OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey October 2023

Prepared for
BHP Western Australian Iron Ore

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Report Reference: 2400-017-23-BISR-1Rev0_240702

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A	30/11/2023	Draft Issued for Client Review	S. Smithies	D. Keirle
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Approval

Rev	Date	Issued to	Authorised by	
			Name	**Signature**
A	30/11/2023	T. Betts	B. Lucas	
B	02/04/2024	T. Betts	B. Lucas	
C	24/05/2024	T. Betts	B. Lucas	
0	02/07/2024	T. Betts	B. Lucas	

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Abbreviations

Abbreviation	Definition
ARU	Autonomous Recording Unit
Astron	Astron Environmental Services
BC Act	*Biodiversity and Conservation Act 2016*
BHP WAIO	BHP Western Australian Iron Ore
CR	Critically Endangered
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEWHA	Department of Water, Heritage and the Arts
DSWEPaC	Department of Sustainability, Water, Environment, Population and Communities
EN	Endangered
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
GPS	Geographical Positioning System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
kHz	Kilohertz
km	Kilometre
MI	Migratory
mm	Millimetres
MNES	Matters of National Environmental Significance
OB	Orebody
OS	Specially Protected
P	Priority
SM	SongMeter
sp.	Species (singular)
ssp.	Species (plural)
T	Threatened
TSSC	Threatened Species Scientific Committee
VU	Vulnerable
°C	Degrees Celsius

Executive Summary

Astron Environmental Services was commissioned by BHP Western Australian Iron Ore (BHP WAIO) to undertake a targeted significant vertebrate fauna survey of the Orebody 29, 30 and 35 expansion and Newman surplus water survey area. The survey area occurs approximately 5 km south to 10 km north-east of Newman and covers an area of 5,230 ha. The fauna assessment was conducted from 26 September to 4 October 2023.

Eleven broad fauna habitat types were recorded and mapped within the survey area comprising, in decreasing order of extent: Stony Plain, Sandy/ Stony Plain, Undulating Low Hills, Hillcrest/ Hillslope, Drainage Area/ Floodplain, Major Drainage Line, Mulga Woodland, Wetland, Minor Drainage Line, Medium Drainage Line, and Breakaway/ Cliff. Most of these fauna habitat types have the potential to support significant species to varying extents with all habitat types, with the exception of Wetlands, not restricted at a local or sub-regional scale. Large sections of the survey area (2,078.5 ha, 39.7%) comprised Cleared/ Disturbed areas, including parts of the Newman Townsite and Mt Whaleback Mine site, and provide little to no fauna habitat value for significant species.

With regard to Matters of National Environmental Significance (MNES) fauna species, the Wetland and Major Drainage Line habitats provide critical habitat for Pilbara olive python (*Liasis olivaceus barroni*) (VU; VU) and supporting habitat for ghost bat (*Macroderma gigas*) (VU; VU), Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) (VU; VU), and northern quoll (*Dasyurus hallucatus*) (EN; EN). One water feature was identified within each of the Wetland and Major Drainage Line habitats providing important microhabitats for a suite of fauna species. Due to a proximate Category 2 ghost bat roost cave (CWER-03) outside of the survey area, areas of ghost bat foraging habitat within the survey area are accordingly considered as critical habitat for this species. This includes areas of Major Drainage Line, Minor Drainage Line, Mulga Woodland, Sandy/ Stony Plain and Stony Plain within a 12 km buffer of the cave. These habitat types within the survey area outside of the 12 km buffer are considered as supporting habitat only.

Five caves were identified within Hillcrest/ Hillslope habitats within the survey area, along with a suite of rocky microhabitats that could potentially provide supporting habitat for MNES species. All five caves were classed as Category 4 (opportunistic use caves) and considered unlikely to support diurnal roosting opportunities for either ghost bat or Pilbara leaf-nosed bat. Breakaway/ Cliff habitat is generally considered as high value habitat within the Pilbara region; however, the small section present within the survey area was considered as highly disturbed, degraded, and representing supporting rather than critical habitat for Pilbara olive python, ghost bat, and Pilbara leaf-nosed bat.

One-hundred and one vertebrate fauna species were recorded within the survey area, comprising eight reptiles, 77 birds, and 16 mammals (including five introduced species). The fauna species assemblage recorded was considered typical for a targeted vertebrate fauna survey within the Hamersley subregion.

No MNES or other significant species were recorded during the survey. Ten significant species were considered to have a 'high' post-survey likelihood of occurrence: Pilbara olive python, ghost bat, Pilbara leaf-nosed bat, common sandpiper (*Actitis hypoleucos*) (MI; MI), wood sandpiper (*Tringa glareola*) (MI; MI), common greenshank (*Tringa nebularia*) (MI; MI), marsh sandpiper (*Tringa stagnatilis*) (MI; MI), western pebble-mound mouse (*Pseudomys chapmani*) (P4), peregrine falcon (*Falco peregrinus*) (OS) and Gane's blind snake (*Anilios ganei*) (P1). These species have been recorded within or proximate (within 5 km) to the survey area on previous surveys, and supporting habitat is present.

The likelihood of occurrence for the northern quoll was assessed as 'moderate' due to the presence of supporting foraging, denning, and dispersal habitat but few previous records within or proximate to the survey area. Three other significant species were assessed as having a 'moderate' likelihood of occurrence: glossy ibis (*Plegadis falcinellus*) (MI; MI), fork-tailed swift (*Apus pacificus*) (MI; MI), and long-tailed dunnart (*Antechinomys longicaudata*) (P4).

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1 Introduction

1.1 Project Background

Astron Environmental Services (Astron) was commissioned by BHP Western Australian Iron Ore (BHP WAIO) to undertake a single season targeted significant vertebrate fauna survey, specifically targeting the presence of Matters of National Environmental Significance (MNES) and other significant vertebrate fauna, covering the Orebody (OB) 29, 30 and 35 expansion and Newman surplus water (hereafter referred to as the survey area). The survey area commences at OB35 and extends in an easterly direction to approximately 10 km north-east of Newman and covers an area of approximately 5,230 ha (Figure 1).

1.2 Scope and Objectives

The objective was to undertake a targeted vertebrate fauna assessment of the survey area, with a specific focus on MNES and other significant fauna species, via a desktop assessment and subsequent field survey. The desktop assessment informed the field survey and included a comprehensive database and literature review for potentially occurring MNES species, including ghost bat (*Macroderma gigas*) (VU; VU), Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) (VU; VU), bilby (*Macrotis lagotis*) (VU; VU), northern quoll (*Dasyurus hallucatus*) (EN; EN), grey falcon (*Falco hypoleucos*) (VU; VU), southern whiteface (*Aphelocephala leucopsis*) (VU), princess parrot (*Polytelis alexandrae*) (VU), night parrot (*Pezoporus occidentallis*) (EN; CR), great desert skink (*Liopholis kintorei*) (VU; VU), and Pilbara olive python (*Liasis olivaceus barroni*) (VU; VU). Additional significant fauna species likely to occur in the general locality, such as brush-tailed mulgara (*Dasycercus blythi*) (P4), peregrine falcon (*Falco peregrinus*) (OS), western pebble-mound mouse (*Pseudomys chapmani*) (P4), and long-tailed dunnart (*Antechinomys longicaudata*) (P4) were also assessed.

