

MEMO

MULGA DOWNS IRON

ORE MINE

**TARGETED BILBY & NIGHT
PARROT SURVEY**

PREPARED FOR: JBS&G | HANROY





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1. INTRODUCTION

1.1. Background

Mulga Downs Iron Ore Mine (MDIOM) is currently being assessed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, Commonwealth (EPBC 2022/9255)) and the *Environmental Protection Act 1986* (EP Act, Western Australia (WA) (Assessment Number 2326)). The MDIOM Development Envelope is located on the Mulga Downs Station, approximately 210 kilometres (km) south of Port Hedland and 180 km north-west of Newman in the Pilbara region of WA.

JBS&G Pty Ltd (JBS&G, on behalf of HanRoy Iron Ore Projects Pty Ltd (HanRoy)), engaged ecologia Environment (ecologia) and Biologic Environmental Survey (Biologic) to conduct surveys at the MDIOM in 2018-2020 and 2021-2022, respectively. Some areas were identified as potentially suitable for the Bilby (*Macrotis lagotis*; EPBC Act & *Biodiversity Conservation Act 2016* (WA, BC Act): Vulnerable (VU)), and the Night Parrot (*Pezoporus occidentalis*; EPBC Act: Endangered (EN) & BC Act: Critically Endangered (CR)) and additional targeted surveys for these species are required to support the Commonwealth and State environmental impact assessments for the Proposal.

1.2. Scope

Spectrum Ecology & Spatial (Spectrum) was engaged by JBS&G | HanRoy to undertake targeted Bilby and Night Parrot surveys at the MDIOM Development Envelope and surrounding tenements (Malay Well E47/2117-1, Mine Area M47/1621 and Murrays Hill L45/316 (the Survey Area)) within potential habitat. The Survey Area covered 34, 708 hectares (ha).

Biologic (2022a) and ecologia (2021) identified two habitat types as potential foraging and dispersal habitat for the Bilby and three habitat types as potential foraging and nesting habitat for the Night Parrot. Furthermore, the Department of Climate Change, Energy, the Environment and Water (DCCEEW), outlined in the Guidelines for the Content of a Draft Public Environment Report: Mulga Downs Iron Ore, Mine, WA (EPBC 2022/9255), an additional foraging habitat type for the Night Parrot (Claypan), that required further survey effort (DCCEEW, 2022). Attachment 4 of DCCEEW (2022), provides the interim guidelines for Pilbara matters of national environmental significance (MNES) and supporting habitat characterisation, which outlines critical habitat (breeding/nesting) and supporting (foraging and dispersal) habitat for both these species and was also reviewed to identify habitats requiring survey. The Survey Area and habitat types are outlined in Table 1.1, and shown on Map 1.1 and Map 1.2.

Table 1.1: Bilby and Night Parrot Habitat Identified by ecologia, Biologic and DCCEEW

Habitat type	Bilby		Night Parrot	
	Potential breeding	Potential foraging & dispersal	Potential nesting	Potential foraging
Stony Plains and Slopes that support dense, mature <i>Triodia</i>	-	X ¹	X	X
Chenopod/Cracking Clay	-	X ¹	-	X
Claypan	-	-	-	X ¹
Drainage Area/Floodplain, where dense, mature <i>Triodia</i> is present	X ¹	X	X	X
Mulga Woodland	X ¹	X	-	-

¹ = (DCCEEW, 2022)

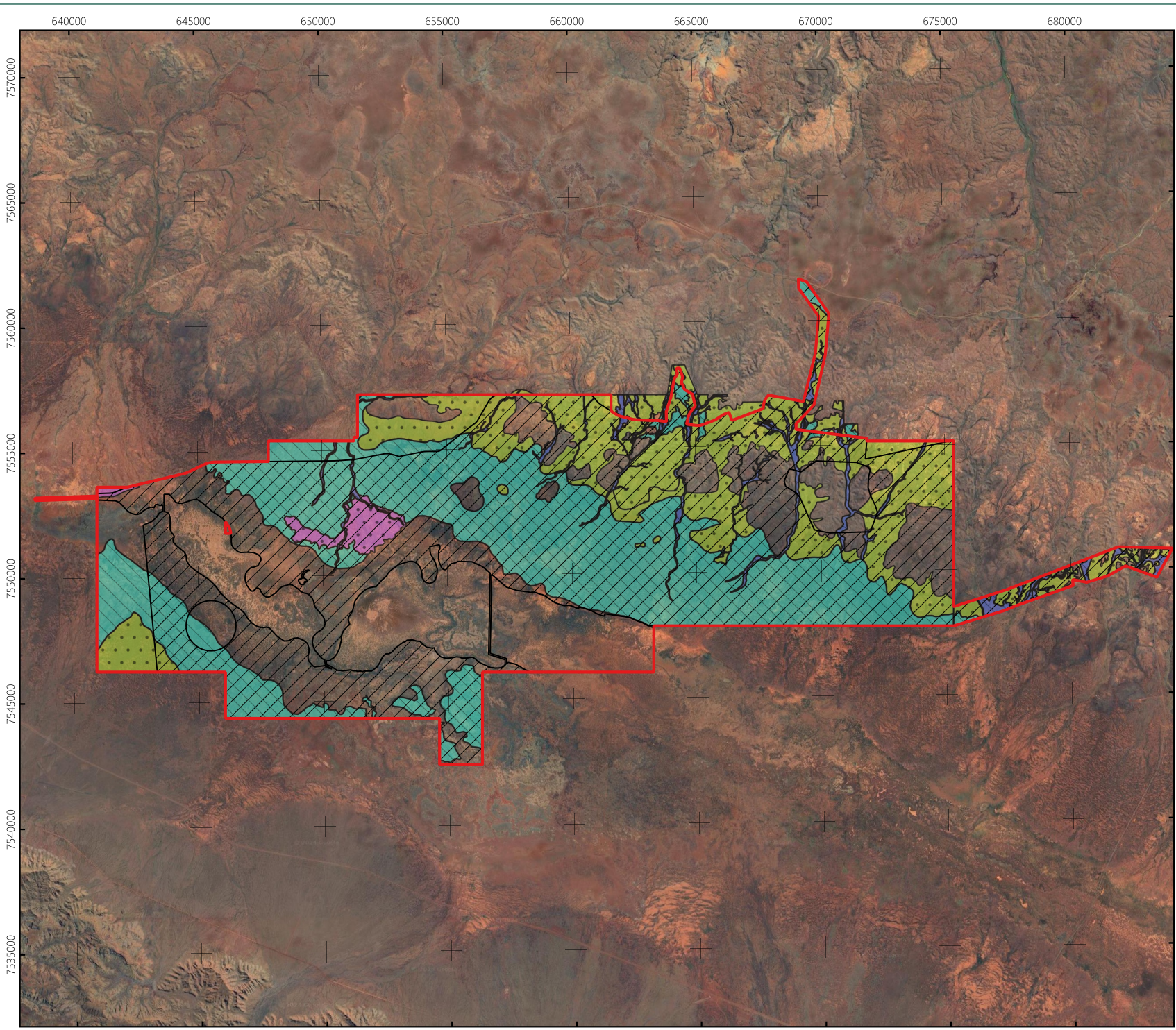
1.3. Legislation & Guidelines

Terrestrial vertebrates in Western Australia are protected under various legislation (Appendix A), including:

- BC Act, WA;
- EP Act, WA; and
- EPBC Act, Commonwealth.

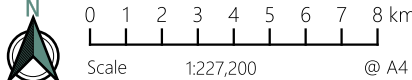
The survey was compliant with survey guidelines and species-specific plans, as outlined in:

- EPA Environmental Factor Guideline: Terrestrial Fauna (Environmental Protection Authority, 2016);
- EPA Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (Environmental Protection Authority [EPA], 2020);
- Survey guidelines for Australia's Threatened birds (Department of the Environment Water Heritage and the Arts [DEWHA], 2010);
- Survey guidelines for Australia's threatened mammals (Department of Sustainability Environment Water Population and Communities [DSEWPaC], 2011);
- Guidelines for determining the likely presence and habitat usage of night parrot (*Pezoporus occidentalis*) in Western Australia (Department for Biodiversity Conservation and Attractions [DBCA], 2024);
- Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) in Western Australia (Department of Parks and Wildlife [DPaW], 2017);
- Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA, 2017); and
- Recovery Plan for the Greater Bilby (*Macrotis lagotis*) (DCCEEW, 2023).



Legend

- Survey Area
- MDIOM Development Envelope
- Fauna Habitats
- Chenopod/ Cracking Clay Floodplain
- Drainage Lines/ Floodplains
- Mulga Woodland
- Stony Spinifex Plains and Hillslopes
- Habitat Type
- Potential Foraging & Dispersal
- Potential Breeding, Foraging & Dispersal



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre



Author: GF Date: 12-08-2024

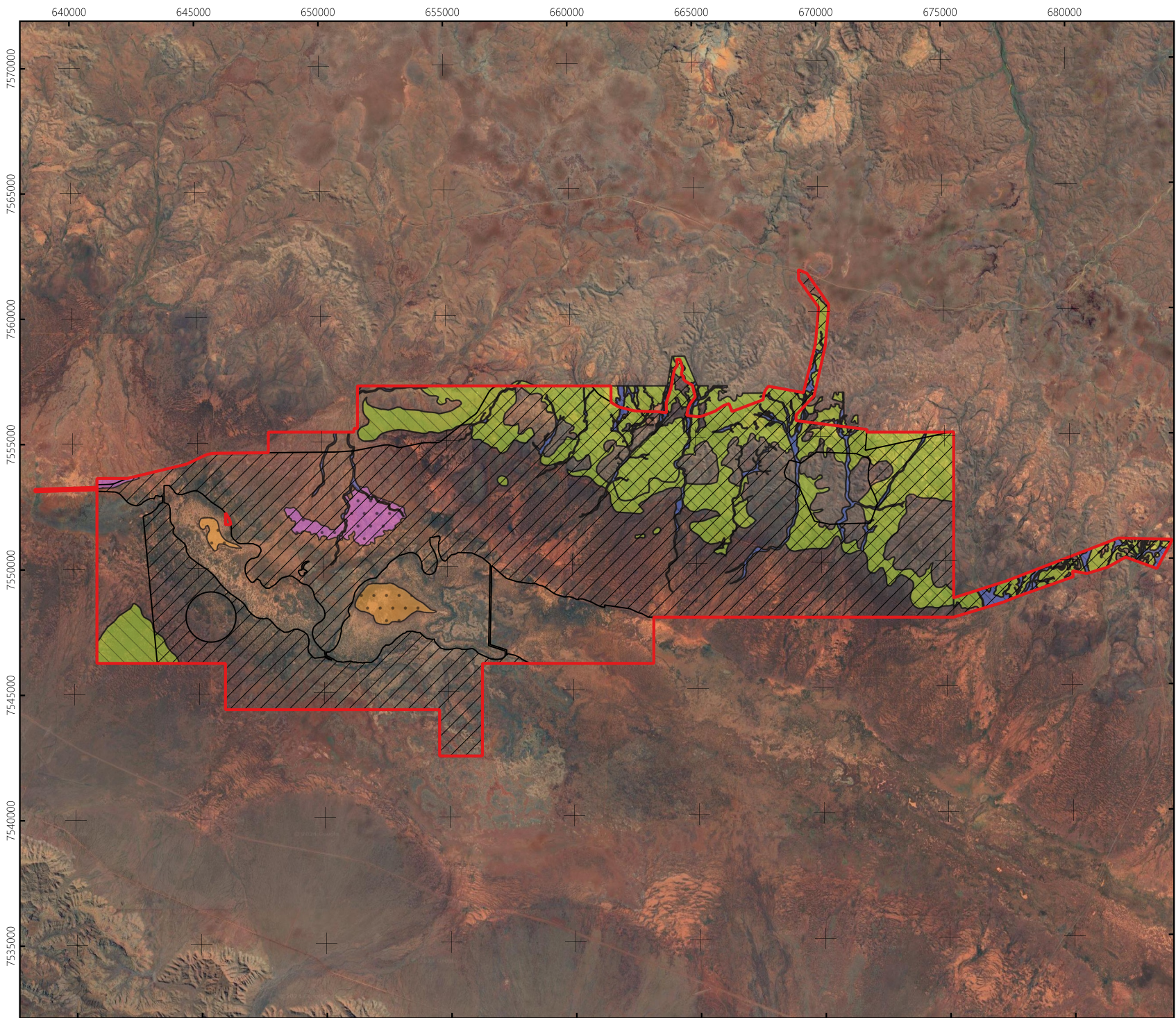
Potential Bilby Habitat

MDIOM Bilby & Night Parrot









MAP

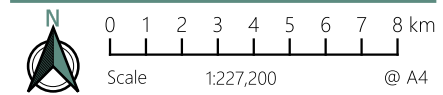
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1.1



Legend

-  Survey Area
-  MDIOM Development Envelope
- Fauna Habitats
 -  Chenopod/ Cracking Clay Floodplain
 -  Claypan
 -  Drainage Lines/ Floodplains
 -  Stony Spinifex Plains and Hillslopes
- Habitat Type
 -  Potential Foraging
 -  Potential Nesting or Foraging



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre



Author: GF

Date: 12-08-2024

Potential Night Parrot Habitat

MDIOM Bilby & Night Parrot

MAP

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1.2

1.4. Significant Species Information

1.4.1. Bilby, *Macrotis lagotis*

Conservation Status: EPBC Act & BC Act: Vulnerable.

