Ministers North
Consolidated Targeted Significant Vertebrate Fauna Surveys
October 2024

Prepared for
BHP Western Australian Iron Ore

astron
an ecocene company

Report Reference: 2400-020-24-BISR-1Rev0_250313

This page has been left blank intentionally.

Ministers North
Consolidated Targeted Significant Vertebrate Fauna Surveys

Prepared for
BHP Western Australian Iron Ore

Job Number: 2400-020-24

Reference: 2400-020-24-BISR-1Rev0_250313

Revision Status

Rev	Date	Description	Author(s)	Reviewer
A	31/10/2024	Draft Issued for Review	S. Smithies A. McCreery	D. Keirle
B	13/12/2024	Draft Issued for Review	S. Smithies	D. Keirle
0	13/03/2025	Final Issued for Client Reference	S. Smithies	D. Keirle

Approval

Rev	Date	Issued to	Authorised by	
A	31/10/2024	T. Betts	B. Lucas	
B	13/12/2024	T. Betts	B. Lucas	
0	13/03/2025	T. Betts	B. Lucas	

astron
an ecocene company

Abbreviations

Abbreviation	Definition
ARU	Autonomous Recording Unit
Astron	Astron Environmental Services
BC Act	*Biodiversity and Conservation Act 2016*
BIF	Banded Iron Formation
BHP WAIO	BHP Western Australia Iron Ore
BOM	Bureau of Meteorology
CR	Critically Endangered
DBCA	Department of Biodiversity, Conservation and Attractions
DEWHA	Department of Water, Heritage and the Arts
DSWEPaC	Department of Sustainability, Water, Environment, Population and Communities
eDNA	Environmental DNA
EN	Endangered
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
FV	Field Visit
GDV	Groundwater Dependent Vegetation
GPS	Geographical Positioning System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
kHz	Kilohertz
km	Kilometre
m	Metre
mm	Millimetre
MI	Migratory
MNES	Matters of National Environmental Significance
OS	Other Specially Protected
P	Priority
PMST	Protected Matters Search Tool
SM	SongMeter
spp.	Species (plural)
TSSC	Threatened Species Scientific Community
VU	Vulnerable
WA	Western Australia
°C	Degrees Celsius

Executive Summary

Astron Environmental Services was commissioned by BHP Western Australian Iron Ore to undertake two targeted significant vertebrate fauna surveys covering a combined area of 6,519.6 ha, comprising Ministers North and the northwest infrastructure corridor (the Survey Area). The fauna surveys were conducted from 13 to 22 April 2023, and 7 to 18 June 2024.

Nine broad fauna habitat types were recorded in the Survey Area in decreasing order of extent: Hillcrest/ Hillslope, Gorge/ Gully, Drainage Area/ Floodplain, Minor Drainage Line, Breakaway/ Cliff, Undulating Low Hills, Major Drainage Line, Boulders/ Rockpiles, and Medium Drainage Line. Some Cleared/ Disturbed areas in the form of exploration and access tracks were present within the Survey Area. Most of the habitat was rated 'High Quality' with some disturbances including weed infestation, cattle grazing, mining exploration, and road/access tracks present. No fauna habitats within the Survey Area are restricted at a local or sub-regional scale and are well-represented in surrounding areas.

Gorge/ Gully (approximately 9.5% of the Survey Area) and Breakaway/ Cliff (approximately 1.6%) habitats provide caves and crevices and represent critical habitat for Matters of National Environmental Significance (MNES) species northern quoll (*Dasyurus hallucatus*), ghost bat (*Macroderma gigas*), and Pilbara olive python (*Liasis olivaceus barroni*), and supporting habitat for Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) in the absence of critical roost caves. Pending potential reclassification, a current Category 2 ghost bat roost cave (CMIN-03[1]) is proximate (2 km south) to the Survey Area, and large portions of associated foraging habitat within 12 km are therefore considered as critical for this species. Major Drainage Lines (approximately 1.0%) provide critical habitat for ghost bat and Pilbara olive python, and supporting habitat to Pilbara leaf-nosed bat and northern quoll; in particular, Yandicoogina Creek. Drainage Area/ Floodplain (approximately 4.5%), Medium Drainage Line (approximately 0.1%) and Minor Drainage Line (approximately 3.2%) habitats offer critical habitat to ghost bat and supporting habitat to northern quoll and Pilbara leaf-nosed bat. Hillcrest/ Hillslope (approximately 75.4%) is widespread across the Survey Area and provides supporting habitat to ghost bat, northern quoll, and Pilbara leaf-nosed bat. Hillcrest/ Hillslope habitat, along with Undulating Low Hills (approximately 1.6%), is also important for Priority species western pebble-mound mouse (*Pseudomys chapmani*). Boulders/ Rockpiles (approximately 0.5%) habitat was shallow and not extensive enough to provide critical denning habitat for northern quoll and Pilbara olive python but did represent supporting habitat for both species.

Significant microhabitats were present in the Survey Area with 14 caves and 10 surface water features recorded during the current surveys. The caves provide potential roosting habitat for ghost bat and Pilbara leaf-nosed bat, with one (CMN-02) recently recorded containing six ghost bats prior to the current survey, and records of ghost bat scat during this survey. Cave CMN-02 has attributes of a potential Category 2 roost for ghost bats, displaying suitable geological and microclimatic conditions and a long-term bat detector and scat sheet were deployed within CMN-02 between field visits. Observations and analysis failed to detect any evidence of ghost bat usage during that time, and the cave was given a reduced Category rating of 3 (occasional rather than regular occupancy). A cluster of

[1] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

three caves including CMN-02, two of which also recorded ghost bat scats, indicated that this area is used as transitionary roosts and likely locally important in the dispersal of ghost bat. Two caves were classified as Category 3 roosts for ghost bats, nine caves were classed as Category 4, and the remaining three were classed as Category 5. All 14 caves were classed as Category 4 roosts for Pilbara leaf-nosed bat. Of the 10 pools recorded, seven were located in Gorge/ Gully habitat and three in Major Drainage Line habitat.

One-hundred and eleven vertebrate fauna were recorded within the Survey Area, comprising one amphibian, 25 reptile, 64 bird, and 21 mammal (including three introduced) species. The fauna assemblage recorded during the survey is considered typical of the local Hamersley subregion and the broader Pilbara bioregion.

Three MNES species, northern quoll, ghost bat, and Pilbara olive python, were recorded during the current surveys. The northern quoll was recorded on three separate motion cameras across two transects associated with Yandicoogina Creek. Two cameras recorded an individual on multiple nights, with imagery suggesting this is likely the same individual. Results suggest that the northern quoll is likely to be patchily distributed within the Survey Area and at a low population density that would not be considered important to the long-term survival of the northern quoll as per Environmental Protection and Biodiversity Conservation referral guidelines.

A heritage team observed six ghost bats roosting in cave CMN-02 in late March/early April 2023. The cave was investigated during the current survey, and approximately 50 to 100 ghost bat scats were recorded but no individuals present. Another cave 700 m north (CMNY-05), was also found to have approximately 50 to 100 ghost bat scats.

Pilbara olive python was detected via scat proximate to a water body within Major Drainage Line habitat. The scat was assessed as being 6 months – 1 year old and no further evidence of this species was detected within the Survey Area.

One additional species of significance was recorded during the current survey, the Priority 4 western pebble-mound mouse, with 14 recently inactive mounds and one inactive mound recorded within Hillcrest/ Hillslope and Undulating Low Hills habitats.

The MNES species, Pilbara leaf-nosed bat, is considered to have a high post-survey likelihood of occurrence as supporting habitat is present throughout the Survey Area, and previous records exist nearby. An additional three significant species; the peregrine falcon (*Falco peregrinus*), Pilbara barking gecko (*Underwoodisaurus seorsus*), and *Anilios ganei* were assessed as having a high likelihood of occurring in the Survey Area. MNES species grey falcon (*Falco hypoleucos*) and southern whiteface (*Aphelocephala leucopsis*) are considered to have a moderate likelihood of occurrence while the night parrot (*Pezoporus occidentalis*) and bilby (*Macrotis lagotis*) are considered to have a low likelihood of occurrence.

Table of Contents

List of Figures

List of Plates

List of Tables

List of Appendices

1 Introduction

1.1 Project Background

Astron Environmental Services (Astron) was commissioned by BHP Western Australian Iron Ore (BHP WAIO) to undertake two targeted significant vertebrate fauna surveys, focussing on Matters of National Environmental Significance (MNES) covering Ministers North and the northwest infrastructure corridor (hereafter referred to as the combined "Survey Area"). The Survey Area is on the boundary of BHP WAIO Yandi mining operations in active Geoscience tenure, and also covers pastoral leases and non-BHP tenure. The Survey Area is located approximately 10 km south of the Yandi Camp and the Yandi Mining operation and covers a combined area of 6,519.6 ha (Figure 1).

The fauna assessment is not assessing any specific development proposed by BHP WAIO; however, may be used to inform future environmental approvals across the area.

1.2 Scope and Objectives

The objective was to undertake a targeted vertebrate fauna assessment, with a specific focus on MNES and other significant fauna species, through a desktop assessment and subsequent field surveys. The desktop assessment informed the field surveys and included a comprehensive database and literature review for potentially occurring MNES species. The scope of work was to undertake:

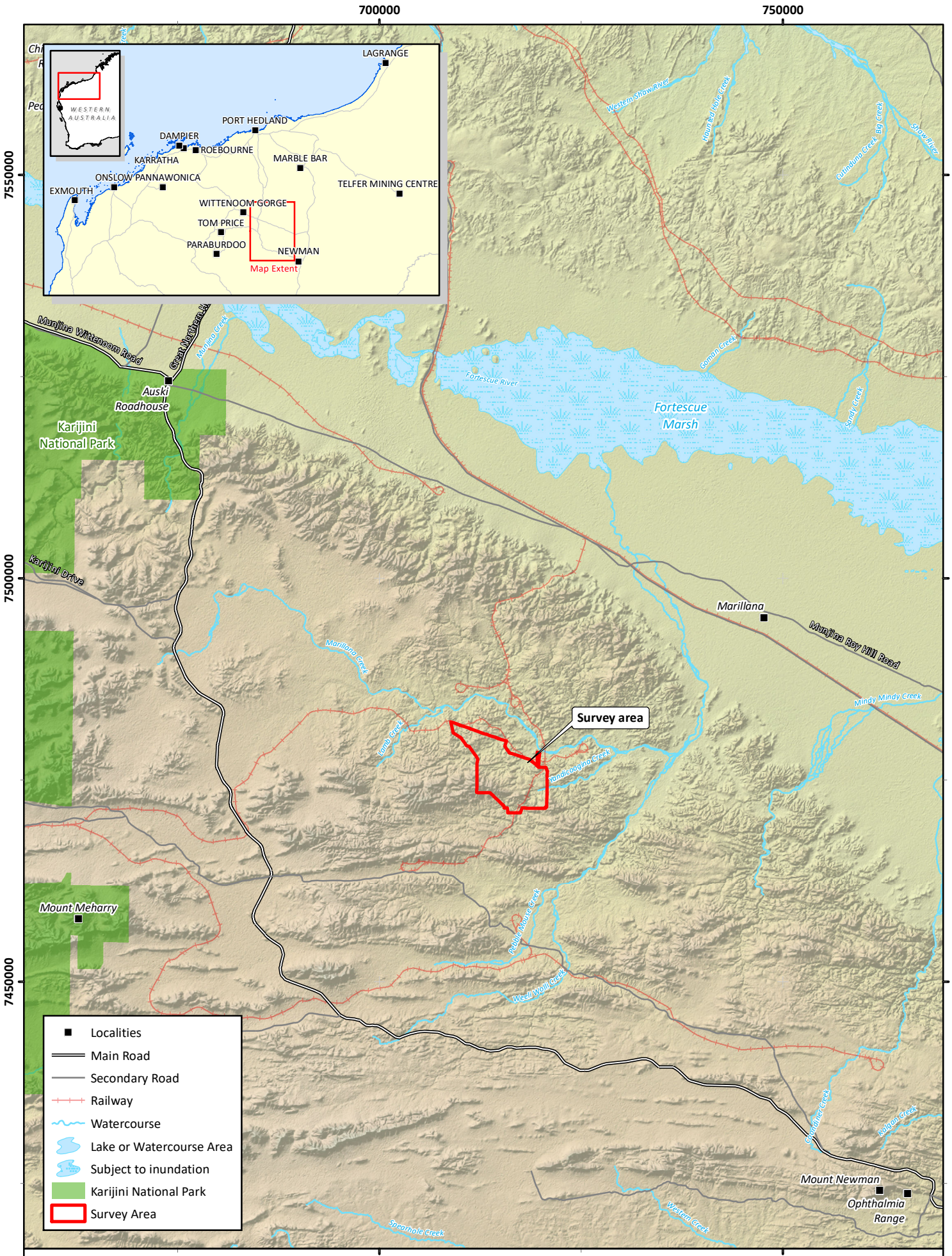
- A desktop assessment including a comprehensive database and literature review for the presence, or likely presence, of significant vertebrate fauna species and communities.
- Targeted vertebrate fauna field surveys, including:
    - targeted MNES species sampling and searches
    - sampling of other fauna species, particularly significant fauna
    - fauna habitat assessments and mapping.

Astron conducted the fauna surveys in accordance with the regulatory guidance detailed in Table 1, and BHP WAIO's internal guidance document (BHP 2023a) and Spatial Data Requirements (BHP 2023b). Section 3.4 of this report provides details on the limitations of the survey.

Table 1: Summary of Astron's targeted significant vertebrate fauna surveys.

Level of survey	Survey Area size (combined)	Survey timing	Relevant regulatory and industry guidance documents
Targeted significant vertebrate fauna survey	6,519.6 ha	13 – 22 April 2023 7 – 18 June 2024	• Environmental Protection Authority (EPA) (2022) Statement of Environmental Principles, Factors and Objectives and aims of EIA (Environmental Protection Authority 2022) • EPA (2016) Environmental Factor Guideline – Terrestrial Fauna (Environmental Protection Authority 2016) • EPA (2020) Technical Guidance – Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (Environmental Protection Authority 2020) • Department of Environment, Water, Heritage and the Arts (DEWHA) (2013) Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Department of Environment 2013) • DEWHA (2010) Survey Guidelines for Australia's Threatened Bats (Department of the Environment, Water, Heritage and the Arts 2010a) • DEWHA (2010) Survey Guidelines for Australia's Threatened Birds (Department of the Environment, Water, Heritage and the Arts 2010b) • DEWHA (2010) Survey Guidelines for Australia's Threatened Frogs (Department of the Environment, Water, Heritage and the Arts 2010c) • Department of Sustainability, Environment, Water, Population and Communities (DSWEPaC) (2011) Survey Guidelines for Australia's Threatened Mammals (Department of Sustainability Environment Water Population and Communities 2011a) • DSWEPaC (2011) Survey Guidelines for Australia's Threatened Reptiles (Department of Sustainability Environment Water Population and Communities 2011b) • Department of the Environment and Energy (2016) Referral guideline for the endangered northern quoll *Dasyurus hallucatus* (Department of the Environment and Energy 2016) • Department of Biodiversity, Conservation and Attractions (DBCA) (2017) Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (Department of Biodiversity Conservation and Attractions 2017) • Department of Parks and Wildlife (2017) Interim Guideline for Preliminary Surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (Department of Parks and Wildlife 2017) • DBCA (2024). Guidelines for determining the likely presence and habitat usage of night parrot (*Pezoporus occidentalis*) in Western Australia (Department of Biodiversity Conservation and Attractions 2024). • Bat Call WA (2021) A review of Pilbara leaf nosed bat ecology, threats and survey requirements (Bat Call WA 2021a) • Bat Call WA (2021) A review of ghost bat ecology, threats and survey requirements (Bat Call WA 2021b)

Level of survey	Survey Area size (combined)	Survey timing	Relevant regulatory and industry guidance documents
			• Threatened Species Scientific Committee (TSSC) (2008) Conservation advice for *Liasis olivaceus barroni* (Olive python – Pilbara subspecies) (Threatened Species Scientific Committee 2008) • TSSC (2016) Conservation advice for *Macroderma gigas* (ghost bat) (Threatened Species Scientific Committee 2016a) • TSSC (2016) Conservation advice *Rhinonicteris aurantia* (Pilbara form), Pilbara leaf-nosed bat (Threatened Species Scientific Committee 2016b) • BHP WAIO's (2022) Guidance for Vertebrate Fauna Surveys in the Pilbara (SPR-IEN-EMS-012) • BHP WAIO's (2020) Biological Survey Spatial Data Requirements (SPR-IEN-EMS-015).



BHP Western Australian Iron Ore
Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure 1: Survey area location

astron
an ecocene company

Author: S. Smithies	Date: 09-08-2024
Drawn: C. Dyde	Figure Ref: 2400-020-24-BIDR-1RevA_240809_Fig1_Locn

Datum: GDA 1994 - Projection: MGA Zone 50

0 5 10 15 20 25 30 Km

N

2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2024).

Based on long-term climatic data from the nearest Bureau of Meteorology (BOM) weather station at Newman Aero (Station 007176) (approximately 88 km south-east of the Survey Area) the mean annual rainfall since 1971 is 318.2 mm. The mean maximum daily temperatures range between 23.1°C and 39.4°C, and range above 30°C for much of the year (Figure 2) (Bureau of Meteorology 2024).

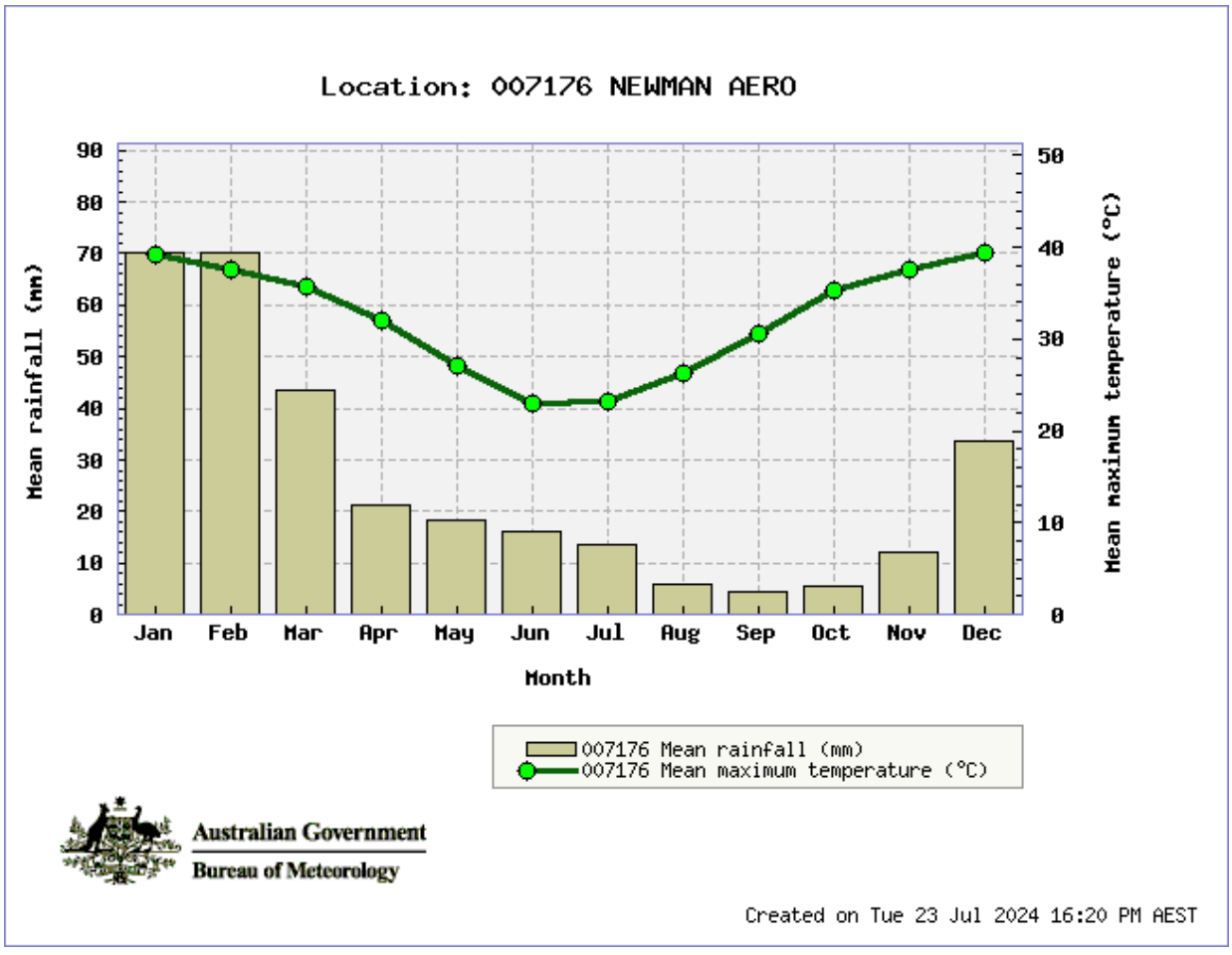


Figure 2: Climate data for Newman Aero Station (007176). Mean annual rainfall data has been calculated from 1971 to 2024, and mean maximum temperature has been calculated from 1996 to 2024 (Bureau of Meteorology 2024).

2.1.2 Geology and Soils

The surface geology of the Survey Area is comprised of four units (Geoscience Australia 2008, Stewart et al. 2008) with Weeli Wolli Formation the most dominant (Table 2). Geological mapping of the Survey Area and surrounds is presented in Figure A.1 (Appendix A).

Table 2: Geological units of the Survey Area (Stewart et al. 2008).

Geological name	Label	Area within Survey Area
Weeli Wolli Formation: Banded iron-formation (commonly jaspilitic), mudstone, siltstone; common interlayered metadoleritic sills	Lchw	3,063.7 ha
Brockman Iron Formation: Banded iron-formation, chert, mudstone, and siltstone	Lchk	2,114.3 ha
Ferruginous duricrust 38498: Pisolitic, nodular or vuggy ferruginous laterite, some lateritic soils, ferricrete, magnesite, ferruginous and siliceous duricrusts, and reworked products, calcrete, kaolinised rock, gossan, residual ferruginous saprolite.	Czl	1,327.9 ha
Robe Pisolite: Pisolitic, oolitic, and massive limonite, goethite, and hematite deposits containing fossil wood fragments; iron ore	Czlr	13.6 ha

2.1.3 Surface Water and Hydrology

The Survey Area occurs within the 'Fortescue River Upper' catchment (Department of Water 2023). No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the Survey Area (Department of the Environment and Energy 2020a, 2020b). The nearest Nationally Important Wetland is Fortescue Marshes, located approximately 33 km north of the Survey Area. Two watercourses intersect the Survey Area: Yandicoogina Creek in the southern portion and a major tributary of Marillana Creek in the northern portion of the Survey Area.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA, version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of Agriculture, Water and the Environment 2021a). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The Survey Area is situated in the Pilbara bioregion, of which less than 5% is represented in the national reserve system (Department of Agriculture, Water and the Environment 2021b).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002). The Survey Area occurs within the Hamersley subregion of the Pilbara region. This subregion is described as:

- Hamersley PIL03 – mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale, and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Agriculture and Food outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion, covering an area of 181,723 km^2. Four land systems occur in the Survey Area (Table 3) with Newman the most dominant. The distribution of these land systems within the Survey Area is shown in Figure A.2 (Appendix A).

Table 3: Distribution of land systems within the Survey Area.

Land system	Total area within bioregion (ha)	Total area within Survey Area (ha) (proportion of Survey Area)	Proportion of land system within Survey Area
Pilbara bioregion			
Boolgeeda (BOO) – stony lower slopes and plains below hill systems, supporting hard and soft spinifex grasslands or mulga shrublands	962,141.0	88.7 (1.4%)	<0.1%
McKay (MCK) – hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks, supporting hard spinifex grasslands with acacias and occasional eucalypts	425,967.0	1,443.5 (22.1%)	0.3%
Newman (NEW) – rugged jaspilite plateaux, ridges, and mountains, supporting hard spinifex grasslands	1,996,418.0	4,922.8 (75.5%)	0.2%
Robe (ROB) – low plateaux, mesas, and buttes of limonites, supporting soft spinifex (and occasionally hard spinifex) grasslands	128,680.0	64.7 (1.0%)	<0.1%

2.2.3 Pre-European Vegetation

Beard (1975) completed broad-scale (1:1,000,000) pre-European vegetation mapping at an association level. The Beard mapping was later used by the former Department of Agriculture and Food Western Australia (Shepherd et al. 2002) to compile vegetation units that assisted with identifying pre-European and current extents of vegetation throughout Western Australia.

Two pre-European vegetation units, 18 and 82 (Shepherd et al. 2002, Department of Primary Industries and Regional Development 2019), are associated with the Survey Area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these two vegetation units in the Pilbara bioregion and the Survey Area).

Table 4: Extent of pre-European vegetation within the Survey Area by Interim Biogeographic Regionalisation for Australia (IBRA) sub-region (Government of Western Australia 2018).

Vegetation unit	Mapping unit (Beard 1975)	Description	Extent in Survey Area	Pre-European extent	Current extent in bioregion	Proportion of pre-European extent remaining	Pre-European extent with formal protection
Pilbara bioregion (PIL03 IBRA sub-region)							
18	a1Li	Low woodland, open low woodland, or sparse woodland: Mulga *Acacia aneura* and associated species.	98.2 ha	581,246.1 ha	576,541.7 ha	99.2%	19.5%
82	e16Lr t3Hi	Low tree-steppe: Hummock grassland with scattered bloodwoods & snappy gum *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*.	6,421.4 ha	2,177,573.9 ha	2,165,224.2 ha	99.4%	12.0%

*Data sourced from the '2018 Statewide Vegetation Statistics – Full report', please note all areas and percentages in presented in table may be out of date.

2.3 Conservation Categories and Management

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage MNES, including listed flora, fauna, and ecological communities. These listed flora, fauna, and ecological communities are allocated a conservation category, which are outlined in Tables B.1 – B.2 and B.5 (Appendix B).

Ecological communities may be subject to processes that threaten to destroy or significantly modify them across much of their range. These communities are identified as threatened ecological communities that are listed at the Commonwealth level under the EPBC Act (Tables B.1 and B.2, Appendix B).

Under Western Australian legislation, all native fauna is protected, and it is an offence to 'take' protected fauna. The *Biodiversity Conservation Act 2016* (BC Act) also provides for native fauna species to be specially protected when they are considered rare, threatened with extinction, or have a high conservation value (Table B.3, Appendix B). In addition, due to the diversity of Western Australia's fauna, many species are known from only a few collections or locations but have not been adequately surveyed. Such fauna may be rare or threatened but cannot be considered for declaration as 'Threatened fauna' until adequate surveys have been undertaken. These fauna species are included on a supplementary conservation list managed by the Department of Biodiversity, Conservation and Attractions (DBCA) called the *Priority Fauna List*. Priority fauna species are categorised according to their level of threat and other information. These conservation categories are described in Table B.4 (Appendix B).

2.4 Land Use and Tenure

The Survey Area is located within the Shire of East Pilbara. Approximately 713 ha of the Survey Area is situated on Juna Downs Station pastoral lease and approximately 435 ha is situated on Marillana Station pastoral lease. The local area is used for pastoralism, mineral exploration, and mining activity.

Karijini National Park is the nearest conservation reserve, located approximately 42 km to the west of the Survey Area. Mungaroona Range Nature Reserve is located approximately 99 km to the north-northwest of the Survey Area.

3 Methods

3.1 Desktop Assessment

To obtain contextual information, the desktop assessment involved a review of all conservation listed fauna species related information relevant to the Survey Area, including database searches and previous surveys in the area. Information collated during the desktop assessment also assisted with refining survey methods.

3.1.1 Database Searches

The desktop assessment focused on key habitats for MNES and other significant fauna species that occur in the Pilbara bioregion. The database searches conducted are summarised in Table 5.

Table 5: List of databases reviewed for the desktop assessment.

Database name	Date search results received	Search focus	Search area
NatureMap (Department of Biodiversity, Conservation and Attractions 2023a)	3/03/2023	Terrestrial vertebrate fauna and fauna of significance	40 km radius from the Survey Area boundary
Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water 2023)	19/06/2023	MNES species	40 km radius from a central point within the Survey Area
Threatened and Priority Fauna Database (Department of Biodiversity, Conservation and Attractions 2023b)	9/03/2023	Threatened and Priority fauna species	80 km radius from the Survey Area boundary
Birdlife Australia Birdata (Birdlife Australia 2023)	2/03/2023	Bird species	40 km radius from a central point within the Survey Area
Atlas of Living Australia (Atlas of Living Australia 2023)	2/03/2023	Terrestrial vertebrate fauna species	40 km radius from the Survey Area boundary
Index of Biodiversity Surveys for Assessment (Department of Water and Environmental Regulation 2023)	13/03/2023	Review of reports relevant to the Survey Area	Surveys in vicinity of Survey Area

3.1.2 Literature Review

Fauna surveys have been previously commissioned by BHP WAIO overlapping and/or within the vicinity of the Survey Area and were supplied to Astron for the desktop assessment. The previous Survey Areas in relation to the current survey are shown in Figure 3. The reports reviewed as part of this assessment included:

- Targeted Pilbara Olive Python Survey: South Flank and Mining Area C (Biologic Environmental Survey 2023a)
- Central Pilbara Hub Targeted Matters of National Environmental Significance Vertebrate Fauna Survey (Biologic Environmental Survey 2023b)
- Ministers North Fauna Survey Level 2 Survey (GHD Pty Ltd 2021)
- Ministers North Level 2 Vertebrate Fauna Survey (Biologic Environmental Survey 2017a)

- Ministers North to Yandi Corridor Level 2 Vertebrate Fauna survey (Biologic Environmental Survey 2017b)
- Marillana Infrastructure Corridor Level 1 Vertebrate Fauna Survey (Biologic Environmental Survey 2016)
- Area C West to Yandi Level 2 Vertebrate Fauna Survey (Biota Environmental Sciences 2013)
- Area C to Yandi Fauna Survey (Biologic Environmental Survey 2011a)
- Yandi Vertebrate Fauna Review (Biologic Environmental Survey 2011b)
- Yandicoogina Junction South West Oxbow Fauna Survey (Biota Environmental Sciences 2010)
- Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment (ENV Australia 2009)
- Marillana Creek (Yandi) Iron ore Mine Modification Level 2 Fauna Survey (Ecologia Environment 2008)
- Summary of Important Findings from RGP5 Railway Project Biological Assessments (ENV Australia 2008)
- Munjina and Minsters North (Yandi Hub) Fauna Assessment (ENV Australia n.d.) (field survey 2007)
- Minsters North Biological Survey (Ecologia Environment 2006)
- Yandi Life of Mine Flora and Fauna (Maunsell Australia 2003)
- Marillana Creek Western Access Corridor – Biological Assessment (Halpern Glick Maunsell 1999)
- Mining Area C Biological Survey (Ecologia Environment 1998).

BHP WAIO also provided spatial data for significant fauna species located within 10 km of the Survey Area boundary.