The scope of work was to undertake:

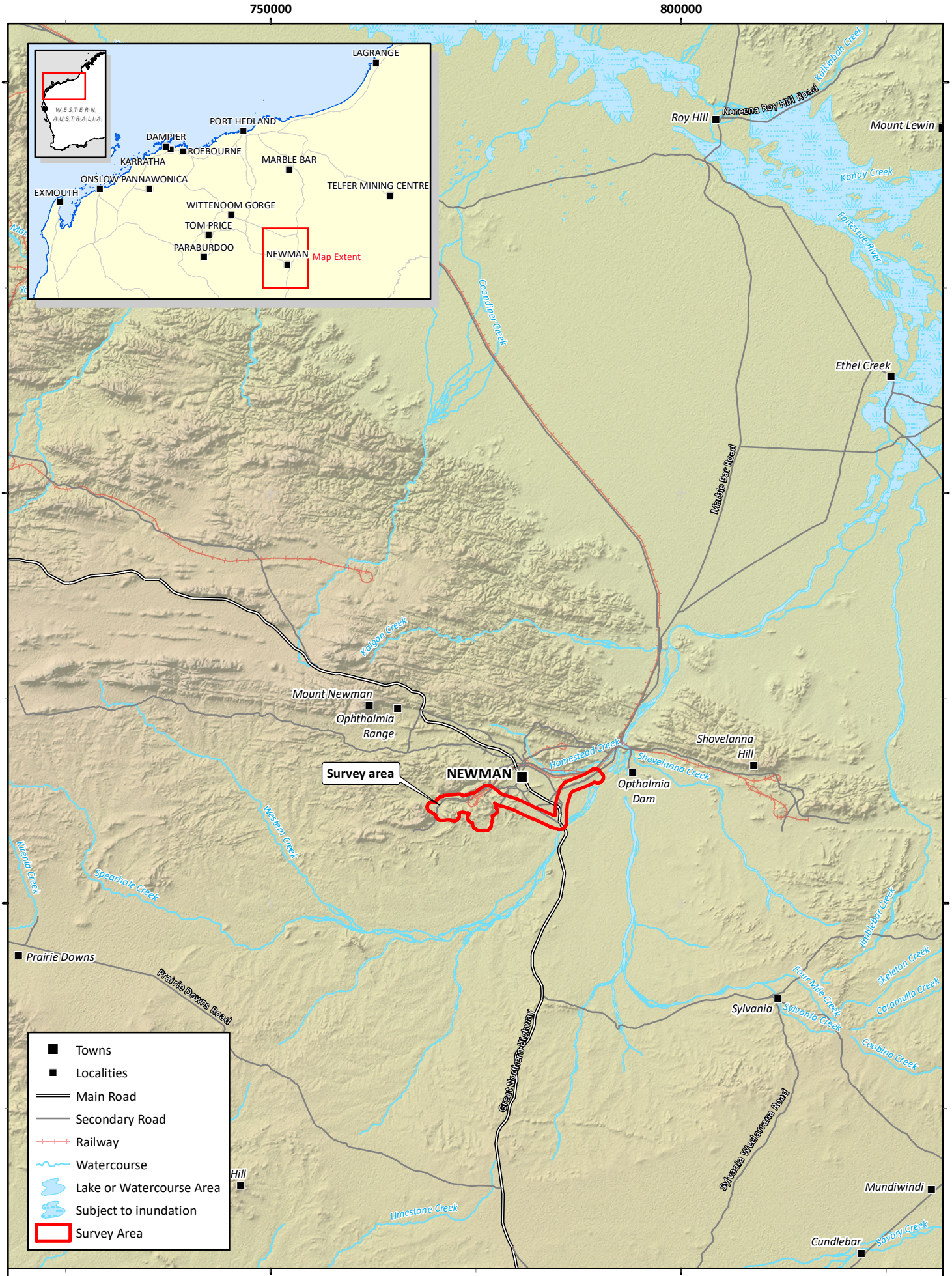
- A desktop assessment, including a comprehensive database and literature review for the presence, or likely presence, of significant vertebrate fauna species and communities.
- A targeted vertebrate fauna field survey, including:
    - targeted MNES species sampling and searches
    - sampling of other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

Astron conducted the fauna survey 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).

The scope of the survey is outlined in Table 1. Section 3.4 of this report provides details on the limitations of the survey.

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

Level of survey	Survey area size	Survey timing	Relevant regulatory guidance documents
Targeted vertebrate fauna assessment (specifically Matters of National Environmental Significance and other significant fauna species)	5,230 ha	26 September – 5 October 2023	• Environmental Protection Authority (EPA) (2018) Statement of Environmental Principles, Factors and Objectives • EPA (2016) Environmental Factor Guideline – Terrestrial Fauna • EPA (2020) Technical Guidance – Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment • Department of Environment, Water, Heritage and the Arts (DEWHA) (2013) Significant Impact Guidelines 1.1 – Matters of National Environmental Significance • DEWHA (2010a) Survey Guidelines for Australia's Threatened Bats • DEWHA (2010b) Survey Guidelines for Australia's Threatened Birds • DEWHA (2010c) Survey Guidelines for Australia's Threatened Frogs • Department of Sustainability, Environment, Water, Population and Communities (DSWEPaC) (2011a) Survey Guidelines for Australia's Threatened Mammals • DSWEPaC (2011b) Survey Guidelines for Australia's Threatened Reptiles • Department of the Environment and Energy (2016) Referral guideline for the endangered northern quoll *Dasyurus hallucatus* • 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 Parks and Wildlife (2017) Interim Guideline for Preliminary Surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia • Bat Call WA (2021a) A review of ghost bat ecology, threats and survey requirements • Bat Call WA (2021b) A review of Pilbara leaf nosed bat ecology, threats and survey requirements • Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023b) Conservation Advice for *Aphelocephala leucopsis* (southern whiteface) • Threatened Species Scientific Committee (TSSC) (2008) Approved conservation advice for *Liasis olivaceus barroni* (olive python – Pilbara subspecies) • BHP WAIO's (2023a) Vertebrate Fauna Surveys in Western Australia Technical Process Instruction (SPR-IEN-EMS-012) • BHP WAIO's (2023b) Biological Survey Spatial Data Requirements (SPR-IEN-EMS-015).



BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure 1: Survey area location

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Author: S. Smithies	Date: 11-03-2024
Drawn: C. Dyde	Figure Ref: 2400-17-23-BIDR-1RevB_240311_Fig01_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 2023).

Based on long-term climatic data from the nearest Bureau of Meteorology weather station at Newman Aero (Station 007176) (approximately 10 km south-east of the survey area) the mean annual rainfall since 1971 is 316.7 mm. The mean maximum daily temperatures range between 23°C and 39.3°C, and range above 30°C for much of the year (Figure 2) (Bureau of Meteorology 2023).