Distribution, Habitat and Ecology: The Bilby is a medium-sized marsupial that formerly inhabited the arid and semi-arid zones of 70% of Australia (Department of Environment and Conservation [DEC], 2012). The distribution of this species has contracted to less than 20% of their former range, and the distribution is thought to have further decreased to the north, due to threatening processes (DCCEEW, 2023). The remaining populations occur in the Northern Territory, some isolated areas in south-west Queensland and within central and northern WA (DEC, 2012; Dziminiski et al., 2020; Northover et al., 2023).

Within WA, the Bilby populations are limited to the Pilbara, Kimberley and the central desert and rangelands regions. The current Bilby distribution within the Pilbara region encompasses the eastern portion or around 48%. The western boundary of this distribution extends south-east from around 50 km west of Port Hedland to approximately 350 km past Newman (Dziminiski, Carpenter and Morris, 2020). However, there are historic or unreliable records in areas to the west and south-west of their current distribution in the Pilbara. These areas require further survey work to confirm the Bilby is absent (Dziminiski, Carpenter and Morris, 2020).

The Bilby inhabits a variety of substrate and vegetation types in northern WA from sand plains with low *Acacia* spp. over hummock grasses to Mulga shrubland on loamy-clay soils, and can broadly fit into three landscape types as per the Cramer et al. (2017) conceptual model (Cramer et al., 2017; Northover et al., 2023) which is detailed in Table 1.2.

Table 1.2: Suitable Habitat Characteristics of the Bilby in the north of WA

Landform	Substrate	Vegetation
Fluvial, includes a variety of drainage lines: <ul style="list-style-type: none"> • Creek lines including upland systems • Broad paleodrainage, low-lying and perched systems • Calcrete 	<ul style="list-style-type: none"> • Sandy to sandy loam soils • Alluvial and calcrete • Salt channels and lakes 	<ul style="list-style-type: none"> • Low shrubs of <i>Acacia</i> spp. and <i>Melaleuca</i> spp. over <i>Cyperus bulbosus</i>. and hummock grasslands usually with <i>Triodia basedowii</i>, <i>T. pungens</i> and <i>T. schinzii</i>
Residual, includes: <ul style="list-style-type: none"> • Laterite • Silcrete • Stony rises • Uplands • Breakaways • Plateaus • Granitic hills 	<ul style="list-style-type: none"> • Sandy to sandy loam soils • Red earths usually with lateritic, small gravel, stony matrix 	<ul style="list-style-type: none"> • Low shrubs of <i>Acacia</i> spp., including Mulga shrubland (<i>A. aneura</i>), over hummock and tussock grasslands
Sand plan and sand dune, includes: <ul style="list-style-type: none"> • Flat to gently undulating plains • Dune fields • Isolated dunes 	<ul style="list-style-type: none"> • Soil texture ranges from coarse sand to light medium clay • Non-calcareous gradational soils • Duplex soils – red sand, loamy sand plains and dune fields 	<ul style="list-style-type: none"> • Low woodland (<10 m) of <i>Eucalyptus</i> and <i>Acacia</i> spp. over shrub-steppe communities over <i>Triodia</i> hummock grasslands, occasionally with rich understorey; or • Pindan woodland over hummock and tussock grassland (Kimberley)

Where rainfall is higher in northern WA, the Bilby tends to occupy all three landforms, while in the south, they are more restricted to fluvial and residual landforms (Cramer et al., 2017). It is uncertain why the residual landforms are so important, as the substrate tends to be harder and includes less inundated run-off areas.

They also include shrub species such as *Acacia hilliana* that support root-dwelling larvae that the Bilby use for food, so it appears these areas are more suitable for foraging (Cramer et al., 2017). Additionally, it seems that fire may influence the type and availability of food resources and may assist in improving habitat favourability in parts of the Bilbies range (Cramer et al., 2017; Northover et al., 2023).

Within the Pilbara, some preliminary distribution modelling undertaken by Dziminski and Carpenter (2017) showed that the habitat variables of soil type, depth and elevation are the major variables predicting preferred Bilby habitat. Observations have also shown that in addition to the species requiring a substrate that is suitable for burrowing, such as sand, sandy clay or sandy gravel, the Bilby also has an association with certain stands of *Acacia* spp (and other plants) that provide a key food resource for the root-dwelling larvae (Cramer et al., 2017; Northover et al., 2023). In particular, the Cossidae (moth) larvae appears to be a major food resource for the Bilby (Dziminski and Carpenter, 2017; Southgate et al., 2019). Within the Pilbara, these plant species include:

- *Acacia bivenosa*;
- *A. colei*;
- *A. dictyophleba*;
- *A. melleodora*;
- *A. stellaticeps*;
- *A. trachycarpa* including dwarf variant; and
- *Senna notabilis*.

In addition, two other species that also occur in the Pilbara; *Acacia hilliana* and *A. rhodophloia*; also have records of Cossidae larvae, however the observations of Bilby digging at the base of these plants are only from the Tanami Desert (NT) or the Central Desert and Gibson Desert IBRA regions (Southgate et al., 2019).

The larvae are extracted from the root systems and the Bilby is the only known species in the arid and semi-arid areas of Australia that opens the root system in this specific way (Southgate et al., 2019).

The Bilby is omnivorous and consumes a variety of invertebrates such as root-dwelling larvae mentioned previously, beetles, and termites, along with plant materials such as seeds and bulbs. The majority of the food resources for the Bilby are either acquired from the soil surface or by digging (Southgate et al., 2019).

The Bilby is a nocturnal species that shelters during the day in an extensive burrow system of up to 4.5 m in length and 2 m deep, which could spiral down, have side branches, or the tunnel entrances may be blocked by freshly dug soil. Most burrows have a single entrance; however, some can have multiple entrances like rabbit warrens. A single individual may use up to 18 burrows (Moseby et al., 2003; DEC, 2012).

The size of the Bilby's home range is estimated to be between 0.18 km² and 3.16 km² depending on the location and availability of foraging habitat supporting insects, fungi and vegetation (Pavey, 2006). Sudden shifts in spatial distribution can occur, particularly in sandy deserts, in response to changing food availability. Females appear to display long-term site fidelity whereas males display a roaming behaviour allowing them to mate with multiple females (Pavey, 2006).

1.4.2. Night Parrot, *Pezoporus occidentalis*

Conservation Status: EPBC Act: Endangered & BC Act: Critically Endangered.

Distribution, Habitat and Ecology: The Night Parrot is a rarely encountered, elusive, nocturnal parrot that is primarily ground-feeding (Bamford Consulting Ecologists, 2005). Records are very rare and therefore the information about this species is limited (Department of Parks and Wildlife, 2017). Historically, the species occurred over much of the semi-arid and arid zone of Australia (Garnett, Szabo and Dutson, 2011). Recently, Night Parrots have been recorded from a number of locations, including Pullen Pullen reserve in Queensland, near the Fortescue Marsh in the Pilbara (Fortescue Metals Group, 2021) and the East Murchison region of WA (N.A. Jackett et al., 2017).

Based on the limited information and observations, it is thought that a range of habitats are utilised by the Night Parrot. Roosting and foraging habitats can differ in the composition of plants. Roosting sites are located in *Triodia* spp. grassland where the Night Parrot shelters in *Triodia* hummocks. Historical records also suggest that roosting may take place under dense succulent samphire shrubs (*Tecticornia* spp.; Murphy et al., 2018). Foraging sites are visited during the night and are in treeless non-*Triodia* open grasslands and herb fields. The foraging areas are often associated with drainage systems which concentrate limited rainfall and provide a rich floristic diversity (Murphy et al., 2018). Radio-tracking studies have shown that the species can travel up to 40 km each night in a cumulative manner, with roost and feeding sites being not more than 10 km apart (Murphy et al., 2018). They have been recorded visiting open water sources, including artificial water holes for drinking, during the night (Bamford Consulting Ecologists, 2005; McDougall et al., 2009; Murphy et al., 2018).

Ecological information is currently limited though studies are ongoing. Roosting and nesting appears to occur in long unburnt, often ring forming, *Triodia* spp. hummocks. An observation of nesting activity was made in 2017 in the East Murchison IBRA sub-region in WA. The nest consisted of a chamber within a *Triodia* sp. hummock with a steep downward angled entrance and contained a single round, white egg (N.A. Jackett et al., 2017). Breeding/ nesting activity may be triggered by above average rainfall. Historically, feeding habitat was thought to consist of chenopod vegetation, salt lake fringing *Triodia* hummock grasslands and other grasslands (Garnett et al., 1993). Recent observations in Queensland confirm that chenopods, soft perennial grasses, *Triodia* hummock grass and herbs are used for foraging with no particular specialisation observed (Murphy et al., 2018). There is no information on migration activities of the Night Parrot though literature suggests that the species may migrate in response to changing climatic conditions and associated changes in food resource availability (Fortescue Metals Group, 2005; Bamford Consulting Ecologists, 2008; Murphy et al., 2018).

2. METHODS

2.1. Desktop Assessment

A species-specific desktop review of relevant and available biological data sources for the Study Area was undertaken prior to the field survey. The desktop Study Area includes a buffer of approximately 50 km surrounding the Survey Area.

2.1.1. Biological Database Searches

The following databases were searched and incorporated into the desktop assessment (Table 2.1).

Table 2.1: Summary of Database Searches

Database	Custodian	Species Group	Details
Commonwealth Protected Matters Search Tool (PMST)	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	EPBC Act listed vertebrate and invertebrate fauna species	Date: 22/09/2023 Buffer: 50 km
Threatened Fauna Database Search	Department of Biodiversity, Conservation and Attractions (DBCAs)	Threatened and Priority vertebrate and invertebrate fauna species	Date: 10/10/2023 Buffer: 50 km Reference: #7549
Dandjoo		Vertebrate and invertebrate fauna species	Date: 1/11//2023 Buffer: 50 km
Index of Biodiversity Surveys and Assessments (BSA) Database	Department of Water and Environmental Regulation (DWER)	Vertebrate and invertebrate fauna species	Date: 1/11//2023 Buffer: 50 km

2.1.2. Literature Review

Previously conducted assessments within the desktop Study Area were reviewed for Bilby and Night Parrot records. Reports were incorporated if they were provided by the client or if they were publicly available. The nine reports incorporated into the literature review are listed in Table 2.2.

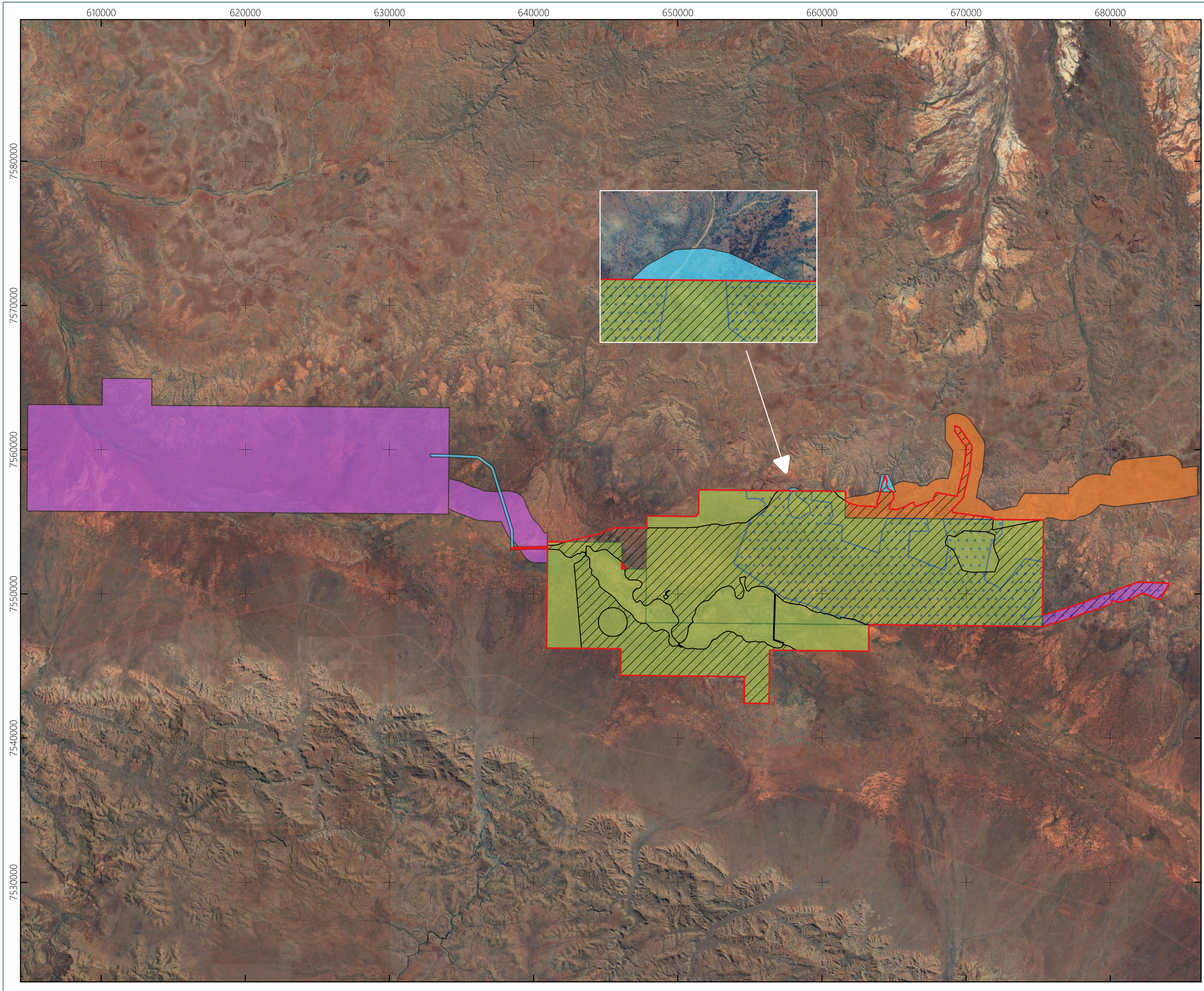
Table 2.2: Previously Conducted Biological Assessments