680000
700000
720000
740000
7500000
7480000
7460000

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Survey Area

Previous Fauna Surveys

- Area C West to Yandi Level 2 Vertebrate Fauna Survey
- Area C to Yandi Fauna Survey
- Central Pilbara Hub Targeted Matters of National Environmental Significance Vertebrate Fauna Survey
- Consolidated Fauna Habitat Mapping 2017
- Marillana Creek Western Access Corridor - Biological Assessment
- Mining Area C Biological Survey
- Ministers North Level 2 Vertebrate Fauna Survey
- Ministers North to Yandi Corridor Level 2 Vertebrate Fauna survey
- Minsters North Biological Survey
- Munjina and Minsters North (Yandi Hub) Fauna Assessment
- Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment
- Summary of Important Findings from RGP5 Railway Project Biological Assessments (Letter Report)
- Targeted Vertebrate Fauna Survey: Pilbara olive python South Flank and Mining Area C
- Yandi Life of Mine Flora and Fauna
- Yandi Vertebrate Fauna Review
- Yandicoogina Junction South West Oxbow Fauna Survey

BHP Western Australian Iron Ore

Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure 3: Previous fauna surveys conducted in the vicinity of the survey area

Scale: 1:200,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

astron an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 09-12-2024 | Figure Ref: 2400-020-24-BIDR-1RevB_241209_Fig3_PrevSurvey

3.1.3 Conservation Assessment

Significant vertebrate fauna species (inclusive of Threatened and Migratory MNES listed fauna, and DBCA Priority fauna species) that were returned from the database searches were categorised for likelihood of occurrence within the Survey Area according to the criteria listed in Table B.6 (Appendix B). Post-survey, the likelihood table was re-assessed utilising the information obtained during the field visits and updated accordingly. The additional criteria used for the assessment are outlined in Table B.6 (Appendix B). The likelihood table was then updated to reflect an improved understanding of the likelihood that a species would occur in the Survey Area.

3.2 Field Survey

3.2.1 Survey Timing and Personnel

The first field survey (FV 1) was undertaken by Senior Zoologists Andrew McCreery and Lucy Dadour, and Zoologists Amelia Catterick-Stoll and Andy Mack from 13 to 22 April 2023. A second field survey (FV 2) was undertaken by Senior Zoologist Sean Smithies and Zoologist Brianna Collard from 7 to 18 June 2024. Senior Zoologists Andy McCreery, Lucy Dadour, and Sean Smithies all have over 6 years of experience conducting biodiversity surveys in the Pilbara region.

The field surveys were conducted under DBCA Authorisation to Take or Disturb Threatened Species (Section 40 of the BC Act) (TFA 2223-0232 and TFA 2324-0292) and under the Department of Primary Industries and Regional Development Scientific Use Licence U279/2023 and Wildlife Animal Ethics Committee approval (WAEC 22-08-86).

3.2.2 Weather

Daily weather observations recorded from Newman Aero (station 007176) were used to describe local rainfall and temperature preceding each survey (Figure 4).

The annual rainfall recorded preceding FV 1 (368.0 mm) was 16.9% above the annual mean of 314.9 mm (Bureau of Meteorology 2024). Rainfall in the three months preceding FV 1 (198.2 mm) was 7.8% above the long-term mean (183.8 mm) (Bureau of Meteorology 2024). The maximum daily temperatures during FV 1 ranged from 22.5°C to 29.0°C (Bureau of Meteorology 2023).

The annual rainfall recorded preceding FV 2 (306.6 mm) was 2.6% below the annual mean of 314.9 mm (Bureau of Meteorology 2024). Rainfall in the three months preceding FV 2 (102.4 mm) was 23.5% above the long-term mean (82.9 mm) owing to a large rainfall event in March. (Bureau of Meteorology 2024). The maximum daily temperatures during FV 2 ranged from 22.7°C to 31.3°C (Bureau of Meteorology 2024).

The rainfall recorded between field surveys (306.6 mm) was 8% below the long-term mean (333.1 mm) for the corresponding period (Bureau of Meteorology 2024).

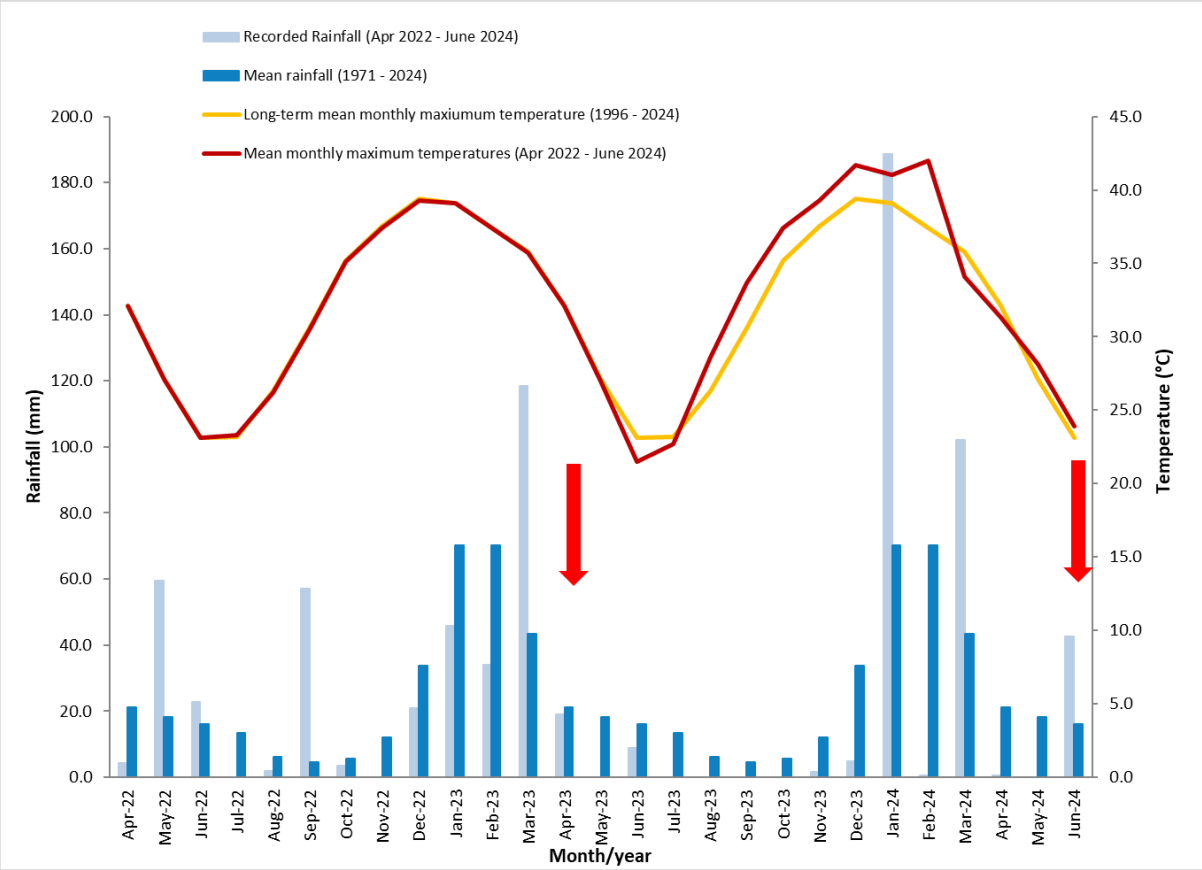


Figure 4: Newman Aero (station 007176) mean monthly rainfall (1971 to 2024), total recorded rainfall (April 2022 to June 2024), long-term mean monthly maximum temperatures (1996 to 2024), and mean monthly maximum temperatures (April 2022 to June 2024) (Bureau of Meteorology 2024). The red arrows indicate timings of each field survey.

3.2.3 Vertebrate Fauna

The field survey methodology followed the BHP Technical Process Instruction: Vertebrate Fauna Surveys in Western Australia, document no. SPR-IEN-EMS-012 (BHP 2023a) and is outlined below. The data collection categorisation followed the BHP procedure; Biodiversity Survey Spatial Data Requirements, document no. SPR-IEN-EMS-015 (BHP 2023c).

3.2.3.1 Habitat Assessments

One-hundred and forty-six habitat assessments were conducted within the fauna habitats (excluding Cleared/ Disturbed) present in the Survey Area. This included 37 habitat assessment sites, with the remaining habitat assessments completed at all other sampling sites (Figure 5). The following information was collected at each site:

- Location – coordinates measured using a handheld GPS (GDA94).
- Recorder and date – personnel involved in undertaking the fauna habitat assessment and the survey date.
- Habitat/landform – position in the landscape – major fauna habitat types were described based on the landform and vegetation.
- Vegetation type – a broad description of vegetation type and structure.
- Soils – a brief description of soil type.

- Microhabitat – presence of specific microhabitat features; for example, leaf litter, logs, burrows, rocky outcrops, rock crevices, hollows, permanent, or semi-permanent water.
- Condition – habitat condition was assessed based on the presence of anthropogenic (human-induced) disturbances, and using the conditions ratings suggested by Thompson and Thompson (2010) (Table B.7, Appendix B).
- Disturbance – any disturbance such as clearing, fire, weeds, flooding, vehicular, machinery, tracks, or grazing.
- Photographs – a representative photograph was taken of each habitat assessment site.

The information derived from the fauna habitat assessments and traversing on-ground through the Survey Area, combined with aerial imagery was used to delineate fauna habitats throughout the Survey Area, which were then mapped accordingly.

The potential for the habitats to provide suitable habitat for MNES species bilby (*Macrotis lagotis* (Vulnerable (VU; VU)), northern quoll (*Dasyurus hallocatus* (Endangered (EN); EN)), ghost bat (*Macroderma gigas* (VU; VU)), Pilbara leaf-nosed bat (*Rhinonicteris aurantia* (Pilbara form) (VU; VU)), night parrot (*Pezoporus occidentalis* (EN; Critically Endangered (CR)), southern whiteface (*Aphelocephala leucopsis* (VU)), grey falcon (*Falco hypoleucos* (VU)) and Pilbara olive python (*Liasis olivaceus barroni* (VU; VU) were ranked according to the criteria listed in Table B.8 (Appendix B).

710000

715000

720000

7480000

7475000

GPS Tracklog

Survey Area

Sample Point

- Audio Unit
- Bat Detector
- Bilby Plot
- Camera
- Habitat Assessment
- Nocturnal Search
- Targeted Search
- eDNA Sampling

BHP Western Australian Iron Ore

Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure 6: Fauna sampling locations

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron an ecocene company

Author: S.Smithies | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_Fig6_Sampling

3.2.3.2 Motion Sensitive Cameras

Motion sensitive cameras (Reconyx, Browning, Moultrie and Bushnell) were set at 71 locations; comprising ten transects of between four and eight cameras for five to six nights, and three opportunistic placements for three to five nights, with a combined trapping effort of 382 camera trap nights. The cameras were placed in prospective/suitable habitat (as defined in Table B.8, Appendix B), such as gorges, gullies, breakaways, drainage lines, and water holes, aimed at targeting MNES species, particularly northern quoll and Pilbara olive python. Cameras were baited with a non-reward scent lure (fish oil and pellets in a plastic jar with holes in the lid). Camera locations are shown in Figure 5.

3.2.3.3 Acoustic Bat Surveys

Acoustic ultrahigh frequency recording equipment was used to detect the presence of bats, in particular the Pilbara leaf-nosed bat and ghost bat. Recording devices (Song Meter SM4) were positioned in a total of 18 locations to target the most likely foraging and roosting habitat across the Survey Area for the two significant bat species, e.g. drainage lines and cave entrances. The ultrasonic recorders were set for three nights, resulting in a total of 54 recording nights. The locations are depicted in Figure 5. The bat echolocation data was analysed by external specialist Robert Bullen (Bat Call WA) for presence of all bat species.

3.2.3.4 Night Parrot Surveys

The Survey Area is in the area mapped as 'high priority for survey' for the night parrot according to DBCA's Guidelines for determining the likely presence and habitat usage of night parrot in Western Australia (Department of Biodiversity Conservation and Attractions 2024). Therefore, habitat usage assessments and passive acoustic surveys were undertaken, and Autonomous Recording Units (ARUs) used in the most prospective habitats (Department of Biodiversity Conservation and Attractions 2024).

The ARUs, recorded 1-hour pre-sunset to 1-hour post-dawn, were set at six locations for six nights, resulting in a total of 36 recording nights. The audio data was recorded at 44.1 k bits and covered the frequency range 100 kHz to 21,000 kHz, which brackets the night parrot call frequency range of 1,500 kHz to 3,500 kHz (Greatwich and Jackett). The audio data was analysed by external specialist Robert Bullen (Bat Call WA) for presence of the night parrot. The ARU locations are depicted in Figure 5.

3.2.3.5 Targeted Bilby Plot Searches

Targeted searches for signs of bilby were conducted using a combination of the 2 ha plot protocol and linear survey methods outlined in the DBCA's guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (Department of Biodiversity, Conservation and Attractions 2017). Two 4 ha plots of 200 m x 200 m, and three 2 ha plots of 200 m x 100 m were traversed on foot with track logs recorded on a handheld GPS unit. Any evidence of bilby, including burrows, tracks, foraging signs, and scats were recorded, photographed, and GPS located. The bilby plot search locations are depicted in Figure 5.

3.2.3.6 eDNA Sampling

An assessment of the presence of Pilbara olive python was undertaken using eDNA metabarcoding from water samples collected at three sampling sites at two pools within the Survey Area. Three replicates were collected at each sampling site, giving a total of 9 samples. Samples were filtered using 1.2 µM filters with a hand driven syringe system to capture eDNA present in the water. Samples were

preserved in DNA Shield reagent and transported at ambient temperature to eDNA Frontiers' laboratory for DNA extraction and analysis (eDNA Frontiers 2024). The collection point locations are depicted in Figure 5.

3.2.3.7 Nocturnal Surveys

Spotlighting and head-torching at night for signs of Pilbara olive python was conducted following DBCA guidelines to detect threatened reptiles (Department of Sustainability Environment Water Population and Communities 2011b). Spotlighting was undertaken at night, on foot and from vehicles to target fauna that are nocturnal or crepuscular. A total of 48 person hours of nocturnal spotlighting over five nights was undertaken in the Survey Area. Track logs were recorded using a handheld GPS and are shown in Figure 5.

3.2.3.8 Cave Assessments

Any potential roost caves identified within the Survey Area were assessed for the suitability to provide roosting for the ghost bat and Pilbara leaf-nosed bat using the following information:

- cave characteristics, including position of the cave in the landscape, angle of cave floor, orientation of cave opening, exposure of cave, and type of cave entrance
- cave dimensions, including overhang depth, cave entrance height and width, cave depth, number of chambers and their dimension (height and width)
- humidity and temperature inside the cave
- bat species present within the cave, including the presence of scats and feeding debris.

Caves were categorised as per definitions for ghost bat usage according to (Bat Call WA 2021b) in decreasing level of significance:

- Category 1 – Maternity/diurnal roost sites with permanent ghost bat occupancy
- Category 2 – Maternity/diurnal roost cave with regular occupancy
- Category 3 – Diurnal roost caves with occasional occupancy
- Category 4 – Nocturnal roost cave with opportunistic usage.

An additional lower classification is considered for the purposes of this report:

- Category 5 – Caves/overhangs considered generally unsuitable for ghost bat usage due to a restricted entrance or unsuitable dimensions. No evidence of usage.

Caves were also categorised as per definitions for Pilbara leaf-nosed bat usage according to Bat Call WA (2021a) in decreasing level of significance:

- Category 1 – Permanent diurnal roosts
- Category 2 – Non-permanent breeding roost
- Category 3 – Transitory diurnal roosts
- Category 4 – Nocturnal refuge.

Searches for roost caves provide a more accurate assessment of ghost bat presence because ghost bats are notoriously difficult to detect as their echolocation calls show wide variation, and they do not always call (utilising ultrasonic calls) when exiting and entering caves (McKenzie and Bullen 2009). In

addition, acoustic recording devices are not always successful in picking up vocal calls (audible sound) when ghost bats utilise certain feeding strategies.

3.2.3.9 Targeted Searches for Other Species

Targeted searches were conducted to identify areas of potential suitable habitat features for significant fauna, such as caves and water sources, and to detect secondary signs including tracks, scats, diggings, and burrows. Visual observation for significant fauna habitat and individuals was ongoing whilst moving through the Survey Area. Targeted searches were undertaken for significant species considered likely to occur in the area, including northern quoll, Pilbara olive python, ghost bat, Pilbara leaf-nosed bat, grey falcon, bilby, southern whiteface, peregrine falcon (*Falco peregrinus* (Specially protected (OS)), western pebble-mound mouse (*Pseudomys chapmani* (Priority(P) 4), brush-tailed mulgara (*Dasycercus blythi* (P4)) and Pilbara barking gecko (*Underwoodisaurus seorsus* (P2)).

For Pilbara olive python and northern quoll, targeted searches were undertaken within the suitable habitats present; Gorge/ Gully, Breakaway/ Cliff and Major Drainage Line habitats, and specifically targeting areas of rock outcrops, caves and surface water features therein. Targeted searches for these species focussed on the detection of secondary signs such as scats, tracks, sloughed skins and dens. Targeted searches for ghost bat and Pilbara leaf-nosed bat were also undertaken in Gorge/ Gully and Breakaway/ Cliff habitats in search for suitable roost caves described in Section 3.2.3.8.

Peregrine falcon and grey falcon searches were focused within Major Drainage Line habitat where large trees provide potential nesting and perching opportunities. Breakaway/ Cliff habitat was a focus for peregrine falcon as potential nesting habitat.

Southern whiteface may occur throughout the Survey Area and opportunistic observations were undertaken. Although their preferred habitat of Mulga Woodland was not present, this species may occur in habitats containing open Eucalypt woodland with an understorey of grasses or shrubs which is common within the Hillcrest/ Hillslope, Minor Drainage Line, and Drainage Area/ Floodplain habitats present.

Brush-tailed mulgara searches were carried out concurrently with bilby searches in areas with sandy substrates (Drainage Area/ Floodplain), with an emphasis on identifying their distinctive burrows. Opportunistic observations for western pebble-mound mouse were conducted within Hillcrest/ Hillslope habitat and focused on the identification of their distinctive pebble mounds. Pilbara barking gecko were targeted during nocturnal surveys, when geckos are most active. Visual observations for significant fauna and opportunistic bird recordings were ongoing whilst moving through the Survey Area.

Track logs were recorded using a handheld GPS and are shown in Figure 5. Any opportunistic sightings of fauna species were recorded whilst traversing through the Survey Area.

3.3 Taxonomy and Nomenclature

For species identified in the desktop assessment, every effort was made to determine the current scientific name for each taxon, including wherever there was doubt as to their true taxonomy (through subsequent name changes).

In accordance with the Environmental Protection Authority (EPA) technical guidance (Environmental Protection Authority 2020), nomenclature for herpetofauna, birds, and mammals follows that of the Western Australian Museum Checklist of the Vertebrates of Western Australia (Western Australian Museum 2023).

3.4 Limitations

Following the completion of the desktop review and field surveys, a review of any limitations that may affect a complete assessment of the data collected was conducted. The limitations listed in Table 6 are based on those suggested as consideration in the EPA technical guidance (Environmental Protection Authority 2020).

Table 6: Statement of limitations for the targeted vertebrate fauna survey.

Potential limitation	Degree of limitation	Statement regarding potential limitation
(i) Competency/experience	No limitation	The zoologists responsible for conducting the survey have extensive experience in conducting vertebrate fauna surveys in the Pilbara region. Andrew McCreery (Senior Zoologist) and Lucy Dadour (Senior Ecologist) have over 10 years of fauna surveying experience within the Pilbara region, Sean Smithies (Senior Zoologist) has over 6 years of fauna surveying experience within the Pilbara region, Amelia Catterick-Stoll (Zoologist) has over three years of fauna surveying experience, Andy Mack has two years of fauna surveying experience within the Pilbara region and Brianna Collard has one year of fauna surveying experience.
(ii) Scope What faunal groups were sampled, and were some sampling methods not able to be employed because of constraints such as weather conditions?	No limitation	The survey scope was able to be completed, and all sampling methods adequately employed. The fauna observed and identified are likely to represent a portion of the suite of species that utilise the Survey Area.
(iii) Proportion of fauna identified, recorded and/or collected	No limitation	The survey effort was targeted towards MNES and other significant vertebrate fauna species and was focused on habitats considered suitable for these species within the Survey Area. The use of motion sensitive cameras and ultrasonic recorders were employed to identify species that are cryptic or nocturnal. Given the nature of the surveys (single-phase targeted), the fauna observed and identified are likely to represent a portion of the suite of species that utilise the Survey Area.
(iv) Sources of information Previously available information (whether historic or recent) as distinct from new data.	No limitation	Previous biological surveys have been conducted in the broader area. Sixteen previous biological reports within close proximity of the Survey Area were reviewed for context and fauna data from an additional eight surveys were provided. Adequate information was available from database searches and previous studies in the Survey Area and region, as such this is not considered a limiting factor.
(v) Proportion of task achieved Further work which might be needed.	Minor limitation	A portion of the Survey Area in the south-west corner was unable to be assessed due to its remoteness. Within this area, habitat mapping was extrapolated and was characterised as Gorge/ Gully habitat, which is likely to provide high quality habitat for several MNES species. This is considered a minor limitation.

Potential limitation	Degree of limitation	Statement regarding potential limitation
(vi) Timing/weather/season/cycle	No limitation	Rainfall was 7.8% above average in the three months preceding FV 1, and 16.9% above the average for the year preceding. Survey timing for this field visit was optimal for this for reptiles and mammals (September – April) and numerous seasonal pools were observed within the Survey Area from the recent rainfall, which indicates favourable conditions for fauna species. Rainfall was 23.5% above the average in the three months preceding FV 2, but 2.6% below the average for the year preceding. Survey timing for this field visit was outside the typical optimal timing for reptiles and mammals, however, due to the high recent rainfall and warm on-ground conditions, the field visit timing is not considered to be a limitation.
(vii) Disturbances For example, fire, flood, accidental human intervention which affected results of the survey.	No limitation	No major disturbances were recorded in the Survey Area that would have affected the survey results.
(viii) Intensity In retrospect, was the intensity adequate?	No limitation	The intensity of the survey was considered adequate for a targeted vertebrate fauna assessment.
(xi) Completeness Was the relevant area fully surveyed?	Minor limitation	Apart from the portion of Gorge/ Gully habitat through the south-west corner, all target habitats considered suitable for MNES species within the Survey Area were adequately surveyed.
(x) Resources Degree of expertise available in animal identification to taxon level.	No limitation	Adequate resources were available to identify fauna species. All technical personnel involved in identification have extensive experience in conducting vertebrate fauna surveys, and external specialists were used to analyse the data from the echolocation and audio units, and eDNA samples.
(xi) Remoteness and/or access problems	Minor limitation	Access to the south-west corner and the northern part of the Survey Area was limited. This south-west corner represented the highest elevation in the Survey Area and consisted of steep Gorge/ Gully habitat in an area furthest from disturbance. Access was possible to a small section of this range, where two transects of eight cameras plus one individual camera was deployed. However, the remainder of this area could not be surveyed. The northern section of the Survey Area had limited access due to only one main track through this area. Most of this northern section consisted of Hillcrest/ Hillslope habitat which does not usually provide significant microhabitat for MNES species. However, these landforms can sometimes provide caves suitable for bats if the geology is suitable for cave forming. As such, access to these parts of the Survey Area was considered a minor limitation.

Potential limitation	Degree of limitation	Statement regarding potential limitation
(xii) Availability of contextual information For example, biogeographical information on the region.	No limitation	Database searches and previous fauna surveys in the vicinity of the Survey Area provided contextual information.

4 Results

4.1 Desktop Assessment

4.1.1 Environmentally Sensitive Areas

No Environmentally Sensitive Areas (ESAs) intersected the Survey Area. The nearest ESA is Fortescue Marsh, located approximately 33 km north of the Survey Area, and Karijini National Park, located approximately 42 km west of the Survey Area (Department of the Environment and Energy 2020a).

4.1.2 Vertebrate Fauna

The database searches indicated that 373 vertebrate fauna have previously been recorded, or potentially occur within a 40 km radius of the Survey Area (80 km radius through 'Threatened and Priority Fauna Database') (Table C.1 to C.4, Appendix C), including nine amphibian species, 132 reptile species, 177 bird species, and 55 mammal species (including nine introduced mammal species) (Department of Climate Change, Energy, the Environment and Water 2022, Atlas of Living Australia 2023, Birdlife Australia 2023, Department of Biodiversity, Conservation and Attractions 2023b, 2023a). Of these, 29 species are listed as MNES (specifically those listed as Threatened and Migratory species) as occurring, or potentially occurring, within the Survey Area. These 29 species comprise two reptile species, 22 bird species, and five mammal species (Table 7). A further 10 species, comprising three reptile species, two bird species, and five mammal species, are Priority listed species.

An additional seven species (three MNES, three Priority, and one introduced species) were identified in the desktop review but are either not within their current known distribution, or the Survey Area is lacking suitable habitat to support these species; Lake Disappointment ground gecko (*Diplodactylus fulleri*) (P2), spotted ctenotus (northeast subpop.) (*Ctenotus uber johnstonei)* (P2), barking owl (southwest subpop.) (*Ninox connivens connivens*) (P3), central rock-rat, (*Zyzomys pedunculatus*) (CR; CR), water buffalo (*Bubalus bubalis*), southern giant petrel (*Macronectes giganteus*) (EN & Migratory (MI); MI) and bridled tern (*Onychoprion anaethetus*) (MI; MI). These species were omitted from the desktop review and are not considered further.

Of the 39 significant listed species (MNES and Priority species), the pre-survey likelihood of occurrence assessment identified two species as previously recorded within the Survey Area, seven species with a high likelihood of occurrence, seven species with a moderate likelihood of occurrence, and 23 species with a low likelihood of occurrence within the Survey Area (Table 7). This is based on their respective ecology, habitats considered likely to be present, and any previous records from historic survey and database records.

Previous surveys undertaken for BHP WAIO in the vicinity of the Survey Area identified six MNES species: ghost bat, Pilbara leaf-nosed bat, Pilbara olive python, common greenshank (*Tringa nebularia*) (MI; MI), common sandpiper (*Actitis hypoleucos*) (MI; MI) fork-tailed swift (*Apus pacificus*) (MI; MI), and an additional three species of significance: western pebble-mound mouse (P4), *Anilios ganei* (P1) and peregrine falcon (OS) (Table 8). Additional unpublished BHP database records in the vicinity of the Survey Area identified a further three records of significance: northern quoll, osprey (*Pandion cristatus*) (MI; MI) and Pilbara barking gecko (P2).

Table 7: Likelihood of occurrence of significant vertebrate fauna species listed as potentially occurring in the vicinity of the Survey Area.

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Reptiles						
Pilbara barking gecko (*Underwoodisaurus seorsus*)			P2	Confined in the Pilbara to the Hammersley Ranges from Tom Price to Newman. Occurs in rocky areas with spinifex and low tree cover (Wilson and Swan 2020). Fourteen previous fauna records were detailed on the DBCA Threatened and Priority Fauna Database search result and eleven from BHP-provided data, with all recorded south/south-west of the survey boundary and the nearest record 7.5 km south. Suitable habitat occurs within the Survey Area.	High	High
Unpatterned robust slider (Robertson Range) (*Lerista macropisthopus remota*)			P2	Acacia shrublands and woodlands in the central interior. Shelters in loose soil under leaf litter at the base of shrubs (Wilson and Swan 2020). Three previous fauna records were detailed on the DBCA Threatened and Priority Fauna Database search result, with all records over 30 km south of the survey boundary. Preferred habitat is limited to Floodplains/Drainage Areas within the Survey Area and previous records are uncommon.	Moderate	Low
Great desert skink (*Liopholis kintorei*)	VU	VU		Most commonly found on red sandplains and sand ridges. Prefers a mosaic landscape of different aged vegetation and inhabits sites that have been burnt (3-15 years) (Wilson and Swan 2020). Sparsely distributed across arid sand flats and clay-based or loamy soils vegetated with spinifex. Constructs a burrow system of inter-connected network of tunnels. No previous fauna records were detailed in the database search results but featured in PMST database search due to potential habitat suitability. Suitable habitat was limited within the Survey Area and current records are further east; therefore, the likelihood of occurrence is low.	Low	Low
Anilios ganei			P1	Little information is available on this species, but it is believed to be associated with moist gorges and gullies (Wilson and Swan 2020). Sixteen previous records were detailed on the DBCA Threatened and Priority Fauna Database search result and thirteen from BHP data provided data, the nearest approximately 7 km south-west of the survey boundary. Suitable habitat is common throughout the Survey Area.	High	High

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Pilbara olive python (*Liasis olivaceus barroni*)	VU	VU		Generally rocky habitats in close association to permanent and semi-permanent water sources. This includes gorges, rock pools, and riparian zones (Department of Climate Change, Energy, the Environment and Water 2023a). Thirty-three previous records were detailed on the DBCA Threatened and Priority Fauna Database search result and forty-two from BHP-provided data. Eight records were along Marillana Creek to the north of the Survey Area with the closest being within 1 km of the Survey Area. An additional four records were along Weeli Wolli Creek to the east of the Survey Area. Evidence of this species was detected during the current survey.	High	**Recorded**
Birds						
Glossy ibis (*Plegadis falcinellus*)	MI	MI		Wetland habitats such as freshwater marshes at the edges of lakes, rivers, and wet swamp areas (Menkhorst et al. 2017). This species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes, and coastal lagoons. Two previous records were detailed on the DBCA Threatened and Priority Fauna Database search result. Both records were over 40 km from the survey boundary in the Fortescue Marsh. Suitable habitat is limited within the Survey Area.	Low	Low
Letter-winged kite (*Elanus scriptus)*			P4	The letter-winged kite is a bird of open country and grasslands in arid and semi-arid Australia, where there are tree-lined streams or water courses (Menkhorst et al. 2017). It is a highly mobile species, One previous record was detailed on the DBCA Threatened and Priority Fauna Database result, over 30 km from the survey boundary. Tree-lined drainage lines and drainage/floodplain areas provide suitable habitat within the Survey Area. This species may be a vagrant to the Survey Area.	Low	Low
Red goshawk (*Erythrotriorchis radiatus*)	VU	VU		This species usually occurs in the tropics and subtropics of northern and eastern Australia however there are occasional records in the Pilbara, likely dispersing juveniles (Department of Climate Change, Energy, the Environment and Water 2023b). It is primarily found in tall woodland and open forest systems. Detailed on PMST database search based on potential habitat suitability. This species may be an unlikely vagrant to the Survey Area.	Low	Low

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Osprey (*Pandion cristatus*)	MI	MI		Occurs in littoral and coastal habitats, and terrestrial wetlands and offshore islands but occasionally travels inland along major drainage lines, particularly in northern Australia (Menkhorst et al. 2017). This species requires extensive areas of open fresh, brackish or saline water for foraging. Three previous records were detailed on the DBCA Threatened and Priority Fauna Database result toward the Fortescue Marsh, with an additional nine records from BHP-provided data, all between 8 to 10 km south-east along Weeli Wolli Creek. Records also detailed on NatureMap. Preferred habitat is limited within the Survey Area.	Moderate	Low
Oriental plover (*Charadrius veredus*)	MI	MI		This species prefers open areas such as sparsely vegetated plains, grasslands, beaches, and tidal flats, and saltworks and sewage ponds. Arrives August-September and departs in February (Menkhorst et al. 2017). Two previous records were detailed on the DBCA Threatened and Priority Fauna Database result, over 40 km from the Survey Area in the Fortescue Marsh. Preferred habitat is limited within the Survey Area.	Low	Low
Australian painted snipe (*Rostratula australis*)	EN	EN		Inhabits shallow terrestrial freshwater wetlands, lakes, swamps, and claypans. Also found in waterlogged grassland and saltmarsh. Typical sites include areas with emergent tussocks of grass, sedges, or samphire, often scattered with clumps of lignum *Muehlenbeckia*, or canegrass or sometimes with tea-tree (*Melaleuca*) (Menkhorst et al. 2017). Two previous records were detailed on the DBCA Threatened and Priority Fauna Database result, over 40 km from the survey boundary near the Fortescue Marsh. Preferred habitat is limited within the Survey Area.	Low	Low
Common sandpiper (*Actitis hypoleucos*)	MI	MI		Non-breeding migrant to a wide variety of habitats, such as riverbanks, estuaries, freshwater seeps on coastal shores, tidal creeks, mangrove swamps, and saltmarshes. Migrates north about March and returns August (Menkhorst et al. 2017). One previous record was detailed on the DBCA Threatened and Priority Fauna Database result and eight from BHP-provided data, with the eight BHP-provided records identified in 2022 and located approximately 6 km north-west of the survey boundary. Alsodetailed on PMST and Atlas of Living Australia database searches. Preferred habitat is limited within the Survey Area.	Moderate	Low