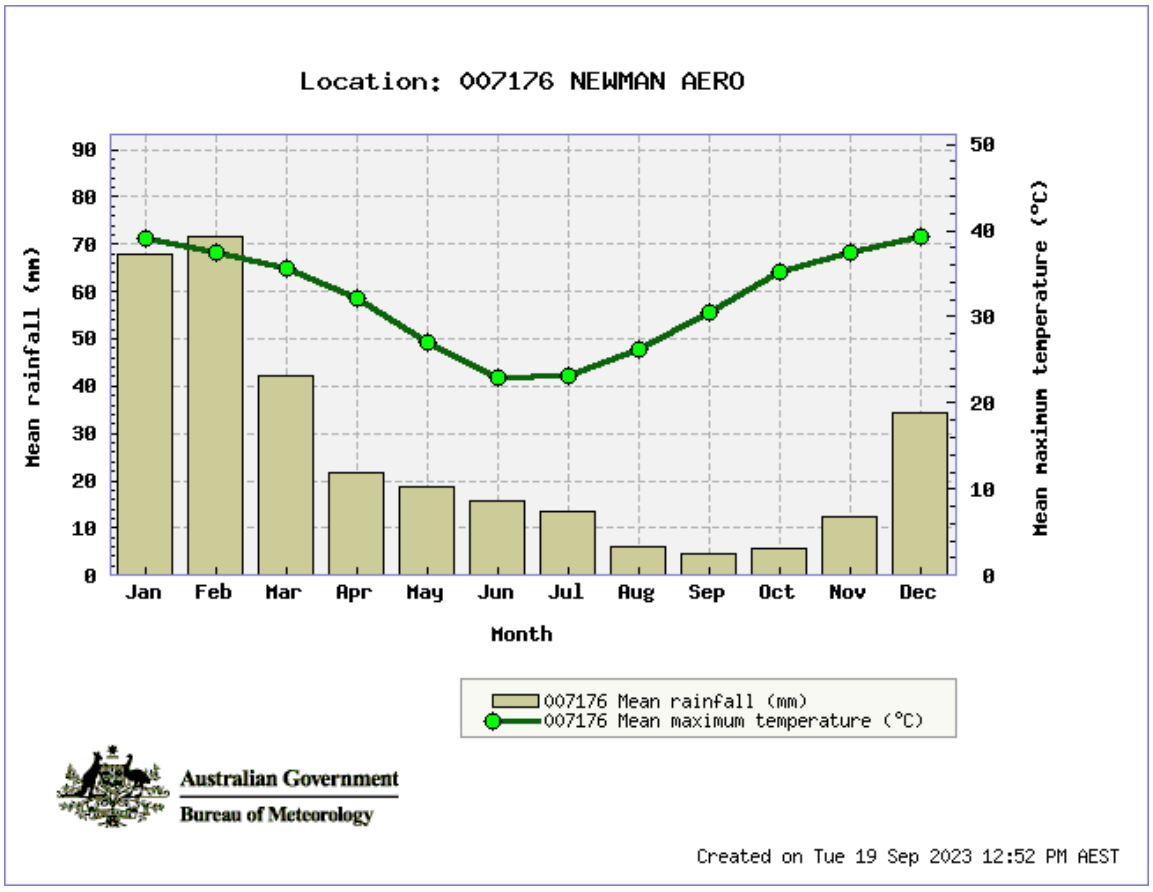

Figure 2: Climate data for Newman Aero Station (007176). Mean annual rainfall data has been calculated from 1971-2023 and mean maximum temperature has been calculated from 1996-2023 (Bureau of Meteorology 2023).

2.1.2 Geology and Soils

The surface geology of the survey area is comprised of ten units (Geoscience Australia 2008, Stewart et al. 2008), with Marra Mamba Iron Formation the most dominant (Table 2). Geological mapping of the survey area 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 (ha)
Marra Mamba Iron Formation: Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.	Achm	1,998.0
Jeerinah Formation: Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	838.3
Colluvium 38491: Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	705.3
Calcrete 38497: Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified.	Czk	695.8
Anthropogenic deposits 74790: Made ground, mining areas, mullock heaps.	Qsm	318.3
Fortescue group – mafic intrustions: Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	298.8
Wittenoom Formation: Calcitic dolomite, interbedded chert and shale in upper and lower parts, volcaniclastic sandstone.	Alhw	172.7
Bunjinah Formation: Metabasaltic pillow lava and breccia; metatuff and minor chert.	Abfb	119.2
Alluvium 38485: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.	Qa	79.8
Brockman Iron Formation: Banded iron-formation, chert, mudstone and siltstone.	Lchk	3.4

2.1.3 Surface Water and Hydrology

The survey area occurs within the 'Fortescue River Upper' catchment. 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 67 km north of the survey area. The Fortescue River and the most south-western portion of Ophthalmia Dam intersect 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 the Environment and Energy 2021). 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 and Gascoyne Bioregions, of which 5% to 10% is represented in the national reserve system (Department of the Environment and Energy 2021).

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 (3,990 ha) of the Pilbara region and the Augustus subregion (1,240 ha) of the Gascoyne region. These subregions are 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 leucopholia* over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001)
- Augustus GAS03 – Desert and Xeric Shrubland ecoregion. Low Proterozoic sedimentary and granite ranges dissected by wide flat valleys with extensive areas of alluvial valley fills (Desmond et al. 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 181,723 km^2, and a total of 172 land systems occur in the Gascoyne bioregion covering 183,784 km^2. Seven land systems occur in the survey area (Table 3). 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.	962,140.8	210.5 (4.0%)	<0.1%
Elimunna (ELM) - Stony plains on basalt supporting sparse acacia and cassia shrublands and patchy tussock grasslands.	62,850.7	826.2 (15.8%)	1.3%
McKay (MCY) - Hills, ridges, plateaux remnants, and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	426,124.4	84.4 (1.6%)	<0.1%
Newman (NEW) - Rugged jaspilite plateaux, ridges, and mountains supporting hard spinifex grasslands.	1,996,418.6	1,799.8 (34.4%)	<0.1%
River (RIV) - Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	497,230.2	206.2 (3.9%)	<0.1%

Land system	Total area within bioregion (ha)	Total area within survey area (ha) (proportion of survey area)	Proportion of land system within survey area
Rocklea (RCK) - Basalt hills, plateaux, lower slopes, and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,023.4	862.3 (16.5%)	<0.1%
Gascoyne bioregion			
Elimunna (ELM) - Stony plains on basalt supporting sparse acacia and cassia shrublands and patchy tussock grasslands.	2,697.2	858.5 (16.4%)	31.8%
McKay (MYK) - Hills, ridges, plateaux remnants, and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	1,323.9	91.1 (1.7%)	6.9%
Newman (NEW) - Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	6,021.2	53.7 (1.0%)	0.9%
River (RIV) - Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	73,008.4	132.4 (2.5%)	0.2%
Spearhole (SPR) - Gently undulating gravelly hardpan plains and dissected slopes supporting groved mulga shrublands and hard spinifex.	31,879.7	104.4 (2.0%)	0.3%

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.

Three pre-European vegetation units 18, 29, 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 three vegetation units in the Pilbara bioregion, Gascoyne 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 (ha)	Pre-European extent (ha)	Current extent in IBRA sub-region (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
Pilbara bioregion (PIL03, Hamersley IBRA sub-region)							
18	a1Li	Low woodland: Mulga *Acacia aneura* and associated species.	694.0	581,246.1	576,541.7	99.2	19.5
29	a1Lp	Low woodland, open low woodland, or sparse woodland: Mulga *Acacia aneura* and associated species.	57.8	172,082.6	170,747.6	99.2	11.2
82	e16Lr t3Hi	Low tree-steppe: Hummock grassland with scattered bloodwoods & snappy gum *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*.	3,237.7	2,177,573.9	2,165,224.2	99.4	12.0
Gascoyne bioregion (GAS03, Augustus IBRA sub-region)							
18	a1Li	Low woodland: Mulga *Acacia aneura* and associated species.	0.5	2,425,858.4	2,424,368.5	99.9	3.4
29	a1Lp	Low woodland, open low woodland or sparse woodland: Mulga *Acacia aneura* and associated species.	1,239.4	2,188,768.7	2,185,968.5	99.9	0.1
82	e16Lr t3Hi	Low tree-steppe: Hummock grassland with scattered bloodwoods & snappy gum *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*.	0.1	310.1	310.1	100.0	0.0

Data sourced from the '2018 Statewide Vegetation Statistics – Full report'; please note areas and percentages presented in table may now 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 it across much of its 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 level of threat and other information; the 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 6 ha of the survey area is situated on Ethel Creek Station pastoral lease. The local area is used for water reservation, pastoralism, transport and communications, waste treatment and disposal, mineral exploration, and mining activity.