Reference	Title & Full Reference	Year	Distance (km)
Solar Farm, Haul Road & Pipeline (Spectrum, 2023a)	MDIOM Solar Farm, Haul Road & Pipeline Vertebrate & Short-range Endemic Terrestrial Fauna Assessment (Spectrum, 2023a)	2023	0
Mulga Downs West Borefield and Southern Corridor (Biologic, 2022a)	Mulga Downs Iron Ore Mine: Mulga West Borefield and Mulga East Southern Corridor Terrestrial Fauna Survey (Biologic, 2022)	2021-2022	0
Mulga Downs Transport Corridor (Biologic, 2022b)	Mulga Downs Iron Ore Project: Transport Corridor to Great Northern Hwy Terrestrial Fauna Survey (Biologic, 2022b)	2021-2022	0
Mulga Downs Hub and Rail Spur (Spectrum, 2022)	RHIL Mulga Downs Hub and Rail Spur – Eastern Portion of Alignments 8B & 1B Basic & Targeted Terrestrial Fauna Assessment (Spectrum, 2022)	2022	10

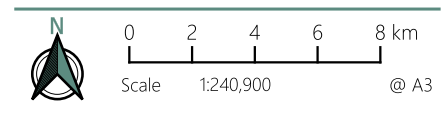
Reference	Title & Full Reference	Year	Distance (km)
Mulga East (ecologia 2021)	Hancock Prospecting Pty Ltd Mulga East Baseline Terrestrial Fauna Assessment (ecologia 2021)	2018-2020	0
Investigator Project (ecologia 2014)	Fortescue Metals Group Ltd Investigator Project Terrestrial Vertebrate Fauna Assessment (ecologia, 2014)	2014	0-5
Mulga Downs (Terrestrial Ecosystems, 2013)	Level 2 Fauna Assessment for the Mulga Downs Project Area (Terrestrial Ecosystems, 2013)	2013	0
Option 8B (Spectrum, 2023b)	Extended Alignment of Option 8B - Basic & Targeted Terrestrial Fauna Assessment Interim Report (Spectrum, 2023b)	2023	24.2
Brockman Rail (ecologia, 2011)	Brockman Resources Limited Rail Proposal Area Level 2 Vertebrate Fauna Survey (ecologia, 2011)	2011	35

2.1.3. Previous Surveys Completed for the Bilby and Night Parrot

As outlined in section 2.1.2 and Table 2.2, several assessments have previously been completed within, or immediately adjacent to, the Survey Area from 2012 to 2023 (Map 2.1). The reports and data were reviewed to understand the fauna habitats present and the previous survey effort completed for both the Bilby and Night Parrot within the Survey Area.



- Legend**
- Survey Area
 - MDIOM Development Envelope
 - Spectrum (2023a)
 - Biologic (2022a)
 - Biologic (2022b)
 - ecologia (2021)
 - Terrestrial Ecosystems (2013)



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre



Author: GF Date: 23-08-2024

Previous Surveys at the MDIOM

MDIOM Bilby & Night Parrot

MAP
2.1

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2.2. Field Methods & Sampling Effort

2.2.1. Survey Timing and Weather

The survey was completed over the following field events:

- A four-day period from 18 to 21 March 2024 (Phase one);
- A two-day period from 26 to 27 March 2024 (Phase one); and
- An eight-day period from 13 to 20 May 2024 (Phase two).

Phase one encompassed the March field events, and Phase two was completed in May. The nearest Bureau of Meteorology (BoM) weather station - Karijini North (BoM #005098), approximately 10.6 km south of the Survey Area, recorded 101.6 mm of rain in the two weeks prior to the first field event, so the timing was optimal for this survey (Figure 2.1). No rain was recorded in the months of April and May 2024.

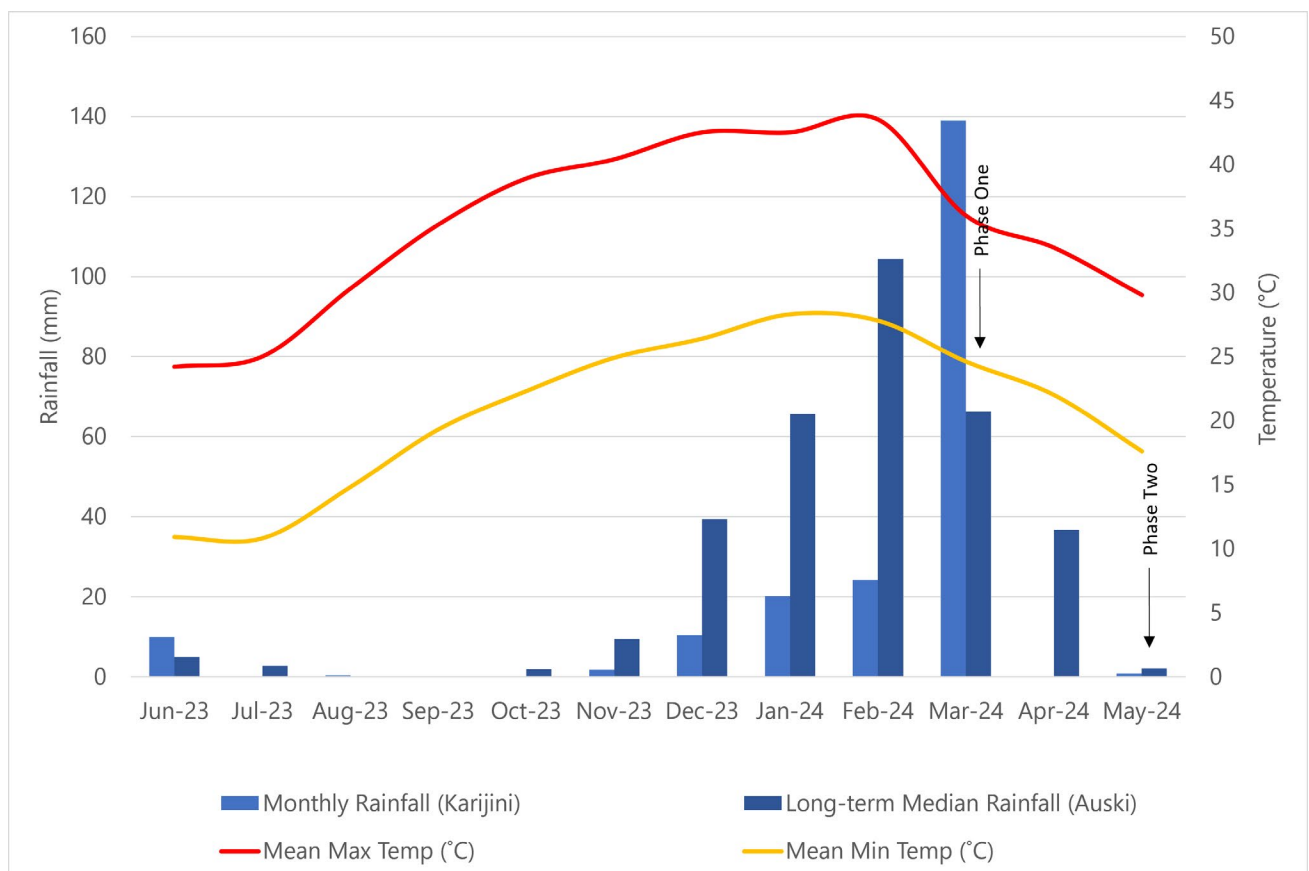


Figure 2.1: Historical and Recent Temperature and Rainfall Data

2.2.2. Bilby

Previous assessments in the Survey Area and surrounds, were reviewed as outlined in section 2.1.3.

Thirty habitat assessments and 49 targeted Bilby searches were conducted across the Survey Area over both phases, totalling 80 person-hours of effort and 132.2 km traversed (Table 2.3, Map 2.2).

Targeted searches were completed using the 2-hectare (ha) plot technique as defined in the Bilby survey guidelines (DBCA, 2017). Due to the size of the Survey Area, plots were spaced at approximately 4 km (where possible) over the Survey Area to ensure sampling independence, with additional sites located in areas of preferred habitat. The targeted searches included looking for Bilby evidence in the form of tracks, scats, diggings, and burrows for approximately 1 person hour at each site. Where plant species could be identified in the field, more focus was placed on specific *Acacia* species (see section 1.4.1) known to contain root-dwelling larvae that the Bilby favours as a food source (Southgate et al., 2019). Bilbies can be surveyed any time of the year using non-invasive techniques (DBCA, 2017).

2.2.3. Night Parrot

Survey techniques for the Night Parrot comprised of habitat assessments, and the installation of passive acoustic recorders (PARs) in likely roosting and nesting sites (i.e. in areas with large, mature clumps of *Triodia*) in the months following significant rainfall events (DBCA, 2024; DPaW, 2017; S. A. Murphy et al., 2017).

During the survey, 18 Song Meter Mini passive acoustic recorders (PARs) were deployed for up to eight nights within the habitat types defined in Table 1.1, especially in areas that contained large, long unburnt *Triodia* or potential foraging and drinking sites (DBCA, 2024). Some areas of the Claypan habitat could not be accessed due to flooding and heritage site access restrictions, and areas previously surveyed were taken into consideration (section 2.1.3). Site locations are displayed on Map 2.3. Of the 18 PARs, 12 were deployed during Phase one (March) and an additional six were deployed during Phase two (May), with a total of 131 recording nights and 1,572 hours of recordings. The survey site locations and habitat types are detailed in Table 2.3.

The PARs were elevated off the ground at around 1-1.5 metres to maximise the detection range. Units were installed on living or dead shrubs, trees or attached to stakes, ensuring minimal noise interference from wind blowing branches, leaves, or flagging tape surrounding each PAR. Each recorder was programmed to record from 25 minutes pre-dusk to 25 minutes post-dawn for each night. The ARUs were set to record between 0 to 24,000 Hz, despite known Night Parrot calls typically falling within the range of 1500 to 3500 Hz (Leseberg et al., 2019). This broad range was chosen to capture potential irregular calls and to record other bird species. Recordings were sent to Dr. Nick Leseberg (Adaptive NRM) for analysis (Appendix B). All files were scanned using Kaleidoscope Pro v 5.2.1, within the frequency range of 1,500 to 3,500 Hz, the calls within this range were then compared to a reference library of Night Parrot calls and were manually reviewed. The methods used follow the DBCA Guidelines for determining the likely presence and habitat usage of night parrot (*Pezoporus occidentalis*) in Western Australia (2024) and it was confirmed by Nick Leseberg that "the number of nights of data collected was sufficient to allow robust conclusions around the presence of long-term stable roost sites in the immediate vicinity of each survey point at the time of the survey" (Appendix B).

2.2.4. Opportunistic Records

Additional fauna species were opportunistically sampled as encountered in the Survey Area. Opportunistic records included direct sightings or indirect evidence (i.e. tracks, scats, remains).