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Sharp-tailed sandpiper (*Calidris acuminata*)	MI	MI		Muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass, and low vegetation, forages in nearby damp grasslands. Migrates north in March-April (Menkhorst et al. 2017). One previous record was detailed on the DBCA Threatened and Priority Fauna Database result, over 40 km from the survey boundary on the Fortescue Marsh. Also detailed on PMST database search. Preferred habitat is limited within the Survey Area.	Low	Low
Curlew sandpiper (*Calidris ferruginea*)	CR, MI	CR, MI		Mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast (Menkhorst et al. 2017). Record detailed on PMST database search. Preferred habitat is limited within the Survey Area.	Low	Low
Pectoral sandpiper (*Calidris melanotos*)	MI	MI		Mainly swamps, lagoons, river pools, irrigation channels, and sewerage ponds. Also, in samphire flats around estuaries and salt lakes. Uncommon but regular visitor to Australia (Menkhorst et al. 2017). Detailed on PMST database search based on potential habitat suitability. Preferred habitat is limited within the Survey Area.	Low	Low
Wood sandpiper (*Tringa glareola*)	MI	MI		Freshwater wetlands, especially sites with emergent sedges or other small plants, and taller fringing vegetation. Usually near shorelines and often alone and occasionally in small flocks. In Australia from August to April (Menkhorst et al. 2017). One previous record was detailed on the DBCA Threatened and Priority Fauna Database result and one from BHP-provided data, over 25 km south-west from the survey boundary, with records also detailed on Atlas of Living Australia database search. Preferred habitat is limited within the Survey Area.	Low	Low
Common greenshank (*Tringa nebularia*)	MI	MI		A variety of freshwater, marine, and artificial wetlands, including swamps, open muddy or rocky shores of lakes and large rivers, sewage farms, saltworks, muddy coastal flats, mangroves, and estuaries. Arrives in August (Menkhorst et al. 2017). Six previous records were detailed on the DBCA Threatened and Priority Fauna Database result, with the closest being 8 km north-east of the Survey Area. This record was also provided by BHP fauna data. The majority were found in the Fortescue Marsh. Preferred habitat is limited within the Survey Area.	Moderate	Low

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Marsh sandpiper (*Tringa stagnatilis*)	MI	MI		Permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats, and also regularly at sewage farms and saltworks (Menkhorst et al. 2017). One previous record was detailed on the DBCA Threatened and Priority Fauna Database result, being over 70 km north-east of the Survey Area in the Fortescue Marsh. Preferred habitat is limited within the Survey Area.	Low	Low
Gull-billed tern (*Gelochelidon (Sterna) nilotica*)	MI	MI		Shallow sheltered seas close to land, estuaries, tidal creeks, near-coastal salt lakes, samphire flats, swamps, lagoons, river pools, claypans, dams, and over grain crops (Menkhorst et al. 2017). Record detailed on NatureMap. Five previous records were detailed on the DBCA Threatened and Priority Fauna Database result, with the nearest over 30 km from the Survey Area. The majority were found in the Fortescue Marsh. Preferred habitat is limited within the Survey Area.	Low	Low
Caspian tern (*Hydroprogne caspia*)	MI	MI		Mostly found in sheltered coastal bays, including harbours, lagoons, inlets, estuaries, and river deltas with sandy or muddy margins preferred. This species also occurs on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers, and creeks (Menkhorst et al. 2017). One previous record was detailed on the DBCA Threatened and Priority Fauna Database result, being over 40 km north of the Survey Area in the Fortescue Marsh. Preferred habitat is limited within the Survey Area.	Low	Low
Fork-tailed swift (*Apus pacificus*)	MI	MI		Summer migrant to Australia and occurs in low to very high airspace, largely independent of terrestrial habitats and landforms (Menkhorst et al. 2017). Twelve previous records were detailed on the DBCA Threatened and Priority Fauna Database result and eighteen from BHP-provided data. The nearest record is approximately 7 km south of the Survey Area.	Moderate	Moderate

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Grey falcon (*Falco hypoleucos*)	VU	VU		Occurs in open habitats of semi-arid deserts, grassy inland plains, timbered watercourses, and pastoral lands (Department of Climate Change, Energy, the Environment and Water 2023c). The species usually nests in the tallest trees along watercourses, particularly in River Red Gum (*Eucalyptus camaldulensis*) and Coolibah (*E. coolabah*), but also in telecommunication towers (Marchant and Higgins 1993, Schoenjahn 2013, Schoenjahn 2018). Records detailed from PMST, NatureMap, Atlas of Living Australia, including fourteen previous records from DBCA Threatened and Priority Fauna Database result and three records from BHP-provided data, with the two nearest approximately 24 km south-west of the Survey Area. Moderate chance of occurring along major drainage lines with large trees and foraging within supporting habitats of drainage area/floodplain and minor drainage line habitats.	Moderate	Moderate
Peregrine falcon (*Falco peregrinus*)		OS		Cosmopolitan, will hunt in any habitat, soaring at height or from a perch, often near cliffs. Nests on rocky ledges in tall, vertical cliff faces and tall trees associated with drainage lines (Menkhorst et al. 2017). Data provided from BHP detailed one record from inside the Survey Area and another less than 10 km south-east. NatureMap and Atlas of Living Australia also displayed records, along with 42 records within 80 km sourced from the DBCA Threatened and Priority Fauna Database result. High chance of occurring along major drainage lines with large trees.	**Recorded**	High
Night parrot (*Pezoporus occidentalis*)	EN	CR		Arid and semi-arid areas characterised by dense, low vegetation. Based on accepted records, the habitat consists of *Triodia* grasslands in stony or sandy environments, of samphire and chenopod shrublands, on floodplains and claypans and margins of salt lakes, creeks, and other water sources (Department of Climate Change, Energy, the Environment and Water 2023d). One record detailed on the DBCA Threatened and Priority Fauna Database capturing three individuals from 2005 approximately 52 km north in the Fortescue Marsh. The habitat required for this species, being old growth hummock grassland and/or chenopod shrubland, does not occur within the Survey Area.	Low	Low

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Princess parrot (*Polytelis alexandrae*)	VU		P4	The Princess Parrot inhabits sand dunes and sand flats in the arid zone of western and central Australia. It occurs in open savanna woodlands and shrublands that usually consist of scattered stands of *Eucalyptus, Casuarina* or *Allocasuarina* trees with an understorey of shrubs such as *Acacia, Cassia, Eremophila, Grevillia, Hakea* and *Senna* with a ground cover of *Triodia* species (Menkhorst et al. 2017). One record detailed on the DBCA Threatened and Priority Fauna Database over 60 km east of the Survey Area. Preferred habitat is limited, and this species distribution is on the western edge of its range.	Low	Low
Southern whiteface (*Aphelocephala leucopsis*)	VU			Inhabits a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both. These areas are usually in habitats dominated by Acacias or Eucalypts on ranges, foothills and lowlands, and plains (Menkhorst et al. 2017). The species prefers Acacia woodlands, particularly those dominated by mulga and drought-resistant chenopod shrub species, including saltbush and bluebush (Higgins and Peter 2002). Records detailed on NatureMap and Atlas of Living Australia, and Survey Area is within the modelled 'known to occur' distribution of the PMST.	High	Moderate
Barn swallow (*Hirundo rustica*)	MI	MI		Coastal open country generally, especially near surface water and man-made structures, such as bridges and power wires (Menkhorst et al. 2017). Detailed on PMST database search based on potential habitat suitability. Preferred habitat is limited within the Survey Area.	Low	Low
Yellow wagtail (*Motacilla flava*)	MI	MI		Damp short-grass flats, edges of swamps, sewerage ponds, grazed, or mowed grass, and irrigated areas. Vagrant to Australia (Menkhorst et al. 2017). Detailed on PMST database search based on potential habitat suitability. Preferred habitat is limited within the Survey Area.	Low	Low
Grey wagtail (*Motacilla cinerea*)	MI	MI		Mainly banks and rocks in fast flowing fresh water. Vagrant to Australia (Menkhorst et al. 2017). Records detailed on the PMST database search, and one record from the DBCA Threatened and Priority Fauna Database result, more than 40 km north. This species rarely reaches Australia during migration.	Low	Low

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Mammals						
Brush-tailed mulgara (*Dasycercus blythi*)			P4	Common in a range of habitats, including tussock/hummock grasslands and sparse shrubs and low open woodlands on ridge tops, cliffs, scree slopes, hills, and valley floors (Van Dyck and Strahan 2008). Records detailed on NatureMap database search, along with six previous records detailed on the DBCA Threatened and Priority Fauna Database result and sixty-three from BHP-provided data, all since 2009, with nearest approximately 16 km east of the Survey Area. Suitable habitat present (Drainage Area/Floodplain in particular) but likelihood is moderate due to limited historical records within the vicinity and species distribution is generally further east.	Moderate	Moderate
Northern quoll (*Dasyurus hallucatus*)	EN	EN		Occurs in a variety of habitats, but commonly found in rocky escarpments and open lowland savanna forest. Found in areas associated with rocky areas, but also along watercourses (Department of Climate Change, Energy, the Environment and Water 2023e). Records detailed on PMST and NatureMap, along with fourteen records from BHP surveys, and 549 previous records detailed on the DBCA Threatened and Priority Fauna Database result. The nearest records were provided by BHP with two approximately 2 km and 5 km north at Yandi. Suitable habitat is common throughout the Survey Area. This species was recorded at four locations within the Survey Area during the current survey.	High	**Recorded**
Long-tailed dunnart (*Sminthopsis longicaudata*)			P4	Occurs in rocky areas and specifically, found in rocky scree and plateau areas with minimal vegetation or in Triodia grassland, shrubland and open woodland. A rare species that is patchily distributed (Van Dyck and Strahan 2008). One record detailed on the DBCA Threatened and Priority Fauna Database over 70 km south-east of the Survey Area. Its preferred habitat occurs within the Survey Area although previous records are sparse.	Low	Low

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Bilby, dalgyte (*Macrotis lagotis*)	VU	VU		The major habitats they now occupy in Western Australia include mulga scrub and hummock grasslands on sandplains, or along drainage or salt lake systems. This species requires sandy or loamy soils in which to burrow (Department of Climate Change, Energy, the Environment and Water 2023f). Records detailed on PMST and NatureMap as well as DBCA Threatened and Priority Fauna Database search and BHP-provided data with forty-one and forty-three previous records respectively. The nearest record to the Survey Area was identified over 35 km east of the survey boundary. The preferred habitat of sandplain is limited within the Survey Area and is unlikely to occur.	Low	Low
Spectacled hare-wallaby (*Lagorchestes conspicillatus leichardti*)			P4	Occurs in Acacia shrubland and spinifex grassland and shelters in large spinifex hummocks (Van Dyck and Strahan 2008). Records detailed from Atlas of Living Australia. Low numbers in mainland Pilbara and unlikely to occur within the Survey Area.	Low	Low
Black-flanked rock-wallaby (*Petrogale lateralis lateralis*)	EN	EN		This species is patchily distributed across Western Australia. Populations are scattered and restricted to sites with suitable rocky habitat with caves and crevices (Van Dyck and Strahan 2008). One record detailed on the DBCA Threatened and Priority Fauna Database over 70 km south-east of the Survey Area. Habitat exists within the Survey Area however previous records are sparse and therefore, highly unlikely to occur.	Low	Low
Short-tailed mouse (*Leggadina lakedownensis*)			P4	Open tussock and hummock grassland, Acacia shrubland and savanna woodland on alluvial clay/sandy soils and cracking clays (Van Dyck and Strahan 2008). Records detailed from NatureMap and Atlas of Living Australia as well as 33 previous records detailed on the DBCA Threatened and Priority Fauna Database and two from BHP-provided data. The closest records are over 30 km from the Survey Area with the Survey Area situated toward the southern boundary of its distribution and preferred habitat is limited.	Low	Low

Group Common name (*Scientific name*)	Conservation codes			Preferred habitat and previous records	Pre-survey likelihood of occurrence	Post-survey likelihood of occurrence
	EPBC Act	BC Act	DBCA			
Western pebble-mound mouse (*Pseudomys chapmani*)			P4	Gentle rocky slopes, hills and spurs with small pebble surface cover and sparse vegetation. This species distribution has contracted to the inland Pilbara away from the coastal Pilbara, Murchison, and Gascoyne (Van Dyck and Strahan 2008). Records detailed from NatureMap, Atlas of Living Australia, BHP-provided data (2802 records) and DBCA Threatened and Priority Fauna Database result with 456 previous records, occurring both within and in close proximity to the Survey Area. Fourteen recently active pebble-mound mouse mounds were recorded across the current surveys.	**Recorded**	**Recorded**
Pilbara leaf-nosed bat (*Rhinonicteris aurantia* (Pilbara form))	VU	VU		Roosts in deep, warm, humid caves or rock cracks, especially in proximity to water pools. Forages while flying low along watercourses and gorges and over *Triodia* grassland (Bat Call WA 2021a). Records detailed from NatureMap, Atlas of Living Australia, PMST and DBCA Threatened and Priority Fauna Database with 1,456 previous records, and BHP-provided data with fourteen records. The closest record was approximately 10 km north-west of the Survey Area, but the majority were clustered in the range of 22 km to 26 km north of the Survey Area. The Survey Area contains caves that are likely to support this species opportunistically.	High	High
Ghost bat (*Macroderma gigas*)	VU	VU		Occurring in rocky landscapes along gorge and gully formations and roosting within caves with warm, humid microclimates. They prefer an “apartment block” of roost sites concentrated within close range and where water is accessible (Bat Call WA 2021b). Records detailed from NatureMap, Atlas of Living Australia, PMST, previous BHP surveys and DBCA Threatened and Priority Fauna Database with 187 previous records. Prior to the survey the closest record was approximately 1.2 km from the Survey Area, but the majority were clustered 16 km to 30 km south. Ghost bat evidence was detected within the Survey Area during the current survey.	High	**Recorded**

Table 8: Summary of literature review effort, timing and results from surveys conducted within the vicinity of the Survey Area.

Author (year)	Survey area; size	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded
Targeted Pilbara Olive Python Survey: South Flank and Mining Area C (Biologic Environmental Survey 2023a)	Mining Area C, South Flank and surrounding area Area not stated	Single-season Targeted	March 2023	Habitat assessments, targeted diurnal and nocturnal searches, eDNA sampling.	Pilbara olive python (*Liasis olivaceus barroni*) Northern quoll (*Dasyurus hallucatus*)
Central Pilbara Hub Targeted Matters of National Environmental Significance Vertebrate Fauna Survey (Biologic Environmental Survey 2023b)	Central Pilbara Hub 60,000 ha	Single-season Targeted	November 2021 April 2022 May 2022	Habitat assessments, avifauna census, echolocation recorders to detect presence of bats, targeted diurnal and nocturnal searches, active foraging, camera trap transects.	Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) Ghost bat (*Macroderma gigas*) Western pebble-mound mouse (*Pseudomys chapmani*)
Marillana Creek Western Access Corridor Biological Assessment (Halpern Glick Maunsell 1999)	Marillana Creek 37, 715 ha	Level 1 Fauna and Flora survey	April 1999	Habitat assessments, avifauna census, opportunistic searches.	Western pebble-mound mouse (*Pseudomys chapmani*)
Yandi Life of Mine Flora and Fauna (Maunsell Australia 2003)	Yandi 12, 921 ha	Level 1 and Targeted Fauna and Flora survey	September 2003	Habitat assessments, avifauna census, echolocation recorders to detect presence of bats, targeted searches, active foraging, spotlighting.	Western pebble-mound mouse (*Pseudomys chapmani*) Common sandpiper (*Actitis hypoleucos*)
Summary of Important Findings from RGP5 Railway Project Biological Assessments (ENV Australia 2008)	Jimblebar Junction to Yandi Junction 32, approx. 120 km	Level 2 Flora and Level 1 Fauna survey	April 2008	Habitat assessments, opportunistic searches, nocturnal searches, active searches for significant species	Pilbara olive python (*Liasis olivaceus barroni*)

Author (year)	Survey area; size	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded
Mining Area C Biological Survey (Ecologia Environment 1998)	Area C 103,300 ha	Level 2 Fauna survey	April/May 1997	Thirteen trapping sites comprising pitfalls (PVC pipes and 20 L buckets), funnel traps and Elliott traps. Avifauna census and active foraging at each trapping site. Mist-netting for bats and nocturnal spotlighting.	Peregrine falcon (*Falco peregrinus*) Western pebble-mound mouse (*Pseudomys chapmani*)
Minsters North Biological Survey (Ecologia Environment 2006)	Ministers North Area not stated	Level 1 Fauna Survey	May 2006	Habitat assessments, avifauna census and active foraging at twenty-three sites. Echolocation recorders to detect presence of bats and nocturnal searches at two sites.	Western pebble-mound mouse (*Pseudomys chapmani*)
Munjina and Minsters North (Yandi Hub) Fauna Assessment (ENV Australia n.d.)	Munjina and Minsters North 2,800 ha	Level 2 Fauna Survey	November 2007	Five trapping sites comprising pitfalls, funnel traps, Elliott traps and cage traps. Echolocation recorders to detect presence of bats. Avifauna census, active foraging, nocturnal searches and targeted searches for western pebble-mound mouse mounds.	Western pebble-mound mouse (*Pseudomys chapmani*)
Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment (ENV Australia 2009)	Newman to Yandi Transmission Line 2,076 ha	Level 1 Fauna Survey	May 2009	Habitat assessment, avifauna census, echolocation recorders to detect presence of bats, targeted searches.	No significant fauna recorded
Area C to Yandi Fauna Survey (Biologic Environmental Survey 2011a)	Area C to Yandi 2,182 ha	Level 1 Fauna survey	September 2010	Targeted searches, motion camera traps, avifauna census and active foraging. SM4 echolocation recorders to detect presence of significant bat species.	Ghost bat (*Macroderma gigas*) Western pebble-mound mouse (*Pseudomys chapmani*)

Author (year)	Survey area; size	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded
Yandi Vertebrate Fauna Review (Biologic Environmental Survey 2011b)	Yandi Mine 13,209 ha	Level 1 and Targeted Fauna survey	December 2010	Habitat assessment, avifauna census, motion sensitive cameras, echolocation recorders to detect presence of bats, targeted searches, active foraging.	Western pebble-mound mouse (*Pseudomys chapmani*) Pilbara olive python (*Liasis olivaceus barroni*) Fork-tailed swift (*Apus pacificus*)
Area C West to Yandi Level 2 Vertebrate Fauna Survey (Biota Environmental Sciences 2013)	Area C West to Yandi 23,520 ha	Level 2 Fauna survey (3 phases)	May/June 2011 September 2011 February 2012	Twenty-three trapping sites comprising pitfalls, funnel traps and Elliott traps. Avifauna census and active foraging at each trapping site. Echolocation recorders and harp traps to detect presence of significant bat species. Nocturnal targeted searches.	Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) Peregrine falcon (*Falco peregrinus*) Western pebble-mound mouse (*Pseudomys chapmani*) Common greenshank (*Tringa nebularia*)
Yandicoogina Junction South West and Oxbow Fauna Survey (Biota Environmental Sciences 2010)	Yandicoogina 723 ha	Level 2 Fauna survey	July 2008	Eleven trapping sites comprising pitfalls, funnel traps and Elliott traps. Avifauna census and active foraging at each trapping site. Echolocation recorders and harp traps were used to detect presence of significant bat species.	Western pebble-mound mouse (*Pseudomys chapmani*)
Ministers North Level 2 Vertebrate Fauna Survey (Biologic Environmental Survey 2017a)	Ministers North 3,028 ha	Level 2 Fauna survey	October 2016, April 2017	Two-season survey of ten trapping sites comprising pitfalls, funnel traps, Elliott traps and cage traps. Targeted and nocturnal searches. Echolocation recorders to detect presence of significant bat species. Motion cameras and habitat assessments	Western pebble-mound mouse (*Pseudomys chapmani*)

Author (year)	Survey area; size	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded
Ministers North to Yandi Corridor (Biologic Environmental Survey 2017b)	Ministers North to Yandi Corridor 2,025 ha	Level 2 Fauna and Flora/ vegetation survey	October 2017	Targeted searches, motion sensitive cameras, SM4 echolocation recorders to detect presence of significant bat species. SM4 acoustic units were used to detect presence of night parrot.	Western pebble-mound mouse (*Pseudomys chapmani*)
Ministers North Level 2 Fauna Survey (GHD Pty Ltd 2021)	Yandicoogina Creek 256 ha	Level 2 (Detailed) fauna survey	September 2019 March 2020	Two trapping sites comprising pitfalls, funnel traps and Elliott traps. Avifauna census and active foraging. SM4 echolocation recorders, acoustic night parrot recorders, remote cameras and nocturnal targeted searches.	Ghost bat (*Macroderma gigas*) Western pebble-mound mouse (*Pseudomys chapmani*) Pilbara olive python (*Liasis olivaceus barroni*) *Anilios ganei*
Marillana Creek (Yandi) Iron ore Mine Modification Level 2 Fauna Survey (Ecologia Environment 2008)	Yandi Mine 2,395 ha	Level 2 Fauna survey	March 2008	Six trapping sites comprising pitfalls, cage traps, funnel traps and Elliott traps. Avifauna census and active foraging at each trapping site. Echolocation recorders to detect presence of significant bat species. Nocturnal spotlighting	Western pebble-mound mouse (*Pseudomys chapmani*)
Marillana Infrastructure Corridor Level 1 Vertebrate Fauna Survey (Biologic Environmental Survey 2016)	Track between the existing mining operations at Yandi and the Marillana exploration tenement 2,676 ha	Level 1 vertebrate Fauna survey	January 2016	Targeted transects, motion sensitive cameras, echolocation units to record significant bat species, habitat assessments and opportunistic searches.	Western pebble-mound mouse (*Pseudomys chapmani*)

4.2 Field Survey

4.2.1 Vertebrate Fauna Habitats

4.2.1.1 Fauna Habitats

Nine broad fauna habitat types (excluding Cleared/ Disturbed) were recorded in the Survey Area in decreasing order of extent: Hillcrest/ Hillslope, Gorge/ Gully, Drainage Area/ Floodplain, Minor Drainage Line, Breakaway/ Cliff, Undulating Low Hills, Major Drainage Line, Boulders/ Rockpiles, and Medium Drainage Line. Some Cleared/ Disturbed areas in the form of exploration and access tracks were present through the central and southern part of the Survey Area. Cleared/ Disturbed areas have low to no value as a fauna habitat for vertebrate fauna, apart from potentially being traversed or used as movement corridors, particularly for introduced predator species. The habitats present are summarised in Table 9 and mapped in Figures F.1a and F.1b (Appendix F).

Most of the habitat was rated 'High Quality' with some disturbances of weed infestation, cattle grazing, mining exploration, and road/access tracks present. Previous exploration was largely limited to the central and northern parts of the Survey Area mostly in Hillcrest/ Hillslope habitat. Evidence of weed infestation and cattle grazing was present mostly in Major Drainage Line, Medium Drainage Line, Minor Drainage Line, and Drainage Area/ Floodplain habitats.

A current Category 2 ghost bat roost cave (CMIN-03[2]) is situated 2 km to the south of the Survey Area, as such all ghost bat foraging habitats and habitats containing Category 3 ghost bat roost caves within a 12 km radius of this cave are categorised as (elevated to) critical habitat (Bat Call WA 2021b, BHP 2023a).

Gorge/ Gully habitat was widespread throughout the southern two-thirds of the Survey Area and was characterised by semi-enclosed rock formations with scattered *Eucalyptus/Corymbia* trees, mixed shrubs, and hummock and tussock grasses. Microhabitats included caves, crevices, and overhangs that have potential to support and provide critical habitat for MNES species northern quoll, ghost bat (with the presence of maternity and/or diurnal roost caves) and Pilbara olive python. The geology across the Survey Area varied with mostly banded iron formation (BIF) with some areas of conglomerate, and a mix of the two. The conglomerate and BIF – conglomerate mix offered the majority of suitable cave-forming structure with suitable deeper/humid microclimates for the two MNES bat species. Most of the BIF lacked the structural stability to produce caves with appropriate shape and size for roosting MNES bats. All Gorge/ Gully habitats featured crevices suitable for northern quoll denning. Twelve potential ghost bat roost caves were recorded in this habitat type, including two ghost bat Category 3 roost caves. Seven small surface water features were recorded in this habitat type, providing an important foraging resource for several MNES fauna species (Northover et al. 2023). Further discussion on roost caves and surface water features is provided in Sections 4.2.1.2 and 4.2.2.4.

Hillcrest/ Hillslope habitat was characterised by large open rocky areas with open grasslands (predominantly *Triodia* hummock grasslands) and tended to be more open and structurally basic than

[2] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

other fauna habitats. This habitat was widespread and consistent across the entire Survey Area and is suitable for western pebble-mound mouse mounds. The structural geology can sometimes provide shallow caves at the junctions of two intersecting hills, although these features are not common in this landscape. There were two caves (CMN-06 and CMNY-06) within this habitat in the Survey Area with suitable dimensions for a potential nocturnal roost for ghost bat and Pilbara leaf-nosed bat (Category 4). Hillcrest/ Hillslope habitat provides both critical (within 12 km of a Category 2[3] roost cave CMIN-03) and supporting foraging habitat for ghost bat, and supporting habitat for northern quoll and Pilbara leaf-nosed bat due to its foraging value.

Major Drainage Line is a common habitat within the Pilbara bioregion and is considered to be of high value to a suite of fauna species. The Survey Area consisted of two major drainage channels in association with rocky habitats – Gorge/ Gully, Breakaway/ Cliff and Hillcrest/ Hillslope habitats. A tributary of Weeli Wolli Creek, Yandicoogina Creek, occurs in the southern part of the Survey Area and is flanked by tall gorge walls. Vegetation consisted of tall groundwater dependant vegetation (GDV) *Melaleuca argentea* and *Eucalyptus victrix* and/or *E. camaldulensis* trees that produce tree hollows and woody debris. Three surface water features were identified within this habitat type during the current survey (Table 10, Table 11). Previous surveys (BHP-provided data) identified one surface water feature along Yandicoogina Creek which was dry at the time of the current survey. The other major drainage line is a tributary of Marillana Creek and occurs in the northern section of the Survey Area. It is characterised by a more open landscape, in association with a surrounding floodplain. Disturbances of buffel grass (*Cenchrus ciliaris*) and cattle grazing were common through this habitat type. This habitat provides critical habitat for the grey falcon as it offers potential nesting habitat within large trees associated with Major Drainage Line habitat, as well as critical habitat for Pilbara olive python, northern quoll and ghost bat (within 12 km of Category 2[3] roost cave) due to foraging value and dispersal pathways. Major Drainage Line habitat provides supporting habitat for Pilbara leaf-nosed bat.

Medium Drainage Line habitat is common within the Pilbara bioregion and considered to be of low to moderate value to a wide spectrum of fauna species. Medium Drainage Lines typically consisted of small drainage channels with low eucalypt and *Acacia* woodland growing in the riparian zone and is an intermediate of Major and Minor Drainage Line habitats. A moderate diversity of microhabitats was exhibited with rock piles, tree hollows, and woody debris (logs and leaf litter) present. Buffel grass was often present in the ground storey vegetation, reducing floral diversity. This habitat provides critical foraging habitat for ghost bat (within 12 km of Category 2[3] roost cave CMIN-03) and supporting habitat for ghost bat (outside of the 12 km buffer), northern quoll, Pilbara leaf-nosed bat, Pilbara olive python, southern whiteface, and grey falcon.

Minor Drainage Line habitat is common within the Pilbara region and generally provides limited microhabitats for fauna to exploit. Minor Drainage Lines typically consisted of small drainage channels with low eucalypt woodland growing on the fringes. Microhabitats included tree hollows and woody debris (logs and leaf litter) and occasional soft soil for burrowing. Buffel grass (*Cenchrus ciliaris*) was sometimes present in the ground storey vegetation, reducing floral diversity. Minor Drainage Line habitat provide critical foraging habitat for ghost bat (within 12 km of Category 2[3] roost cave CMIN-

[3] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

03), while supporting habitat is provided to northern quoll, ghost bat (outside of the 12 km buffer), Pilbara leaf-nosed bat, Pilbara olive python, and southern whiteface due to foraging and dispersal values.

Drainage Area/ Floodplain habitat consisted of two valleys running east-west through the central and northern part of the Survey Area, in which the northern valley is intersected by a tributary of Marillana Creek. This habitat consisted of hummock and tussock grasslands with emergent shrubs and scattered *Corymbia* trees on mostly stony soils with sparse patches of sandy substrates. The soft substrates provide some microhabitats for burrowing fauna, and moderate-sized trees offer supporting habitat for the grey falcon. This habitat type was well-represented both inside and outside of the Survey Area and is likely to provide value for other MNES species if and when populations are present, including supporting habitat for the Pilbara leaf-nosed bat and northern quoll, and critical habitat for the southern whiteface and ghost bat (foraging habitat within 12km buffer from CMIN-03[4]). This habitat type provides some limited potential habitat for bilby foraging and burrowing.

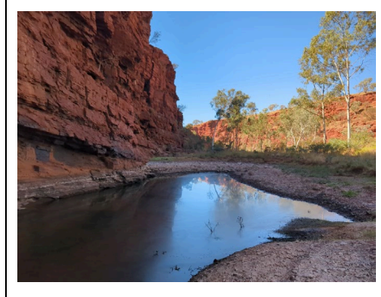
Breakaway/ Cliff habitat is characterised by broad rock faces mostly in association with Hillcrest/ Hillslopes, Drainage Area/ Floodplain and Major Drainage Line habitats and is generally unsuitable for a wide range of fauna species due to limited soft soil, leaf litter, and dense vegetation. The value to MNES species is based around the geological structures which provide potential denning, roosting, foraging and sheltering, and offers critical habitat to northern quoll and Pilbara olive python, and supporting habitat for ghost bat and Pilbara leaf-nosed bat in the absence of critical roost caves.

Undulating Low Hills habitat is widespread and common throughout the Pilbara region, and although there are some significant species that may utilise this habitat (for example, the western pebble-mound mouse for denning; the Pilbara leaf-nosed bat and ghost bat for foraging), they are unlikely to be restricted to it. This habitat had low vegetation complexity and low diversity of potential opportunities for burrowing species. This habitat is considered of low value to a broad spectrum of fauna species.

Boulders/ Rockpiles habitat is in the form of basalt outcrops scattered across the northern part of the Survey Area. The boulder piles were shallow and not extensive enough to provide significant (critical) denning habitat, although provides supporting habitat to fauna species that utilise crevices in rocky substrates, such as the northern quoll and Pilbara olive python. This habitat type is found in association with Minor Drainage Lines and Hillcrest/ Hillslope surrounded by *Eucalyptus/Corymbia* trees over mixed shrubs, *Triodia* spp., and tussock grassland.