Karijini National Park is the nearest conservation reserve to the survey area, located approximately 110 km to the north-west 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 field 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 and Gascoyne bioregions. 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
Threatened and Priority Fauna Database (Department of Biodiversity, Conservation and Attractions 2023a)	13/09/2023	Threatened and Priority fauna species	40 km radius from the survey area boundary
NatureMap (Department of Biodiversity, Conservation and Attractions 2023b)	07/09/2023	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 2023b)	05/09/2023	Matters of National Environmental Significance species	40 km radius from the survey area boundary
Birdlife Australia Birdata (Birdlife Australia 2023)	05/09/2023	Bird species	40 km radius from the survey area boundary
Atlas of Living Australia (Atlas of Living Australia 2023)	05/09/2023	Terrestrial vertebrate fauna and fauna of significance	40 km radius from the survey area boundary
Index of Biodiversity Surveys for Assessment (Department of Water and Environmental Regulation 2023)	13/09/2023	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 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 include:

- Western Ridge Project Paddy Bore Area Vertebrate Fauna Assessment (Biologic Environmental Survey 2022a)
- Western Ridge Pipelines Vertebrate Fauna Survey (Biologic Environmental Survey 2022b)
- Jimblebar Targeted Ghost Bat Survey (GHD Pty Ltd 2021)
- Western Ridge Targeted Vertebrate Fauna Survey (Biologic Environmental Survey 2020)

- Flora & Vegetation and Vertebrate Fauna Review, Mt Whaleback AML 7/244 (Onshore Environmental 2013)
- Orebody 37 Level 1 Vertebrate Fauna Assessment (Eco Logical Australia 2012)
- Orebody 35 and Western Ridge Vertebrate Fauna Survey (Biologic Environmental Survey 2011)
- Newman Power Line Corridor Level 1 Flora and Fauna Survey (Eco Logical Australia 2011)
- Eastern Ridge (OB23/24/25) Fauna Assessment (ENV Australia Pty Ltd 2011a)
- Newman Power Network, Level 2 Flora and Level 1 Fauna Survey (Biologic Environmental Survey 2009)
- Orebody 25 to Newman Fauna Assessment (ENV Australia Pty Ltd 2009)
- Flora & Vegetation Survey and Fauna Assessment, Mt Whaleback Mine Site (Onshore Environmental 2009)
- RGP5 Fauna Survey, Newman to Jimblebar Junction (Ecologia Environment 2008)
- Mount Whaleback Fauna Assessment Survey Phase III (ENV Australia Pty Ltd 2006)
- Baseline Biological & Soil Surveys and Mapping for the ML244SA West of the Fortescue River (Biota Environmental Sciences 2001).

BHP WAIO also provided spatial data for significant fauna species records located in proximity to the survey area.

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7420000

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7400000

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Newman

Survey Area

Previous Surveys

- Baseline Biological & Soil Surveys and Mapping for the ML244SA West of the Fortescue River (Biota Environmental Sciences, 2001)
- Eastern Ridge (OB23/24/25) Fauna Assessment (ENV Australia Pty Ltd, 2011)
- Flora & Vegetation and Vertebrate Fauna Review, Mt Whaleback AML 7/244 (Onshore Environmental, 2013)
- Jimblebar Targeted Ghost Bat Survey (GHD Pty Ltd, 2021a)
- Mount Whaleback Fauna Assessment Survey Phase III (ENV Australia Pty Ltd, 2006)
- Newman Power Network, Level 2 Flora and Level 1 Fauna Survey (Biologic Environmental Survey, 2009)
- Newman power line corridor Level 1 flora and fauna survey (Eco Logical Australia, 2011)
- Orebody 25 to Newman Fauna Assessment (ENV Australia Pty Ltd, 2009)
- Orebody 35 and Western Ridge Vertebrate Fauna Survey (Biologic Environmental Survey, 2011)
- Orebody 37 Level 1 Vertebrate Fauna Assessment (Eco Logical Australia, 2012)
- RGP5 Fauna Survey, Newman to Jimblebar Junction (Ecologia Environment, 2008)
- Western Ridge Project Paddy Bore Area Vertebrate Fauna Assessment (Biologic Environmental Survey, 2022)
- Western Ridge Targeted Vertebrate Fauna Survey (Biologic Environmental Survey, 2020)
- Western Ridge Pipelines Vertebrate Fauna Survey (Biologic, 2022b)

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

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

Scale: 1:100,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_Fig03_PrevSurv

3.1.3 Significant Fauna Likelihood of Occurrence Assessment

Significant vertebrate fauna species (inclusive of Threatened and Migratory MNES listed fauna, and DBCA Priority and otherwise Specially Protected 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 visit 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 actually occur in the survey area.

3.2 Field Survey

3.2.1 Survey Timing and Personnel

The field survey was undertaken by Astron Senior Zoologist Kady Grosser and Zoologist Sean Smithies from 26 September to 5 October 2023. Kady has over 10 years and Sean over five years of experience conducting vertebrate fauna surveys, specifically within the Pilbara region of Western Australia.

The survey was conducted under DBCA Fauna Taking (Biological Assessment) Licence (BA27000925) and Authorisation to Take or Disturb Threatened Species (Section 40 of the BC Act) (TFA 2324-0095), 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 the survey (Bureau of Meteorology 2023) (Figure 4). The annual rainfall recorded preceding the survey (250.2 mm) was 20.3% below the long-term mean of 313.9 mm recorded at Newman (Bureau of Meteorology 2023). Rainfall in the three months preceding the field survey was also below the long term mean for the same period (8.8 mm versus 35.3 mm) (Bureau of Meteorology 2023). The maximum daily temperatures during the field survey period were typical for September/October and ranged between 32.3°C and 38.1°C (Bureau of Meteorology 2023).