Table 2.3: Survey Site Locations

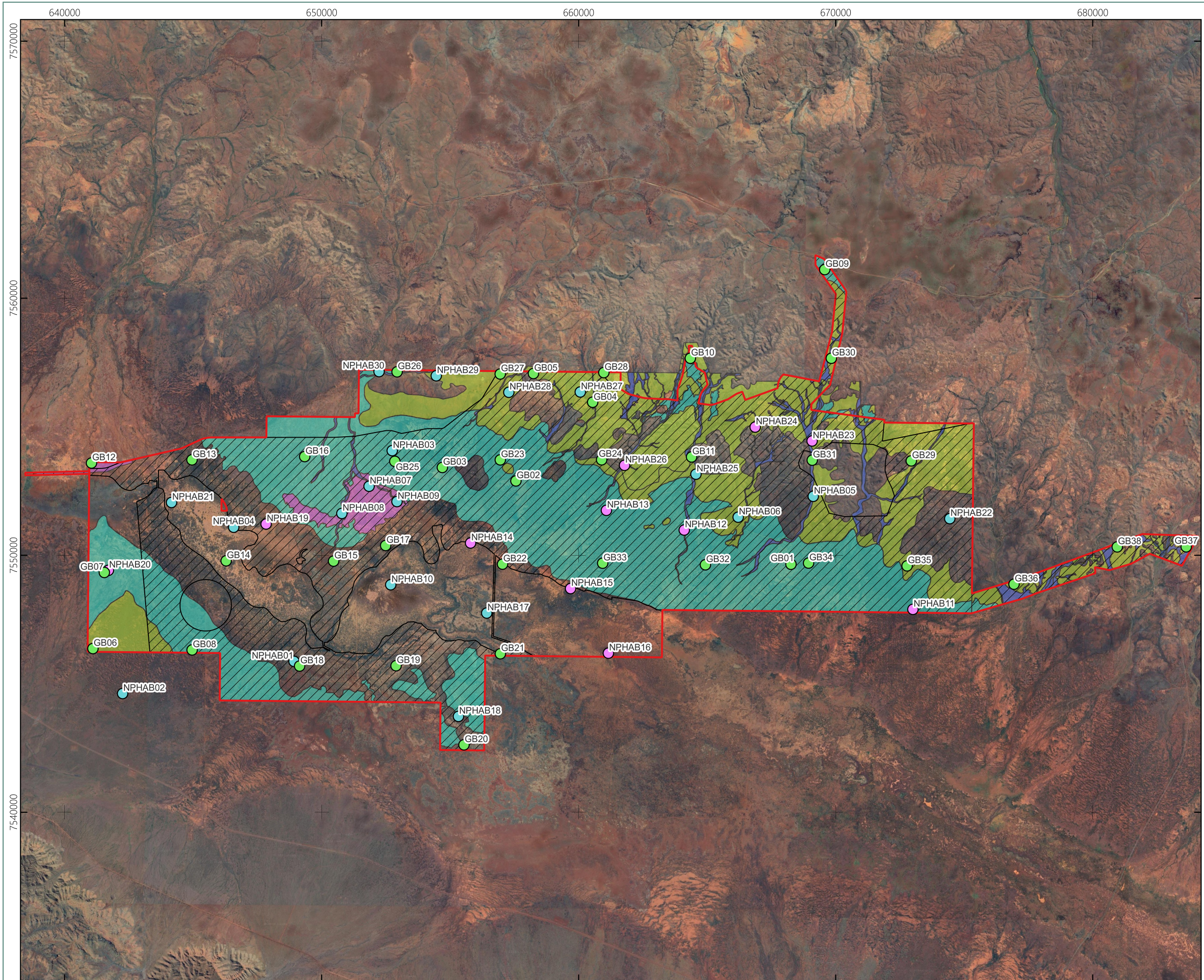
Site name	Coordinates		Habitat Type
	Easting	Northing	
Bilby			
GB01	668258	7549651	Mulga Woodland
GB02	657559	7552893	Mulga Woodland
GB03	654696	7553417	Mulga Woodland
GB04	660543	7555955	Stony Spinifex Plain
GB05	658239	7557071	Stony Spinifex Plain
GB06	641103	7546373	Mulga Woodland
GB07	641547	7549333	Mulga Woodland
GB08	644962	7546320	Mulga Woodland
GB09	669573	7561117	Mulga Woodland
GB10	664345	7557667	Stony Spinifex Plain
GB11	664392	7553827	Drainage Line
GB12	641047	7553591	Chenopod/Cracking Clay
GB13	644957	7553715	Drainage Area/Floodplain
GB14	646286	7549786	Drainage Area/Floodplain
GB15	650465	7549775	Drainage Area/Floodplain
GB16	649342	7553842	Mulga Woodland
GB17	652492	7550382	Drainage Area/Floodplain
GB18	649143	7545693	Stony Plain
GB19	652896	7545705	Stony Plain
Night Parrot - Habitat Assessments			
NPHAB01	648925	7545874	Stony Spinifex Plain
NPHAB02*	642257	7544622	Spinifex Plain
NPHAB03	652746	7554072	Mulga Woodland
NPHAB04	646578	7551091	Claypan
NPHAB05	669125	7552294	Spinifex Plain adjacent to Drainage Line
NPHAB06	666204	7551483	Stony Spinifex Plain
NPHAB07	651845	7552686	Chenopod/Cracking Clay
NPHAB08	650787	7551628	Chenopod/Cracking Clay
NPHAB09	652931	7552090	Chenopod/Cracking Clay
NPHAB10	652687	7548854	Claypan
NPHAB11	673002	7547897	Mulga Woodland
NPHAB12	664106	7550983	Drainage Line
NPHAB13	661078	7551749	Mulga Woodland
NPHAB14	655794	7550478	Drainage Area/Floodplain
NPHAB15	659684	7548706	Drainage Area/Floodplain
NPHAB16	661155	7546192	Drainage Area/Floodplain
NPHAB17	656423	7547753	Stony Spinifex Plain
NPHAB18	655322	7543733	Stony Spinifex Plain

Site name	Coordinates		Habitat Type
	Easting	Northing	
Bilby			
GB20	655538	7542628	Stony Spinifex Plain
GB21	656954	7546171	Drainage Area/Floodplain
GB22	657038	7549657	Drainage Area/Floodplain
GB23	656951	7553714	Mulga Woodland
GB24	660893	7553716	Stony Spinifex Hills
GB25	652848	7553656	Mulga Woodland
GB26	652936	7557138	Spinifex Plain adjacent to Drainage Line
GB27	656948	7557054	Stony Spinifex Plain
GB28	660979	7557128	Stony Spinifex Plain
GB29	672940	7553675	Spinifex Plain adjacent to Drainage Line
GB30	669829	7557667	Drainage Line
GB31	669086	7553702	Drainage Line
GB32	664931	7549632	Mulga Woodland
GB33	660934	7549694	Mulga Woodland
GB34	668944	7549699	Mulga Woodland
GB35	672777	7549590	Stony Spinifex Hills
GB36	676936	7548877	Mulga Woodland adjacent to Drainage Line
GB37	683635	7550331	Floodplain
GB38	680953	7550328	Stony Spinifex Hills
Acoustic Recordings			
NP01	638562	7553142	Alluvial Clay Plain
NP02	650604	7550786	Drainage Line
NP03	654973	7547358	Stony Spinifex Plain
NP04	642338	7547797	Stony Spinifex Plain
NP05	642287	7553339	Floodplain
NP06	671328	7550651	Stony Spinifex Plain
NP07	652375	7552136	Chenopod/Cracking Clay
NP08	650875	7552009	Drainage Line
NP09	650680	7551586	Chenopod/Cracking Clay
NP10	652753	7545459	Stony Spinifex Plain
NP11	670953	7553433	Rocky Spinifex Hills
NP12	673781	7554246	Stony Spinifex Plain
NP13	666603	7553119	Stony Spinifex Plain
NP14	673536	7550421	Rocky Spinifex Hills
NP15	665109	7553881	Rocky Spinifex Hills
NP16	662272	7554920	Stony Spinifex Plain
NP17	658484	7556770	Rocky Spinifex Hills
NP18	657346	7556149	Stony Spinifex Plain

Site name	Coordinates		Habitat Type
	Easting	Northing	
Night Parrot - Habitat Assessments			
NPHAB19	647840	7551217	Drainage Area/Floodplain
NPHAB20	641704	7549416	Mulga Woodland
NPHAB21	644160	7552055	Drainage Area/Floodplain
NPHAB22	674436	7551426	Stony Spinifex Hills
NPHAB23	669080	7554447	Drainage Line
NPHAB24	666866	7554988	Stony Spinifex Plain

* 1.6 km outside the Survey Area

Site name	Coordinates		Habitat Type
	Easting	Northing	
Night Parrot - Habitat Assessments			
NPHAB25	664562	7553156	Drainage Line
NPHAB26	661784	7553501	Drainage Line
NPHAB27	660062	7556354	Stony Spinifex Plain
NPHAB28	657282	7556342	Stony Spinifex Plain
NPHAB29	654459	7556983	Stony Spinifex Plain
NPHAB30	652234	7557146	Stony Spinifex Plain



Legend

- Survey Area
- MDIOM Development Envelope
- Survey Sites
 - Habitat Assessment
 - Habitat Assessment & Targeted Search
 - Targeted Search
- Fauna Habitats
 - Chenopod/ Cracking Clay Floodplain
 - Drainage Lines/ Floodplains
 - Mulga Woodland
 - Stony Spinifex Plains and Hillslopes

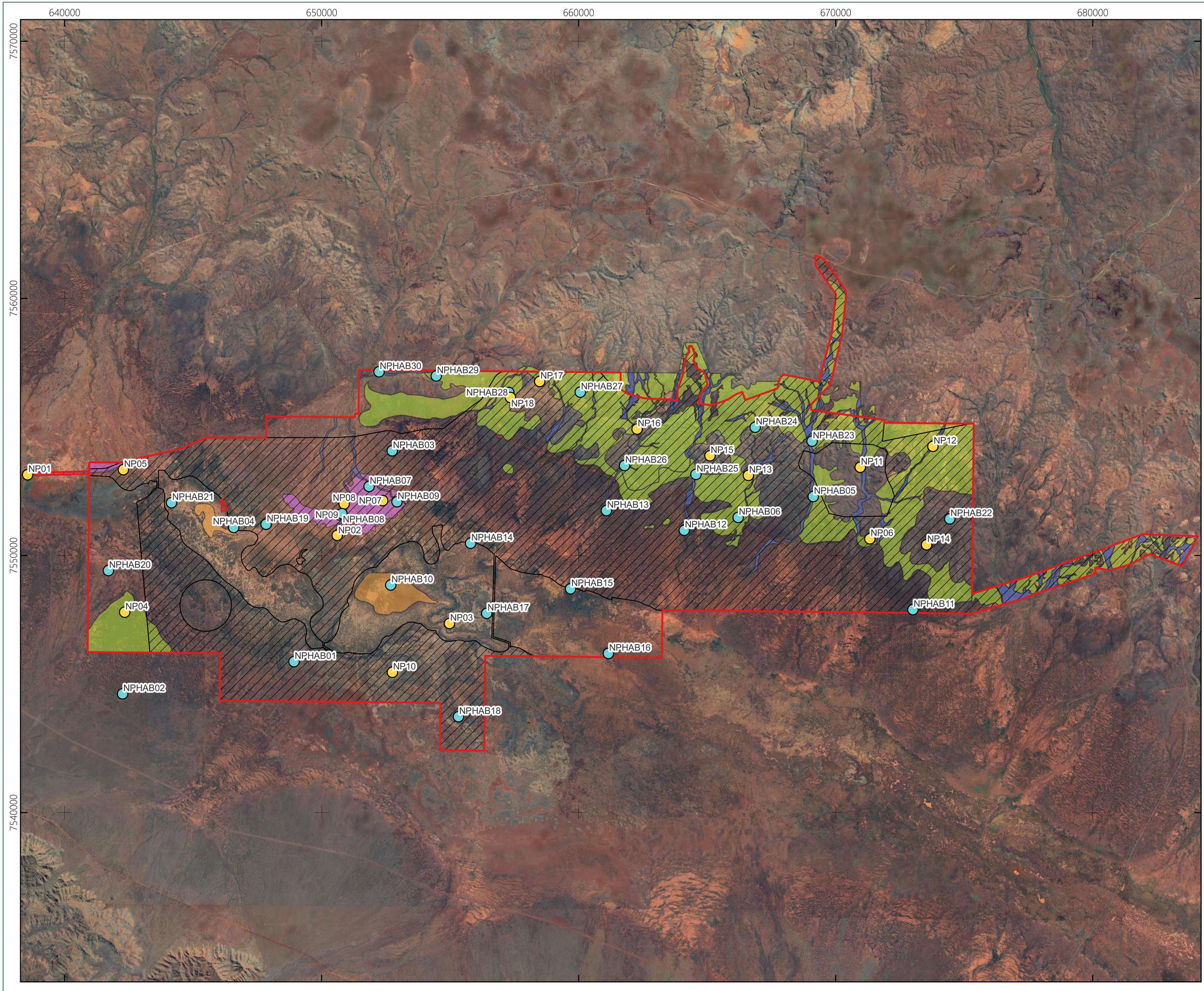
0 1 2 3 4 5 km
 Scale 1:135,100 @ A3

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre
 Spectrum
ECOLOGY • SPATIAL

Author: GF
Date: 23-08-2024

Survey Sites - Bilby

MDIOM Bilby & Night Parrot



Legend

- Survey Area
- MDIOM Development Envelope
- Survey Sites
 - Acoustic Recorder
 - Habitat Assessment
- Fauna Habitats
 - Chenopod/ Cracking Clay Floodplain
 - Claypan
 - Drainage Lines/ Floodplains
 - Stony Spinifex Plains and Hillslopes

0 1 2 3 4 5 km
 Scale 1:135,100 @ A3

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre
 Spectrum
ECOLOGICAL • SPATIAL

Author: GF Date: 23-08-2024

Survey Sites - Night Parrot

 MDIOM Bilby & Night Parrot

 MAP
2.3

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3. RESULTS & DISCUSSION

3.1. Desktop Assessment

To provide regional context, a species-specific desktop assessment was completed, these results are discussed in detail in the following sections.