[4] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

Table 9: Fauna habitats recorded within the Survey Area.

Fauna habitat	Extent in Survey Area (proportion)	Broad habitat description	Microhabitats*	Sites	Habitat condition	Value (broad faunal assemblage and significant species with a high likelihood of occurrence)**	Representative photo
Gorge/ Gully	617.4 ha (9.5%)	Semi-enclosed rock formations in association with rocky hills, drainage lines and breakaways. *Eucalyptus/Corymbia* trees over mixed shrubs, *Triodia* spp. and tussock grassland.	• caves • overhangs • crevices • rock pile • leaf litter • thick undergrowth • old *Triodia* • pools • semi-permanent water • tree hollows • logs	• BAT-01, 02, 03, 05, 06, 07, 08, 09, 11, 12, 13, 14, 16 • CAM-1-01, 1-02, 1-03, 1-04, 1-05, 1-06, 2-01, 2-02, 2-03, 2-04, 2-05, 2-06, 2-07, 2-08, 3-01, 3-02, 3-03, 3-04, 3-05, 3-06, 3-07, 3-08, 4-01, 4-02, 4-03, 4-04, 4-05, 4-06, 4-07, 4-08, 6-01, 6-02, 6-03, 6-04, 6-05, 6-06, 6-07, 7-01, 7-02, 7-03, 7-04, 9-01, 9-02, 9-03, 9-04, 9-05, 9-08, OPP-3 • HA-02, 04, 05, 07, 08, 12, 23, 26, 31 • NS-03	Good to High Quality	**MNES critical habitat** Northern quoll – denning and foraging. Ghost bat – roosting (due to the presence of Category 3 roosts caves and proximity to Category 2 roost cave CMIN-03). Pilbara olive python – foraging and shelter. **MNES supporting habitat** Pilbara leaf-nosed bat – foraging. Ghost bat – foraging. **Other significant species** Peregrine falcon – breeding and foraging. Previous record within the Survey Area. Pilbara barking gecko – foraging. *Anilios ganei* – foraging.	 **Plate 1: Gorge/ Gully habitat.**
Hillcrest/ Hillslope	4793.2 ha (73.5%)	Characterised by large open rocky areas with open grasslands, predominantly *Triodia* hummock grasslands with emergent *Eucalyptus* trees and mixed shrubs.	• caves • overhangs • tree hollows • crevices • rock piles • old *Triodia* • leaf litter	• HA-06, 09, 22, 24, 27, 28, 29, 30, 35 • NS-01, 02	Good to High Quality	**MNES critical habitat** Ghost bat – foraging (within 12 km buffer of CMIN-03) **MNES supporting habitat** Ghost bat – foraging. Northern quoll – foraging. Pilbara leaf-nosed bat - foraging. **Other significant species** Western pebble-mound mouse - recently active mounds recorded within the Survey Area. Pilbara barking gecko - foraging.	 **Plate 2: Hillcrest/ Hillslope habitat.**
Major Drainage Line	67.7 ha (1.0%)	Large drainage channel over 10 m in width in association with gorges, floodplains, rocky hills. Presence of tall *Melaleuca* and *Eucalyptus* trees over mixed shrubs and tussock and *Triodia* spp. grasses.	• logs • tree hollows • overhangs • crevices • rock pile • thick undergrowth • old *Triodia* • soft soil (burrows) • leaf litter • pools • semi-permanent water	• BAT-18 • CAM-5-01, 5-02, 5-03, 5-04, 5-05, 5-06, 5-06, 5-08, 9-06, 9-07 • eDNA-01, 02, 03 • HA-01, 20, 21	Very Good to High Quality	**MNES critical habitat** Pilbara olive python – foraging and shelter. Northern quoll – foraging and dispersal. Ghost bat – foraging (within 12 km buffer of CMIN-03). **MNES supporting habitat** Pilbara leaf-nosed bat - foraging. Ghost bat – foraging. **Other significant species** Peregrine falcon - breeding and foraging. Previous record within the Survey Area.	 **Plate 3: Major Drainage Line habitat.**

Fauna habitat	Extent in Survey Area (proportion)	Broad habitat description	Microhabitats*	Sites	Habitat condition	Value (broad faunal assemblage and significant species with a high likelihood of occurrence)**	Representative photo
Medium Drainage Line	2.4 ha (0.1%)	Medium drainage channel often with thick *Acacia* growth along banks.	• tree hollows • thick undergrowth • soft soil (burrows) • rock pile • leaf litter	• BAT-15	Good	**MNES critical habitat** Ghost bat – foraging (within 12 km buffer of CMIN-03). **MNES supporting habitat** Pilbara olive python – foraging and shelter. Northern quoll – foraging and dispersal. Pilbara leaf-nosed bat - foraging. Ghost bat – foraging. **Other significant species** Peregrine falcon - breeding and foraging. Previous record within the Survey Area.	 Plate 4: Medium Drainage Line habitat.
Minor Drainage Line	207.9 ha (3.2%)	Minor drainage channel often with thick *Acacia* growth along banks.	• logs • tree hollows • thick undergrowth • soft soil (burrows) • leaf litter • old *Triodia* • overhangs	• BAT-10 • CAM-OPP2 • HA-10, 14, 15, 16, 18, 19, 25, 32, 33	Very Good to High Quality	**MNES critical habitat** Ghost bat – foraging (within 12 km buffer of CMIN-03). **MNES supporting habitat** Northern quoll – foraging and dispersal. Pilbara leaf-nosed bat - foraging. Ghost bat – foraging. Pilbara olive python – foraging and dispersal.	 Plate 5: Minor Drainage Line habitat.
Drainage Area/ Floodplain	298.0 ha (4.6%)	Flat plains in association with drainage lines, gorges and breakaways. Often mixed shrubland with emergent *Corymbia sp.* over *Triodia* spp. on stony soils with occasional sandy soils.	• logs • tree hollows • thick undergrowth • soft soil (burrows) • old *Triodia* • leaf litter • rock pile • termite mounds	• ACO-01, 02, 03, 04, 05, 06 • HA-13 • TS-01, 02, 03, 04, 05	Good to High Quality	**MNES critical habitat** Ghost bat – foraging (within 12 km buffer of CMIN-03) **MNES supporting habitat** Northern quoll - foraging and dispersal. Pilbara leaf-nosed bat - foraging. Ghost bat – foraging.	 Plate 6: Drainage Area/ Floodplain habitat.

Fauna habitat	Extent in Survey Area (proportion)	Broad habitat description	Microhabitats*	Sites	Habitat condition	Value (broad faunal assemblage and significant species with a high likelihood of occurrence)**	Representative photo
Breakaway/ Cliff	105.8 ha (1.6%)	Exposed rock formations often associated with Hillcrest/ Hillslope, Gorge/ Gully, Drainage lines or Floodplains.	• overhangs • logs • tree hollows • crevices • thick undergrowth • caves • rock pile • old *Triodia* • leaf litter	• CAM-1-07, 1-08, 8-01, 8-02, 8-03, 8-04, 10-01, 10-02, 10-03, 10-04, 10-05 • BAT-04, 17 • HA-03, 17	Very Good to High Quality	**MNES critical habitat** Northern quoll - denning, foraging, and breeding. Pilbara olive python – denning and foraging. **MNES supporting habitat** Pilbara leaf-nosed bat – foraging. Ghost bat – foraging. **Other significant species** Peregrine falcon - breeding and foraging. Previous record within the Survey Area. *Anilios ganei* – foraging.	 **Plate 7: Breakaway/ Cliff habitat.**
Undulating Low Hills	103.1 ha (1.6%)	Low stony hills and slopes with dissected valleys and drainage on stony soils.	• Tree hollows • old *Triodia* • leaf litter • rock piles • termite mounds	• HA- 34, 36, 37	Good to High Quality	**MNES supporting habitat** Pilbara leaf-nosed bat - foraging. **Other significant species** Western pebble-mound mouse - recently active mounds recorded within the Survey Area. *Anilios ganei* – foraging.	 **Plate 8: Undulating Low Hills habitat.**
Boulders/ Rockpiles	30.0 ha (0.5%)	Basalt outcrops in association with Minor Drainage Lines and rocky hills with *Eucalyptus/Corymbia* trees over mixed shrubs, *Triodia* spp. and tussock grassland.	• rock pile • crevices • tree hollows • old *Triodia*	• CAM-OPP1 • HA-11	High Quality	**MNES supporting habitat** Northern quoll – foraging. Pilbara olive python – foraging when within species home range (88 to 450 ha) of either critical or supporting habitats e.g. Gorge/Gully, Major Drainage Line, Minor Drainage Line and Breakaway/Cliff. **Other significant species** Pilbara barking gecko – foraging.	 **Plate 9: Boulders/ Rockpiles habitat.**
Cleared/ Disturbed	294.2 ha (4.5%)		• N/A	• N/A	Highly Degraded	Low to no value for all native species.	No photo

*Microhabitats present within the habitat type here are general in nature. Significant microhabitats (e.g. roost caves, water features) are detailed in Table 10, Table 11 and Appendix E.
**Value (broad faunal assemblage and MNES species) critical and supporting habitat for MNES species gained from Table B.8 (Appendix B) and the BHP Technical Process Instruction: Vertebrate Fauna Surveys in Western Australia (SPR-IEN-EMS-012) (BHP 2023a).

4.2.1.2 Significant Habitats

Fourteen caves were recorded within the Survey Area which were considered potential habitat for several significant species, including as critical (when Category 3) and supporting habitat for ghost bat and supporting habitat for Pilbara leaf-nosed bat (Table 10). Of the 14 caves investigated, one (CMN-02) displayed features consistent with a Category 2 ghost bat roost due to the dimensions of the cave, and the recent presence of ghost bats and ghost bat scat (see Section 4.2.2.4 for further descriptions). A long-term bat detector placed within CMN-02 by BHP personnel between September 2023 and June 2024 failed to detect any ghost bat calls. Moreover, no scat was collected on scat sheets placed for the same time period, and no further scat was observed within the CMN-02 on revisitation during the current survey (FV 2). As such, CMN-02 was confirmed to be a Category 3 ghost bat roost (occasional rather than regular occupancy). Of the remaining 13 caves, one was also classed as Category 3 (CMNY-05) for ghost bats, nine as Category 4 for ghost bats, and three as Category 5 (Table 10, Figure E.1 and Table E.1, Appendix E). The recorded caves displayed characteristics suitable for Pilbara leaf-nosed bat, but with no evidence of the bats recorded, all 14 caves were classed as Category 4 roosts (Table 10). More information of the suitability of caves for Pilbara leaf-nosed bat is discussed in Section 4.2.2.4. These caves may also provide important refuges and potential denning opportunities for northern quoll and Pilbara olive python.

Across the Survey Area there are two main clusters of caves that appear to be in association with a geological feature. Three caves, CMNY-05, CMN-02, and CMN-09, are located within a gully in the central part of the Survey Area. Caves CMN-05 and CMNY-02 were both classed as Category 3 and CMN-09 was a provisional Category 3 (FV 1 survey) and subsequently confirmed as Category 4 (FV 2 survey). Ghost bat scat was observed in both CMNY-05 and CMN-02 with six individuals flushed from CMN-02 during a heritage survey March/April 2023 (pers. comm. Ralph Mongoo). These caves likely represent important roosts that aid dispersal and long-distance movement across the landscape and are all located with the 12 km buffer from Category 2[5] roost cave CMIN-03.

An additional cluster of four caves, CMN-04, CMN-03, CMN-01 and CMN-08, are located along Yandicoogina Creek and surrounding Gorge/ Gully habitat. These four latter caves are not all in immediate proximity (4.8 km from CMN-04 to CMN-01), but together may form or contribute to an important network of roosts along this Major Drainage Line habitat particularly considering they are within 12 km from a Category 2 roost cave CMIN-03.

Ten water features were recorded during the current survey (Table 11, Table E.2 and Figure E.1, Appendix E). Seven water features were recorded in Gorge/ Gully habitat in association with drainage lines, while three were in a Major Drainage Line in association with a gorge. Water features WMN-5, WMN-6 and WMN-7 were located in Yandicoogina Creek where GDV species *E. victrix* and/or *E. camaldulensis*, and *Melaleuca argentea* occur. Surface water sources are important for a wide range of fauna, including Pilbara MNES species, northern quoll, ghost bat, Pilbara leaf-nosed bat, and Pilbara olive python, providing refuge, foraging and potential breeding habitat (Northover et al. 2023).

[5] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

Table 10: Caves recorded within the Survey Area during the survey and associated category rating and dimensions.

Cave ID	Floor slope	Aspect	Exposure	Depth (m)	Chambers	GB roost category	PLNB roost category	Habitat type	Notes
CMN-01	Flat	North-West	Semi exposed	15	7	4 (formerly 3 provisional)	4	Gorge/ Gully	
CMN-02	Incline	East	Sheltered	35	4	3 (formerly 2 provisional)	4	Gorge/ Gully	GB scats (50-100)
CMN-03	Incline	South	Sheltered	12	1	4	4	Gorge/ Gully	
CMN-04	Flat	South	Exposed	5	1	4	4	Gorge/ Gully	
CMN-05	Flat	West	Semi exposed	8	1	4	4	Gorge/ Gully	
CMN-06	Incline	South-West	Semi exposed	9	1	4	4	Hillcrest/ Hillslope	
CMN-07	Flat	North-East	Sheltered	8	1	4	4	Gorge/ Gully	
CMN-08	Flat	North-West	Semi exposed	7	2	4 (formerly 3 provisional)	4	Gorge/ Gully	
CMN-09	Incline	West	Sheltered	12	3	4	4	Gorge/ Gully	
CMN-10	Flat	North-West	Sheltered	10	1	5	4	Gorge/ Gully	
CMN-11	Incline	North	Exposed	10	1	5	4	Gorge/ Gully	
CMN-12	Incline	West	Exposed	20	1	5	4	Gorge/ Gully	
CMNY-05	Incline	South-East	Semi exposed	12	1	3	4	Gorge/ Gully	GB scats (50-100)
CMNY-06	Incline	North-East	Exposed	10	1	4	4	Hillcrest/ Hillslope	

Table 11: Water features recorded within the Survey Area during the current survey.

Water Feature ID	Type	Length (m)	Width (m)	Depth (m)	Slope	Habitat type	Outcropping	Groundwater dependant vegetation (GDV)
WMN-1	Water feature	5	3	0.5	Low	Gorge/ Gully	Extensive	None present
WMN-2	Water feature	9	3	0.5	Low	Gorge/ Gully	Extensive	None present
WMN-3	Water feature	4	2	0.6	Low	Gorge/ Gully	Extensive	None present
WMN-4	Water feature	1	2	0.5	Low	Gorge/ Gully	Extensive	None present
WMN-5	Water feature	10	5	0.7	Low	Major Drainage Line	Extensive	*Eucalyptus victrix* and/or *E. camaldulensis*
WMN-6	Water feature	3	1	0.4	Low	Major Drainage Line	Extensive	*Eucalyptus victrix* and/or *E. camaldulensis*
WMN-7	Water feature	3	1	0.6	Flat	Major Drainage Line	Limited	*Eucalyptus victrix* and/or *E. camaldulensis, Melaleuca argentea*
WMN-8	Water feature	1	1	0.3	Moderate	Gorge/ Gully	Major	None present
WMN-9	Water feature	1	0.5	1	Moderate	Gorge/ Gully	Major	None present
WMN-10	Water feature	5	3.5	0.5	Low	Gorge/ Gully	Extensive	None present

4.2.2 Vertebrate Fauna Species

There were 111 vertebrate fauna species recorded within the Survey Area (Table 12). A complete list of recorded species is provided in Tables C.1 to C.4 (Appendix C). The following sections provide detailed results for each major taxonomic group sampled.

Table 12: Number of vertebrate fauna species recorded during the survey.

Fauna taxonomic group	No. of species recorded	No. of MNES species recorded	No. of DBCA Priority fauna species recorded	No. of introduced species recorded
Amphibians	1	0	0	0
Reptiles	25	1	0	0
Birds	64	0	0	0
Mammals	21	2	1	3
Total	**111**	**3**	**1**	**3**

4.2.2.1 Herpetofauna

One amphibian species, the little red tree frog (*Litoria rubella*), was recorded during the survey in a water feature within Major Drainage Line habitat.

Twenty-five reptile species were recorded during the survey, comprising six geckos, six skinks, five snakes, five varanids, and three dragons (Table C.2, Appendix C). The low number of reptiles is not unexpected given the survey focused on the presence/absence of MNES species without the use of pitfall trapping implemented in Detailed fauna surveys. One MNES species, the Pilbara olive python, was recorded during the field surveys (Section 4.2.2.4).

4.2.2.2 Birds

Sixty-four bird species were recorded during the survey. The most speciose families were Accipitridae (hawks, eagles, kites) and Meliphagidae (honeyeaters) with six species, followed by Columbidae (pigeons) and Artamidae (butcherbirds, woodswallows) with four species (Table C.3, Appendix C). No MNES or other significant bird species were recorded during the survey.

4.2.2.3 Mammals

Twenty-one species of mammal were recorded during the survey, including three introduced species: European cattle (**Bos taurus*), cat (**Felis catus*) and dog/dingo (**Canis familiaris*) (Table C.4, Appendix C). Nine bat species were confirmed present from ultrasonic acoustic recording devices set within the Survey Area. An additional bat species (ghost bat) was recorded from scats in two caves.

Three mammal species of significance, northern quoll, ghost bat and western pebble-mound mouse, were recorded during the survey. The northern quoll was captured on three motion sensitive cameras and scat was collected from an additional location. Ghost bat scat was found within two caves (CMNY-05 and CMN-02) within the Survey Area, and fifteen western pebble-mound mouse mounds recorded within the Survey Area. These species are discussed further in Section 4.2.2.4.

4.2.2.4 Significant Species Recorded

Four vertebrate species of significance, including three MNES species, were recorded within the Survey Area: northern quoll (EN; EN), ghost bat (VU; VU), Pilbara olive python (VU; VU) and western

pebble-mound mouse (P4). The locations of these species' records from the current survey, as well as previously recorded species, are shown in Figure G.1 (Appendix G) and detailed in Table E.1 (Appendix E).

Northern Quoll (*Dasyurus hallucatus*) (EN; EN)

The northern quoll is common in a range of habitats within its distribution, including rocky habitats and watercourses. Over 500 northern quoll records were detailed on the DBCA Threatened and Priority Fauna Database (Department of Biodiversity, Conservation and Attractions 2023b) within an 80 km radius of the Survey Area. Most records were located at Gudai-Darri, approximately 20 km north. BHP-provided data included the closest records with two individuals recorded at the Yandi mine approximately 3 km (2016) and 5 km (2010) north of the Survey Area.

The northern quoll was recorded on nine occasions during the current survey from four separate locations within Gorge/ Gully and Major Drainage Line habitats. Individuals were recorded on motion sensitive cameras on eight occasions at three locations on two separate camera transects (CAM6-06, 07 and CAM9-07) (Plate 10-12; Figure G.1, Appendix G). These cameras were located within, or in associated gullies and tributaries of, Yandicoogina Creek. This Major Drainage Line system runs through a deeply incised gorge and exhibits a high diversity of microhabitats critical for the northern quoll including pools/water features, overhangs, rock piles, leaf litter, logs and rock shelters. A review of the spot patterning of the captured individuals indicates that the eight records are likely attributed to the same individual, however, this cannot be confirmed. A further record was attributed to a scat found within the Yandicoogina Creek system, located on a rocky ledge proximate to both pool WMN-6 and CAM06-06 (Figure G.1, Appendix G).

Although over 500 northern quoll records were detailed on the DBCA Threatened and Priority Fauna Database (Department of Biodiversity, Conservation and Attractions 2023b), approximately 90% of these records are derived from the Gudai-Darri region 20 km to the north of the Survey Area. Only twelve records were identified on the BHP-provided data, spread sporadically across the Marillana, Yandi, Area C and South Flank regions. Moreover, the next most southern record from the Gudai-Darri population identified on the DBCA Threatened and Priority Database, was 15 km to the south of the current Survey Area, around Hope Downs 1 (Department of Biodiversity, Conservation and Attractions 2023b). The presence of the northern quoll within the Survey Area is significant as it confirms the persistence of the species in the local area, and the importance of Gorge/ Gully systems incised by Major Drainage Lines for critical foraging and dispersal habitat. The rocky relief and sheltering coupled with the presence of water and woody debris within the Yandicoogina Creek system provides microhabitats necessary to facilitate foraging and dispersal. The sporadic regional records, and the likelihood that current records are attributed to a single individual, suggests that a sustained population is not present within the Survey Area, but habitats within the Survey Area are utilised and are critical for the dispersal of the northern quoll.

Plate 10: Northern quoll at CAM6-06

Plate 11: Northern quoll at CAM6-07

Plate 12: Northern quoll at CAM9-07

Plate 13: Northern quoll scat.

Approximately 791 ha (12.1%) of the Survey Area is critical habitat in the form of Gorge/ Gully, Major Drainage Line and Breakaway/ Cliff habitats. These areas contain the rocky environments of high relief that are particularly important, as they provide denning sites for breeding and shelter, diverse microhabitats for foraging, and suitable pathways for dispersal. Suitable habitat occurs throughout, particularly in the central and southern part of the Survey Area where Gorge/ Gully habitat is common, particularly when in association with Major Drainage Line habitat. The Boulders/ Rockpiles habitat features were shallow and do not provide sufficient outcropping to be defined as a 'boulder field', that would provide a network of cracks and crevices for critical denning habitat; therefore, this habitat type is considered supporting habitat only.

Approximately 5,331 ha (81.8%) of the Survey Area was supporting habitat due to the potential for dispersal and foraging. Medium Drainage Line, Minor Drainage Line, and Drainage Area/ Floodplain habitats offer dispersal pathways and foraging, while Hillcrest/ Hillslope and Boulders/ Rockpiles provide foraging potential (Figure F.3, Appendix F). The remaining 397 ha (6.1%) of the Survey Area was considered to provide limited habitat for the northern quoll, consisting of Undulating Low Hills and Cleared/ Disturbed habitats (Figure F.3, Appendix F).

Ghost Bat (*Macroderma gigas*) (VU; VU)

The ghost bat is found in a wide range of habitats but relies on physiologically benign day roosts in temperature stable caves with chambers or cavities that trap humidity (Bat Call WA 2021b). One hundred and eighty-seven previous records were within an 80 km radius (Department of Biodiversity, Conservation and Attractions 2023b) and 30 records within a 10 km radius sourced from BHP-provided data, with the closest being 1.2 km south of the Survey Area. A critical Category 2[6] ghost bat roost cave CMIN-03 (ACY-01) is located approximately 2 km to the south of the Survey Area (Biologic Environmental Survey 2023b). Environmental consultant GHD (GHD Pty Ltd 2021) previously recorded several suitable diurnal roosts within the Survey Area along Yandicoogina Creek, but no evidence of ghost bat presence.

Biologic Environmental Survey assessed the Survey Area in 2017 and recorded cave CMN-02 (Biologic Environmental Survey 2017a) (Figure E.1, Appendix E). While it was described as having the desired features for a potential maternal roost, no ghost bats or scats were observed. Prior to the current survey, a heritage team observed six individual ghost bats roosting at this cave in late March/early April 2023 (pers. comm. Ralph Mongoo) and all ghost bats were accidentally flushed from the cave. During FV 1 of the current fauna survey, the cave was investigated on two separate occasions and no ghost bats were observed, however, approximately 50 to 100 ghost bat scats were recorded (Table E.1 and Figure E.1, Appendix E). A bat detector was deployed at the entrance of the cave for three nights and did not detect ghost bat presence and scats from the cave were considered not to be recent. A long-term bat detector and scat sheet were placed within the cave between September 2023 and June 2024 by BHP personnel, and no evidence of ghost bat was detected over this time via either sampling method. Moreover, no additional scat was identified during revisitation of the cave during FV 2 of the current survey. Although cave CMN-02 displayed geological characteristics potentially suitable to support a non-permanent maternal roost (Category 2) with two roosting chambers over 2 m in height, elevated above the entrance with the deepest chamber at a depth of approximately 35 m providing warm, humid conditions, the lack of occupancy evident over the breeding and pupping seasons indicates that CMN-02 is more likely a diurnal roost with occasional occupancy (Category 3).

A separate cave CMNY-05 (previously recorded potential feeding roost) was inspected 700 m north and approximately 50 to 100 ghost bat scats were recorded (Table E.1 and Figure E.1, Appendix E). The structure provided roosting opportunities for ghost bat with one chamber at a height of 1.9 m which provided moderate humidity, although some light exposure was evident. It was conservatively classified as a Category 3 roost during the survey due to suitability and evidence of usage but may change following additional surveys or monitoring. Of the remaining twelve caves assessed, two were classed as provisional Category 3 roosts (FV 1), but were since downgraded to Category 4 on reinspection (FV 2), seven were Category 4 roosts and three were Category 5 roosts.

Category 2 roosts are classed as critical habitat, as are Category 3 roost caves when found adjacent to Category 2 roosts, considered to be part of an “apartment block” (Bat Call WA 2021b). Foraging habitat within 1,200 ha or 12 km radius surrounding the critical habitat roosts are also considered critical habitat. Gorge/ Gully formations throughout the central and southern areas of the Survey Area

[6] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

provide microhabitat suitable for diurnal roosts (Category 3) and nocturnal feeding roosts (Category 4). Complex vegetation structures and microhabitats that support prey species were available throughout, and there were several water features (Figure E.1, Appendix E) in the central part of the Survey Area, along the same gully as cave CMN-02. Due to the proximate Category 2 roost cave CMIN-03 and the presence of significant microhabitat features, Gorge/ Gully habitat within the Survey Area is considered as critical habitat for ghost bat, covering approximately 617 ha (9.5%) (Figure F.2 Appendix F).

Foraging habitat for ghost bat is described as tree-lined drainage lines, isolated trees on the outskirts of plains, and productive plains of thin woodland over clumped tussock or *Triodia* hummock grass (Bat Call WA 2021b). All foraging habitat within a 12 km buffer of CMIN-03[7] is considered critical habitat, consisting of Major Drainage Line, Medium Drainage Line, Minor Drainage Line, Hillcrest/ Hillslope and Drainage Area/ Floodplain habitats. Therefore, approximately 5,880.4 ha (90.2%) of the total Survey Area is considered critical habitat (Figure F.2 Appendix F).

Supporting ghost bat habitat consists of Breakaway/ Cliffs, and all foraging habitat outside a 12 km buffer of CMIN-03. Approximately 211.8 ha (3.2%) of the Survey Area is considered as supporting habitat. The remaining approximately 427 ha (6.6%) of the Survey Area was considered to provide limited habitat for the ghost bat, consisting of Boulder/ Rockpiles, Undulating Low Hills and Cleared/ Disturbed habitats (Figure F.2 Appendix F).

Pilbara Olive Python (*Liasis olivaceus barroni*) (VU; VU)

The Pilbara olive python is restricted to ranges within the Pilbara and occurs in rocky outcrops, escarpments, and gorges, often in close proximity to permanent or seasonal water sources (including man-made) which attract suitable sized prey species (Department of Environment 2023). The desktop assessment showed 33 records within 80 km of the Survey Area (Department of Biodiversity, Conservation and Attractions 2023b), and six additional records within 8 km of the Survey Area (BHP-provided data). The closest record (scat) occurred approximately 1.2 km east of the Survey Area along Yandicoogina Creek (GHD Pty Ltd 2021). Other nearby records occur north of the Survey Area along Marilliana Creek, with five records within 5 km of the northern boundary, the closest at 2.5 km. These records include sloughed skins and scats found in a small rocky outcrop near a water discharge point (Biologic Environmental Survey 2011b). Two records from 2003 were near permanent to semi-permanent water sources (Maunsell Australia 2003).

One Pilbara olive python record was recorded during the current survey via scat found along Major Drainage Line habitat, specifically within Yandicoogina Creek near pool WMN-6. The scat was assessed as being approximately 6 months – 1 year old, and no further scat, sloughed skins or other evidence of Pilbara olive python was identified within the Survey Area. Moreover, eDNA samples collected on FV 2 from three water feature locations, including WMN-6, failed to detect Pilbara olive python (eDNA Frontiers 2024). The lack of eDNA recorded from the sampled pools indicates that no, or very little, Pilbara olive python activity had occurred during or in the weeks prior to FV 2 suggesting a significant resident population is unlikely at these locations. Records of this species have previously been

[7] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

identified along Yandicoogina Creek, and despite the lack of eDNA evidence, the presence of scat along this river system within Survey Area indicates that Yandicoogina Creek is an important feature for foraging and dispersal opportunities for this species within the area.

Approximately 791 ha (12.1%) is considered critical habitat for this species, which includes Gorge/ Gully, Breakaway/ Cliff and Major Drainage Lines. Yandicoogina Creek is particularly suitable for this species and is in close proximity to the nearby GHD record. Three surface water pools were recorded at the time of the survey along Yandicoogina Creek, and there was one depression that previously had been recorded as a semi-permanent waterbody (Biologic Environmental Survey 2011a) which would also likely support this species. The gorge contains thick vegetation in patches and logs which provide shelter and ambush locations during times of seasonal inundation. A gorge in the central part of the Survey Area provided four surface water pools all within 500 m, with another two in a gully further west.

Approximately 240 ha (3.7%) of the Survey Area was considered supporting habitat, which consisted of Medium Drainage Line, Minor Drainage Line and Boulders/ Rockpiles habitats that may be useful for foraging and dispersal, particularly where proximate to other supporting or critical habitat (Figure F.5, Appendix F).

The remaining approximately 5,487 ha (84.2%) of the Survey Area was considered to provide limited habitat for the Pilbara olive python, consisting of Cleared/ Disturbed, Drainage Area/ Floodplain, Hillcrest/ Hillslope and Undulating Low Hills (Figure F.5, Appendix F).

Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4)

The western pebble-mound mouse is confined to the central and eastern Pilbara and occurs on stony hillsides with hummock grassland. They shelter in complex burrow systems under a mound which is constructed on the surface using pebbles (Menkhorst and Knight 2011). Fourteen recently inactive mounds and one inactive mound were recorded during the current survey (examples **Plate 14** and **Plate 15**), and sixty-nine previous records occur in the Survey Area (BHP provided data), all located in Hillcrest/ Hillslope and Undulating Low Hills habitats. The western pebble-mound mouse is common in the surrounding area with 1,405 records within 10 km of the Survey Area (BHP provided data), mostly recorded between 3 to 9 km north at the BHP Yandi Mine Site. Hillcrest/ Hillslope and Undulating Low Hills habitats are widespread throughout the Survey Area and greater Pilbara region.

Plate 14: Recently inactive western pebble-mound mouse mound in Hillcrest/ Hillslope habitat.

Plate 15: Recently inactive western pebble-mound mouse mound in Undulating Low Hills habitat.

4.2.2.5 Significant Species Rated as High Likelihood of Occurrence

Four species, including one MNES species, which were not recorded during the current survey, are considered to have a high post-survey likelihood of occurrence (Table 7).

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (VU; VU)

The Pilbara leaf-nosed bat roosts in deep, warm, humid caves or rock cracks near water pools and forages across a wide variety of habitat, typically along vegetated gullies and ridgelines, water courses and drainage lines, and across plains and low hills with complex vegetation structure (Bat Call WA 2021a). While no previous observations have been recorded within the Survey Area, there are numerous surrounding Pilbara leaf-nosed bat records with over 1,400 records within 80 km, most of which occur over 20 km north, and the closest being 10 km north-west (Department of Biodiversity, Conservation and Attractions 2023b).