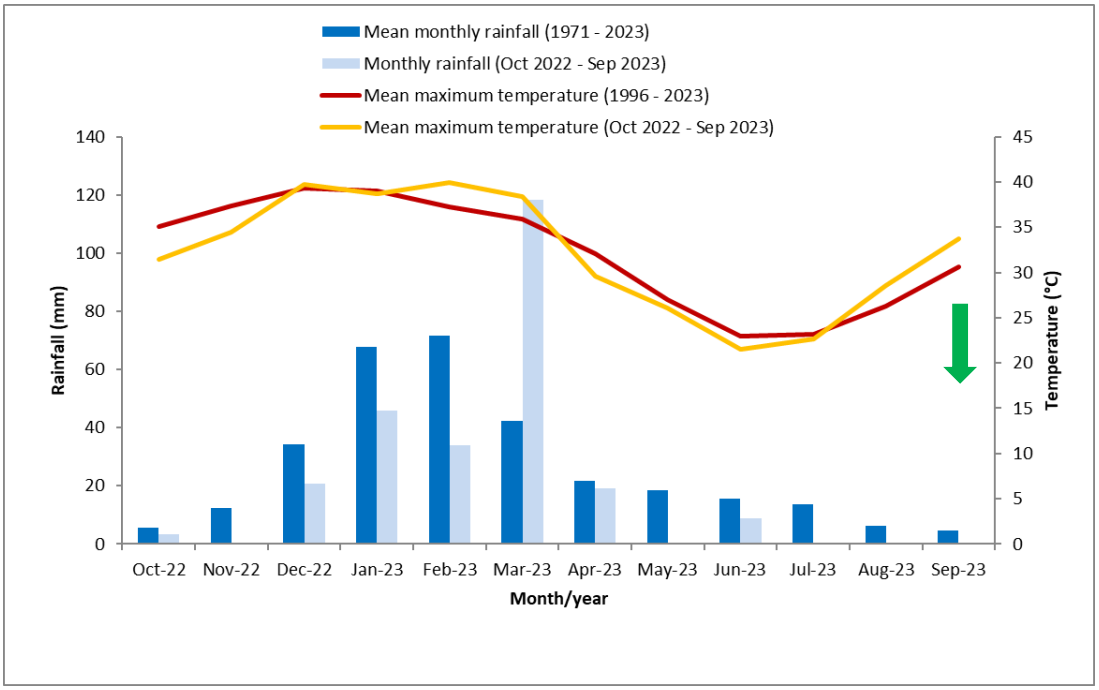

Figure 4: Newman Aero (station 007176) mean monthly rainfall (1971 - 2023), total recorded rainfall (October 2022 - September 2023), long-term mean monthly maximum temperatures (1996-2023), and mean monthly maximum temperatures (October 2022 - September 2023) (Bureau of Meteorology 2023). The green arrow indicates the field survey timing.

3.2.3 Vertebrate Fauna

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

3.2.3.1 Habitat Assessment and Mapping

Sixty-nine habitat assessments were conducted within the fauna habitats (excluding Cleared/ Disturbed) present in the survey area (Table C.1 and Figure C.1, Appendix C). This included 39 habitat-only assessment sites, and 30 habitat assessments completed at targeted fauna sampling sites (Table C.1 and Figure C.1, Appendix C). The following information was collected at each site:

- Location – coordinates recorded 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 and landform type.
- 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, soft soils, rocky outcrops, rock crevices, hollows, permanent, or semi-permanent water.
- Condition – habitat condition assessed based on the presence of anthropogenic (human-induced) disturbances, and using the conditions rating 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/sampling site.

The information derived from the fauna habitat assessments, available imagery, and on-ground traversal of the survey area 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, northern quoll, ghost bat, Pilbara leaf-nosed bat, night parrot, southern whiteface, grey falcon, and Pilbara olive python were ranked according to the criteria listed in Table B.8 (Appendix B).

3.2.3.2 Motion Sensitive Cameras

Motion sensitive cameras (Browning and Moultrie) were set at 16 locations for between three and five nights, with a combined trapping effort of 78 camera trap nights. The cameras were placed in prospective critical or supporting habitat, such as Major Drainage Line, Wetland, and Hillcrest/ Hillslope habitats aimed at targeting MNES species, particularly northern quoll and Pilbara olive python. Cameras were baited with a non-reward scent lure (fish oil in a plastic jar with holes in the lid). Camera locations are shown in Figures C.1.1 to C.1.3 and detailed in Table C.1 (Appendix C).

3.2.3.3 Acoustic Bat Surveys

Acoustic ultrahigh frequency equipment was used to record the presence of bats, in particular the Pilbara leaf-nosed bat and ghost bat. Song Meter 4 (SM4) acoustic recording devices (SM4BAT+ detectors) were set in eight locations to achieve broad coverage of the most likely foraging and roosting habitat across the survey area such as drainage lines, water features, and cave entrances (based on Bat Call WA 2021b, 2021a). The SM4BAT+ detectors were set for three nights, resulting in a total of 24 recording nights. The locations are depicted in Figures C.1.1 to C.1.3 and detailed in Table C.1 (Appendix C). The bat echolocation data collected in the field was analysed by Robert Bullen (Bat Call WA) for presence of all bat species.

3.2.3.4 Cave Assessments

Any potential roost caves identified within the survey area were assessed for suitability to provide roosting opportunities 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 the 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, and 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 2021a):

- 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.

Caves were also categorised as per definitions for Pilbara leaf-nosed bat usage according to Bat Call WA (2021b):

- Priority 1 – Permanent diurnal roosts
- Priority 2 – Non-permanent breeding roost
- Priority 3 – Transitory diurnal roosts
- Priority 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.

3.2.3.5 Night Parrot Surveys

Following the recent discovery of night parrot populations in Western Australia, the survey area falls within the area mapped as 'high priority for survey' for the night parrot according to DBCA's Interim Guidelines for Preliminary Surveys of night parrots in Western Australia (Department of Parks and Wildlife 2017). Passive acoustic surveys using Autonomous Recording Units (ARUs) were undertaken in the most prospective habitats considered as supporting or critical (Sand Plain habitat containing mature *Triodia*) that were available within the survey area (Department of Parks and Wildlife 2017).

The ARUs, recording one hour pre-sunset to one-hour post-dawn, were set at two locations for six nights each, resulting in a total of 12 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 (Leseberg et al. 2019). The ARU locations are depicted in Figures C.1.2 and C.1.3 and detailed in Table C.1 (Appendix C). The audio data collected in the field was analysed by Robert Bullen (Bat Call WA) for the presence of the night parrot.

3.2.3.6 Targeted Bilby Searches

Targeted searches for signs of bilbies were conducted using a combination of the 2 ha plot protocol and linear survey methods as outlined in DBCA guidelines (Department of Biodiversity Conservation and Attractions 2017). Two 2 ha plots (either 50 m x 400 m, or 100 m x 200 m), and two (1.5 km x 200 m) transect searches were traversed on foot, with personnel walking parallel transects spaced 20 to 30 m apart. Any evidence of bilbies including burrows, tracks, foraging signs, and scats was recorded, photographed, and GPS located. Locations of the targeted 2 ha plot sites and transect search locations are depicted in Figures C.1.2 and C.1.3 and detailed in Table C.1 (Appendix C).

3.2.3.7 Targeted Searches for Other Species

The aim of targeted searches was to identify areas of potential suitable habitat for significant fauna, such as caves and water sources, and secondary signs including tracks, scats, diggings, and burrows. Visual observations for significant fauna and opportunistic bird recordings were ongoing whilst moving through the survey area. Significant bird species such as peregrine falcon and grey falcon were targeted opportunistically while traversing though the survey area, which included listening for calls and periods of searching the skies for birds, or any suitably large trees or cliffs for evidence of nests. One night of nocturnal spotlighting was conducted throughout the survey area (six person hours).

Track logs were recorded using a handheld GPS and are shown in Figures C.1.1 to C.1.3 (Appendix C). 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 and mammals follows that of the Western Australian Museum Checklist of the Vertebrates of Western Australia (Western Australian Museum 2021) and birds follows the Australian Faunal Directory (Department of the Agriculture, Water and the Environment 2022).