3.1.1. Bilby

One hundred and thirty-five Bilby records were returned from the DBCA Threatened Species Database Search, with one record within the Survey Area near the Mulga Downs Homestead in 2001 (Map 3.1). Dziminski *et al.* (2020) investigated the validity of this record as part of their comprehensive review of the historic and recent records of the Bilby in the Pilbara. This study outlined a confirmed Bilby range and identified areas that require further surveying due to inaccurate and historic records. The majority of the Survey Area falls outside the confirmed Bilby range, within the area requiring further investigation.

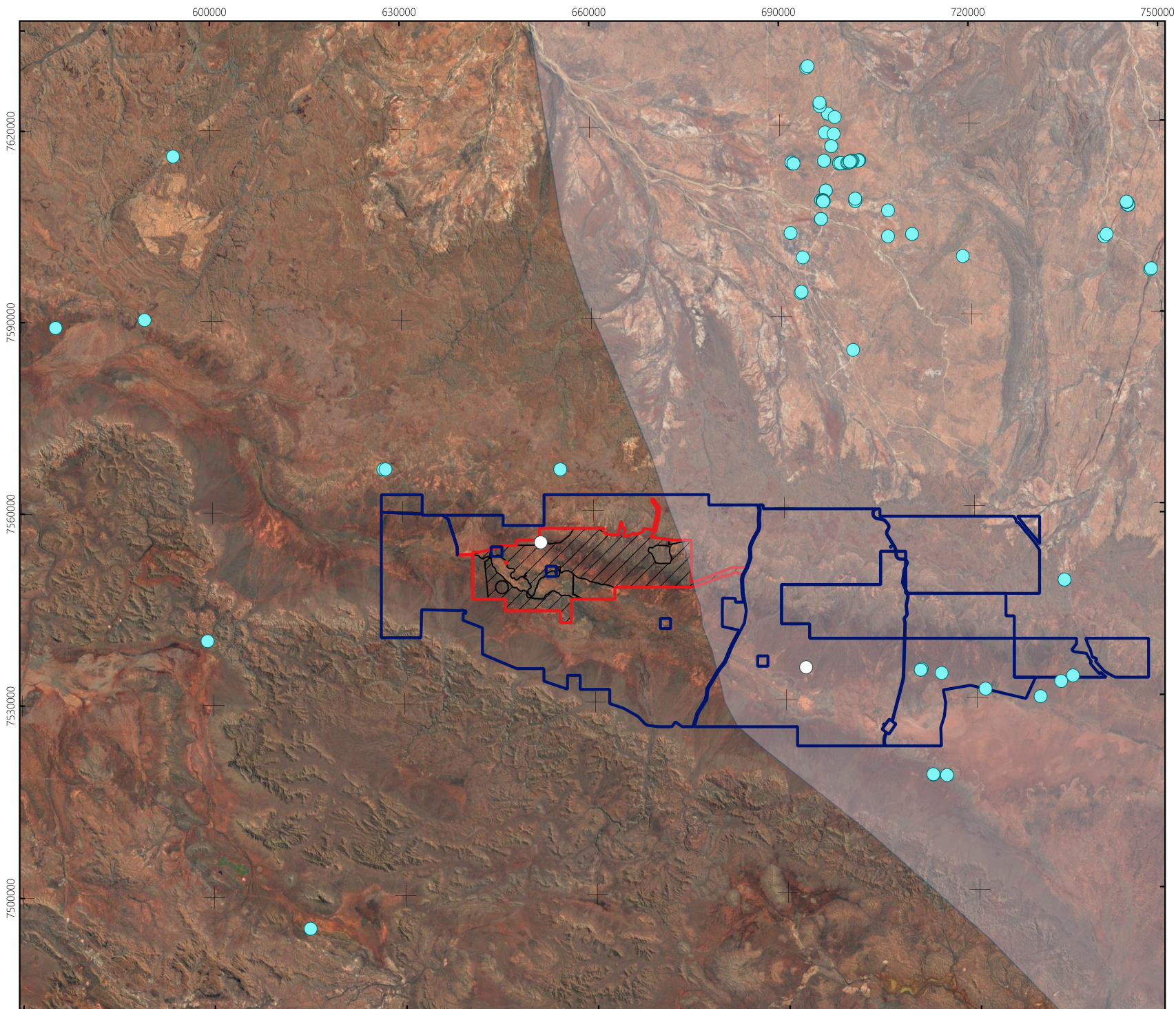
Dziminski *et al.* (2020) state that the 2001 record's accuracy is around 50 km and is indicative of Mulga Downs only, rather than the actual location of the Bilbies. The record was provided by the Mulga Downs pastoral leaseholder, and it appears there was a Bilby colony present in 2011 somewhere at the station, which covers an area of approximately 311,721 ha. The 2001 sighting is likely located within the known range of the Bilby, approximately 31 km east of the Survey Area (Map 3.1). Furthermore, there are an additional seven DBCA records for the Bilby from Mulga Downs Station ranging from 1997 to 2016. However, the locational accuracy of the 2016 record is incorrect; its actual location is further to the north-east, beyond the station's boundary. The other records within Mulga Downs station are located to the east, outside of the Survey Area, within the confirmed range for the Bilby (Map 3.1).

3.1.2. Night Parrot

The Night Parrot was not recorded from the database searches, but is known to occur from a few locations in WA, these include:

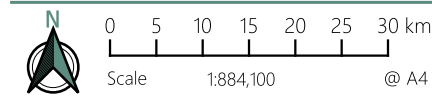
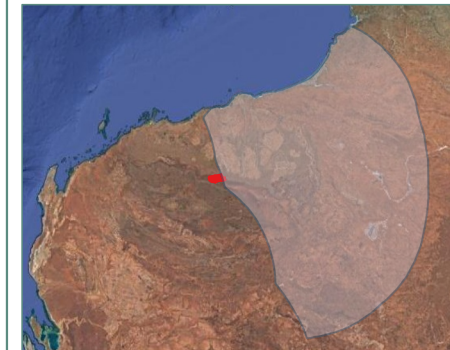
- Fortescue Marsh between 2005 and 2023 (Davis and Metcalf, 2008; Fortescue Metals Group, 2021);
- Near Lake Disappointment, about 285 km east of Newman in 2017-2018 (Harewood, 2018);
- Martu country, Great Sandy and Little Sandy deserts in 2020 (Australian Geographic, 2020);
- Lake Mackay, border of WA and NT in 2020 (Stantec, 2021);
- East Murchison (Hamilton *et al.*, 2017; Nigel A. Jackett *et al.*, 2017); and
- Near Lake Gregory in the Great Sandy Desert in the Kimberley region in 2018 (Kimberley Land Council, 2018).

The closest confirmed record to the Survey Area is located at the Fortescue Marsh (approximately 57 km to the east of the MDIOM), where a population appears to reside. The Survey Area occurs within the High Priority Survey Bioregions as described in the Night Parrot guidelines (DBCA, 2024).



Legend

- Survey Area
- MDIOM Development Envelope
- Mulga Downs Pastoral Lease
- Bilby Range (Dziminski *et al.* 2020)
- Bilby Records
- Dubious Bilby Records



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre



Author: GF

Date: 09-08-2024

DBCAs Threatened Fauna Database Bilby Records

MDIOM Bilby & Night Parrot

MAP

Prepared for
 JBS&G | HanRoy

3.1

3.1.3. Literature Review

The nine previously conducted fauna assessments within the vicinity of the Survey Area did not record the Night Parrot, however one assessment recorded the Bilby (Table 3.1). Spectrum (2023b) recorded potential evidence during a dry season survey for the Mulga Downs Hub and Rail Spur, 36.9 km northeast of the MDIOM, from gait-pattern only tracks and potential burrows (Southgate *et al.*, 2019). Bilby presence was confirmed during the wet season survey Spectrum (2024, in prep) from multiple diggings at the base of *Acacia trachycarpa* for root-dwelling larvae, scats and by a motion camera positioned at one of the many burrows recorded (37 km northeast of the MDIOM). These records are located within the confirmed range for the Bilby.

The Bilby was also previously recorded by Spectrum (2022) along the proposed Mulga Downs Hub and Rail Spur (39.2 km northeast of the MDIOM, within the confirmed Bilby range) and by ecologia (2021) which refers to the inaccurate record within the MDIOM discussed in section 3.1.1.

The majority of previous surveys conducted within the Survey Area all state that the Bilby and Night Parrot are unlikely to occur due to the lack of optimal habitat present for these species (Table 3.1).

Table 3.1: Bilby and Night Parrot Records from Previously Conducted Biological Assessments

Survey	Year	Distance to MDIOM	Bilby Records	Night Parrot Records
Solar Farm, Haul Road & Pipeline (Spectrum 2023)	2023	0 km	Not recorded, considered to have a <i>medium</i> likelihood of occurrence	Not recorded, considered to have a <i>medium</i> likelihood of occurrence
Mulga Downs West Borefield and Southern Corridor (Biologic, 2022)	2022	0 km	Not recorded, considered <i>unlikely</i> to occur	Not recorded, considered <i>unlikely</i> to occur
Mulga Downs Transport Corridor (Biologic, 2022b)	2022	0 km	Not recorded, considered <i>unlikely</i> to occur	Not recorded, considered <i>unlikely</i> to occur
Mulga Downs Hub and Rail Spur (Spectrum, 2022)	2022	10 km NE	Recently recorded, no evidence observed during the survey, <i>medium</i> likelihood	Not recorded, considered to have a <i>medium</i> likelihood of occurrence
Mulga East (ecologia 2021)	2021	0 km	Historically recorded	Not recorded, considered <i>unlikely</i> to occur
Investigator Project (ecologia 2014)	2014	0-5 km N	Not recorded, considered to have a <i>low</i> likelihood of occurrence	Not recorded, considered to have a <i>low</i> likelihood of occurrence
Mulga Downs (Terrestrial Ecosystems, 2013)	2013	0 km	Not recorded, unsuitable habitat	Not recorded, unsuitable habitat
Option 8B (Spectrum, 2023b)	2023	24.2 km NE	Active burrow recorded during wet season survey (report in prep)	Not recorded, considered to have a <i>medium</i> likelihood of occurrence

Survey	Year	Distance to MDIOM	Bilby Records	Night Parrot Records
Brockman Rail (ecologia, 2011)	2011	35 km E	Not recorded, considered to have a <i>medium</i> likelihood of occurrence	Not recorded, considered to have a <i>low</i> likelihood of occurrence

3.1.4. Previous Surveys Completed for the Bilby and Night Parrot in the Survey Area

As outlined in section 2.1.2 and Table 2.2, several surveys have previously been completed in and immediately adjacent to, the Survey Area from 2012 to 2023, these included:

- Terrestrial Ecosystems (2013) completed a single-phase, detailed (Level 2) and targeted vertebrate fauna survey in 2012.
- ecologia (2021) conducted a basic dry season vertebrate fauna survey at the MDIOM in 2018, and detailed (two-phase) and targeted terrestrial vertebrate fauna surveys in 2019 and 2020.
- Biologic (2022a) conducted a basic dry season survey at the Mulga West Borefield and Mulga East Southern Corridor in 2021, and a single-phase wet season detailed terrestrial vertebrate and short-range endemic (SRE) fauna survey in 2022.
- Biologic (2022b) conducted a basic dry season survey of the Transport Corridor to Great Northern Highway in 2021 and a single-phase wet season detailed terrestrial vertebrate and SRE fauna survey in 2022.
- Spectrum (2023a) conducted a basic and targeted terrestrial vertebrate and SRE fauna survey at the Solar Farm, Haul Road and Pipeline areas of the MDIOM in 2023.