Targeted searches identified fourteen caves with characteristics supporting of a Pilbara leaf-nosed bat transitory diurnal roost (Category 4) (Table E.1, Appendix E). This includes tunnels that constrict under 1 m^2 cross section in caves with high and stable temperatures and humidities (Bat Call WA 2021a). All known permanent and natural Pilbara leaf-nosed bat roosts are within flying range of a permanent water source, with the longest linear distance of 8.7 km recorded from roost to water source (Bat Call WA 2021a). While a permanent water source is unlikely within the Survey Area, 10 surface water features of at least a temporary period were recorded (Table E.2, Appendix E). Suitable foraging habitat within the Survey Area consists of deep moist 'open' gorge with hills to the side, which is often found in Major Drainage Line and Gorge/ Gully fauna habitat types. Targeted searches investigated potential roosts for Pilbara leaf-nosed bat presence and ultrasonic bat recorders were deployed at the entrance of five potential roost caves with an additional five deployed in foraging habitat. Pilbara leaf-nosed bats were not detected in the Survey Area during the current survey. No known Pilbara leaf-nosed bat roosts are present in the area, and the nearest known significant roosts are at Gudai-Darri adit (approximately 26 km north) and Kalgan Creek (approximately 80 km southeast) (Bat Call WA 2023).

Approximately 6,195 ha (95.0%) of the Survey Area was identified as supporting habitat which includes Category 4 roosts, and foraging habitat in Gorge/ Gully, Breakaway/ Cliff, Major Drainage Line, Medium Drainage Line, Minor Drainage Line, Drainage Area/ Floodplain, Hillcrest/ Hillslope and Undulating Low Hills. The remaining 324 ha (5.0%) of the Survey Area was considered to provide

limited habitat which included Boulders/ Rockpiles and Cleared/ Disturbed areas (Figure F.4, Appendix F).

Even though this species was not detected during the current survey, there is a high likelihood of occurrence due to the potential roosting and supporting foraging habitat.

Peregrine Falcon (*Falco peregrinus*) (Other Specially Protected (OS))

The peregrine falcon occurs in most habitat types, apart from treeless and waterless desert and dense forests, and is widespread but uncommon throughout Australia. The peregrine falcon utilises the ledges, cliff faces, and large hollows/broken spouts of trees for nesting, and occasionally uses abandoned nests of other birds of prey (Johnstone and Storr 1998). One peregrine falcon record has been recorded within the Survey Area (BHP-provided data) with an additional 42 records within 80 km of the Survey Area (Department of Biodiversity, Conservation and Attractions 2023b).

The Survey Area contains suitable nesting, foraging, and perching habitat within the Major Drainage Line, Breakaway/ Cliff, and Gorge/ Gully habitats. The large gorge walls and tall trees along Yandicoogina Creek is particularly suitable for this species although no evidence of peregrine falcon nests was observed.

Pilbara Barking Gecko (*Underwoodisaurus seorsus*) (P2)

The Pilbara barking gecko is confined to the Hamersley Ranges from Tom Price to Newman and occurs in rocky areas with spinifex and low tree cover. There are 14 previous records detailed on the DBCA Threatened and Priority Fauna Database search (Department of Biodiversity, Conservation and Attractions 2023b), with the nearest being 7.5 km from the Survey Area. There is suitable habitat present in the Survey Area, in the form of Hillcrest/ Hillslope, Gorge/ Gully and Boulders/ Rockpiles therefore there is a high likelihood of this species occurring.

***Anilios ganei* (P1)**

Anilios ganei is a fossorial blind snake species found in gorges and gullies within rocky habitats in the Pilbara (Wilson and Swan 2017) and could be present within other Mulga and stony habitats in the area (BHP 2016). The nearest record was located approximately 7.5 km south-west of the Survey Area in 2010 (BHP-provided data) with an additional 16 records within 80 km (Department of Biodiversity, Conservation and Attractions 2023b). The Survey Area contains suitable habitat, in the form of Gorge/ Gully habitat, therefore, there is a high likelihood of occurrence.

Table 13: Comparison of home range and habitat availability for Matters of National Environmental Significance (MNES) species identified as occurring, or potentially occurring, in the Survey Area.

MNES species	Home range	Nearest record from Survey Area (km)	Critical habitat		Supporting habitat		Likelihood of occurrence	
			Type	Area within Survey Area (proportion of Survey Area)	Type	Area within Survey Area (proportion of Survey Area)	Pre-survey	Post-survey
Northern quoll (*Dasyurus hallucatus*) (EN; EN)	35 ha, up to 100 ha during breeding season	2 km	Denning and foraging habitat in gorges, escarpments, ranges, breakaways, and major drainage lines within home ranges (represented within the Survey Area by Gorge/ Gully, Breakaway/ Cliff and Major Drainage Line fauna habitats).	791 ha (12.1%)	Drainage lines facilitating foraging and dispersal. Basalt outcrops, mesas, stony plains supporting spinifex grasslands (represented within the Survey Area by Medium Drainage Line, Minor Drainage Line, Drainage Area/ Floodplain, Hillcrest/ Hillslope, and Boulders/ Rockpiles fauna habitats).	5,330 ha (81.8%)	High	**Recorded**
Ghost bat (*Macroderma gigas*) (VU; VU)	>12 to 30 km	1.2 km	Rocky outcrops in select geological formations including banded ironstone formation (BIF). Deep, warm, humid caves displaying features consistent with maternity (Category 1 and 2) and/or diurnal roosts (Category 3) in proximity to a maternity roost (represented within the Survey Area by Gorge/ Gully, fauna habitats). Foraging habitat with 12 km of Category 2 roost caves (represented by Major Drainage Line, Medium Drainage line, Minor Drainage Line, Drainage Area/ Floodplain and Hillcrest/ Hillslope[8]).	5,880 ha (90.2%)	Productive plains areas, isolated trees on plain outskirts and tree lined water courses. Shallow caves, shelters and deep overhangs that support opportunistic usage for resting and feeding. (represented by Breakaway/ Cliff, Major Drainage Line, Medium Drainage Line, Minor Drainage Line, Drainage Area/ Floodplain, and Hillcrest/ Hillslope)	212 ha (3.2%)	High	**Recorded**
Pilbara leaf-nosed bat (*Rhinonicteris aurantia* (Pilbara form)) (VU; VU)	>10 to 30 km from permanent/semi-permanent roosts	10 km	Rocky outcrops in select geological formations including BIF. Deep, humid caves displaying features consistent with maternity roost (Category 1 and 2) or transitory diurnal roosts (Category 3). Foraging habitat within a 10 km radius of these caves including, watercourses with semi-permanent or permanent water pools present and three layers in vegetation structure.	0 ha (0.0%)	Nocturnal refuge caves (Category 4). Large watercourses, around rocky outcrop, gullies, gorges, and over pools. Plains and low hills with moderate two-layer non-complex vegetation structure (represented within the Survey Area by Gorge/ Gully, Breakaway/ Cliff, Major Drainage Line, Medium Drainage Line, Minor Drainage Line, Drainage Area/ Floodplain, Hillcrest/ Hillslope and Undulating Low Hills fauna habitats).	6,195 ha (95.0%)	High	High
Pilbara olive python (*Liasis olivaceus barroni*) (VU; VU)	88 to 450 ha	1.2 km	Rocky outcrops in proximity to deep gorges, gullies, and water holes within home range (88 – 450 ha) (represented within the Survey Area by Gorge/ Gully, Breakaway/ Cliff, and Major Drainage Line fauna habitats).	791 ha (12.1%)	Deep gorges, gullies, waterholes, drainage lines, and watercourses. Rock piles (represented within the Survey Area by Medium Drainage Line, Minor Drainage Line and Boulders/ Rockpiles fauna habitats).	240 ha (3.7%)	High	**Recorded**

*The southern whiteface is not currently listed in the Western Australian BC Act, therefore the DBCA Threatened and Priority Fauna Database search does not contain records for this species. Data was sourced from other databases listed in Table 5.

[8] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

5 Discussion

5.1 Fauna Habitats

The nine broad fauna habitats observed within the Survey Area are considered representative of each habitat type generally and provide habitat for a number of vertebrate fauna species. Habitats within the Survey Area are not restricted at the local or sub-regional scale, although several are of high value to many species, including MNES species; northern quoll, Pilbara leaf-nosed bat, ghost bat, Pilbara olive python, southern whiteface, and grey falcon.

Gorge/ Gully habitat was common throughout the southern two-thirds of the Survey Area (approximately 9.5%) and is of high value for a wide range of fauna species. Microhabitats of caves and crevices in association with surface water features provide critical habitat for MNES species northern quoll, ghost bat, and Pilbara olive python, and supporting habitat for Pilbara leaf-nosed bat in the absence of nearby critical roosts.

Hillcrest/ Hillslope habitat was widespread across the Survey Area (approximately 73.5%) and surrounds. This habitat is generally considered of moderate value to Pilbara MNES fauna as it provides limited microhabitats for fauna to exploit; however, parts of this habitat represent critical ghost bat foraging habitat within 12 km of the Category 2[9] roost (CMIN-03). Hillcrest/ Hillslope also provides supporting foraging habitat for northern quoll, ghost bat (outside the 12 km CMIN-03 buffer[9]) and Pilbara leaf-nosed bat. This habitat is also important for Priority species western pebble-mound mouse as it provides high quality habitat for their mound structure.

Major Drainage Line habitat consisted of two major drainage channels in association with rocky habitats (approximately 1%). Yandicoogina Creek contains surface water pools and is flanked by tall gorge walls, providing critical habitat for Pilbara olive python and northern quoll. Vegetation within Yandicoogina Creek consisted of tall *Melaleuca* and *Eucalyptus* trees which offer nesting habitat for the grey falcon and foraging habitat and dispersal pathways for ghost bat within proximity to Category 3 roosts (CMN-02 and CMNY-05) within the Survey Area and nearby Category 2[9] roost CMIN-03, representing critical habitat for both species. Major Drainage Line habitat provide supporting habitat for Pilbara leaf-nosed bat. The tributary of Marillana Creek was characterised by a more open landscape surrounded by Breakaway/ Cliff and Hillcrest/ Hillslope habitats.

Medium Drainage Line habitat was limited across the Survey Area (approximately 0.1%). This habitat is a true intermediate between Major and Minor Drainage Lines, typically consisting of scattered *Eucalyptus* trees across a moderately sized (10 to 15 m) drainage channel lined with thick *Acacia* shrubland along the banks. Medium Drainage Line habitat presents critical ghost bat foraging habitat when within 12 km of CMIN-03[9]. This habitat type also provides supporting habitat for Pilbara olive python, northern quoll, ghost bat (outside the 12 km buffer), Pilbara leaf-nosed bat and grey falcon due to its foraging and dispersal values.

[9] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as critical habitat for ghost bat within the Survey Area.

Minor Drainage Line habitat was common and represented across the Survey Area (approximately 2.4%). This habitat typically consisted of small drainage channels with fringing low eucalypt trees. It provides supporting habitat to northern quoll, ghost bat (outside 12 km CMIN-03[10] buffer), Pilbara leaf-nosed bat, and Pilbara olive python due to foraging and dispersal values.

Drainage Area/ Floodplain habitat consisted of two valleys running east-west through the central and northern part of the Survey Area (approximately 4.6%), in which the northern valley is intersected by a tributary of Marillana Creek. This habitat provides supporting habitat for grey falcon, Pilbara leaf-nosed bat and northern quoll. Drainage Area/ Floodplain habitat provides potential habitat for bilby foraging and burrowing but is limited and outside the current distribution of the species. Both Minor Drainage Line and Drainage Area/ Floodplain habitats provide critical foraging habitat for the ghost bat within 12 km of CMIN-03[10].

Breakaway/ Cliff habitat occurs in association with floodplain and drainage areas and was more common in the northern part of the Survey Area (approximately 1.6%). This habitat type offers critical habitat to northern quoll and Pilbara olive python due to the denning, roosting, foraging and sheltering potential within caves and crevices along the rocky breakaways, and supporting habitat for Pilbara leaf-nosed bats and ghost bat in the absence of nearby critical roosts.

Boulders/ Rockpiles habitat comprises basalt outcrops scattered across the northern part of the Survey Area (approximately 0.5%). The outcrops were shallow and do not provide critical habitat to MNES species but represent supporting habitat for northern quoll and Pilbara olive python which may utilise crevices in rocky substrates.

Undulating Low Hills habitat consisted of rolling slow slopes, usually dissecting larger Hillcrest/ Hillslope habitats, and was sparse across the Survey Area (approximately 1.6%). This habitat offers supporting habitat for Pilbara leaf-nosed bat by way of foraging, but overall is considered to be of low value for MNES fauna species. This habitat is important for Priority species western pebble-mound mouse as it provides high quality habitat for their mound structure.

Eleven caves were recorded as significant habitat with several showing potential for ghost bat (Category 3 or 4) and Pilbara leaf-nosed bat (Category 4) roosts. A further three caves were recorded as non-significant Category 5 ghost bat caves. Six ghost bats were observed roosting in one cave (CMN-02) by a heritage field team two months prior to the first FV of the current survey. Cave CMN-02 has suitable geological and microclimatic attributes for a potential Category 2 roost for ghost bats; displaying significant depth, warmth, humidity and two roosting chambers over 2 m in height elevated above the height of the entrance. A long-term bat detector and scat sheet placed within CMN-02 between the first and second field visits of the current survey failed to detect any evidence of ghost bat occupancy or presence, indicating CMN-02 should be classed as a Category 3 roost with occasional rather than regular usage. A further Category 3 roost (CMNY-05) is present within 1 km of CMN-02 indicating the central gully system containing these caves may be important for the long-distance dispersal of the ghost bat. A second cluster of four caves were located along Yandicoogina Creek and surrounding Gorge/ Gully habitat. This cluster may further aid bat dispersal and temporary roosting

[10] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024). If this cave is downgraded, then all reported critical ghost bat foraging habitat is to be recategorised as supporting habitat, with only Gorge/ Gully habitats to remain as Critical habitat for ghost bat within the Survey Area.

within the area, but are not regarded as a significant (critical) 'apartment block' grouping. Roost categorisation for ghost bat determined two Category 3, nine Category 4, and three Category 5 roosts within the Survey Area. All of the 14 caves were assigned a Category 4 classification for Pilbara leaf-nosed bat. These caves also provide important potential refuges for northern quoll and Pilbara olive python.

Seven of the ten surface water features identified within the Survey Area were recorded in Gorge/ Gully habitat, with the majority located in a gully in the central part of the Survey Area. The remaining three pools were along Yandicoogina Creek where GDV species *Eucalyptus victrix* and/or *E. camaldulensis,* and *Melaleuca argentea* occurs. These water sources in association with rocky habitats are considered locally important for MNES species northern quoll, ghost bat, Pilbara leaf-nosed bat, and Pilbara olive python, providing critical refuge, foraging and potential breeding habitat (Northover et al. 2023).

5.2 Vertebrate Fauna Species

One-hundred and eleven vertebrate fauna including one amphibian, 25 reptile, 64 bird and 21 mammal (including three introduced) species were recorded in the Survey Area. The fauna assemblage recorded during the survey is considered typical of the local Hammersley subregion and the broader Pilbara bioregion.

Of the 39 significant species identified in the desktop assessment, eight species (including four species recorded during the survey) were considered to have a high post-survey likelihood of occurrence. These included MNES species ghost bat (recorded), northern quoll (recorded), Pilbara leaf-nosed bat and Pilbara olive python (recorded) as well as other significant species western pebble-mound mouse (recorded), peregrine falcon (recorded), Pilbara barking gecko, and *Anilios ganei*.

The presence of northern quoll within the Survey Area was confirmed on nine occasions from four separate locations within Gorge/ Gully and Major Drainage Line habitats. An individual/s was captured on three motion sensitive cameras across two targeted camera transect lines running within or associated with Yandicoogina Creek. This drainage system runs through a deeply incised gorge and exhibits a high diversity of microhabitats considered critical for foraging, denning, and dispersal of the northern quoll, including pools/water features, overhangs, rock piles and shelter, and woody debris. It is likely that all camera images are of the same individual, based off spot patterning, however, this could not be confirmed. Regional northern quoll records are sporadic, and with the likelihood of current records being attributed to a singular individual, suggest that a sustained population important to the long-term survival of the northern quoll, as per EPBC referral guidelines, is not currently present within the Survey Area. Habitats within the Survey Area are, however, utilised and represent habitat critical in facilitating the dispersal of the northern quoll at a local scale.

The Category 3 ghost bat roost CMN-02 and surrounding gorge provides the most important (known) roosting habitat in the Survey Area. The presence of six ghost bats in CMN-02, and the geological and microclimatic characteristics potentially suitable to supporting a non-permanent maternal roost is significant. As outlined by Bat Call WA (Bat Call WA 2021b), it is difficult to classify Category 1 or 2 caves in a single visit and often ongoing studies or monitoring may be required to better understand the long-term usage before these categories can be confirmed. In this instance, a conservative categorisation of Category 2 for CMN-02 was assigned after a single visit during FV 1. A long-term bat detector and scat sheet was then deployed within CMN-02 between FV 1 and 2 which failed to detect any ghost bat presence or occupancy. Moreover, no additional ghost bat scat was identified during revisitation to CMN-02 on FV 2 and the Category rating was downgraded accordingly from potential Category 2 to confirmed Category 3. Cave CMN-02, along with another cave (CMNY-05), contained approximately 50 to 100 ghost bat scats below potential roosting chambers. CMNY-05 (Category 3) is

located along the same gorge, approximately 700 m north of CMN-02, along with one Category 4 roost nearby (CMN-09). Yandicoogina Creek and surrounding Gorge/ Gully habitat also provides potential roosting habitat for ghost bat with four roosts recorded in gullies spreading from the major gorge. Caves CMN-01, CMN-03, CMN-04 and CMN-08 (all Category 4), have potential to provide nocturnal roosting with occasional occupancy.

The Pilbara olive python was detected in the Survey Area through one scat record along Yandicoogina Creek. The surface water along Yandicoogina Creek, in conjunction with the surrounding rocky gorges and gullies provide critical habitat and important microhabitats for this species. The creek contains thick vegetation in patches and logs which may provide shelter and ambush locations during times of seasonal inundation (Department of Sustainability Environment Water Population and Communities 2011b; Pearson 2003). Suitable habitat also occurs in the gorge in the central part of the Survey Area where four pools were recorded within 500 m of each other. No other evidence of Pilbara olive python was recorded during the current survey despite targeted searches, nocturnal searches, eDNA sampling and motion cameras deployed in suitable habitats. This species is, however, cryptic and more typically detected in riparian areas during the warmer months, and in rocky areas at other times of the year (Northover et al. 2023). Critical habitat is present in the Gorge/ Gully, Cliff/ Breakaway, and Major Drainage Line habitats of the Survey Area.

Supporting habitat is available to Pilbara leaf-nosed bat within Gorge/ Gully and Breakaway/ Cliff habitats providing roosting, foraging and dispersal habitat. Fourteen caves were described as having transitory diurnal roosting potential (Category 4) in association with foraging habitat along Major Drainage Line and Gorge/ Gully habitats that are common throughout the southern half of the Survey Area. The two main clusters of caves; along the central gully (CMN-02 and surrounds) and along Yandicoogina Creek, are likely to provide dispersal and foraging opportunities within the surrounding region. The current survey did not detect the presence of Pilbara leaf-nosed bat despite the targeted searches for roost caves and the deployment of 18 ultrasonic bat detectors. Therefore, significant maternal roosts are considered unlikely to occur within the Survey Area or immediate surrounds.

The Survey Area contains suitable habitat for southern whiteface but is toward the northern edge of its distribution and few nearby records occur, therefore a moderate likelihood of occurrence is considered. This species lives in and occupies habitat types that are widespread throughout the region, with these areas usually dominated by *Acacia* or *Eucalyptus* species on ranges, foothills and lowlands, and plains (Higgins and Peter 2002), favouring habitat with low tree densities, an herbaceous understorey, and without large amounts of litter cover. This broad description covers 298 ha of the Survey Area (4.6%) comprised of Drainage Area/ Floodplain habitat.

The Major Drainage Line habitat within the Survey Area is considered critical habitat for the grey falcon due to the presence of tall *Eucalyptus*, *Corymbia and Melaleuca* trees suitable for nesting. The grey falcon was considered a moderate likelihood of occurring due to few previous records, but suitable habitat is available within the Survey Area and individuals may be expected to occur on occasion.

None of the habitats within the Survey Area were considered critical habitat for the night parrot or bilby. No evidence of either species was recorded during the survey despite adequate survey effort in line with survey guidance (Department of Parks and Wildlife 2017; Department of Biodiversity Conservation and Attractions 2017), and no contemporary records occur in the vicinity of the Survey Area.

Fourteen recently inactive and one inactive western pebble-mound mouse mounds were recorded during the current survey within stony habitat. The species is likely to occur within the Hillcrest/ Hillslope and Undulating Low Hills habitats present which are common and widespread within the local area and the wider Pilbara region.

The Survey Area contains suitable nesting, perching, and foraging habitat for the peregrine falcon and one previous record occurred within the Survey Area. The tall trees and large gorge walls along Yandicoogina Creek are particularly suitable, and this species is considered to have a high likelihood of occurrence but would not be restricted to any of the habitats within the Survey Area.

Pilbara barking gecko and *Anilios ganei* are both found in rocky areas, and both have previously been recorded within 10 km of the Survey Area. Therefore, a high likelihood of occurrence is expected for both species. An additional two priority species; fork-tailed swift and brush-tailed mulgara have suitable habitat within the Survey Area, but these species are either vagrant or have few nearby records and are considered to have a moderate likelihood of occurrence.

6 References

Atlas of Living Australia. 2023. The Atlas of Living Australia. https://www.ala.org.au/.

Bat Call WA. 2021a. A review of Pilbara leaf nosed bat ecology, threats and survey requirements. Report Prepared for the Department of Agriculture, Water and the Environment, Canberra, ACT.

Bat Call WA. 2021b. A review of ghost bat ecology, threats and survey requirements. Report Prepared for the Department of Agriculture, Water and the Environment, Canberra, ACT.

Bat Call WA. 2023. Homestead West Ultrasonic Recorded Data Analysis. Unpublished report to BHP Western Australia Iron Ore.

Beard, J. S. 1975. The Vegetation of the Pilbara Area 1:1 000 000 Vegetation Series. University of Western Australia Press, Nedlands, Western Australia.

BHP. 2016. Flora and Vertebrate Fauna Screening Assessment. Pilbara Strategic Proposal.

BHP. 2020. Biodiversity Survey Spatial Data Requirements Procedure.

BHP. 2022. Guidance for Terrestrial Vertebrate Fauna Surveys in the Pilbara (SPR-IEN-EMS-012). SPR-IEN-MES-012.

BHP. 2023a. Vertebrate Fauna Surveys in Western Australia - Technical Process Instruction.

BHP. 2023b. Biological Survey Spatial Data Requirements.

BHP. 2023c. Biodiversity Survey Spatial Data Requirements Procedure.

Biologic Environmental Survey. 2011a. Area C to Yandi Fauna Survey.

Biologic Environmental Survey. 2011b. Yandi Vertebrate Fauna Review.

Biologic Environmental Survey. 2016. Marillana Infrastructure Corridor Level 1 Vertebrate Fauna Survey.

Biologic Environmental Survey. 2017a. Ministers North Level 2 Vertebrate Fauna Survey.

Biologic Environmental Survey. 2017b. Ministers North to Yandi Corridor Single Phase Level 2 Fauna and Detailed Flora/Vegetation Survey.

Biologic Environmental Survey. 2023a. Targeted Pilbara Olive Python Survey: South Flank and Mining Area C. published report to BHP Western Australia Iron Ore, Perth WA.

Biologic Environmental Survey. 2023b. Central Pilbara Hub Targeted Matters of National Envionmental Significance Vertebrate Fauna Survey. Unpublished report prepared for BHP WAIO.

Biota Environmental Sciences. 2010. Yandicoogina Junction South West and Oxbow Fauna Survey. Biota Environmental Sciences.

Biota Environmental Sciences. 2013. Area C West to Yandi Level 2 Vertebrate Fauna Survey.

Birdlife Australia. 2022. Birdata. https://birdata.birdlife.org.au/.

Birdlife Australia. 2023. Birdata. https://birdata.birdlife.org.au/.

Bureau of Meteorology. 2023. Climate Data Online. http://www.bom.gov.au/climate/data/index.shtml.

Bureau of Meteorology. 2024. Climate Data Online. http://www.bom.gov.au/climate/data/index.shtml.

Department of Agriculture, Water and the Environment. 2021a. Interim Biogeographic Regionalisation for Australia (IBRA), Version 7. http://www.environment.gov.au/land/nrs/science/ibra.

Department of Agriculture, Water and the Environment. 2021b. National Reserve System - IBRA Region Protection Level. https://www.dcceew.gov.au/sites/default/files/env/pages/5b3d2d31-2355-4b60-820c-e370572b2520/files/ibra-regions-protection-2020.pdf.

Department of Biodiversity Conservation and Attractions. 2017. Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia. Department of Biodiversity, Conservation & Attractions, Perth, WA.

Department of Biodiversity, Conservation and Attractions. 2022. Threatened and Priority Fauna Database.

Department of Biodiversity, Conservation and Attractions. 2023a. NatureMap Database Search. https://naturemap.dbca.wa.gov.au/.

Department of Biodiversity, Conservation and Attractions. 2023b. Threatened and Priority Fauna Database.

Department of Biodiversity Conservation and Attractions. 2024. Guidelines for determining the likely presence and habitat usage of night parrot (*Pezoporus occidentalis*) in Western Australia.

Department of Climate Change, Energy, the Environment and Water. 2022. Protected Matters Search Tool. https://www.environment.gov.au/epbc/protected-matters-search-tool.

Department of Climate Change, Energy, the Environment and Water. 2023a. Liasis olivaceus barroni — Pilbara Olive Python. jurisdiction=Commonwealth of Australia; corporateName=Department of the Environment. https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66699.

Department of Climate Change, Energy, the Environment and Water. 2023b. Erythrotriorchis radiatus — Red Goshawk. jurisdiction=Commonwealth of Australia; corporateName=Department of the Environment. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942.

Department of Climate Change, Energy, the Environment and Water. 2023c. Falco hypoleucos — Grey Falcon. jurisdiction=Commonwealth of Australia; corporateName=Department of the

Environment. https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=929.

Department of Climate Change, Energy, the Environment and Water. 2023d. Pezoporus occidentalis — Night Parrot. jurisdiction=Commonwealth of Australia; corporateName=Department of the Environment. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59350.

Department of Climate Change, Energy, the Environment and Water. 2023e. Dasyurus hallucatus — Northern Quoll. jurisdiction=Commonwealth of Australia; corporateName=Department of the Environment. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=331.

Department of Climate Change, Energy, the Environment and Water. 2023f. Macrotis lagotis — Greater Bilby. jurisdiction=Commonwealth of Australia; corporateName=Department of the Environment. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=282.

Department of Conservation and Land Management. 2002. A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management, Perth.

Department of Environment. 2013. Matters of National Environmental Significance, Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999. Canberra.

Department of Environment. 2023. Liasis olivaceus barroni in Species Profile and Threats Database.

Department of Parks and Wildlife. 2017. Interim Guideline for Preliminary Surveys of Night Parrot *(Pezoporus occidentalis)* in Western Australia. b, Department of Parks and Wildlife, Perth, WA.

Department of Primary Industries and Regional Development. 2019. Pre-European Vegetation (DPIRD-006).

Department of Sustainability Environment Water Population and Communities. 2011a. Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Canberra.

Department of Sustainability Environment Water Population and Communities. 2011b. Survey guidelines for Australia's threatened reptiles. Canberra.

Department of the Environment and Energy. 2016. EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus*. Canberra.

Department of the Environment and Energy. 2020a. Directory of Important Wetlands in Australia. Commonwealth of Australia.

Department of the Environment and Energy. 2020b. Australian Wetlands Database - Ramsar Wetlands. https://www.environment.gov.au/cgi-bin/wetlands/alphablist.pl.

Department of the Environment, Water, Heritage and the Arts. 2010a. Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*.

Department of the Environment, Water, Heritage and the Arts. 2010b. Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*.

Department of the Environment, Water, Heritage and the Arts. 2010c. Survey guidelines for Australia's threatened frogs. Canberra.

Department of Water. 2023. Hydrographic Catchments. https://data.wa.gov.au/.

Department of Water and Environmental Regulation. 2023. Index of Biodiversity Surveys for Assessments (IBSA). https://www.dwer.wa.gov.au/programs/ibsa.

Ecologia Environment. 1998. Mining Area C Biological Survey. unpublished report to BHP Billiton Iron Ore.

Ecologia Environment. 2006. Minsters North Biological Survey.

Ecologia Environment. 2008. Marillana Creek (Yandi) Iron ore Mine Modification Level 2 Fauna Survey.

eDNA Frontiers. 2024. Pilbara olive python detection from filtered water samples taken in the Pilbara area using eDNA analysis (qPCR) EF408. Unpublished Report Prepared for Astron Environmental Services.

ENV Australia. 2008. Summary of Important Findings from RGP5 Railway Project Biological Assessments.

ENV Australia. 2009. Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment.

ENV Australia. (n.d.). Munjina and Minsters North (Yandi Hub) Fauna Assessment.

Environmental Protection Authority. 2016. Environmental Factor Guideline: Terrestrial Fauna. Perth.

Environmental Protection Authority. 2020. Technical Guidance - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. Perth.

Environmental Protection Authority. 2022, August 16. Statement of environmental principles, factors, objectives and aims of EIA.

Geoscience Australia. 2008. Surface geology of Australia 1:1,000,000 scale, Western Australia. https://dasc.dmp.wa.gov.au/dasc/.

GHD Pty Ltd. 2021. Ministers North Fauna Survey Level 2 Survey February 2021. Unpublished Report Prepared for BHP Western Australian Iron Ore.

Government of Western Australia. 2018. 2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics/resource/b7bd60c2-bff6-4637-b213-aee4706412c7.

Greatwich, B., and N. Jackett. no date. WA Anitphonal Duet for Night Parrot.

Halpern Glick Maunsell. 1999. Marillana Creek Western Access Corridor - Biological Assessment. prepared for BHP Billiton Iron Ore.

Higgins, P. J., and J. M. Peter. 2002. Handbook of Australian, New Zealand and Antarctic Birds: Pardalotes to Shrike-thrushes. 6th edition. Oxford University Press, Melbourne, VIC.

Johnstone, R. E., and G. M. Storr. 1998. Handbook of Western Australian Birds Volume 1 - Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.

Kendrick, P. 2001. Pilbara 2 (PIL2 - Fortescue Plains Subregion). Department of Conservation and Land Management, Perth.

Marchant, S., and P. J. Higgins. 1993. Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: Raptors to Lapwings. Oxford University Press, Melbourne.

Maunsell Australia. 2003. Yandi Life of Mine Flora and Fauna. unpublished report to BHP Billiton Iron Ore Pty Ltd.

McKenzie, N. L., and R. D. Bullen. 2009. The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats. Records of the Western Australian Museum Supplement 78:123–155.

Menkhorst, P., and F. Knight. 2011. A Field Guide to the Mammals of Australia. 3rd Edition. Oxford University Press, Melbourne.

Menkhorst, P., D. Rogers, R. Clarke, J. Davies, P. Marsack, and K. Franklin. 2017. The Australian Bird Guide. CSIRO Publishing.