3.4 Limitations

Following the completion of the desktop review and field survey, 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 considerations under EPA fauna survey guidance (Environmental Protection Authority 2020).

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

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. Kady Grosser has over 10 years of fauna surveying experience, and Sean Smithies has over five years.
(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 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 survey (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. Fifteen previous biological reports within close proximity or overlapping the Survey Area were reviewed for context. Adequate information was available from database searches and previous studies in the survey area and region.
(v) Proportion of task achieved Further work which might be needed?	No limitation	The survey scope was able to be completed and all sampling methods adequately employed.
(vi) Timing/weather/season/cycle	No limitation	Survey timing was considered optimal for sampling reptiles and mammals in the Pilbara (September – April).
(vii) Disturbances For example, fire, flood, accidental human intervention which affected results of 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.

Potential limitation	Degree of limitation	Statement regarding potential limitation
(xi) Completeness Was the relevant area fully surveyed?	No limitation	One small section of Breakaway/ Cliff habitat was unable to be surveyed due to mining activities in the vicinity and potential slope failure. As this area was on the opposing slope to active mining operations and highly disturbed, it is considered unlikely that it would be suitable for MNES or other significant species other than as non-critical supporting and/or foraging and dispersal habitat. All other target habitats considered suitable for MNES or other significant 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.
(xi) Remoteness and/or access problems	No limitation	There were no access problems with all the survey area able to be accessed by vehicle and on foot.
(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 Marshes, located approximately 67 km north of the survey area (Department of the Environment and Energy 2020a).

4.1.2 Vertebrate Fauna

The database searches indicated that 374 vertebrate fauna occur, or potentially occur, within a 70 km radius from the centre of the survey area (Table D.1 – D.4, Appendix D), including eight amphibian species, 116 reptile species, 205 bird species, and 45 mammal species (including nine introduced mammal species) (Birdlife Australia 2023, Department of Biodiversity, Conservation and Attractions 2023a, 2023b, Department of Climate Change, Energy, the Environment and Water 2023b).

Of these, 31 species are listed as MNES (specifically those listed as Threatened and Migratory species) comprising two reptile species, 24 bird species and five mammal species (Table E.1, Appendix E). A further eight species, comprising three reptile species, one bird species and four mammal species, are State-listed Priority or Otherwise Specially Protected species (Table E.1, Appendix E). Of the MNES species, three species have been previously recorded within the survey area, 16 species were considered to have a high likelihood of occurrence, two species were considered to have a moderate likelihood of occurrence, and 10 species were considered to have a low likelihood of occurrence within the survey area (Table E.1, Appendix E). 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 within the survey area recorded two MNES species; northern quoll and ghost bat, and one species of significance; western pebble-mound mouse. Surveys in the vicinity of the survey area recorded seven MNES species: northern quoll, ghost bat, Pilbara olive python, marsh sandpiper (*Tringa stagnatilis*) (MI; MI), common greenshank (*Tringa nebularia*) (MI; MI), common redshank (*Tringa totanus*) (MI; MI) and wood sandpiper (*Tringa glareola*) (MI; MI), and an additional four species of significance: long-tailed dunnart, western pebble-mound mouse, peregrine falcon, and Gane's blind snake (*Anilios ganei*) (P1) (Table 7).

Table 7: Summary of literature review results from surveys conducted within the vicinity of the survey area.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded [distance to current survey area]
Biologic Environmental Survey (2022a) – Western Ridge Paddy Bore Targeted Fauna Survey	Whaleback, Orebody 35; 513 ha	Targeted MNES and significant fauna survey	March 2021	Targeted northern quoll (*Dasyurus hallucatus*) camera transects and bilby (*Macrotis lagotis*) plot searches. Habitat assessments and avifauna census. Searches for secondary evidence (scat, diggings, burrows, nests). Song Meter 4 (SM4) echolocation and acoustic recorders to detect presence of significant species.	**MNES Fauna** **None recorded** Other Significant Fauna Western pebble-mound mouse (*Pseudomys chapmani*) [within current survey area]
Biologic Environmental Survey (2022b) – Western Ridge Pipelines Vertebrate Fauna Survey	Western Ridge area; 2,169 ha	Combined basic and targeted vertebrate fauna assessment	March 2021	Targeted northern quoll (*Dasyurus hallucatus*) camera transect and bilby (*Macrotis lagotis*) plot searches. Habitat assessment and mapping. Targeted searches and nocturnal surveys for significant species. Song Meter 4 (SM4) echolocation and acoustic recorders to detect presence of significant species. Pilbara olive python (*Liasis olivaceus barroni*) eDNA sampling of water pools.	**MNES Fauna** **Pilbara olive python (*Liasis olivaceus barroni*) (eDNA)** **[9.2 km south-west]** Other Significant Fauna Western pebble-mound mouse (*Pseudomys chapmani*) [5.6 km south-west]
GHD Pty Ltd (2021) – Jimblebar Targeted Ghost Bat Survey	Jimblebar; size not stated	Targeted ghost bat (*Macroderma gigas*) survey	May 2020	Habitat and roost assessments, in-situ time lapse infrared video camera surveys and SM4 echolocation recorders.	**MNES Fauna** **Ghost bat (*Macroderma gigas*)** **[27.5 km east]** **Pilbara olive python (*Liasis olivaceus barroni*) (scats)** **[27.7 km east]** Other Significant Fauna None recorded

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded [distance to current survey area]
Biologic Environmental Survey (2020) – Western Ridge Targeted Vertebrate Fauna Survey	Western Ridge, Whaleback; 33,970 ha	Targeted Matters of National Environmental Significance (MNES) and significant fauna survey	March 2020	Targeted northern quoll (*Dasyurus hallucatus*) camera transects. Habitat assessments and avifauna census. Searches for secondary evidence (scat, diggings, burrows, nests). SM4 echolocation and acoustic recorders to detect presence of significant species. Collection of eDNA from water pools.	**MNES Fauna** **Northern quoll (*Dasyurus hallucatus*) (old scats)** **[0.8 km south]** **Ghost bat (*Macroderma gigas*)** **[within current survey area]** **Pilbara olive python (*Liasis olivaceus barroni*)** **[1.7 km west]** Other Significant Fauna Western pebble-mound mouse (*Pseudomys chapmani*) [within current survey area] Peregrine falcon (*Falco peregrinus*) [3.1 km west]