The above surveys were completed following the guidelines for vertebrate fauna (EPA, 2020) and the objective of the surveys was to capture all fauna and habitats present, including significant fauna. Four of the five surveys were completed targeting Night Parrot specifically (Ecologia, 2021; Biologic, 2022a; 2022b; Spectrum, 2023a) and three out of the five targeted Bilby specifically (Terrestrial Ecosystems, 2013; Ecologia, 2021; Spectrum, 2023a).

Bilby

The survey effort completed for the Bilby is detailed in Table 3.2 and shown on Map 3.2. A total of 73 person-hours were spent on targeted searches over all five surveys, this includes spotlighting and targeted searches. It is not known how many of the searches were completed within suitable habitat as that detail was not always provided, so 73 person-hours is not a complete representation of effort. Unmanned aerial vehicles (UAV) were used by ecologia (2021) in potential habitat, which covered 228 km.

Night Parrot

The survey effort completed for Night Parrot is outlined in Table 3.2 and displayed on Map 3.3. A total of 123 nights of acoustic recordings were completed within the Survey Area at 23 sites. Unmanned aerial vehicles (UAV), were used by ecologia (2021) in potential habitat, which covered 119 km.

Table 3.2: Previous Survey Methods for Bilby and Night Parrot in the Survey Area

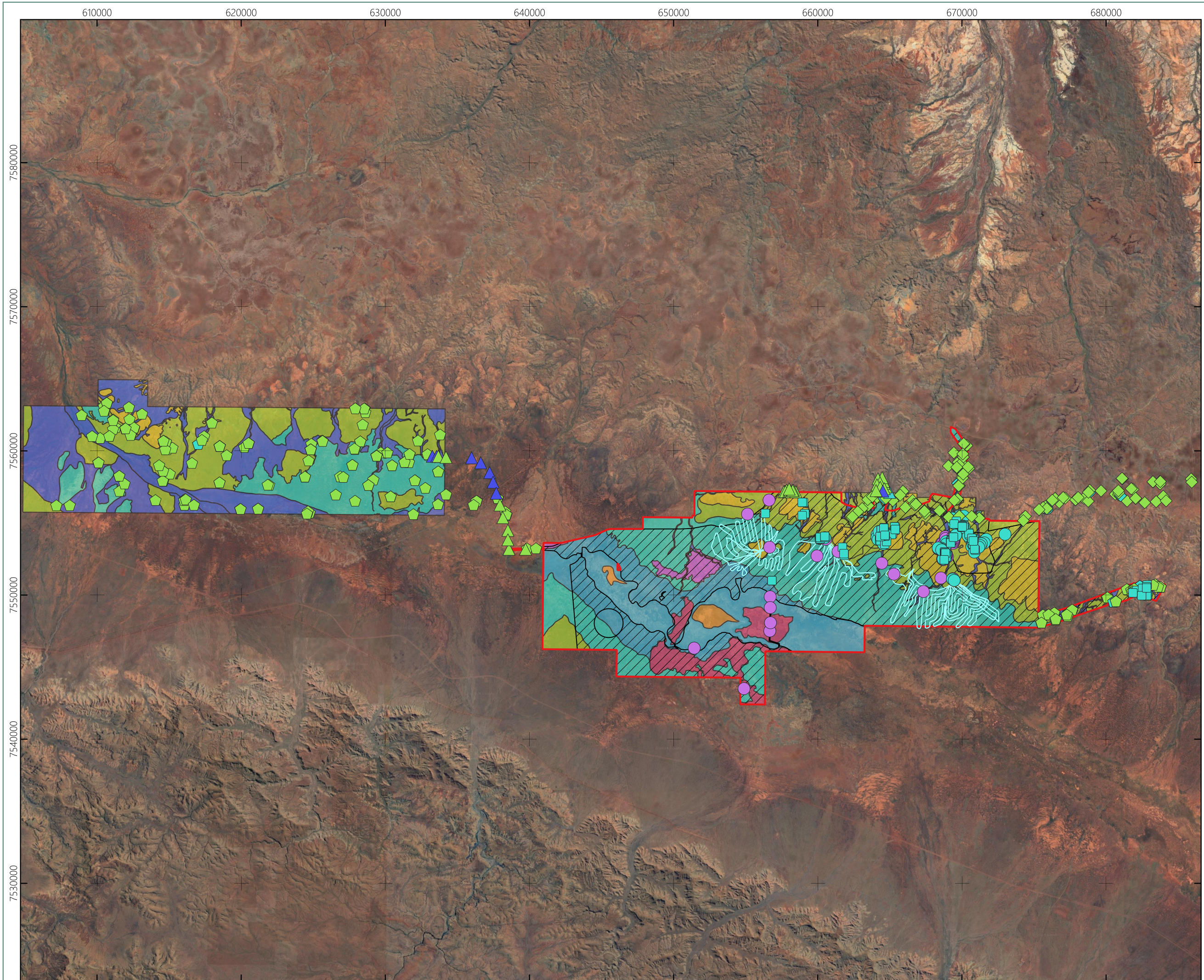
Survey Method	Species		Survey Effort				
	Bilby	Night Parrot	Terrestrial Ecosystems (2013)	Ecologia (2021)	Biologic (2022a)	Biologic (2022b)	Spectrum (2023)
Acoustic recorder	-	X	-	60 nights 10 sites	40 nights 9 sites	11 nights 2 sites	12 nights 2 sites
Active foraging/targeted search	X	-	11 person-hours*^	46 person-hours*	7 hours*	-	9 person-hours
Bird survey ¹	-	X	92 x 20-min bird surveys (30.6 hours) Opportunistic records	7 x 20-min bird surveys at 18 trapping sites (35.6 hours) Opportunistic records	7 x 20-min bird surveys at five trapping sites (11.4 hours) Opportunistic records	7 x 20-min bird surveys at four trapping sites (6.5 hours) Opportunistic records	Opportunistic records
Cage trap ¹	X	-	No cage traps used	1,152 trap nights 18 sites	70 trap nights 5 sites	56 trap nights 4 sites	-
Habitat assessment ¹	X	X	702^ sites	42 sites	176 sites	108 sites	45 sites
Motion camera ¹	X	X	500 nights 100 sites	4,237 nights 91 sites#	98 nights 16 sites	75 nights 9 sites	30 nights 2 sites
Unmanned Aerial Vehicle (UAV)/drone	X	X	-	228 km flight path (Bilby) 119 km flight path (Night Parrot)	-	-	-

¹ not all in suitable habitat for target species.

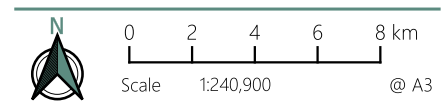
*Spotlighting search effort only and not all in Bilby habitat.

^habitat assessments included targeted searches for Bilby, unclear how many were undertaken in suitable habitat and the number of person-hours.

ecologia's motion cameras were only set up in Rocky Hills habitat targeting Northern Quoll and Pilbara Olive Python.



- Legend**
- Survey Area
 - MDIOM Development Envelope
- Fauna Habitats**
- Alluvial Clay Plain
 - Calcrete Stony Plain
 - Chenopod/ Cracking Clay Floodplain
 - Claypan
 - Drainage Lines/ Floodplains
 - Mixed Eucalypt/ Mulga Floodplain
 - Mulga Woodland
 - Rocky Hills
 - Stony Spinifex Plains and Hillslopes
- Previous Survey Effort**
- Terrestrial Ecosystems (2013)
- Motion Camera
- ecologia (2021)
- Motion Camera
 - Cage Trap
 - UAV/Drone
- Biologic (2022a)
- Active Foraging/Targeted search
 - Habitat Assessment
 - Motion Camera
 - Cage Trap
- Biologic (2022b)
- Habitat Assessment
 - Motion Camera
 - Cage Trap
- Spectrum (2023)
- Active Foraging/Targeted Search
 - Habitat Assessment
 - Motion Camera



Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre

Spectrum
 ECOLOGY • SPATIAL

Author: GF Date: 12-08-2024

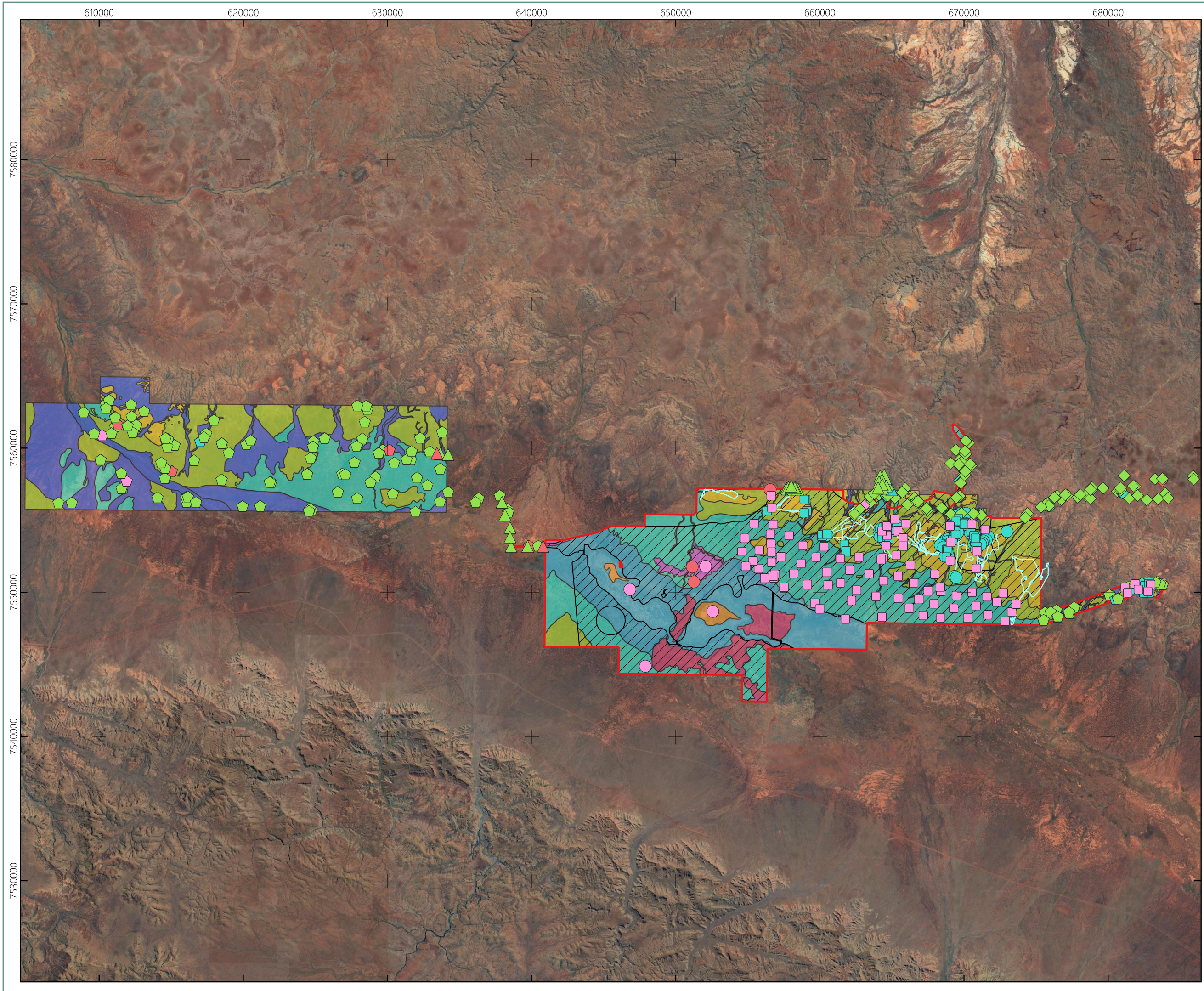
Previous Survey Effort - Bilby

MDIOM Bilby & Night Parrot

MAP

Prepared for
 JBS&G | HanRoy

3.2



Legend

- Survey Area
- MDIOM Development Envelope

Fauna Habitats

- Alluvial Clay Plain
- Calcrete Stony Plain
- Chenopod/ Cracking Clay Floodplain
- Claypan
- Drainage Lines/ Floodplains
- Mixed Eucalypt/ Mulga Floodplain
- Mulga Woodland
- Rocky Hills
- Stony Spinifex Plains and Hillslopes

Previous Survey Effort

Terrestrial Ecosystems (2013)

- Bird Survey
- Motion Camera

ecologia (2021)

- Bird Survey
- Acoustic Recorder
- Motion Camera
- UAV/Drone

Biologic (2022a)

- Acoustic Recorder
- Bird Survey
- Habitat Assessment
- Motion Camera

Biologic (2022b)

- Acoustic Recorder
- Bird Survey
- Habitat Assessment
- Motion Camera

Spectrum (2023)

- Acoustic Recorder
- Habitat Assessment
- Motion Camera

N

0 2 4 6 8 km

Scale 1:240,900 @ A3

Coordinate System: GDA 1994 MGA Zone 50
 Projection: Universal Transverse Mercator
 Units: Metre

Spectrum
 ECOLOGY • SPATIAL

Author: GF Date: 12-08-2024

**Previous Survey Effort -
Night Parrot**

MDIOM Bilby & Night Parrot

MAP

Prepared for
JBS&G | HanRoy

3.3

3.2. Survey Results & Discussion

No Bilby evidence (scats, diggings, tracks or burrows) was recorded within the Survey Area during the 80 person-hours of targeted searches.

