malacostraca** | | | | | |
| | *Stygiocaris lancifera* | lance-beaked cave shrimp | 7 | CS1 (V S2) | Out of range |
| | *Stygiocaris stylifera* | spear-beaked cave shrimp | 7 | CS2 (P4) | Out of range |
| **Remipedia** | | | | | |

| | Latin Name | Common Name | Source | Status | Reason for excluding |
|---|---|---|---|---|---|
| | *Kumonga exleyi* | Cape Range remipede | 7 | CS1 (CR V S2) | Out of range |
| **Annelida** | | | | | |
| | *Prionospio thalanji* | Bundera Sinkhole worm | 7 | CS1 (Cr S2) | Out of range |
| **Gastropoda** | | | | | |
| | *Dupucharopa millestriata* | Depuch Island charopid land snail | 7 | CS2 (P2) | Out of range |

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