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded [distance to current survey area]
Onshore Environmental (2013) – Flora & Vegetation and Vertebrate Fauna Review, Mt Whaleback AML 7/244	Mt Whaleback; 6,650 ha	Desktop review of fauna surveys undertaken within, and within the vicinity of Mt Whaleback	Desktop Review	Desktop Review	**MNES Fauna (desktop review)** **Northern quoll (*Dasyurus hallucatus*)** **Ghost bat (*Macroderma gigas*)** **Wood sandpiper (*Tringa glareola*)** **Common greenshank (*Tringa nebularia*)** **Marsh sandpiper (*Tringa stagnatilis*)** **Common redshank (*Tringa totanus*)** **Pilbara olive python (*Liasis olivaceus barroni*)** Other Significant Fauna (desktop review) Long-tailed dunnart (*Antechinomys longicaudata*) Western pebble-mound mouse (*Pseudomys chapmani*) Peregrine falcon (*Falco peregrinus*) Gane's blind snake (*Anilios ganei*)
Eco Logical Australia (2012)– Orebody 37 Level 1 Vertebrate Fauna Assessment	Orebody 37; 2,900 ha	Basic fauna survey	March/April 2012	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species, including the use of Anabat echolocation recorders and motion sensitive cameras, and active hand foraging for other vertebrates.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded [distance to current survey area]
Biologic Environmental Survey (2011) – Orebody 35 and Western Ridge Vertebrate Fauna Survey	Orebody 35; size not stated	Detailed fauna survey (dual-season)	March and August 2010	Six trapping sites consisting of pitfalls (PVC pipes and 20 L buckets), cage traps, funnel traps, and Elliott traps. Avifauna census and active foraging at each trapping site. Motion sensitive cameras, Anabat echolocation and acoustic recorders to detect presence of significant species. Targeted vertebrate fauna searches and habitat assessments.	**MNES Fauna** **Ghost bat (*Macroderma gigas*)** **[within survey area]** **Wood sandpiper (*Tringa glareola*)** **[0.3 km south]** **Marsh sandpiper (*Tringa stagnatilis*)** **[0.3 km south]** **Common greenshank (*Tringa nebularia*)** **[0.3 km south]** **Pilbara olive python (*Liasis olivaceus barroni*)** **[0.4 km south]** Other Significant Fauna Western pebble-mound mouse (*Pseudomys chapmani*) [within current survey area] Peregrine falcon (*Falco peregrinus*) [0.2 km west] Gane's blind snake (*Anilios ganei*) [0.3 km west]
Eco Logical Australia (2011)– Newman Powerline Corridor Level 1 Flora and Fauna Survey	Newman; 52 ha	Basic fauna survey in conjuction with flora and vegetation survey	August 2011	Habitat assessments, targeted and opportunistic searches of significant species, and active hand foraging for other vertebrates.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded [distance to current survey area]
ENV Australia Pty Ltd (2011b) - Mt Whaleback East Flora, Vegetation and Fauna Assessment	Mt Whaleback East; 703 ha	Basic fauna survey in conjunction with detailed flora and vegetation survey	January 2011	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species, including the use of Anabat echolocation recorders, and active hand foraging for other vertebrates.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded
ENV Australia Pty Ltd (2011a) – Eastern Ridge (OB23/24/25) Fauna Assessment	Eastern Ridge; 8,831 ha	Basic fauna survey	March 2011	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species, including the use of Anabat echolocation recorders, and active hand foraging for other vertebrates.	**MNES Fauna** **Pilbara olive python (*Liasis olivaceus barroni*)** **[6.3 km north]** Other Significant Fauna Western pebble-mound mouse (*Pseudomys chapmani*) [1.2 km north]
Biologic Environmental Survey (2009) – Newman Power Network, Level 2 Flora and Level 1 Fauna Survey	Mt Whaleback, Newman; size not stated	Basic fauna survey in conjunction with detailed flora and vegetation survey	July 2009	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species, including the use of Anabat echolocation recorders, and active hand foraging for other vertebrates.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded
ENV Australia Pty Ltd (2009) – Orebody 25 to Newman Fauna Assessment	Orebody 25, Newman; 603 ha	Basic fauna survey	July 2009	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species, and active hand foraging for other vertebrates.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Significant vertebrate fauna recorded [distance to current survey area]
Onshore Environmental (2009) – Flora & Vegetation Survey and Fauna Assessment, Mt Whaleback Mine Site	Mt Whaleback; 2,6098 ha	Basic fauna survey in conjunction with detailed flora and vegetation survey	June, 2009	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species, including the use of Anabat echolocation recorders, and active hand foraging for other vertebrates.	**MNES Fauna** **Northern quoll (*Dasyurus hallucatus*) – [unconfirmed report within survey area of a roadkill juvenile at access bridge to Whaleback mine site in 2007]** Other Significant Fauna None recorded
Ecologia Environment (2008) – RGP5 Fauna Survey. Newman to Jimblebar Junction	Newman, Jimblebar junction; size not stated	Basic fauna survey	November 2007	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species, including the use of Anabat echolocation recorders, and active hand foraging for other vertebrates.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded
ENV Australia Pty Ltd (2006) – Mount Whaleback Fauna Assessment Survey – Phase III	Mt Whaleback; Size not stated	Detailed fauna survey (single phase)	September 2006	Six trapping sites consisting of pitfalls (PVC pipes and 20 L buckets), cage traps, funnel traps, and Elliott traps. Avifauna census and active foraging at each trapping site. Motion sensitive cameras, Anabat echolocation and acoustic recorders to detect presence of significant species. Targeted vertebrate fauna searches and habitat assessments.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded
Biota Environmental Sciences (2001) - Baseline Biological & Soil Surveys and Mapping for ML244SA West of the Fortescue River.	Mt Whaleback; 17,060 ha	Basic fauna survey in conjunction with detailed flora, vegetation and soil survey	September 2000	Habitat assessments, avifauna census, targeted and opportunistic searches of significant species. Predominantly a review of previous reports in the area.	**MNES Fauna** **None recorded** Other Significant Fauna None recorded

4.2 Field Survey

4.2.1 Vertebrate Fauna Habitats

4.2.1.1 Fauna Habitats

Eleven broad habitat types were recorded in the survey area comprising, in decreasing order of extent: Stony Plain, Sandy/ Stony Plain, Undulating Low Hills, Hillcrest/ Hillslope, Drainage Area/ Floodplain, Major Drainage Line, Mulga Woodland, Wetland, Minor Drainage Line, Medium Drainage Line, and Breakaway/ Cliff. Fauna habitat types are summarised in Table 8 and mapped in Figures F.1.1 to F.1.3 (Appendix F). Areas of Cleared/ Disturbed habitat totalled 2,078.5 ha (39.7%) within the survey area, were in Disturbed to Highly Degraded condition, and have low to no fauna habitat value for significant vertebrate fauna.

The condition of habitats varied greatly, ranging from 'Good' to 'Excellent'. Large portions of the survey area were in or near active mining areas including pits, waste dumps, tailings ponds, and haul roads (Figure F.1.1, Appendix F). These areas were not accessed due to restrictions in entering these areas but are likely to have a 'Disturbed' or 'Poor' condition rating. There were also disturbances caused by livestock (cattle) grazing, erosion, weed invasion, and human activities, including rubbish/litter and roads/access tracks, throughout the survey area and across most habitat types.

A Category 2 ghost bat roost cave (CWER-03) is situated less than 1 km to the south of the survey area, as such all ghost bat foraging habitats within a 12 km radius of this cave are categorised as (elevated to) critical habitat (Bat Call WA 2021a, BHP 2023a).

Stony Plain habitat is widespread and common throughout the Pilbara region and, although there are some MNES species that may utilise it, they are not restricted to this habitat type. Significant fauna likely to occur in this habitat include the western pebble-mound mouse. This habitat generally had low vegetation complexity and microhabitat diversity and is considered to be of low value for MNES species. Old growth *Triodia* was present; however, areas of large hummocks suitable for night parrot were uncommon and unconnected across the survey area. Within the survey area, Stony Plain habitat represents both critical (within 12 km of Category 2 roost cave CWER-03) and supporting foraging habitat for ghost bat (outside of 12 km buffer) and supporting Pilbara leaf-nosed bat habitat, comprising approximately 18.4% (962.7 ha) of the survey area.