Biologic (2022a), ecologia (2021) and DCCEEW (2022) identified Stony Plains and Slopes, and Chenopod/Cracking Clay as potential foraging and dispersal habitat for the Bilby and Drainage Area/Floodplain and Mulga Woodland as potential breeding or foraging and dispersal habitat for the Bilby (Section 1.2). No Bilby evidence was observed across these four habitat types, with 41.98 km traversed over Stony Plains and Slopes, 3.31km over Chenopod/Cracking Clay, 38.77 km over Drainage Area/Floodplain, and 48.13 km traversed over Mulga Woodland. Sandy substrate required for burrow excavation occurred patchily in some drainage lines but was largely absent across the Survey Area.

No calls belonging to the Night Parrot were recorded during both phases of the assessment from 1,572 hours of acoustic recording. The methods used were adequate to detect Night Parrots in the area immediately surrounding the recorders, for the period during which the survey was conducted. The call analysis report is provided in Appendix B.

Biologic (2022a) and ecologia (2021) identified three habitat types as potential foraging and nesting habitat for the Night Parrot (Section 1.2). Dense, mature clumps of *Triodia* were present in isolated areas, but the majority of potential habitat in the Survey Area was degraded due to cattle and/or exploration activities.

The desktop and field survey results indicate that both species have not been recorded but could potentially intermittently use the Survey Area for foraging and dispersal. However, the habitats present are sub-optimal for both species, and it is unlikely that they reside in the Survey Area.

A total of 90 non-target species were recorded (seven mammals, 79 birds, two reptiles, and two amphibians) and are outlined in Table 3.3. Twenty-two of the 79 bird species were recorded on acoustic recordings only (highlighted in blue in Table 3.3). One of these species, Little Curlew (*Numenius minutus*) is listed as Migratory under the EPBC Act and BC Act. The Western Pebble-mound Mouse (*Pseudomys chapmani*; DBCA Priority 4) was recorded from secondary evidence (mounds) at 26 sites (Table 3.4; Plate 3.1).

Table 3.3: Species Recorded

Species Name	Scientific Name	Conservation Status		
		EPBC Act	BC Act	DBCA
Mammals				
Euro	<i>Osphranter robustus</i>	-	-	-
Red Kangaroo	<i>Osphranter rufus</i>	-	-	-
Western Pebble-mound Mouse	<i>Pseudomys chapmani</i>	-	-	P4
*Dingo, Dog	<i>Canis familiaris</i>	-	-	-
*Cat	<i>Felis catus</i>	-	-	-
*Horse	<i>Equus ferus caballus</i>	-	-	-
*European Cattle	<i>Bos primigenius taurus</i>	-	-	-
Birds				
Emu	<i>Dromaius novaehollandiae</i>	-	-	-
Australian Shelduck	<i>Tadorna tadornoides</i>	-	-	-
Pacific Black Duck	<i>Anas superciliosa</i>	-	-	-
Grey Teal	<i>Anas gracilis</i>	-	-	-

Species Name	Scientific Name	Conservation Status		
		EPBC Act	BC Act	DBCA
Plumed Whistling Duck	<i>Dendrocygna eytoni</i>	-	-	-
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	-	-	-
Australian Wood Duck	<i>Chenonetta jubata</i>	-	-	-
Brown Quail	<i>Synoicus ypsilophorus</i>	-	-	-
Spotted Nightjar	<i>Eurostopodus argus</i>	-	-	-
Australian Owlet-Nightjar	<i>Aegotheles cristatus</i>	-	-	-
Australian Bustard	<i>Ardeotis australis</i>	-	-	-
Horsfield's Bronze Cuckoo	<i>Chalcites basalis</i>	-	-	-
Pallid Cuckoo	<i>Heteroscenes pallidus</i>	-	-	-
Common Bronzewing	<i>Phaps chalcoptera</i>	-	-	-
Crested Pigeon	<i>Ocyphaps lophotes</i>	-	-	-
Spinifex Pigeon	<i>Geophaps plumifera</i>	-	-	-
Diamond Dove	<i>Geopelia cuneata</i>	-	-	-
Peaceful Dove	<i>Geopelia placida</i>	-	-	-
Eurasian Coot	<i>Fulica atra</i>	-	-	-
Little Buttonquail	<i>Turnix velox</i>	-	-	-
Bush Stone-curlew	<i>Burhinus grallarius</i>	--	-	-
Banded Lapwing	<i>Vanellus tricolor</i>	-	-	-
Pied Stilt	<i>Himantopus leucocephalus</i>	-	-	-
Red-kneed Dotterel	<i>Erythrogonyx cinctus</i>	-	-	-
Black-fronted Dotterel	<i>Charadrius melanops</i>	-	-	-
Little Curlew	<i>Numenius minutus</i>	MI	MI	-
Australian Pratincole	<i>Stiltia isabella</i>	-	-	-
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	-	-	-
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	-	-	-
White-faced Heron	<i>Egretta novaehollandiae</i>	-	-	-
Little Egret	<i>Egretta garzetta</i>	-	-	-
Australian Pelican	<i>Pelecanus conspicillatus</i>	-	-	-
Wedge-tailed Eagle	<i>Aquila audax</i>	-	-	-
Black Kite	<i>Milvus migrans</i>	-	-	-
Whistling Kite	<i>Haliastur sphenurus</i>	-	-	-
Eastern Barn Owl	<i>Tyto javanica</i>	-	-	-
Southern Boobook	<i>Ninox boobook</i>	-	-	-
Blue-winged Kookaburra	<i>Dacelo leachii</i>	-	-	-
Sacred Kingfisher	<i>Todiramphus sanctus</i>	-	-	-
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>	-	-	-
Rainbow Bee-eater	<i>Merops ornatus</i>	-	-	-
Nankeen Kestrel	<i>Falco cenchroides</i>	-	-	-
Australian Hobby	<i>Falco longipennis</i>	-	-	-

Species Name	Scientific Name	Conservation Status		
		EPBC Act	BC Act	DBCA
Brown Falcon	<i>Falco berigora</i>	-	-	-
Cockatiel	<i>Nymphicus hollandicus</i>	-	-	-
Galah	<i>Eolophus roseicapilla</i>	-	-	-
Australian Ringneck	<i>Barnardius zonarius</i>	-	-	-
Bourke's Parrot	<i>Neopsephotus bourkii</i>	-	-	-
Budgerigar	<i>Melopsittacus undulatus</i>	-	-	-
Purple-backed Fairywren	<i>Malurus assimilis</i>	-	-	-
White-winged Fairywren	<i>Malurus leucopterus</i>			
Crimson Chat	<i>Epthianura tricolor</i>	-	-	-
Brown Honeyeater	<i>Lichmera indistincta</i>	-	-	-
Singing Honeyeater	<i>Gavicalis virescens</i>	-	-	-
Grey-headed Honeyeater	<i>Ptilotula keartlandi</i>	-	-	-
White-plumed Honeyeater	<i>Ptilotula penicillata</i>	-	-	-
Yellow-throated Miner	<i>Manorina flavigula</i>	-	-	-
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	-	-	-
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	-	-	-
Masked Woodswallow	<i>Artamus personatus</i>	-	-	-
Black-faced Woodswallow	<i>Artamus cinereus</i>	-	-	-
Australian Magpie	<i>Gymnorhina tibicen</i>			
Grey Butcherbird	<i>Cracticus torquatus</i>	-	-	-
Pied Butcherbird	<i>Cracticus nigrogularis</i>	-	-	-
Black-faced Cuckooshrike	<i>Coracina novaehollandiae</i>	-	-	-
White-winged Triller	<i>Lalage tricolor</i>	-	-	-
Crested Bellbird	<i>Oreoica gutturalis</i>	-	-	-
Rufous Whistler	<i>Pachycephala rufiventris</i>	-	-	-
Willie Wagtail	<i>Rhipidura leucophrys</i>	-	-	-
Magpie-lark	<i>Grallina cyanoleuca</i>	-	-	-
Torresian Crow	<i>Corvus orru</i>	-	-	-
Hooded Robin	<i>Melanodryas cucullata</i>	-	-	-
Horsfield's Bush Lark	<i>Mirafrja javanica</i>	-	-	-
Fairy Martin	<i>Petrochelidon ariel</i>	-	-	-
Spinifexbird	<i>Poodytes carteri</i>	-	-	-
Brown Songlark	<i>Cincloramphus cruralis</i>	-	-	-
Rufous Songlark	<i>Cincloramphus mathewsi</i>	-	-	-
Painted Finch	<i>Emblema pictum</i>	-	-	-
Australian Zebra Finch	<i>Taeniopygia castanotis</i>	-	-	-
Reptiles				
Western Ring-tailed Dragon	<i>Ctenophorus caudicinctus</i>	-	-	-
Central Netted Dragon	<i>Ctenophorus nuchalis</i>	-	-	-

Species Name	Scientific Name	Conservation Status		
		EPBC Act	BC Act	DBCA
Amphibians				
Sheep Frog	<i>Cyclorana maini</i>	-	-	-
Little Red Tree Frog	<i>Litoria rubella</i>	-	-	-

*Introduced; note: Species recorded from acoustic recorders are highlighted in blue.

Table 3.4: Western Pebble-mound Mouse Mounds Recorded

Pebble Mouse ID	Location		Details
	Easting	Northing	
PEBMND01	667025	7554875	Inactive
PEBMND02	660901	7557194	
PEBMND03	660940	7557123	
PEBMND04	672774	7549587	Possibly active
PEBMND05	672879	7549629	Inactive
PEBMND06	672906	7549643	
PEBMND07	672914	7549673	
PEBMND08	672944	7549710	
PEBMND09	673003	7549904	
PEBMND10	681600	7550316	Active
PEBMND11	681467	7550432	Inactive
PEBMND12	681435	7550457	
PEBMND13	681393	7550481	
PEBMND14	681274	7550472	
PEBMND15	681271	7550548	
PEBMND16	681106	7550476	Active
PEBMND17	681067	7550443	Inactive
PEBMND18	680955	7550295	
PEBMND19	681051	7550268	
PEBMND20	681125	7550201	
PEBMND21	681193	7550207	
PEBMND22	681205	7550202	
PEBMND23	681249	7550185	
PEBMND24	681390	7550164	
PEBMND25	681464	7550123	
PEBMND26	661059	7553973	



Plate 3.1: Inactive mound (left) and active mound (right) of Western Pebble-mound Mouse

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Appendix A: Conservation Codes



Appendix A1: Definitions of Conservation Categories under the EPBC Act

Category	Definition
Extinct	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	The species is known to survive only in cultivation or in captivity, or as a naturalised population well outside its past range.
Critically Endangered	The species is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	the species is not critically endangered, but it is facing a very high risk of extinction in the wild in the near future
Vulnerable	The species is not critically endangered or endangered, but it is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	The species is the focus of a specific conservation program without which the species would become vulnerable, endangered or critically endangered within five years.
Migratory	The EPBC Act provides for protection of migratory species as a matter of national environmental significance. Migratory species are those animals that migrate to Australia and its external territories or pass through or over Australian waters during their annual migrations (DotE 2013). Migratory species are listed under the following international conventions: <ul style="list-style-type: none"> • Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention); • China-Australia Migratory Bird Agreement (CAMBA); • Japan-Australia Migratory Bird Agreement (JAMBA); and, • Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Appendix A2: Definitions of Conservation Categories Under the BC Act

Code	Definition (BC Act)
Threatened Species (T)	Published as Specially Protected under the Wildlife Conservation Act 1950, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora). <ul style="list-style-type: none"> • Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act. • Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.
Critically Endangered (CR)	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".
Endangered (EN)	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".
Vulnerable (VU)	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".
Extinct species	Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.
Extinct species (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
Extinct in the wild species (EW)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form".
Specially protected species	Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.
Migratory species (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program.