Northover, A., R. Palmer, A. Burbidge, D. Pearson, M. Dziminski, K. Ottewell, D. Prada, L. Umbello, and L. Gibson. 2023. Summary of knowledge for six faunal species that are Matters of National Environmental Significance in the Pilbara, Western Australia. Department of Biodiversity, Conservation and Attractions.

Pearson, D. 2003. Giant Pythons of the Pilbara. Landscope 19:32–39.

Schoenjahn, J. 2013. A hot environment and one type of prey: investigating why the Grey Falcon (*Falco hypoleucos*) is Australia's rarest falcon. Emu 113:19–25.

Schoenjahn, J. 2018. Adaptations of the rare endemic Grey Falcon *Falco hypoleucos* that enable its permanent residence in the arid zone of Australia. University of Queensland.

Shepherd, D. P., G. R. Beeston, and A. J. M. Hopkins. 2002. Native Vegetation in Western Australia: Extent, Type and Status. Department of Agriculture, Perth WA.

Stewart, A. J., I. P. Sweet, R. S. Needham, O. L. Raymond, A. J. Whitaker, S. F. Liu, D. Phillips, A. J. Retter, D. P. Connolly, and G. R. Stewart. 2008. Surface Geology of Australia 1: 1 000 000 Scale, Western Australia [Digital Dataset]. http://www.ga.gov.au/homeID - 2284.

Thompson, S. A., and G. G. Thompson. 2010. Terrestrial Vertebrate Fauna Assessments for Ecological Impact Assessment. Terrestrial Ecosystems, Mt Claremont.

Threatened Species Scientific Committee. 2008. Approved Conservation Advice for *Liasis olivaceus barroni* (Olive Python - Pilbara subspecies). Canberra.

Threatened Species Scientific Committee. 2016a. Conservation Advice for *Macroderma gigas* (ghost bat). Canberra.

Threatened Species Scientific Committee. 2016b. Conservation Advice for *Rhinonicteris aurantia* (Pilbara form) Pilbara Leaf-nosed Bat). Canberra.

Van Dyck, S., and R. Strahan. 2008. The Mammals of Australia. Third edition. New Holland Publishers, Sydney.

Western Australian Museum. 2023. Western Australian Museum Checklist of the Vertebrates of Western Australia. Western Australian Museum.

Wilson, S., and G. Swan. 2017. A Complete Guide to Reptiles of Australia. 5th edition. New Holland Publishers, Sydney.

Wilson, S., and G. Swan. 2020. A Complete Guide to Reptiles of Australia. New Holland Publishers, Sydney.

Appendix A: Background Information Figures

This page has been left blank intentionally.

700000 710000 720000 730000

7480000

7470000

Survey Area

QUATERNARY

Qa

Qrc - colluvium 38491

CENOZOIC

Czk

Czl

Czlr

PALEOPROTEROZOIC

Lchk - Brockman Iron Formation

Lchw - Weeli Wolli Formation

PROTEROZOIC

-Pd

ARCHEAN

Alhw

Ashm

BHP Western Australian Iron Ore

Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure A.1: Geological units of the survey area

Scale: 1:100,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

astron an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 09-08-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_240809_FigA1_Geo

700000 710000 720000 730000

7480000

7470000

Survey Area

Land System

- Boolgeeda System
- Calcrete System
- McKay System
- Newman System
- Oakover System
- Platform System
- River System
- Robe System
- Rocklea System

BHP Western Australian Iron Ore

Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure A.2: Land systems of the survey area

Scale: 1:100,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

astron an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 09-08-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_240809_FigA2_LS

700000
710000
720000
730000
7480000
7470000

Survey Area

Pre-European Vegetation

FORTESCUE VALLEY_29

HAMMERSLEY_18

HAMMERSLEY_82

BHP Western Australian Iron Ore

Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure A.3: Pre-European vegetation of the survey area

Scale: 1:100,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

astron

an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 09-08-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_240809_FigA3_PEV

This page has been left blank intentionally.

Appendix B: Conservation Listed Fauna Categories, Habitat Condition Scales and Likelihood Criteria

This page has been left blank intentionally.

Table B.1: Categories of Threatened Ecological Communities (Department of Environment and Conservation 2013).

PD: Presumed Destroyed
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or** B) All occurrences recorded within the last 50 years have since been destroyed.
CR : Critically Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more of** the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

En: Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C): A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii): i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short-term future (within approximately 20 years); ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
VU: Vulnerable
An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C): A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.>

Table B.2: Definitions and criteria for Threatened Ecological Communities (Department of Environment and Conservation 2013).

Three categories exist for listing Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An ecological community may be categorised as:

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

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.>

Table B.3: Conservation codes for Western Australian fauna (Department of Parks and Wildlife 2019).

Code	Conservation category	Definition
CR	Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is rare or likely to become extinct, as critically endangered fauna.
EN	Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is rare or likely to become extinct, as endangered fauna.
VU	Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is rare or likely to become extinct, as vulnerable fauna.
EX	Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is presumed to be extinct.
IA	Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Birds that are subject to international agreements relating to the protection of migratory birds.
CD	Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that are of special conservation need being species dependent on ongoing conservation intervention.
OS	Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Declared to be fauna that is in need of special protection, otherwise than for the reasons mentioned.

Reference: Department of Parks and Wildlife 2019, *Conservation Codes For Western Australian flora and fauna*, The Government of Western Australia.

Table B.4: Priority species under Western Australian *Biodiversity Conservation Act 2016* (Department of Parks and Wildlife 2019).

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.

P1: Priority One – Poorly known taxa
Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2: Priority Two – Poorly known taxa
Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly known taxa
Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
(a) Rare. Taxa 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 taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5: Priority Five: Conservation dependent taxa
Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

Reference: Department of Parks and Wildlife 2019, *Conservation Codes For Western Australian flora and fauna*, The Government of Western Australia.

Table B.5: Categories and definitions for EPBC Act listed fauna species.

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalized population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: ○ the taxa is a species of fish; ○ the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; ○ the management plan is in force under a law of the Commonwealth or of a State or Territory; ○ Cessation of the management plan would adversely affect the conservation status of the taxa Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.
Migratory (MI)	Taxa are considered migratory species on International Agreements; i) if they are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II); ii) all migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and iii) Are native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Note: CD and Mi are only related to conservation significant fauna

Table B.6: Criteria used to define likelihood occurrence of significant fauna species.

Likelihood of occurrence	Pre-survey	Post-survey
Recorded	N/A	Species or evidence of species recorded during survey.
High	Species has been recorded within the survey area or within 20 km of the survey area and preferred habitat appears to be present.	Core or preferred habitats present in the survey area which are abundant and/or high quality condition. OR Species is known to be cryptic and may not have been detected despite adequate survey effort and suitable habitat present within the survey area. OR Species or evidence of species recorded within the survey area however doubt remains over the taxonomic identification, validity of record.
Moderate	Species has not been recorded from within the survey area, however species has been recorded within the prescribed database search area and suitable habitat appears to be present.	Core or highly suitable habitats present in the survey area, however non-cryptic species that was not detected despite adequate survey effort. OR Core or preferred habitats present in the survey area are mainly in poor or modified condition.
Low	Species recorded from within the prescribed database search area but suitable habitat does not appear to be present.	Species has not been recorded in the survey area despite adequate survey effort. OR Species dependent on specific habitats that do not occur in the survey area. OR Species considered locally extinct.

Table B.7: Fauna habitat condition scale (Thompson and Thompson 2010).

Habitat condition	Condition description
High Quality Fauna Habitat (1.0)	These areas closely approximate the vegetation mix and quality that would have been in the area prior to any human induced disturbance. The habitat has connectivity with other habitats and is likely to support the most natural vertebrate fauna assemblage.
Very Good Fauna Habitat (0.8)	These areas show minimal signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) and retain almost all of the characteristics of the habitat had it not been disturbed. The habitat has connectivity with other habitats, and fauna assemblages in these areas are likely to be minimally effected by disturbance.
Good Fauna Habitat (0.6)	These areas show signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat had it not been disturbed. The habitat still retains some connectivity with other habitats but fauna assemblages in these areas are likely to be affected by disturbance. Fauna assemblages in these areas are likely to be similar to what might be expected in this habitat.
Disturbed Fauna Habitat (0.4)	These areas show signs of human induced significant disturbance (e.g. mining, clearing, tracks and roads). Many of the trees, shrubs and undergrowth have died or have been cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain an abundance of weeds or have been damaged by vehicles or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
Highly Degraded Fauna Habitat (<0.2)	These areas often have a significant human induced loss of vegetation, and / or a large number of vehicle tracks and / or have been completely cleared, and / or areas have been heavily grazed or farmed. There is limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to differ significantly from what existed prior to the disturbance, and are often depleted compared to what existed prior to the disturbance.

Reference: Thompson, SA & Thompson, GG 2010, *Terrestrial Vertebrate Fauna Assessments for Ecological Impact Assessment*, Terrestrial Ecosystems, Mt Claremont

Table B.8: Suitability/significance of habitat ranking criteria for potentially occurring Matters of National Environmental Significance (MNES) species based on DAWE (2022).

Species	Critical habitat (a)	Supporting habitat (b)	Limited habitat (c)
Bilby *(Macrotis lagotis)*	• Denning and foraging within the home range (18 ha (female) to 316 ha (male)) of stony sandplain, sandplain and/ or recently burnt sandplain. • Denning and foraging within the home range of interdune corridors or stony plains dominated by *Triodia* spp. and *Acacias*. • Denning and foraging within the home range surrounding salt lakes that are dominated with samphire and or *Melaleuca* habitats. • Denning and foraging within the home range of paleo-drainage systems habitat.	Habitat important for foraging including: • Open tussock grasslands on uplands and hills. • Mulga woodland/ shrubland growing on ridges and rises. • Hummock grassland growing on sand plains and dunes, drainage systems, salt lake systems and other alluvial areas. • Laterite and rock feature substrates that support *Acacia kempeana*, *Acacia hilliana* and *Acacia rhodophylla* shrub species and spinifex hummocks with open runways between the hummocks for easy movements.	Habitat that has limited burrowing capacity for the greater bilby.
Pilbara olive python (*Liasis olivaceus barroni*)	Rocky outcrops in proximity to deep gorges, gullies, and water holes within home range (88 – 450 ha).	• Deep gorges, gullies, waterholes, drainage lines and watercourses. • Under rock piles, on top of rocks or under spinifex to ambush prey.	Habitat that has limited sheltering and foraging capacity with no permanent or semi-permanent water.
Northern quoll *(Dasyurus hallucatus)*	• Denning and foraging habitat within the home range (35 hectares (ha) to >100 ha in breeding season) of low rocky hills, gorges, escarpments, ranges, breakaways and boulder fields. • Denning and foraging within the home range of major drainage lines and tree lined creeks. • Denning and foraging within the home range of structurally diverse woodland or forest. • Offshore islands.	• Variable foraging habitats within the home range and dispersal habitats that include: o Drainage lines that act as dispersal corridors o Basalt hills, mesas, high and low plateaus and lower slopes o Stony plains supporting hard or soft spinifex grasslands o Sandstone and dolomite hills and ridges, shrublands, sandy plains, clay pans and tussock grasslands o Coastal fringes including dunes islands and beaches	Habitat that has limited sheltering and foraging capacity and not connected to potential denning/shelter and foraging habitat.

Species	Critical habitat (a)	Supporting habitat (b)	Limited habitat (c)
Ghost bat (*Macroderma gigas*)	• Category 1 - Maternity/Diurnal roost caves with permanent Ghost bat occupancy. These may be abandoned underground mines. • Category 2 - Maternity/Diurnal roost caves with regular (but not continuous) Ghost bat occupancy that is capable of supporting one or more reproducing females and their habitat. These may be abandoned underground mines. • Category 3 - Diurnal roost caves with occasional occupancy if adjacent to one or Diurnal roost caves with occasional occupancy if adjacent to one or more Category 2 cave(s). These may be abandoned underground mines. • Foraging habitat within 12 km radius of these caves or 1,200 ha of habitat surrounding each of these caves.	• Category 3 - Diurnal roost caves with occasional occupancy if isolated from Category 1 and 2 caves. • Category 4 – shallow caves, shelters and deep overhangs that support opportunistic usage for resting and feeding. • Productive plain areas with thin mature woodland over patchy or clumped tussock or hummock grass (*Triodia* spp.) on sand or stony ground. • Isolated trees and trees on the edge of thin thickets on the plains. • Trees along the edges of watercourse woodlands. • Prefer gully or gorge system that opens onto a plain or riparian line. • Rocky outcrops in geological formations such as the following: o Brockman and Marra Mamba banded iron formation (BIF) o Robe Pisolite channel iron deposit (CID) geology o ironstone geology and granite rockpiles.	Habitat that has limited ecological value but may provide capacity for transitory movement across the landscape and/or limited foraging potential.

Pilbara leaf-nosed bat (*Rhinonicteris aurantia*)	• Roosting habitat o Priority/Category 1 Cave - Permanent diurnal roost and maternity roost with seasonal presence of young. o Priority/Category 2 – Permanent/semi-permanent possible breeding roosts that are used during some part of the breeding cycle (but without the proven presence of young). o Priority/Category 3 - Transitory diurnal roosts, occupied part of the year only, outside the breeding season (i.e. April-June) that facilitate long distance dispersal. • Permanent water sources within 8.7 km of a known Priority/Category 1-3 roosts. • Foraging habitat within 10 km (1,000 ha) radius of these caves that include: o Plain and low hill habitat that includes watercourses and other sites with semi-permanent or permanent surface water (natural or anthropogenic). Three layers in vegetation structure. o Mesa side or long ridge line with south, east or west facing, deeply incised gullies with vertical walls. Semi-permanent or permanent water pools present. Vegetation is complex. Also north facing gullies with permanent water. o Deep wet 'open' gorge with hills to the side. Wet 'closed' gorge with one or 2 vertical walls. Complex 3-layer, dense vegetation structure. Semi-permanent or permanent water pools present. (priority 1 foraging habitat type).	• Priority/Category 4- Nocturnal refuge that are occupied at night for resting, feeding or other purpose, with perching not a requirement, which can be moderately deep caves and shallow abandoned mines. • Plains and low hills with three-layer, complex vegetation structure. Or moderate two-layer non-complex vegetation structure. Includes ephemeral watercourse. • Mesa side or long ridge line with north facing, deeply incised gullies with vertical walls. Or Mesa side or long ridge line with deeply incised gullies in weathered strata (45º sloping walls). Caves and overhangs present. Shrubs and thin tree cover in gully base. Ephemeral watercourse in gully or nearby. (priority 2 foraging habitat). • Dry deeply incised gorge into a ridge or mountain. Complex 3 layer vegetation structure. Ephemeral water course. (priority 1 foraging habitat). Large watercourses, around rocky outcrop, gullies, gorges and over pools. • Rocky outcrop areas of exposed rock at the top of rocky outcrop and mesa hills that contain caves and overhangs, and boulder piles in the granite terrains (priority 3 foraging habitat). • Major watercourses that support riparian vegetation on flat land plus the main gravelly or sandy channel of the river bed, sometimes containing pools that persist for weeks or months, and generally supporting higher productivity of biomass than the surrounding habitats. (priority 4 foraging habitat). • Open grassland and woodland dominated by *Triodia*, on lowland plains, colluvial slopes and hilltops. (priority 5 foraging habitat) • Large watercourses, around rocky outcrop, gullies, gorges and over pools • Rocky outcrop geological formations such as the following:	Habitat that has limited ecological value but may provide capacity for transitory movement across the landscape and/or limited foraging potential.

Species	Critical habitat (a)	Supporting habitat (b)	Limited habitat (c)
		o banded Iron Formations (Hamersley Group ironstone terrain) o dolerite/gabbro formations • granite top rockpiles in the eastern Pilbara	
Night parrot (*Pezoporus occidentalis*)	• Nesting and foraging in areas that can support multiple to many occurrences of dense roosting habitat such as old-growth dense hummock-forming spinifex (*Triodia* spp.), thickets of lignum, or dense shrubby samphire. • Nesting and foraging in old-growth spinifex (*Triodia* spp.) in close proximity to ephemeral water sources, which may be associated with the following: o Hummock grasslands (unburnt) in stony or sandplain environments. o Paleo-drainage features in a landscape mosaic with spinifex (*Astrebla* spp.) and *Acacia aneura* (Mulga) woodland, o Treeless areas and bare gibber.	• Areas that are likely to be of relatively high vegetative or seed productivity such as run-on areas, floodplains, salt or clay pans, salt-lake margins. • Paleo-drainage systems, salt lakes and pans. • Permanent or ephemeral sources of free water, or areas where high soil moisture ephemerally or permanently support vegetation that offers a source of water. • Flyways varying from river and creek drainage systems, surrounding dune-fields, forb–grasslands on mainly ironstone gravel-covered plains, low ranges and low dissected tablelands supporting sparse shrublands, undulating stony clay plains supporting Mitchell Grass, and Gidgee.	Habitat that has limited roosting and foraging potential for the night parrot.
Grey falcon (*Falco hypoleucos*)	• Major drainage habitats with suitably size Eucalypts (*Eucalyptus camaldulensis*, E. *coolabah*) as potential nesting habitat, often in the abandoned nest of a raptor or corvid in trees.	• Timbered lowland plains, particularly *Acacia* shrublands that are crossed by tree-lined water courses. • The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland.	Habitat that has limited nesting and foraging potential for the grey falcon.

Species	Critical habitat (a)	Supporting habitat (b)	Limited habitat (c)
Southern whiteface (*Aphelocephala leucopsis*)	• Habitat within the 'known or likely' modelled distribution consisting of: o Relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both. o Habitat with low tree densities and an herbaceous understorey litter cover which provides essential foraging habitat. • Living and dead trees with hollows and crevices which are essential for roosting and nesting.	• Habitat within the 'may occur' modelled distribution consisting of: o Relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both. o Habitat with low tree densities and an herbaceous understorey litter cover which provides essential foraging habitat. • Living and dead trees with hollows and crevices which are essential for roosting and nesting.	Habitat that has limited nesting and foraging potential for the southern whiteface.

Reference: Department of Agriculture, Water and the Environment (DAWE) (2022, in draft), Interim guidelines for Pilbara MNES critical and supporting habitat characterisation, DAWE, Canberra.

This page has been left blank intentionally.

Appendix C: Fauna Species Lists

This page has been left blank intentionally.

Table C.1: Amphibian species list – results of database searches, literature reviews and Astron survey results.

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List						
Pelodryadidae											
Cyclorana australis	Giant Frog						X				
Cyclorana maini	Sheep Frog					X	X			X	
Cyclorana occidentalis	Western Water-holding Frog					X					
Litoria rubella	Little Red Tree Frog					X	X			X	X
Limnodynastidae											
Neobatrachus aquilonius	Northern Burrowing Frog					X	X				
Neobatrachus sutor	Shoemaker Frog					X	X				
Myobatrachidae											
Pseudophryne douglasi	Gorge Toadlet					X	X				
Uperoleia russelli	Northwest Toadlet					X					
Uperoleia saxatilis	Pilbara Toadlet					X	X			X	

Note: EPBC = Environment Protection and Biodiversity Conservation; BC = Biodiversity and Conservation; DBCA = Department of Biodiversity, Conservation and Attractions; ALA = Atlas of Living Australia; PMST = Protected Matters Search Tool; T = Threatened; P = Priority.

Table C.2: Reptile species list – results of database searches, literature reviews and Astron survey results.

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List						
Carphodactylidae											
Nephrurus wheeleri	Southern Banded Knob-tailed Gecko					X				X	
Underwoodisaurus milii	Southern Barking Gecko					X					
Underwoodisaurus seorsus	Pilbara Barking Gecko				P2	X	X		X	X	
Diplodactylidae											
Crenadactylus ocellatus	South-western Clawless Gecko					X					
Crenadactylus pilbarensis	Pilbara Clawless Gecko						X			X	
Diplodactylus bilybara	Western Fat-tailed Gecko						X				
Diplodactylus conspicillatus	Variable Fat-tailed Gecko					X					
Diplodactylus laevis	Desert Fat-tailed Gecko						X				
Diplodactylus pulcher						X	X				
Diplodactylus savagei	Southern Pilbara Beak-faced Gecko					X	X			X	
Lucasium stenodactylus						X					
Lucasium wombeyi						X	X			X	
Lucasium woodwardi						X				X	
Oedura fimbria	Western Marbled Velvet Gecko					X	X			X	X
Rhynchoedura ornata	Western Beaked Gecko					X	X			X	
Strophurus elderi						X	X				
Strophurus jeanae						X	X				
Strophurus wellingtonae						X	X			X	
Gekkonidae											
Gehyra crypta	Western Cryptic Gehyra						X				
Gehyra fenestrula	Hamersley Range Spotted Gehyra					X	X				
Gehyra micra	Small Pilbara Spotted Rock Gehyra						X				
Gehyra montium						X	X			X	X
Gehyra pilbara						X					
Gehyra punctata						X	X			X	X
Gehyra purpurascens						X	X				
Gehyra variegata						X	X			X	X
Heteronotia binoei	Bynoe's Gecko					X	X			X	X
Heteronotia spelea	Pilbara Cave Gecko					X	X			X	X
Pygopodidae											
Delma butleri						X	X				
Delma elegans						X	X				
Delma nasuta						X	X			X	
Delma pax						X	X			X	
Delma tincta						X	X				
Lialis burtonis						X	X			X	
Pygopus nigriceps						X	X				
Agamidae											

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List						
Ctenophorus caudicinctus	Western Ring-tailed Dragon					X	X			X	X
Ctenophorus isolepis isolepis	Central Military Dragon					X	X			X	X
Ctenophorus nuchalis	Central Netted Dragon					X	X				
Ctenophorus reticulatus	Western Netted Dragon					X	X				
Ctenophorus scutulatus						X					
Diporiphora amphiboluroides	Mulga Dragon					X	X				
Diporiphora valens	Southern Pilbara Tree Dragon					X	X				
Gowidon longirostris	Long-nosed Dragon					X	X			X	X
Pogona minor minor	Western Bearded Dragon					X	X				
Tympanocryptis diabolicus	Hamersley Pebble-mimic Dragon						X				
Scincidae											
Carlia munda						X	X			X	
Carlia triacantha						X	X				
Cryptoblepharus buchananii						X	X				
Cryptoblepharus plagiocephalus						X					
Cryptoblepharus ustulatus						X	X			X	X
Ctenotus ariadnae						X	X				
Ctenotus duricola	Eastern Pilbara Lined Ctenotus					X	X			X	
Ctenotus grandis titan						X	X				
Ctenotus hanloni						X	X			X	
Ctenotus helenae						X	X				
Ctenotus inornatus						X	X			X	
Ctenotus leonhardii						X					
Ctenotus pallasotus	Western Pilbara Lined Ctenotus					X	X				
Ctenotus pantherinus						X	X			X	
Ctenotus quattuordecimlineatus						X					
Ctenotus robustus						X					
Ctenotus rubicundus						X	X			X	X
Ctenotus rufescens						X					
Ctenotus rutilans						X	X				
Ctenotus saxatilis	Rock Ctenotus					X					X
Ctenotus schomburgkii						X	X				X
Ctenotus serventyi						X	X				
Ctenotus uber uber						X	X				
Cyclodomorphus melanops melanops						X	X			X	
Egernia cygnitos	Western Pilbara Spiny-tailed Skink					X	X				
Egernia depressa	Southern Pygmy Spiny-tailed Skink					X	X				
Egernia formosa						X	X			X	X
Eremiascincus isolepis						X	X			X	
Eremiascincus pallidus	Western Narrow-banded Skink					X				X	
Eremiascincus richardsonii	Broad-banded Sand Swimmer					X	X				
Eremiascincus rubiginosus	Rusty Skink						X				

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List						
Lerista amicorum						X	X				
Lerista bipes						X					
Lerista chalybura							X			X	
Lerista jacksoni						X					
Lerista labialis						X	X				
Lerista macropisthopus fusciceps						X					
Lerista macropisthopus remota	Unpatterned Robust Slider				P2		X		X		
Lerista muelleri						X	X			X	
Lerista neander						X	X				
Lerista timida						X	X				
Lerista verhmens						X					
Liopholis kintorei	Great Desert Skink		VU	VU				X			
Menetia greyii						X	X			X	X
Menetia surda surda						X	X				
Morethia ruficauda exquisita						X	X			X	
Notoscincus ornatus ornatus						X	X				
Proablepharus reginae						X	X				
Tiliqua multifasciata	Central Bluetongue					X	X				
Varanidae											
Varanus acanthurus	Spiny-tailed Goanna					X	X			X	
Varanus brevicauda	Short-tailed Pygmy Goanna					X	X				
Varanus bushi	Pilbara Mulga Goanna					X	X			X	
Varanus caudolineatus						X	X				
Varanus eremius	Pygmy Desert Goanna					X	X				
Varanus giganteus	Perentie					X	X			X	X
Varanus gilleni	Pygmy Mulga Goanna					X					
Varanus gouldii	Bungarra or Sand Goanna					X	X				X
Varanus hamersleyensis	Southern Pilbara Rock Goanna					X	X				X
Varanus panoptes rubidus						X	X			X	X
Varanus pilbarensis	Northern Pilbara Rock Goanna					X				X	
Varanus tristis tristis	Racehorse Goanna					X	X			X	X
Typhlopidae											
Anilios ammodytes						X	X			X	
Anilios ganei	Gane's Blind Snake (Pilbara)				P1	X	X		X	X	
Anilios grypus						X	X				
Anilios hamatus						X	X				
Anilios pilbarensis						X					
Anilios waitii						X	X				
Pythonidae											
Antaresia childreni	Children's Python					X	X			X	X
Antaresia perthensis	Pygmy Python					X	X			X	X
Aspidites melanocephalus	Black-headed Python					X					

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List						
Liasis olivaceus barroni	Pilbara Olive Python		VU	VU		X	X	X	X	X	X
Elapidae											
Acanthophis wellsi	Pilbara Death Adder					X	X			X	
Brachyurophis approximans						X	X			X	
Brachyurophis fasciolatus fasciolatus							X				
Demansia reticulata						X	X			X	
Demansia rufescens	Rufous Whipsnake					X	X			X	X
Furina ornata	Moon Snake					X	X			X	
Pseudechis australis	Mulga Snake					X	X			X	X
Pseudonaja mengdeni	Western Brown Snake					X	X			X	
Pseudonaja modesta	Ringed Brown Snake					X	X				
Simoselaps bertholdi	Jan's Banded Snake						X				
Suta fasciata	Rosen's Snake					X	X				
Suta gaikorstorum							X				
Suta monachus						X					
Suta punctata	Spotted Snake					X					
Vermicella snelli						X					

Note: EPBC = Environment Protection and Biodiversity Conservation; BC = Biodiversity and Conservation; DBCA = Department of Biodiversity, Conservation and Attractions; ALA = Atlas of Living Australia; PMST = Protected Matters Search Tool; T = Threatened; P = Priority.

Table C.3: Bird species list – results of database searches, literature reviews and Astron survey results.