Code	Definition (BC Act)
Conservation Dependent (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).
Priority species (P)	
Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the priority fauna or priority flora Lists maintained by the Department of Biodiversity, Conservation and Attractions.	
Priority 1: Poorly-known species (P1)	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2: Poorly-known species (P2)	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3: Poorly-known species (P3)	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4: Rare, Near Threatened and other species in need of monitoring (P4)	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix A3: Legal Status Definition of Listed Plants in Western Australia

Legal Status	Definition
Declared Pest, Prohibited – s12	Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits.
Declared Pest – s22(2)	Declared pests must satisfy any applicable import requirements when imported and may be subject to control keeping requirements.
Permitted – s11	Permitted organisms must satisfy applicable import requirements and import permits (where required).
Permitted, Requires Permit – r73	Regulation 73 permitted organisms may be subject to restriction under legislation other than the BAM Act (2007).
Unlisted	Unlisted organisms are prohibited in WA.
Control Categories	Definition
C1 Exclusion	Organisms should be excluded from parts or all of WA.
C2 Eradication	Organisms should be eradicated from all or parts of WA.
C3 Management	Organisms should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism, or prevent or contain the spread of the organism.
Unassigned	Declared pest that are recognised as having a harmful impact under certain circumstances where their subsequent control requirements are determined by a plan or other legislative arrangements under the Act.
Keeping Categories	Definition
Prohibited keeping	Can only be kept under a permit for public display, education, or scientific purposes.
Restricted keeping	Kept under a permit by private individuals due to a low risk of becoming a problem for the environment.

Exempt keeping	No permit or conditions are required for keeping. Organism may be subject to restrictions under the Wildlife Conservation Act (WCA, 1950).
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Appendix B: Night Parrot Acoustic Analysis Report



Results of acoustic surveys
Project 2417
JBS & G Targeted Night Parrot Surveys
March-May 2024

Report to:
Spectrum Ecology

Prepared by:
Nick Leseberg
Adaptive NRM
15th July 2024



1. Summary

In March 2024 autonomous recording units (ARUs) were deployed at 12 sites within the Project 2417 JBS & G Targeted Night Parrot Survey project area, in the Fortescue subregion of Western Australia to survey for Night Parrots (*Pezoporus occidentalis*). In May 2024 ARUs were deployed at a further six sites within the project area. No Night Parrot calls were detected.

2. Survey effort

Analysis of historical Night Parrot records suggest it was formerly found throughout arid central Australia, before undergoing a significant decline and range contraction during the late-19th and early-20th centuries (Leseberg *et al.* 2021). The species is now known from a small area in western Queensland, and the central and northern inland of Western Australia, including the Pilbara. There are several recent confirmed historical reports of Night Parrot from the Fortescue bioregion, mainly from the Fortescue Marsh area, approximately 60 km east of the project area (Leseberg *et al.* 2021). Given this pattern of records, it is feasible that if suitable habitat exists, Night Parrots could occur in the survey area.

Research in western Queensland has demonstrated Night Parrots occupy long-term stable roost sites for periods of up to several years. These long-term stable roost sites support both roosting and breeding. The birds also have predictable year-round calling periods at dusk and dawn (Murphy *et al.* 2017a, Leseberg *et al.* 2019). This ensures that if Night Parrots are roosting at a particular site, the likelihood of detecting them using ARUs is very high, provided the ARU is placed for a minimum of four nights in calm weather, and the recorder is set to record during the peak calling periods. During breeding, and following large rain events, calling is more frequent, extends throughout the night, and the likelihood of detection is increased (Murphy *et al.* 2017a). Preliminary results from research in central Western Australia suggest patterns of behaviour in that region are similar (Jackett *et al.* 2017).

Night Parrots are also known to call during the night at feeding and drinking sites (S. Murphy, N. Leseberg, N. Jackett unpubl. data). Anecdotal evidence suggests they may call when moving between these sites (N. Leseberg, N. Jackett, S. Murphy unpubl. data). However, the detection of birds away from roosting sites is likely to be a chance event given the large area over which birds range at night (Murphy *et al.* 2017b). Night Parrots are known to drink, and modelling suggests they may be reliant on free-standing water (or succulent food containing >55% water)

during hot weather (Kearney *et al.* 2016). Birds have been detected in the Great Sandy Desert by focusing survey effort at water sources (J. Brown pers. comm.). It is likely this technique will be most effective during periods of water scarcity, when survey effort can focus on just a few possible locations.

The likelihood of detection is also influenced by the type of ARU being used. In calm conditions, a Song Meter 4 (Wildlife Acoustics, MA, USA), which was the primary ARU type used for these surveys, is known to be capable of reliably detecting 95% of Night Parrot calls out to a range of around 205 m (Leseberg *et al.* 2022). Song Meter Minis were also used for these surveys. Their performance is comparable to that of an SM4.

Spectrum Ecology conducted sampling at a total of 18 sites in the project area. All ARUs were set to record from 25 minutes after sunset until 25 minutes before sunrise, and each recorded for a minimum of seven nights. These ARUS all recorded at least four calm nights, and for the recommended period when trying to establish the presence of a long-term stable roost site. The number of nights of data collected was sufficient to allow robust conclusions around the presence of long-term stable roost sites in the immediate vicinity of each survey point at the time of the survey. Details of the data recorded at each site are given at Table 1.

3. Data analysis

ANRM received the raw acoustic data in '.wav' format. All files were scanned using the software Kaleidoscope Pro v5.2.1, targeting the frequency range of 1500 – 3500 Hz, within which all known Night Parrot calls are distributed (Leseberg *et al.* 2019), and most other bird calls. These parameters have been tested on a random selection of 250 Night Parrot call examples manually detected from both Great Sandy Desert and East Murchison datasets, of which 205 (82.0%) were automatically detected. Calls not detected were typically extremely faint. The probability of non-detection of a true-positive call was 18.0%; two true-positive calls was 3.2%; three true-positive calls was 0.6%; etc. Of the data tested, the median number of consecutive (spaced at < 5 minutes apart) calls in a sequence when Night Parrots were recorded was 5 (1–34, $n = 29$). The probability of at least one call being detected within a sequence of median length, assuming there was variation in the location of the source of the call, was > 99.9%.

Table 1. Bioacoustic recordings analysed from the March-May 2024 survey.

Site name	Recording start date (PM)	Recording end date (AM)	Total recording nights
NP01	18-Mar-24	26-Mar-24	8
NP02	18-Mar-24	26-Mar-24	8
NP03	19-Mar-24	26-Mar-24	7
NP04	19-Mar-24	26-Mar-24	7
NP05	19-Mar-24	26-Mar-24	7
NP06	19-Mar-24	27-Mar-24	8
NP07	19-Mar-24	26-Mar-24	7
NP08	19-Mar-24	26-Mar-24	7
NP09	19-Mar-24	26-Mar-24	7
NP10	19-Mar-24	26-Mar-24	7
NP11	19-Mar-24	27-Mar-24	8
NP12	19-Mar-24	27-Mar-24	8
NP13	13-May-24	20-May-24	7
NP14	13-May-24	20-May-24	7
NP15	13-May-24	20-May-24	7
NP16	13-May-24	20-May-24	7
NP17	13-May-24	20-May-24	7
NP18	13-May-24	20-May-24	7
Total			131

The resulting ‘detections’ were then compared to a reference library comprising several thousand Night Parrot calls from Western Australia and Queensland. This library consists of calls recorded at sites where Night Parrots have been confirmed using visual means and is therefore considered of high reliability. The library also comprises multiple examples of all known call types from Western Australia and Queensland (Leseberg *et al.* 2019).

4. Survey results

A total of 318,066 Kaleidoscope detections were manually assessed for Night Parrot vocalisations. No calls attributable to Night Parrots were detected during the analysis. A total of 57 other species were detected during the analysis and are listed in Appendix 1.

5. Conclusion

It is unlikely long-term stable Night Parrot roosts exist within approximately 200 m of the 18 sites that were sampled, at the time of sampling. Additionally, it is unlikely that Night Parrots were foraging in proximity to these surveyed points at the time of sampling. It is important to reinforce that these results pertain specifically to that area immediately surrounding the survey points, and only for the period during which the survey was conducted. The results of these surveys do not enable robust conclusions about the presence or absence of Night Parrots in the wider landscape.

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Appendix 1 – Non-target species detected during analysis

Appendix 1. Bird species detected during analysis. Taxonomy follows the Checklist of the Terrestrial Vertebrate Fauna of Western Australia (November 2023).

	NP01	NP02	NP03	NP04	NP05	NP06	NP07	NP08	NP09	NP10	NP11	NP12	NP13	NP14	NP15	NP16	NP17	NP18
Plumed Whistling Duck <i>Dendrocygna eytoni</i>	x	x			x													
Pink-eared Duck <i>Malacorhynchus membranaceus</i>		x		x	x		x											
Australian Wood Duck <i>Chenonetta jubata</i>	x	x					x	x	x									
Pacific Black Duck <i>Anas superciliosa</i>		x	x		x				x									
Grey Teal <i>Anas gracilis</i>	x	x	x		x		x											
Brown Quail <i>Synoicus ypsilophorus</i>	x	x	x	x	x	x	x	x	x	x	x					x	x	
Spotted Nightjar <i>Eurostopodus argus</i>				x		x				x	x	x	x	x		x	x	x
Australian Owlet-Nightjar <i>Aegotheles cristatus</i>			x	x		x		x				x	x	x	x	x	x	x
Australian Bustard <i>Ardeotis australis</i>		x					x		x									
Horsfield's Bronze Cuckoo <i>Chalcites basalus</i>	x	x	x	x	x	x	x		x	x	x	x			x	x	x	x
Pallid Cuckoo <i>Heteroscenes pallidus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Diamond Dove <i>Geopelia cuneata</i>				x	x	x				x								
Peaceful Dove <i>Geopelia striata</i>					x													
Eurasian Coot <i>Fulica atra</i>		x	x		x													
Little Buttonquail <i>Turnix velox</i>	x	x	x	x	x	x	x	x	x	x	x		x	x				x
Bush Stone-curlew <i>Burhinus grallarius</i>		x	x	x	x	x				x				x		x		x
Black-winged Stilt <i>Himantopus himantopus</i>	x	x	x	x	x	x			x									
Banded Lapwing <i>Vanellus tricolor</i>	x	x	x		x	x	x	x	x	x				x				

Appendix 1 – Non-target species detected during analysis

	NP01	NP02	NP03	NP04	NP05	NP06	NP07	NP08	NP09	NP10	NP11	NP12	NP13	NP14	NP15	NP16	NP17	NP18
Black-fronted Dotterel		x	x		x													
Little Curlew			x					x										
Australian Pratincole	x	x																
Nankeen Night Heron		x	x		x		x	x	x									
Whistling Kite									x									
Eastern Barn Owl	x		x	x			x		x							x		
Southern Boobook			x		x	x		x		x	x					x		
Blue-winged Kookaburra			x		x	x				x								
Red-backed Kingfisher																	x	
Rainbow Bee-eater			x															
Brown Falcon		x		x					x	x	x	x						x
Galah		x	x			x		x	x		x	x	x	x	x	x	x	x
Little Corella		x	x				x		x									
Australian Ringneck				x								x						
Bourke's Parrot			x	x			x	x										
Budgerigar		x	x	x		x				x	x	x						
Purple-backed Fairywren	x			x	x	x						x						
White-winged Fairywren			x							x			x	x	x	x		
Brown Honeyeater											x	x						
Singing Honeyeater	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
White-plumed Honeyeater			x		x													x
Spiny-checked Honeyeater				x													x	

Appendix 1 – Non-target species detected during analysis

	NP01	NP02	NP03	NP04	NP05	NP06	NP07	NP08	NP09	NP10	NP11	NP12	NP13	NP14	NP15	NP16	NP17	NP18
Yellow-throated Miner <i>Manorina flavigula</i>		x						x	x							x		
Black-faced Woodswallow <i>Artamus cinereus</i>			x						x									
Australian Magpie <i>Gymnorhina tibicen</i>																	x	x
Grey Butcherbird <i>Cracticus torquatus</i>				x		x								x			x	
Pied Butcherbird <i>Cracticus nigrogularis</i>						x	x	x	x		x	x	x	x	x	x	x	x
Crested Bellbird <i>Oreoica gutturalis</i>		x	x	x	x	x					x						x	
Rufous Whistler <i>Pachycephala rufiventris</i>		x	x	x		x					x	x						
Grey Shrikethrush <i>Colluricincla harmonica</i>						x						x						
Willie Wagtail <i>Rhipidura leucophrys</i>				x		x	x	x			x	x	x	x		x	x	x
Magpie-lark <i>Grallina cyanoleuca</i>		x	x															
Torresian Crow <i>Corvus orru</i>	x	x	x	x	x		x	x	x	x								
Hooded Robin <i>Melanodryas cucullata</i>						x				x	x	x						
Horsfield's Bush Lark <i>Mirafra javanica</i>		x	x		x		x		x	x								
Fairy Martin <i>Petrochelidon ariel</i>							x											
Spinifexbird <i>Poodytes carteri</i>											x		x	x	x	x	x	x
Brown Songlark <i>Cincloramphus cruralis</i>	x				x		x	x		x			x			x	x	x
Rufous Songlark <i>Cincloramphus mathewsi</i>	x	x	x	x	x				x	x								