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List							
Dromaiidae												
Dromaius novaehollandiae	Emu					X	X			X		
Anatidae												
Anas gracilis	Grey Teal						X				X	
Anas superciliosa	Pacific Black Duck					X	X			X	X	
Aythya australis	Hardhead						X					
Chenonetta jubata	Australian Wood Duck						X					
Cygnus atratus	Black Swan						X			X		
Dendrocygna eytoni	Plumed Whistling Duck					X	X					
Malacorhynchus membranaceus	Pink-Eared Duck						X					
Phasianidae												
Synoicus ypsilophorus	Brown Quail					X	X			X	X	X
Podicipedidae												
Poliocephalus poliocephalus	Hoary-headed Grebe						X					
Tachybaptus novaehollandiae	Australasian Grebe						X					
Threskiornithidae												
Plegadis falcinellus	Glossy Ibis		MI	MI					X			
Threskiornis spinicollis	Straw-necked Ibis					X	X					
Ardeidae												
Ardea ibis	Cattle Egret										X	
Ardea modesta	Eastern Great Egret	-				X	X				X	
Ardea pacifica	White-necked Heron					X	X			X		
Butorides striatus	Striated Heron						X					
Egretta garzetta	Little Egret						X					
Egretta novaehollandiae	White-faced Heron					X	X				X	
Ixobrychus flavicollis	Black Bittern					X	X					
Nycticorax caledonicus	Nankeen Night-heron					X	X				X	
Pelecanidae												
Pelecanus conspicillatus	Australian Pelican					X	X				X	
Phalacrocoracidae												
Microcarbo melanoleucos	Little Pied Cormorant						X				X	
Phalacrocorax sulcirostris	Little Black Cormorant					X	X				X	
Phalacrocorax varius	Pied Cormorant					X					X	
Anhingidae												
Anhinga novaehollandiae	Australasian Darter					X	X				X	
Accipitridae												
Accipiter cirrocephalus	Collared Sparrowhawk					X	X				X	
Accipiter fasciatus	Brown Goshawk					X	X			X	X	X
Aquila audax	Wedge-tailed Eagle					X	X			X		X
Circus approximans	Swamp Harrier					X						
Circus assimilis	Spotted Harrier					X	X				X	X

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List							
Elanus axillaris	Black-shouldered Kite					X	X				X	
Elanus scriptus	Letter-winged Kite				P4	X			X			
Erythrotriorchis radiatus	Red Goshawk		VU	VU				X				
Haliastur sphenurus	Whistling Kite					X	X			X	X	X
Hamirostra melanosternon	Black-breasted Buzzard					X	X			X	X	X
Hieraaetus morphnoides	Little Eagle					X	X			X	X	
Lophoictinia isura	Square-tailed Kite					X	X					
Milvus migrans	Black Kite					X	X			X	X	X
Pandion cristatus	Osprey		MI	MI		X			X		X	
Otididae												
Ardeotis australis	Australian Bustard					X	X				X	X
Rallidae												
Fulica atra	Eurasian Coot						X					
Hypotaenidia philippensis	Buff-banded Rail					X	X					
Porphyrio porphyrio	Purple Swamphen					X						
Porzana tabuensis	Spotless Crake					X						
Turnicidae												
Turnix varius	Painted Button-quail					X						
Turnix velox	Little Button-quail					X	X			X	X	X
Burhinidae												
Burhinus grallarius	Bush Stone-curlew					X	X					X
Recurvirostridae												
Himantopus himantopus	Black-winged Stilt					X	X					
Charadriidae												
Charadrius ruficapillus	Red-capped Plover						X					
Charadrius veredus	Oriental Plover		MI	MI				X	X			
Elseyornis melanops	Black-fronted Dotterel					X	X				X	
Erythrogonys cinctus	Red-kneed Dotterel					X	X					
Rostratulidae												
Rostratula australis	Australian Painted Snipe		EN	EN				X	X			
Scolopacidae												
Actitis hypoleucos	Common Sandpiper		MI	MI			X	X	X		X	
Calidris acuminata	Sharp-tailed Sandpiper		MI	MI				X	X			
Calidris ferruginea	Curlew Sandpiper		CR & MI	CR & MI				X				
Calidris melanotos	Pectoral Sandpiper		MI	MI				X				
Tringa glareola	Wood Sandpiper		MI	MI			X		X			
Tringa nebularia	Common Greenshank		MI	MI		X			X		X	
Tringa stagnatilis	Marsh Sandpiper		MI	MI					X			
Glareolidae												
Stiltia isabella	Australian Pratincole						X					
Laridae												
Gelochelidon nilotica	Gull-billed Tern		MI	MI		X			X			
Hydroprogne caspia	Caspian Tern		MI	MI					X			

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List							
Columbidae												
Geopelia cuneata	Diamond Dove					X	X			X	X	X
Geopelia striata placida	Peaceful Dove					X	X			X	X	X
Geophaps plumifera ferruginea	Spinifex Pigeon					X	X			X	X	X
Ocyphaps lophotes	Crested Pigeon					X	X			X	X	X
Phaps chalcoptera	Common Bronzewing					X	X			X	X	X
Cuculidae												
Cacomantis pallidus	Pallid Cuckoo					X	X			X	X	
Chrysococcyx basalis	Horsfield's Bronze Cuckoo					X	X			X	X	X
Chrysococcyx osculans	Black-eared Cuckoo					X	X					
Centropodidae												
Centropus phasianinus	Pheasant Coucal					X	X			X		
Tytonidae												
Tyto javanica delicatula	Eastern Barn Owl					X	X					X
Strigidae												
Ninox connivens	Barking Owl					X	X				X	
Ninox boobook	Southern Boobook					X	X			X	X	X
Podargidae												
Podargus strigoides	Tawny Frogmouth					X	X					
Caprimulgidae												
Eurostopodus argus	Spotted Nightjar					X	X			X	X	
Aegothelidae												
Aegotheles cristatus	Australian Owlet-nightjar					X	X				X	X
Apodidae												
Apus pacificus	Pacific Swift (Fork-tailed Swift)		MI	MI		X	X	X	X	X	X	
Alcedinidae												
Dacelo leachii leachii	Blue-winged Kookaburra					X	X			X	X	X
Todiramphus pyrrhopygius	Red-backed Kingfisher					X	X			X	X	X
Todiramphus sanctus	Sacred Kingfisher					X	X			X	X	X
Meropidae												
Merops ornatus	Rainbow Bee-eater					X	X			X	X	X
Falconidae												
Falco berigora	Brown Falcon					X	X			X	X	X
Falco cenchroides	Australian Kestrel (Nankeen Kestrel)					X	X			X	X	X
Falco hypoleucos	Grey Falcon			VU		X	X	X	X			
Falco longipennis	Australian Hobby					X	X			X	X	
Falco peregrinus	Peregrine Falcon			OS		X	X		X		X	
Cacatuidae												
Cacatua sanguinea	Little Corella					X	X			X	X	X
Cacatua roseicapilla	Galah					X	X			X	X	X
Lophochroa leadbeateri	Major Mitchell's Cockatoo						X					
Nymphicus hollandicus	Cockatiel					X	X				X	X
Psittacidae												

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List							
Barnardius zonarius zonarius	Australian Ringneck					X	X			X	X	X
Melopsittacus undulatus	Budgerigar					X	X			X	X	X
Neopsephotus bourkii	Bourke's Parrot					X	X					
Pezoporus occidentalis	Night Parrot		EN	CR				X	X			
Polytelis alexandrae	Princess Parrot		VU		P4				X			
Psephotus varius	Mulga Parrot					X	X					
Ptilonorhynchidae												
Ptilonorhynchus maculatus guttatus	Western Bowerbird					X	X			X	X	X
Climacteridae												
Climacteris melanura	Black-tailed Treecreeper						X					
Maluridae												
Amytornis whitei whitei	Pilbara Grasswren					X	X				X	X
Malurus assimilis assimilis	Purple-backed Fairywren					X	X			X	X	X
Malurus leucopterus leuconotus	White-winged Fairywren					X	X				X	X
Malurus splendens	Splendid Fairywren					X	X					
Stipiturus ruficeps	Rufous-Crowned Emu-wren					X	X					
Meliphagidae												
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					X	X			X		
Certhionyx variegatus	Pied Honeyeater					X	X					
Epthianura tricolor	Crimson Chat					X	X					
Gavicalis virescens virescens	Singing Honeyeater					X	X			X	X	X
Grantiella picta	Painted Honeyeater					X						
Conopophila whitei	Grey Honeyeater					X	X					
Lichmera indistincta	Brown Honeyeater					X	X			X	X	X
Manorina flavigula	Yellow-throated Miner					X	X			X	X	X
Melithreptus gularis laetior	Black-chinned Honeyeater					X	X			X	X	X
Myzomela erythrocephala	Red-headed Honeyeater										X	
Ptilotula keartlandi	Grey-headed Honeyeater					X				X	X	X
Ptilotula ornata	Yellow-plumed Honeyeater					X						
Ptilotula penicillata	White-plumed Honeyeater					X	X			X	X	X
Ptilotula plumula	Grey-fronted Honeyeater					X	X					
Purnella albifrons	White-fronted Honeyeater					X	X					
Sugomel niger	Black Honeyeater					X	X				X	
Pardalotidae												
Pardalotus rubricatus	Red-browed Pardalote					X	X				X	X
Pardalotus striatus murchisoni	Striated Pardalote					X	X				X	X
Acanthizidae												
Acanthiza apicalis	Inland Thornbill					X	X			X		X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill					X	X					
Acanthiza robustirostris	Slaty-backed Thornbill					X	X					
Acanthiza uropygialis	Chestnut-rumped Thornbill					X	X					
Aphelocephala leucopsis	Southern Whiteface		VU			X	X	X	*			
Gerygone fusca	Western Gerygone					X	X				X	

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List							
Pyrrholaemus brunneus	Redthroat					X	X					
Smicrornis brevirostris	Weebill					X	X			X	X	X
Pomatostomidae												
Pomatostomus superciliosus	White-browed Babbler					X	X			X		
Pomatostomus temporalis rubeculus	Grey-crowned Babbler					X	X			X	X	X
Psophodidae												
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush					X	X					
Cinclosoma castaneothorax marginatum	Western Quail-thrush						X					
Psophodes occidentalis	Western Wedgebill (Chiming Wedgebill)					X	X					
Artamidae												
Artamus cinereus	Black-faced Woodswallow					X	X			X	X	X
Artamus cyanopterus	Dusky Woodswallow					X					X	
Artamus leucorynchus	White-breasted Woodswallow					X						
Artamus minor	Little Woodswallow					X	X			X	X	X
Artamus personatus	Masked Woodswallow					X	X			X	X	X
Cracticus nigrogularis	Pied Butcherbird					X	X			X	X	X
Cracticus torquatus	Grey Butcherbird					X	X				X	
Cracticus tibicen	Australian Magpie					X	X			X	X	X
Campephagidae												
Coracina maxima	Ground Cuckoo-shrike					X	X				X	
Coracina novaehollandiae	Black-faced Cuckoo-shrike					X	X			X	X	X
Lalage tricolor	White-winged Triller					X	X			X	X	X
Neosittidae												
Daphoenositta chrysoptera	Varied Sittella						X					
Oreoidae												
Oreoica gutturalis	Crested Bellbird					X	X				X	X
Pachycephalidae												
Colluricincla harmonica	Grey Shrike-thrush					X	X			X	X	X
Pachycephala rufiventris rufiventris	Rufous Whistler					X	X			X	X	X
Rhipiduridae												
Rhipidura albiscapa	Grey Fantail					X	X				X	
Rhipidura leucophrys leucophrys	Willie Wagtail					X	X			X	X	X
Monarchidae												
Grallina cyanoleuca	Magpie-lark					X	X			X	X	X
Corvidae												
Corvus bennetti	Little Crow					X	X			X	X	X
Corvus coronoides	Australian Raven					X						
Corvus orru cecilae	Torresian Crow					X	X			X	X	X
Petroicidae												
Melanodryas cucullata	Hooded Robin					X	X				X	X
Petroica goodenovii	Red-Capped Robin					X	X					
Alaudidae												
Mirafra javanica	Horsfield's Bush Lark					X	X				X	

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List							
Hirundinidae												
Cheramoeca leucosterna	White-backed Swallow					X	X					
Hirundo rustica	Barn Swallow		MI	MI				X				
Petrochelidon ariel	Fairy Martin					X	X					
Petrochelidon nigricans	Tree Martin					X	X				X	
Acrocephalidae												
Acrocephalus australis	Australian Reed Warbler					X	X			X	X	
Megaluridae												
Cincloramphus cruralis	Brown Songlark					X	X					
Cincloramphus mathewsi	Rufous Songlark					X	X			X	X	
Eremiornis carteri	Spinifexbird					X	X				X	X
Nectariniidae												
Dicaeum hirundinaceum	Mistletoebird					X	X				X	
Estrildidae												
Emblema pictum	Painted Finch					X	X			X	X	X
Neochmia ruficauda	Star Finch					X					X	
Taeniopygia castanotis	Zebra Finch					X	X			X	X	X
Motacillidae												
Motacilla flava	Yellow Wagtail		MI	MI				X				
Motacilla cinerea	Grey Wagtail		MI	MI				X	X			
Anthus australis australis	Australian Pipit					X	X				X	X

Note: EPBC = Environment Protection and Biodiversity Conservation; BC = Biodiversity and Conservation; DBCA = Department of Biodiversity, Conservation and Attractions; ALA = Atlas of Living Australia; PMST = Protected Matters Search Tool; T = Threatened; P = Priority.

*DBCA Threatened and Priority Fauna Database search was requested prior to this species being listed as Vulnerable.

Table C.4: Mammal species list – results of database searches, literature reviews and Astron survey results.

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List						
Tachyglossidae											
Tachyglossus aculeatus acanthion	Short-beaked Echidna					X				X	X
Dasyuridae											
Dasycercus blythi	Brush-tailed Mulgara, Ampurta				P4	X			X		
Dasykaluta rosamondae	Kaluta					X	X				
Dasyurus hallucatus	Northern Quoll		EN	EN		X		X	X	X	X
Ningaui ridei	Wongai Ningaui					X	X			X	
Ningaui timealeyi	Pilbara Ningaui						X			X	
Planigale ingrami	Long-tailed Planigale					X				X	
Planigale maculata	Common Planigale					X					
Planigale species 1'	Pilbara Planigale					X					
Pseudantechinus woolleyae	Woolley's Pseudantechinus					X	X			X	X
Sminthopsis dolichura	Little Long-tailed Dunnart					X					
Sminthopsis hirtipes	Hairy-footed Dunnart					X					
Sminthopsis longicaudata	Long-tailed Dunnart				P4				X		
Sminthopsis macroura	Stripe-faced Dunnart					X	X			X	
Sminthopsis ooldea	Ooldea Dunnart					X	X				
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart					X	X				
Thylacomyidae											
Macrotis lagotis	Greater Bilby, Dalgyte		VU	VU		X		X	X		
Macropodidae											
Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby (Mainland)				P4		X				
Osphranter robustus erubescens	Euro, Biggada					X	X			X	X
Osphranter rufus	Red Kangaroo, Marlu					X				X	X
Petrogale lateralis lateralis	Black-footed Rock-wallaby		EN	EN					X		
Petrogale rothschildi	Rothschild's Rock-wallaby					X	X			X	X
Muridae											
Leggadina lakedownensis	Short-tailed Mouse, Kerakenga				P4	X	X		X		
Mus musculus	House Mouse	*				X	X			X	
Notomys alexis alexis	Spinifex Hopping-mouse					X	X				
Pseudomys chapmani	Western Pebble-mound Mouse, Ngadji				P4	X	X		X	X	X
Pseudomys delicatulus	Delicate Mouse					X	X				
Pseudomys desertor	Desert Mouse					X	X			X	
Pseudomys hermannsburgensis	Sandy Inland Mouse					X	X			X	
Pseudomys nanus nanus	Western Chestnut Mouse					X					
Zyzomys argurus	Common Rock-rat					X	X			X	X
Leporidae											
Oryctolagus cuniculus	Rabbit	*				X	X				
Rhinonycteridae											
Rhinonicteris aurantia (Pilbara form)	Pilbara Leaf-nosed Bat		VU	VU		X	X	X	X	X	
Megadermatidae											
Macroderma gigas	Ghost Bat		VU	VU		X	X	X	X	X	X
Emballonuridae											

Family *Scientific name*	Common Name	Introduced	Conservation Codes			NatureMap	ALA	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna List						
Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat					X	X			X	
Taphozous georgianus	Common Sheath-tailed Bat					X	X			X	X
Taphozous hilli	Hill's Sheath-tailed Bat					X	X				X
Molossidae											
Austronomus australis	White-striped Free-tailed Bat					X	X			X	X
Chaerephon jobensis colonicus	Northern Free-tailed Bat					X	X			X	X
Ozimops lumsdenae	Northern Free-tailed Bat					X	X			X	X
Vespertilionidae											
Chalinolobus gouldii	Gould's Wattled Bat					X	X			X	X
Chalinolobus morio	Chocolate Wattled Bat					X	X			X	
Chalinolobus nigrogriseus rogersi	Hoary Wattled Bat						X				
Nyctophilus daedalus	Northwestern Long-eared Bat					X	X			X	
Nyctophilus geoffroyi geoffroyi	Lesser Long-eared Bat					X	X			X	X
Scotorepens balstoni	Inland Broad-nosed Bat						X				
Scotorepens greyii	Little Broad-nosed Bat					X	X			X	X
Vespadelus finlaysoni	Finlayson's Cave Bat					X	X			X	X
Canidae											
Canis familiaris	Dingo	*				X	X			X	X
Felidae											
Felis catus	Cat	*				X	X			X	X
Equidae											
Equus asinus	Donkey	*				X				X	
Equus caballus	Horse	*				X					
Camelidae											
Camelus dromedarius	Dromedary, Camel	*				X	X				
Bovidae											
Bos taurus	European Cattle	*				X				X	X

Note: EPBC = Environment Protection and Biodiversity Conservation; BC = Biodiversity and Conservation; DBCA = Department of Biodiversity, Conservation and Attractions; ALA = Atlas of Living Australia; PMST = Protected Matters Search Tool; T = Threatened; P = Priority.

This page has been left blank intentionally.

Appendix D: Fauna Sampling Locations

This page has been left blank intentionally.

Table D.1: Fauna sampling locations.

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
Habitat Assessment									
HA-01	720201	7473886	Habitat Assessment	14/04/2023	Major Drainage Line	0.8	Cattle grazing, weed invasion	Logs, tree hollows, thick undergrowth	
HA-02	718220	7472326	Habitat Assessment	14/04/2023	Gorge/ Gully	0.6	Weed invasion	Overhangs, crevices	
HA-03	715964	7476880	Habitat Assessment	15/04/2023	Breakaway/ Cliff	1.0	None discernible	Overhangs, crevices, rock pile	
HA-04	713564	7473722	Habitat Assessment	16/04/2023	Gorge/ Gully	1.0	None discernible	Overhangs, crevices	
HA-05	712493	7475655	Habitat Assessment	16/04/2023	Gorge/ Gully	1.0	None discernible	Overhangs, tree hollows, crevices, old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
HA-06	712389	7475533	Habitat Assessment	16/04/2023	Hillcrest/ Hillslope	1.0	None discernible	Overhangs, tree hollows, crevices, old *Triodia*, leaf litter	
HA-07	712665	7475304	Habitat Assessment	16/04/2023	Gorge/ Gully	1.0	None discernible	Overhangs, tree hollows, crevices, old *Triodia*, leaf litter	
HA-08	712934	7475536	Habitat Assessment	16/04/2023	Gorge/ Gully	1.0	None discernible	Overhangs, tree hollows, crevices, old *Triodia*, leaf litter	
HA-09	713895	7479587	Habitat Assessment	18/04/2023	Hillcrest/ Hillslope	1.0	None discernible	Old *Triodia*	
HA-10	713980	7479763	Habitat Assessment	18/04/2023	Minor Drainage Line	1.0	None discernible	Logs, tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	

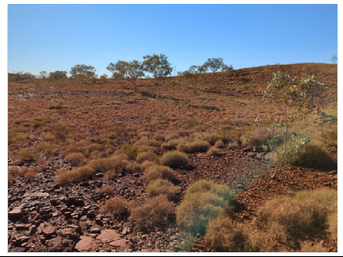
Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
HA-11	711712	7480865	Habitat Assessment	18/04/2023	Boulders/ Rockpiles	1.0	None discernible	Crevices, rock pile, old *Triodia*	
HA-12	716255	7475084	Habitat Assessment	19/04/2023	Gorge/ Gully	1.0	None discernible	Overhangs, crevices	
HA-13	715163	7477053	Habitat Assessment	19/04/2023	Drainage Area/ Floodplain	1.0	None discernible	Logs, tree hollows, old *Triodia*, leaf litter, termite mounds	
HA-14	710300	7480855	Habitat Assessment	20/04/2023	Minor Drainage Line	0.8	Weed invasion	Tree hollows, thick undergrowth	
HA-15	709742	7481357	Habitat Assessment	20/04/2023	Minor Drainage Line	1.0	None discernible	Overhangs, logs, tree hollows, thick undergrowth	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
HA-16	709739	7481747	Habitat Assessment	20/04/2023	Minor Drainage Line	0.8	Weed invasion	Overhangs, logs, tree hollows, crevices, thick undergrowth	
HA-17	709377	7481879	Habitat Assessment	20/04/2023	Breakaway/ Cliff	1.0	None discernible	Overhangs, tree hollows, crevices	
HA-18	709880	7480543	Habitat Assessment	20/04/2023	Minor Drainage Line	1.0	Weed invasion	Logs, tree hollows, leaf litter	
HA-19	710686	7480735	Habitat Assessment	20/04/2023	Minor Drainage Line	1.0	None discernible	Logs, thick undergrowth	
HA-20	713042	7478880	Habitat Assessment	20/04/2023	Major Drainage Line	0.8	Weed invasion	Logs, tree hollows, thick undergrowth	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
HA-21	719245	7473487	Habitat Assessment	20/04/2023	Major Drainage Line	1.0	None discernible	Logs, tree hollows, crevices, rock pile, old *Triodia*, leaf litter	
HA-22	714323	7474037	Habitat Assessment	21/04/2023	Hillcrest/ Hillslope	1.0	None discernible	Overhangs, tree hollows, crevices	
HA-23	714027	7473844	Habitat Assessment	21/04/2023	Gorge/ Gully	1.0	None discernible	Overhangs, crevices	
HA-24	713875	7474105	Habitat Assessment	21/04/2023	Hillcrest/ Hillslope	1.0	None discernible	Overhangs, tree hollows, crevices	
HA-25	720039	7474827	Habitat Assessment	21/04/2023	Minor Drainage Line	1.0	None discernible	Logs, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
HA-26	714190	7474203	Habitat Assessment	21/04/2023	Gorge/ Gully	1.0	None discernible	Caves, overhangs, crevices	
HA-27	720069	7474469	Habitat Assessment	21/04/2023	Hillcrest/ Hillslope	1.0	None discernible	Crevices	
HA-28	719251	7474164	Habitat Assessment	21/04/2023	Hillcrest/ Hillslope	1.0	None discernible	Crevices	
HA-29	719914	7474319	Habitat Assessment	21/04/2023	Hillcrest/ Hillslope	1.0	None discernible	Crevices	
HA-30	719421	7476302	Habitat Assessment	8/06/2024	Hillcrest/ Hillslope	1.0	Road/Access Track	Tree hollows, old *Triodia*	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
HA-31	717277	7470999	Habitat Assessment	8/06/2024	Gorge/ Gully	1.0	None discernible	Overhangs, logs, tree hollows, crevices, thick undergrowth, rock pile, leaf litter	
HA-32	717464	7477744	Habitat Assessment	9/06/2024	Minor Drainage Line	1.0	None discernible	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
HA-33	720697	7475395	Habitat Assessment	11/06/2024	Minor Drainage Line	1.0	None discernible	Thick undergrowth, old *Triodia*, leaf litter	
HA-34	720706	7475563	Habitat Assessment	11/06/2024	Undulating Low Hills	1.0	None discernible	Old *Triodia*, leaf litter, termite mounds	
HA-35	720498	7476131	Habitat Assessment	11/06/2024	Hillcrest/ Hillslope	0.8	Frequent Fire	Tree hollows, rock pile, old *Triodia*	

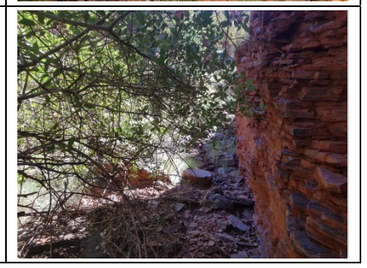
Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
HA-36	716794	7477922	Habitat Assessment	12/06/2024	Undulating Low Hills	1.0	None discernible	Tree hollows, rock pile, old *Triodia*	
HA-37	715301	7479770	Habitat Assessment	15/06/2024	Undulating Low Hills	0.6	Other	Tree hollows, old *Triodia*, leaf litter	
Targeted Search									
TS-01	715228	7477182	Targeted Search	20/04/2023	Drainage Area/ Floodplain (targeting bilby)	0.8	Cattle grazing, weed invasion	Soft soil (burrows), rock pile, leaf litter	
TS-02	717706	7476879	Targeted Search	21/04/2023	Drainage Area/ Floodplain (targeting bilby)	0.8	Weed invasion	Soft soil (burrows), rock pile, leaf litter	
TS-03	713054	7478791	Targeted Search	20/04/2023	Drainage Area/ Floodplain (targeting bilby)	0.8	Weed invasion	Soft soil (burrows), rock pile, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
TS-04	717849	7477633	Targeted Search	14/06/2024	Drainage Area/ Floodplain (targeting bilby)	0.8	Road/Access Track	Tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
TS-05	712296	7478375	Targeted Search	15/06/2024	Drainage Area/ Floodplain (targeting bilby)	0.6	Weed Invasion	Logs, tree hollows, thick undergrowth, soft soil (burrows), rock pile, old *Triodia*, leaf litter	
Nocturnal Search									
NS-01	716869	7473960	Nocturnal Search	16/04/2023	Hillcrest/ Hillslope (targeting Pilbara olive python)	0.6	Mining exploration, road/access track	Crevices	
NS-02	717190	7475886	Nocturnal Search	17/04/2023	Gorge/ Gully (targeting Pilbara olive python)	1.0	None discernible	Caves, overhangs, tree hollows, crevices, pools, semi-permanent water	
NS-03	718695	7473282	Nocturnal Search	18/04/2023	Major Drainage (targeting Pilbara olive python)	0.8	Cattle grazing, weed invasion	Logs, tree hollows, crevices, rock pile, old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
Camera (active)									
CAM-1-01	714990	7477477	Camera (active)	14/04/2023 – 20/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	
CAM-1-02	715115	7477470	Camera (active)	14/04/2023 – 20/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices	
CAM-1-03	715340	7477565	Camera (active)	14/04/2023 – 20/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	
CAM-1-04	715403	7477665	Camera (active)	14/04/2023 – 20/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Tree hollows, crevices	
CAM-1-05	715433	7477402	Camera (active)	14/04/2023 – 20/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-1-06	715492	7477428	Camera (active)	14/04/2023 – 20/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices	
CAM-1-07	715482	7477296	Camera (active)	14/04/2023 – 20/04/2023	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Crevices	
CAM-1-08	715566	7477272	Camera (active)	14/04/2023 – 20/04/2023	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Crevices	
CAM-2-01	716898	7475981	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices	
CAM-2-02	716941	7475847	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-2-03	717018	7475853	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices	
CAM-2-04	717133	7475925	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, pools, semi-permanent water	
CAM-2-05	717226	7475836	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, pools, semi-permanent water	
CAM-2-06	717173	7475787	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	0.8	Weed invasion	Caves, overhangs, logs, crevices	
CAM-2-07	717203	7475675	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, pools, semi-permanent water	

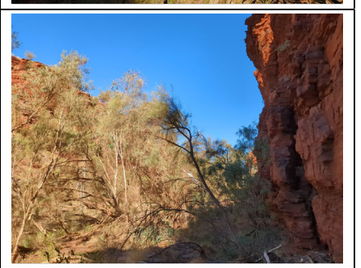
Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-2-08	717212	7475606	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, logs, crevices	
CAM-3-01	713676	7473667	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices, rock pile, leaf litter	
CAM-3-02	713773	7473614	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices, rock pile, leaf litter	
CAM-3-03	713878	7473522	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices, rock pile, leaf litter	
CAM-3-04	713969	7473609	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices, rock pile, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-3-05	713981	7473741	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices, rock pile, leaf litter	
CAM-3-06	714184	7473644	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices, rock pile, leaf litter	
CAM-3-07	714242	7473786	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, tree hollows, crevices, rock pile	
CAM-3-08	714217	7473873	Camera (active)	16/04/2023 – 21/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, tree hollows, crevices, rock pile	
CAM-4-01	718273	7472887	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	0.8	Road/ access track	Caves, overhangs, crevices	

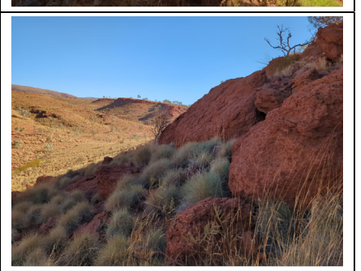
Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-4-02	718299	7472847	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	
CAM-4-03	718327	7472849	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	
CAM-4-04	718389	7472868	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	
CAM-4-05	718471	7472877	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	
CAM-4-06	718591	7472944	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Caves, overhangs, crevices	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-4-07	718767	7472846	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	0.8	Weed invasion	Caves, overhangs, crevices	
CAM-4-08	718784	7472752	Camera (active)	14/04/2023 – 19/04/2023	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Caves, overhangs, crevices	
CAM-5-01	719606	7473723	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	
CAM-5-02	719696	7473783	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	
CAM-5-03	719809	7473835	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-5-04	719922	7473856	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	
CAM-5-05	720025	7473911	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	
CAM-5-06	720107	7473946	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	
CAM-5-07	720203	7473930	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	
CAM-5-08	720317	7473927	Camera (active)	14/04/2023 – 19/04/2023	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Cattle grazing, weed invasion	Overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM-OPP1	711522	7481099	Camera (active)	18/04/2023 – 21/04/2023	Boulders/ Rockpiles (targeting northern quoll)	1.0	None discernible	Tree hollows, crevices, rock pile, old *Triodia*	
CAM-OPP2	713979	7479769	Camera (active)	18/04/2023 – 21/04/2023	Minor Drainage Line (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Logs, tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
CAM-OPP3	713661	7475444	Camera (active)	16/04/2023 – 21/04/2023	Gorge/Gully (targeting northern quoll)	0.8	Road/access track, weed invasion	Caves, overhangs, logs, tree hollows, crevices, thick undergrowth, rock pile, old *Triodia*, leaf litter	
CAM6-01	717261	7471110	Camera (active)	8/06/2024 - 14/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, leaf litter	
CAM6-02	717452	7471371	Camera (active)	8/06/2024 - 14/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM6-03	717464	7471445	Camera (active)	8/06/2024 - 14/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	Weed Invasion	Overhangs, logs, crevices, thick undergrowth, rock pile, leaf litter	
CAM6-04	717305	7471530	Camera (active)	8/06/2024 - 14/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	Weed Invasion	Overhangs, logs, crevices, thick undergrowth, rock pile, leaf litter	
CAM6-05	716623	7471687	Camera (active)	8/06/2024 - 14/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, soft soil (burrows), semi-permanent water, leaf litter	
CAM6-06	716720	7471501	Camera (active)	8/06/2024 - 14/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, soft soil (burrows), rock pile, leaf litter	
CAM6-07	716929	7471442	Camera (active)	8/06/2024 - 14/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM7-01	717459	7477777	Camera (active)	9/06/2024 - 15/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, thick undergrowth, rock pile, old *Triodia*, leaf litter	
CAM7-02	717271	7477763	Camera (active)	9/06/2024 - 15/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, thick undergrowth, rock pile, old *Triodia*, leaf litter	
CAM7-03	716827	7477793	Camera (active)	9/06/2024 - 15/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, thick undergrowth, rock pile, old *Triodia*, leaf litter	
CAM7-04	716599	7477649	Camera (active)	9/06/2024 - 15/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, thick undergrowth, rock pile, old *Triodia*, leaf litter	
CAM8-01	712298	7478158	Camera (active)	9/06/2024 - 15/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices, rock pile, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM8-02	712335	7478335	Camera (active)	9/06/2024 - 15/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices, rock pile, leaf litter	
CAM8-03	712248	7478269	Camera (active)	9/06/2024 - 15/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices, rock pile, leaf litter	
CAM8-04	712076	7478142	Camera (active)	9/06/2024 - 15/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices, rock pile, leaf litter	
CAM9-01	714930	7473163	Camera (active)	10/06/2024 - 16/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, old *Triodia*	
CAM9-02	715096	7473160	Camera (active)	10/06/2024 - 16/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, old *Triodia*	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM9-03	715190	7472927	Camera (active)	10/06/2024 - 16/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, old *Triodia*	
CAM9-04	715158	7472972	Camera (active)	10/06/2024 - 16/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, old *Triodia*	
CAM9-05	715410	7472523	Camera (active)	10/06/2024 - 16/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, rock pile, old *Triodia*	
CAM9-06	715609	7471761	Camera (active)	10/06/2024 - 16/06/2024	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Weed Invasion	Overhangs, logs, tree hollows, crevices, thick undergrowth, rock pile, leaf litter	
CAM9-07	715449	7471957	Camera (active)	10/06/2024 - 16/06/2024	Major Drainage Line (targeting northern quoll, Pilbara olive python)	0.8	Weed Invasion	Overhangs, logs, crevices, soft soil (burrows), rock pile, old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM9-08	715507	7472123	Camera (active)	10/06/2024 - 16/06/2024	Gorge/ Gully (targeting northern quoll, Pilbara olive python)	1.0	None discernible	Overhangs, crevices, rock pile, old *Triodia*, leaf litter	
CAM10-01	720274	7475932	Camera (active)	11/06/2024 - 16/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	0.8	Road/Access Track	Logs, tree hollows, crevices, rock pile, old *Triodia*, leaf litter	
CAM10-02	720420	7475892	Camera (active)	11/06/2024 - 16/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	0.8	Road/Access Track	Logs, tree hollows, crevices, rock pile, old *Triodia*, leaf litter	
CAM10-03	720503	7475759	Camera (active)	11/06/2024 - 16/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	0.8	Road/Access Track	Logs, tree hollows, crevices, rock pile, old *Triodia*, leaf litter	
CAM10-04	719687	7476049	Camera (active)	11/06/2024 - 16/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	Road/Access Track	Logs, crevices, thick undergrowth, rock pile, old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
CAM10-05	719563	7476012	Camera (active)	11/06/2024 - 16/06/2024	Breakaway/ Cliff (targeting northern quoll, Pilbara olive python)	1.0	Road/Access Track	Logs, crevices, thick undergrowth, rock pile, old *Triodia*, leaf litter	
Echolocation Recording									
BAT-01	717202	7475678	Echolocation Recording	14/04/2023- 17/04/2023	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Overhangs, crevices, pools, semi-permanent water	
BAT-02	718795	7472741	Echolocation Recording	14/04/2023- 17/04/2023	Gorge/Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, crevices	
BAT-03	716969	7476115	Echolocation Recording	15/04/2023- 18/04/2023	Gorge/Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, crevices	
BAT-04	715967	7476842	Echolocation Recording	15/04/2023- 18/04/2023	Breakaway/ Cliff (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, crevices, rock pile	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
BAT-05	716045	7471740	Echolocation Recording	15/04/2023-18/04/2023	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, crevices, rock pile	
BAT-06	718589	7472947	Echolocation Recording	17/04/2023-20/04/2023	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, tree hollows, crevices, thick undergrowth, rock pile, old *Triodia*	
BAT-07	717236	7475448	Echolocation Recording	17/04/2023-20/04/2023	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, crevices, pools, semi-permanent water	
BAT-08	716574	7476179	Echolocation Recording	18/04/2023-21/04/2023	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, crevices	
BAT-09	720290	7473613	Echolocation Recording	18/04/2023-21/04/2023	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, crevices, rock pile	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
BAT-10	711823	7479277	Echolocation Recording	18/04/2023-21/04/2023	Minor Drainage Line (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Tree hollows, soft soil (burrows), old *Triodia*, leaf litter	
BAT-11	717555	7471488	Echolocation Recording	8/06/2024 - 11/06/2024	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	0.8	Weed Invasion	Overhangs, logs, tree hollows, crevices, leaf litter	
BAT-12	716701	7477746	Echolocation Recording	9/06/2024 - 12/06/2024	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, logs, crevices, leaf litter	
BAT-13	715218	7472879	Echolocation Recording	10/06/2024 - 13/06/2024	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Caves, overhangs, logs, crevices, thick undergrowth, leaf litter	
BAT-14	715320	7472123	Echolocation Recording	10/06/2024 - 13/06/2024	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Overhangs, logs, crevices, thick undergrowth, old *Triodia*	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
BAT-15	720346	7476358	Echolocation Recording	11/06/2024 - 14/06/2024	Medium Drainage Line (targeting Pilbara Leaf-nosed Bat and ghost bat)	0.6	Weed Invasion	Tree hollows, thick undergrowth, soft soil (burrows), rock pile, leaf litter	
BAT-16	719304	7476523	Echolocation Recording	12/06/2024 - 15/06/2024	Gorge/ Gully (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Overhangs, logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), rock pile, old *Triodia*	
BAT-17	712793	7476888	Echolocation Recording	13/06/2024 - 16/06/2024	Breakaway/ Cliff (targeting Pilbara Leaf-nosed Bat and ghost bat)	1.0	None discernible	Overhangs, logs, tree hollows, crevices, rock pile, old *Triodia*, leaf litter	
BAT-18	711968	7478460	Echolocation Recording	13/06/2024 - 16/06/2024	Major Drainage Line (targeting Pilbara Leaf-nosed Bat and ghost bat)	0.8	Weed Invasion	Logs, tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
Acoustic Recording									
ACO-01	719250	7473537	Acoustic Recording	14/04/2023- 20/04/2023	Drainage Area/ Floodplain (targeting night parrot, grey falcon, red goshawk and migratory species)	0.8	Cattle grazing, weed invasion	Tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
ACO-02	717530	7476744	Acoustic Recording	15/04/2023-21/04/2023	Drainage Area/ Floodplain (targeting night parrot, grey falcon, red goshawk and migratory species)	0.8	Weed invasion	Tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
ACO-03	713140	7478999	Acoustic Recording	15/04/2023-21/04/2023	Drainage Area/ Floodplain (targeting night parrot, grey falcon, red goshawk and migratory species)	0.6	Cattle grazing, road/access track, weed invasion	Tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
ACO-04	715183	7477159	Acoustic Recording	15/04/2023-21/04/2023	Drainage Area/ Floodplain (targeting night parrot, grey falcon, red goshawk and migratory species)	0.8	Cattle grazing, weed invasion	Logs, tree hollows, soft soil (burrows), old *Triodia*, leaf litter	
ACO-05	717743	7477533	Acoustic Recording	8/06/2024 - 14/06/2024	Drainage Area/ Floodplain (targeting night parrot, grey falcon, red goshawk and migratory species)	1.0	None discernible	Logs, tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
ACO-06	712090	7478400	Acoustic Recording	9/06/2024 - 15/06/2024	Drainage Area/ Floodplain (targeting night parrot, grey falcon, red goshawk and migratory species)	0.8	Weed Invasion	Logs, tree hollows, thick undergrowth, old *Triodia*, leaf litter	
eDNA									

Site ID	MGA Zone 51 K		Sampling method	Date	Habitat	Condition*	Disturbance	Microhabitats**	Photo
	Easting (mE)	Northing (mN)							
eDNA-01	716617	7471685	eDNA Sampling	17/06/2024	Major Drainage Line (targeting Pilbara olive python)	0.6	Road/Access Track	Overhangs, logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), semi-permanent water, rock pile, leaf litter	
eDNA-02	716041	7471747	eDNA Sampling	17/06/2024	Major Drainage Line (targeting Pilbara olive python)	0.8	Weed Invasion	Overhangs, logs, crevices, thick undergrowth, soft soil (burrows), semi-permanent water, rock pile, leaf litter	
eDNA-03	716543	7471759	eDNA Sampling	17/06/2024	Major Drainage Line (targeting Pilbara olive python)	0.6	Weed Invasion	Overhangs, logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), pools, semi-permanent water, rock pile, leaf litter	

*- Fauna habitat condition scale (Thompson and Thompson 2010) (Appendix B Table B.7). **- Microhabitats present within the habitat type at these locations are general in nature. Significant microhabitats (e.g. roost caves, water features) are detailed in Appendix E.

Condition:

High Quality Fauna Habitat **(1.0)**

Very Good Fauna Habitat **(0.8)**

Good Fauna Habitat **(0.6)**

Disturbed Fauna Habitat **(0.4)**

Highly Degraded Fauna Habitat **(<0.2)**

This page has been left blank intentionally.

Appendix E: Fauna Habitat Mapping and Significant Areas

This page has been left blank intentionally.

715000

720000

7475000

CMN-10
CMN-11
CMNY-06
CMNY-05
WMN-03
WMN-04
WMN-02
WMN-01
CMN-05
CMN-07
CMN-02
CMN-09
WMN-08
WMN-09
CMN-08
CMN-01
WMN-07
CMN-12
CMN-03
WMN-10
CMN-06
CMN-04
WMN-05
WMN-06

Map Extent

Survey Area
Significant Area
Cave
Water Feature

BHP Western Australian Iron Ore
Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure E.1: Significant area locations

Scale: 1:30,000 at A3
Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron
an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigE1_SigAreas

Table E.1: Location of significant caves within the Survey Area.

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMN-01	720294	7473585	Category 4	Category 4	**Entrance:** Wide open entrance (3 m high x 9 m wide) **Orientation:** North-west **Internal:** Seven internal chambers (Main chamber 2 m high x 8 m wide x 9 m deep, first right chamber 1 m high x 5 m wide x 2.5 m deep, second right chamber 0.5 m high x 0.5 m wide x 2 m deep, third right chamber 0.5 m high x 2 m wide x 5 m deep, first left chamber 0.6 m high x 0.5 m wide x 4 m deep, Second left chamber 0.6 m high x 3.5 m wide x 6 m deep, end chamber 2 m high, 4 m wide, 6 m deep) **Conditions:** Bat smell, raised humidity, microbats present.	

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMN-02	717230	7475451	Category 3	Category 4	**Entrance:** Wide open entrance (3.5 m high x 2.5 m wide) **Orientation:** East **Internal:** Four internal chambers (Main chamber 2.5 m high x 7 m wide x 25 m deep, first right chamber 1.8 m high x 2 m wide x 18 m deep, second right chamber 2 m high x 2 m wide x 6+ m deep, End chamber 5+ m high x 6 m wide x 6 m deep with a continued cavity 5+ m deep x 0.3 m high) **Notes:** Three constrictions with no observable end. **Conditions:** Ghost bats previously recorded, ghost bat scat recorded (50-100) current survey, bat smell, raised humidity, microbats present	

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMN-03	718589	7472942	Category 4	Category 4	**Entrance:** Wide open entrance (3 m high x 10 m wide) **Orientation:** South **Internal:** One internal chamber; 1 m high x 1.5 m wide x 12 m deep **Conditions:** Bat smell, microbats present	
CMN-04	715810	7471714	Category 4	Priority 4	**Entrance:** Wide open entrance (1.2 m high x 2.5 m wide) **Orientation:** South **Internal:** One internal chambers 0.7 m high x 5 m wide x 5 m deep **Conditions:** No bat present	

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMN-05	712997	7475612	Category 4	Category 4	**Entrance:** Wide open entrance (2.5 m high x 7 m wide) **Orientation:** West **Internal:** One internal chamber; 0.5 m high x 6 m wide x 8 m deep **Conditions:** No bat present	
CMN-06	716930	7472175	Category 4	Category 4	**Entrance:** Wide open entrance (2.5 m high x 7 m wide) **Orientation:** South-west **Internal:** One internal chamber; 3.5 m high x 6 m wide x 9 m deep **Conditions:** No bats present	

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMN-07	713660	7475449	Category 4	Category 4	**Entrance:** Wide open entrance (2 m high x 6 m wide) **Orientation:** North-east **Internal:** One internal chamber; 4 m high x 3 m wide x 8 m deep **Conditions:** No bats present	
CMN-08	720256	7473611	Category 4	Category 4	**Entrance:** Wide open entrance (2 m high x 3 m wide) **Orientation:** North-west **Internal:** Two internal chambers (font chamber 2.5 m high x 6 m wide x 5 m deep, end chamber 1.6 m high x 2 m wide x 2 m deep) **Conditions:** Bat smell, raised humidity, microbats present	

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMN-09	716540	7475158	Category 4	Category 4	**Entrance:** Wide open entrance (2.2 m high x 5 m wide) **Orientation:** West **Internal:** Three internal chambers (font chamber 1.2 m high x 4 m wide x 5 m deep, middle chamber 1.2 m high x 5 m wide x 5 m deep, end chamber 0.5 m high x 1 m wide x 2 m deep) **Conditions:** Bat smell, raised humidity, microbats present	
CMN-10	716705	7477743	Category 5	Category 4	**Entrance:** Narrow entrance (1 m high x 1 m wide) **Orientation:** North-west **Internal:** One internal chamber; 1 m high x 1 m wide **Conditions:** Microbats present	

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMN-11	716886	7477695	Category 5	Category 4	**Entrance:** Wide open entrance (1 m high x 2 m wide) **Orientation:** North **Internal:** One internal chamber; 1 m high x 2 m wide x 10 m deep **Conditions:** Microbats present, scats recorded	
CMN-12	715216	7472881	Category 5	Category 4	**Entrance:** Wide open entrance (2 m high x 5 m wide) **Orientation:** West **Internal:** One internal chamber; 2 m high x 5 m wide x 20 m deep **Conditions:** Microbats present, scats recorded	

Cave ID	MGA Zone 50 K		Category rating for ghost bat usage (Bat Call WA 2021a)	Category rating for Pilbara leaf-nosed bat usage (Bat Call WA 2021b)	Description	Photograph
	Easting (mE)	Northing (mE)				
CMNY-05	716963	7476116	Category 3	Category 4	**Entrance:** Narrow entrance (1.3 m high x 2 m wide) **Orientation:** South-east **Internal:** One internal chamber; 1.9 m high x 5 m wide x 12 m deep **Conditions:** Ghost bat scats present (50-100), bat smell, raised humidity, microbats present.	
CMNY-06	716570	7476180	Category 4	Category 4	**Entrance:** Wide open entrance (4 m high x 6 m wide) **Orientation:** North-East **Internal:** One internal chamber; 1.5 m high x 7 m wide x 10 m deep. **Conditions:** No bats present	

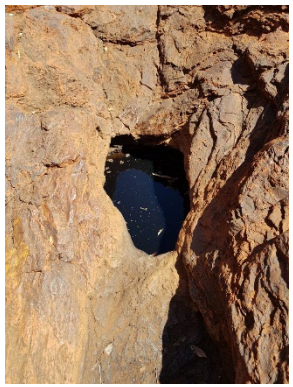
Table E.2: Location of water features within the Survey Area.

Water Feature ID	MGA Zone 50 K		Dimensions (m)	Depth (m)	Groundwater dependant vegetation (GVD)	Photographs
	Easting (mE)	Northing (mE)				
WMN-1	717198	7475671	5.0 x 3.0	0.5	None present	
WMN-2	717218	7475839	9.0 x 3.0	0.5	None present	

Water Feature ID	MGA Zone 50 K		Dimensions (m)	Depth (m)	Groundwater dependant vegetation (GVD)	Photographs
	Easting (mE)	Northing (mE)				
WMN-3	717121	7475917	4.0 x 2.0	0.6	None present	
WMN-4	716994	7475853	1.0 x 2.0	0.5	None present	

Water Feature ID	MGA Zone 50 K		Dimensions (m)	Depth (m)	Groundwater dependant vegetation (GVD)	Photographs
	Easting (mE)	Northing (mE)				
WMN-5	716054	7471737	10.0 x 5.0	0.7	*Eucalyptus victrix* and/or *E. camaldulensis* *Melaleuca argentea*	
WMN-6	716622	7471683	3.0 x 1.0	0.4	*Eucalyptus victrix* and/or *E. camaldulensis* *Melaleuca argentea*	

Water Feature ID	MGA Zone 50 K		Dimensions (m)	Depth (m)	Groundwater dependant vegetation (GVD)	Photographs
	Easting (mE)	Northing (mE)				
WMN-7	718727	7473193	3.0 x 1.0	0.6	*Eucalyptus victrix* and/or *E. camaldulensis* *Melaleuca argentea*	
WMN-8	714357	7474446	1 x 1	0.3	None present	

Water Feature ID	MGA Zone 50 K		Dimensions (m)	Depth (m)	Groundwater dependant vegetation (GVD)	Photographs
	Easting (mE)	Northing (mE)				
WMN-9	714403	7474494	1 x 0.5	1	None present	
WMN-10	720114	7472915	5 x 3.5	0.5	None present	

Appendix F: MNES Fauna Habitat Suitability Mapping

This page has been left blank intentionally.

710000

715000

720000

7480000

7475000

Survey Area

Habitat Type

- Boulders/ Rockpiles
- Breakaway/ Cliff
- Gorge/ Gully
- Hillcrest/ Hillslope
- Minor Drainage Line
- Medium Drainage Line
- Major Drainage Line
- Drainage Area/ Floodplain
- Undulating Low Hills
- Cleared/ Disturbed

BHP Western Australian Iron Ore

Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure F.1: Fauna habitat mapping

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron

an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigF1_Habitat

710000

715000

720000

7480000

7475000

Survey Area

Cave CMIN-03 (Cat 2) - 12km Buffer

Current Fauna Locations

▲ Ghost bat

Ghost bat habitat suitability

Critical habitat

Supporting habitat

Limited foraging and disperal habitat

BHP Western Australian Iron Ore

Ministers North Targeted Significant Vertebrate Fauna Survey

Figure F.2: MNES Fauna Habitat Suitability Mapping - Ghost bat

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron

an ecocene company

Author: A. McCreery | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigF2_GB

710000

715000

720000

7480000

7475000

Survey Area

Current Fauna Locations

Northern quoll

Northern quoll habitat suitability

Critical habitat

Supporting habitat

Limited foraging and disperal habitat

BHP Western Australian Iron Ore

Ministers North Targeted Significant Vertebrate Fauna Survey

Figure F.3: MNES Fauna Habitat Suitability Mapping - Northern quoll

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron

an ecocene company

Author: A. McCreery | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigF3_NQ

710000

715000

720000

7480000

7475000

Survey Area

Pilbara leaf-nosed bat habitat suitability

Supporting habitat

Limited foraging and disperal habitat

BHP Western Australian Iron Ore

Ministers North Targeted Significant Vertebrate Fauna Survey

Figure F.4: MNES Fauna Habitat Suitability Mapping - Pilbara leaf-nosed bat

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron

an ecocene company

Author: A. McCreery | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigF4_PLNB

710000

715000

720000

7480000

7475000

Survey Area

Current Fauna Locations

Pilbara olive python

Pilbara olive python habitat suitability

Critical habitat

Supporting habitat

Limited foraging and disperal habitat

BHP Western Australian Iron Ore

Ministers North Targeted Significant Vertebrate Fauna Survey

Figure F.5: MNES Fauna Habitat Suitability Mapping - Pilbara olive python

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron

an ecocene company

Author: A. McCreery | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigF5_POP

710000

715000

720000

7480000

7475000

Survey Area

Southern whiteface habitat suitability

Critical habitat

Supporting habitat

Limited foraging and disperal habitat

BHP Western Australian Iron Ore

Ministers North Targeted Significant Vertebrate Fauna Survey

Figure F.6: MNES Fauna Habitat Suitability Mapping - Southern whiteface

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron

an ecocene company

Author: A. McCreery | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigF6_SWF

710000

715000

720000

7480000

7475000

Survey Area

Grey falcon habitat suitability

Critical habitat

Supporting habitat

Limited foraging and disperal habitat

BHP Western Australian Iron Ore

Ministers North Targeted Significant Vertebrate Fauna Survey

Figure F.7: MNES Fauna Habitat Suitability Mapping - Grey falcon

Scale: 1:45,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 Metres

N

astron

an ecocene company

Author: A. McCreery | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigF7_GF

This page has been left blank intentionally.

Appendix G: Significant Fauna Species Locations

This page has been left blank intentionally.

Table G.1: Locations of significant vertebrate fauna species recorded during the current survey.

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
Mammals							
Ghost bat (*Macroderma gigas*)	VU; VU	CMN-05	716963	7476116	Scats (50-100)	Cave	
		CMN-02	717230	7475451	Scats (50-100)	Cave	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
Western pebble-mound mouse (*Pseudomys chapmani*)	P4	Opp	714522	7477395	Mound (recently inactive)	Hillcrest/ Hillslope	
		Opp	716921	7477851	Mound (recently inactive)	Undulating Low Hills	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		Opp	716829	7477933	Mound (recently inactive)	Undulating Low Hills	
		Opp	720757	7475724	Mound (recently inactive)	Undulating Low Hills	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		Opp	720775	7475770	Mound (recently inactive)	Undulating Low Hills	
		Opp	720822	7475797	Mound (recently inactive)	Undulating Low Hills	

700000 710000 720000 730000

7480000

7470000

Survey Area

Current Fauna Locations

- Ghost bat
- Northern quoll
- Pilbara olive python
- Western pebble-mound mouse

Previous Fauna Locations - BHP

- Common greenshank
- Common sandpiper
- Fork-tailed swift
- Ghost bat
- Northern quoll
- Peregrine falcon
- Pilbara barking gecko
- Pilbara olive python
- Western pebble-mound mouse

Previous Fauna Locations - DBCA

- Common greenshank
- Ghost bat
- Peregrine falcon
- Pilbara barking gecko
- Pilbara leaf-nosed bat
- Pilbara olive python
- Western pebble-mound mouse

BHP Western Australian Iron Ore

Consolidated Ministers North Targeted Significant Vertebrate Fauna Surveys

Figure G.1: Current and Previous Significant Vertebrate Fauna Species Locations

Scale: 1:100,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

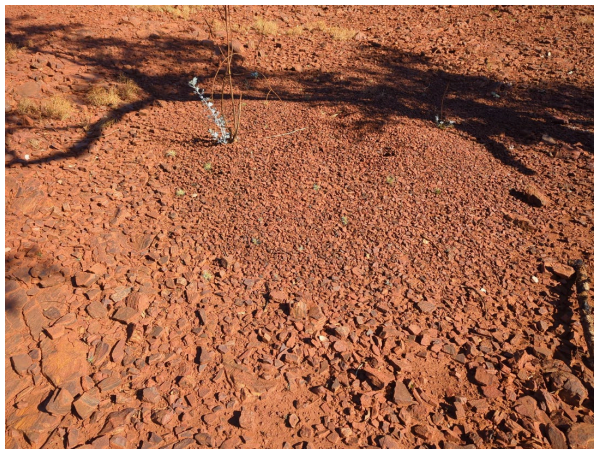
0 1 2 3 4 5 Kilometres

N

astron an ecocene company

Author: A. McCreery | Drawn: C. Dyde | Date: 31-10-2024 | Figure Ref: 2400-020-24-BIDR-1RevA_241031_FigG1_Fauna

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		Opp	720681	7475904	Mound (recently inactive)	Undulating Low Hills	
		Opp	720665	7475936	Mound (recently inactive)	Undulating Low Hills	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		Opp	720530	7476156	Mound (recently inactive)	Hillcrest/ Hillslope	
		Opp	720361	7475988	Mound (recently inactive)	Hillcrest/ Hillslope	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		Opp	719457	7476051	Mound (inactive)	Hillcrest/ Hillslope	
		Opp	719499	7476057	Mound (recently inactive)	Hillcrest/ Hillslope	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		Opp	720721	7474862	Mound (recently inactive)	Undulating Low Hills	
		Opp	719609	7476091	Mound (recently inactive)	Hillcrest/ Hillslope	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		Opp	718813	7477145	Mound (recently inactive)	Undulating Low Hills	
Northern quoll *(Dasyurus hallucatus)*	EN; EN	Opp	716638	7471727	Scat	Gorge/ Gully	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		CAM6-06	716720	7471501	Individual (alive), (3)	Gorge/ Gully	
		CAM9-07	715449	7471957	Individual (alive)	Major Drainage Line	

Group Common name (*Species name*)	Status	Site ID	MGA Zone 51 K		Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)			
		CAM6-07	716929	7471442	Individual (alive), (4)	Gorge/ Gully	
Reptiles							
Pilbara olive python *(Liasis olivaceus barroni)*	VU	Opp	716628	7471629	Scat	Major Drainage Line	

Appendix H: eDNA Frontiers Report

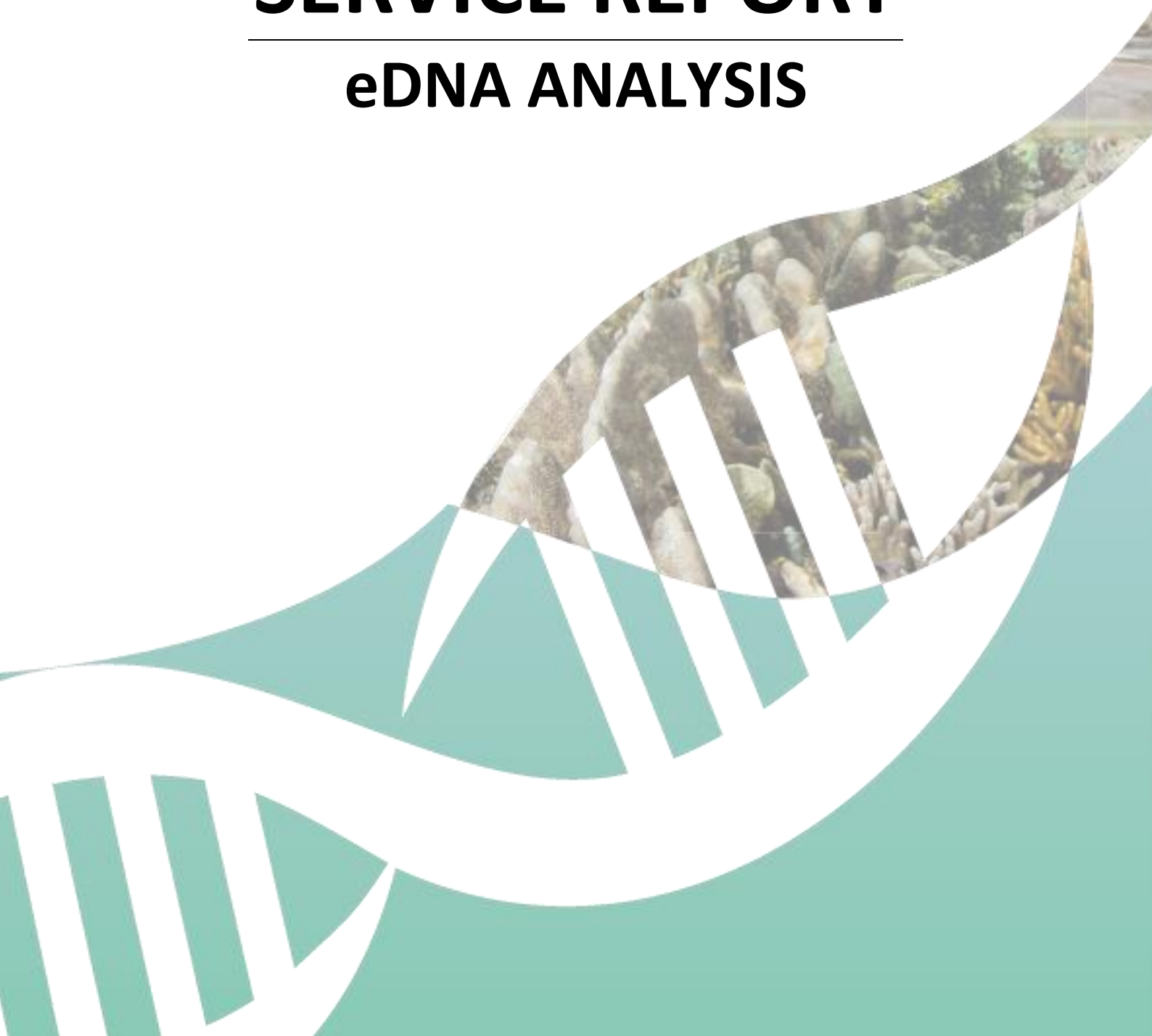
This page has been left blank intentionally.

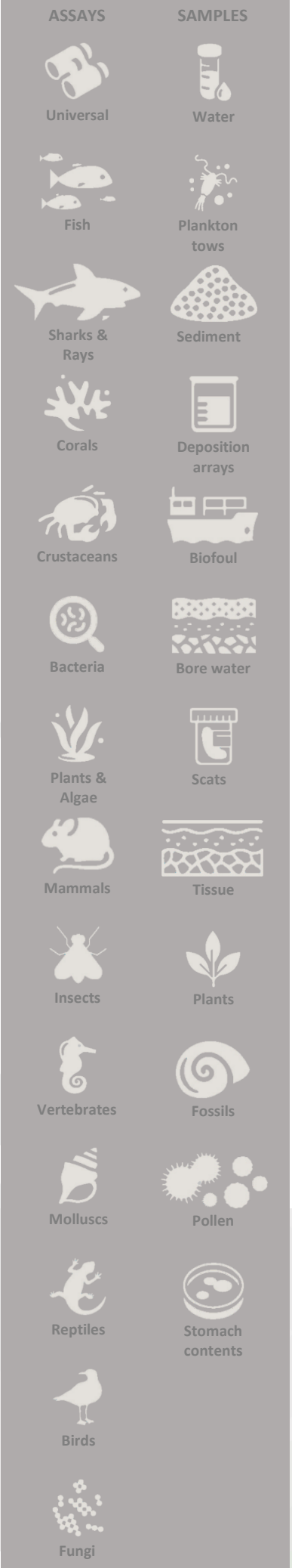
This page has been left blank intentionally.

eDNA FRONTIERS | Curtin University

SERVICE REPORT

eDNA ANALYSIS





DNA	Deoxyribonucleic acid
eDNA	Environmental DNA
NCBI	National Centre for Biotechnology Information
OTU	Operational taxonomic unit
ZOTU	Zero-radius operational taxonomic unit
AIS	Alien Invasive Species
LULU	A post-clustering algorithm for curation of DNA amplicon data
PCR	Polymerase chain reaction
mtGenome	The full mitochondrial genome
fasta	A formatting type for sequence data
18S	The nuclear gene region, 18S
COI	The mitochondrial gene region, cytochrome c oxidase I
16S	The mitochondrial subunit ribosomal RNA gene region, 16S
12S	The mitochondrial gene region, 12S

Project Details

Scope of Work: EF408

Project Title: Pilbara olive python detection from filtered water samples taken in the Pilbara area using eDNA analysis (qPCR).

Client Details

Client: Astron Environmental Services Pty Ltd (ABN: 64 115 081 591)
129 Royal St, East Perth, WA 6004

Contact: Sean Smithies| Senior Environmental Scientist
E: Sean.Smithies@astron.com.au | P: +61 8 9421 9600

Report Details

Report reference: EF408_Astron_Final Report

Report issue date: 15/11/2024

Laboratory start date: 25/07/2024 Laboratory end date: 26/07/2024

Test Facility

eDNA Frontiers
Curtin University
ABN: 99 143 842 569
303.194 Kent Street, Bentley WA 6102
Phone: +61 8 9266 4119
Email: ednaFrontiers@curtin.edu.au

Study Author

Dr Kat Dawkins
eDNA Frontiers | Curtin University
Email: kat.dawkins@curtin.edu.au

Curtin Office Contact

Director, Research Services and Systems
Research Office at Curtin
B100 Kent Street, Bentley WA 6102
E: director.research@curtin.edu.au

Approvals

Dr Kathryn Dawkins
(Author)

1.0 OBJECTIVE

The objective of this study was to assess the presence of *Liasis olivaceus barroni* (Pilbara olive python) using species-specific qPCR applied to environmental DNA.

1.1 Study Scope

Using environmental DNA (eDNA) testing, eDNA Frontiers was tasked with analysing water samples for the presence of *Liasis olivaceus barroni* (Pilbara olive python). The client provided a total of 9 samples consisting of water filtrate suspended on 1.2µM filter membranes (Tables 1 and 2). Water was filtered using a hand-driven syringe system, with samples preserved in DNA Shield.

2.0 SAMPLE DETAILS

Table 1. Sample receipt details.

Date received:	25/06/2024
Transport temp:	Ambient (DNA Shield)
Number of samples:	9
Storage:	All samples were stored ambiently prior to analysis.

Table 2. Supplied sample details.

eDNA Frontiers ID	Client Sample ID	Sample Type	Collection Date	Collection Location
E-408-001	eDNA01-AMN	Water	17/06/2024	Ministers North
E-408-002	eDNA01-AMN	Water	17/06/2024	Ministers North
E-408-003	eDNA01-AMN	Water	17/06/2024	Ministers North
E-408-004	eDNA02-AMN	Water	17/06/2024	Ministers North
E-408-005	eDNA02-AMN	Water	17/06/2024	Ministers North
E-408-006	eDNA02-AMN	Water	17/06/2024	Ministers North
E-408-007	eDNA03-AMN	Water	17/06/2024	Ministers North
E-408-008	eDNA03-AMN	Water	17/06/2024	Ministers North
E-408-009	eDNA03-AMN	Water	17/06/2024	Ministers North

3.0 METHODS

3.1 Sample Collection

Water samples were collected at three locations by Astron staff on June 17, 2024. Samples were filtered using 1.2µM filters with a hand driven syringe system to capture eDNA present in the water. All filtering was carried out by Astron staff. All samples were transported at ambient temperature while preserved in DNA Shield to eDNA Frontiers' laboratories where they were stored until scheduled for DNA extraction.

3.2 eDNA Extraction and Analysis

The DNA Shield was removed from each cartridge unit and DNA was extracted using a custom protocol on the Kingfisher Flex system. Samples were analysed using a species-specific probe-based assay targeting the Pilbara olive python. Samples were analysed in triplicate at two dilutions (neat and 1/10), with positive and negative controls included for all analyses.

4.0 RESULTS

4.1 Species-specific qPCR analysis

Result criteria:

Positive:	Indication of exponential amplification with a C_T average of <45
Possible:	Indication of exponential amplification with a C_T average of 45-50
Negative:	Lack of amplification, C_T average 50 and above

Note: Due to the cryptic and rare nature of the target, any amplification in any number of replicates should be considered an indication of potential presence of the target DNA within the sample. The criteria above flag a threshold for where positive amplification may become less reliable, but these instances should still be considered as possible detections.

No amplification was observed in any environmental samples. All positive controls amplified for all replicates, and no extraction or negative controls showed amplification for any replicate.

ARCHIVING OF STUDY DATA

The DNA extracts derived from this study will be stored within eDNA Frontiers' premises for a period of 12 months. If samples are required to be stored longer a sample archiving service can be provided.

All electronic data relating to the study is stored in an offsite secure server. This includes; all laboratory raw data; personnel records; and the study report. Hard copy documents are archived by study number into a locked area of the test facility located in eDNA Frontiers, Curtin University administration area.