Sandy/ Stony Plain habitat is common throughout the Pilbara region and has low to moderate value to a wide spectrum of fauna species. Sandy/ Stony Plain represented some of the habitat within the survey area that is considered as supporting habitat for burrowing species such as the bilby, if they were to occur in the area. Within the survey area, Sandy/ Stony plain habitat represents critical (within 12 km of Category 2 roost cave) and supporting habitat for ghost bat (outside of 12 km buffer) and supporting habitat for Pilbara leaf-nosed bat and grey falcon. This habitat type comprised approximately 15.9% (831.2 ha) of the survey area and is well-represented both inside and outside of the survey area.

Undulating Low Hills habitat is widespread and common throughout the Pilbara region and, although there are some significant species that may utilise this habitat, they are unlikely to be restricted to it, with the possible exception of the western pebble-mound mouse. This habitat had low vegetation complexity and low diversity of microhabitats available for fauna species to exploit. The soils were stony and compact, reducing the potential opportunities for burrowing species. This habitat is considered to be of low value to a broad spectrum of fauna species including MNES. Within the survey area, Undulating Low Hills habitat represents supporting habitat for bilby and Pilbara leaf-nosed bat

with limited value to other targeted Pilbara MNES species likely to occur. Approximately 14.5% (760.2 ha) of the survey area consisted of Undulating Low Hills.

Hillcrest/ Hillslope habitat is common and widespread throughout the Pilbara, and is characterised by large, open, rocky areas with open grasslands. This habitat had low vegetation complexity and low diversity of microhabitats; however, five caves were identified within this habitat within the survey area. Overall, it is considered to be of moderate to low value as it provides limited microhabitats for fauna to exploit, and the stony, compact soil reduces potential opportunities for burrowing species. Hillcrest/ Hillslope habitat provides supporting habitat (roosting) for ghost bat and Pilbara leaf-nosed bat which may opportunistically utilise the caves within this habitat, and for Pilbara olive python and northern quoll which may traverse and forage within these habitats on occasion. Other significant species, such as the western pebble-mound mouse and Gane's blind snake, may also utilise this habitat. Hillcrest/ Hillslope habitat comprised approximately 4.7% (245.5 ha) of the survey area.

Drainage Area/ Floodplain habitat is of low to moderate value to a wide spectrum of fauna species. There were grasslands and soft soils associated with this habitat type within the survey area, creating microhabitats for some reptile and marsupial species, and potential habitat for MNES species, such as bilby, night parrot, southern whiteface, and grey falcon, if they were to occur in the area. Drainage Area/ Floodplain habitat within the survey area was variously impacted by buffel grass. Drainage Area/ Floodplain habitat within the survey area represents supporting habitat for ghost bat (as outside 12 km buffer from CWER-03) and Pilbara leaf-nosed bat. This habitat type comprised approximately 2.9% (153.5 ha) of the survey area and is well-represented both inside and outside of the survey area.

Major Drainage Line habitat consists of large drainage channels over 10 m in width, typically lined with mature *Eucalyptus/Corymbia* spp., and is considered to be of moderate value to a wide spectrum of fauna species, but of high value to MNES species including Pilbara olive python and grey falcon (if it were to occur in the area). Within the survey area, buffel grass was present in the ground storey vegetation, which may reduce floral diversity, increase fire fuel loading, and indirectly displace native fauna, particularly herpetofauna (Schlesinger et al. 2020). Major Drainage Line habitat exhibited a high diversity of microhabitats with some tree hollows, woody debris (logs and leaf litter) and crevices present. One water feature was recorded within the Major Drainage Line habitat with this likely to be temporary remnants following large rainfall events. Major Drainage Line habitat within the survey area represents critical habitat for Pilbara olive python, supporting habitat for Pilbara leaf-nosed bat, and both critical (within 12km of Category 2 roost cave) and supporting ghost bat habitat. Major Drainage Line habitat comprised approximately 1.0% (51.5 ha) of the survey area.

Mulga Woodland habitat is common throughout the Pilbara and largely consists of stands of Mulga vegetation over clay or stony substrates. This habitat exhibited a moderate diversity of microhabitats, with some logs, woody debris, and some soft soil for burrowing. Mulga Woodland is considered as high value for one MNES species, southern whiteface (if it were to occur in the area), as it includes critical habitat features such as low tree densities and a herbaceous understorey litter cover, which provide essential foraging habitat, and living and dead trees with hollows and crevices, which are essential for roosting and nesting (Department of Climate Change, Energy, the Environment and Water 2023a). Mulga Woodland is considered of moderate value for MNES species bilby (if it were to occur), as these areas contain soft soils for digging, with opportunities to dig and forage at the base of termite mounds and expose the roots of wattle and other shrubs that have root-dwelling invertebrate larvae (Pavey 2006b, Commonwealth of Australia 2019). Within the survey area, Mulga Woodland habitat represents critical (within 12 km of Category 2 roost cave) and supporting ghost bat habitat, supporting habitat for Pilbara leaf-nosed bat and limited value to other target Pilbara MNES species likely to occur. Approximately 0.8% (42.9 ha) of the survey area consisted of Mulga Woodland.

Wetland habitats differ from permanent/semi-permanent pools as they are generally a larger water body that supports their own distinct ecosystem and aquatic fauna assemblages (waterfowl, fish etc.). Due to their rarity in the Pilbara region, these habitats generally have elevated significance. Depending on the surrounding habitat, these areas can be of importance to MNES species, such as northern quoll and Pilbara olive python (if surrounded by rocky habitats) and to some Migratory listed bird species. The Wetland habitat of the survey area represents critical habitat for Pilbara olive python, and supporting habitat for northern quoll, ghost bat, Pilbara leaf-nosed bat, and some migratory bird species. Wetland habitat within the survey area consisted of the most south-western reaches of Ophthalmia Dam (Figure F.1.3, Appendix F) and comprised approximately 0.8% (41.6 ha) of the survey area.

Minor Drainage Line habitat is a commonly recorded habitat for the Pilbara region and considered to be of low to moderate value to a wide spectrum of fauna species. Minor Drainage Lines within the survey area typically consisted of small drainage channels less than 10 m wide, with thick *Acacia* sp. growth along banks. A moderate diversity of microhabitats was exhibited, with tree hollows and woody debris (logs and leaf litter) present. Buffel grass was present in the ground storey vegetation. Minor Drainage Line habitat within the survey area represents critical (all within 12 km of Category 2 roost cave) ghost bat habitat, and supporting habitat for Pilbara olive python, northern quoll and Pilbara leaf-nosed bat due to foraging and dispersal value. Minor Drainage Line habitat comprised approximately 0.7% (34.0 ha) of the survey area.

Medium Drainage Line habitat is a commonly recorded habitat for the Pilbara region and considered to be of low to moderate value to a wide spectrum of fauna species. Medium Drainage Lines within the survey area typically consisted of small drainage channels with eucalypt woodlands growing in the riparian zone. A moderate diversity of microhabitats was exhibited with some seasonal presence of pools, tree hollows and woody debris (logs and leaf litter). Medium Drainage Line habitat within the survey area represents supporting habitat for Pilbara olive python, northern quoll, ghost bat (as outside 12 km buffer from CWER-03) and Pilbara leaf-nosed bat. Buffel grass was present in the ground story vegetation, reducing floral diversity. Medium Drainage Line habitat comprised approximately 0.4% (18.3 ha) of the survey area.

Breakaway/ Cliff habitat is a common feature of the Pilbara but, because they tend to be narrow, linear features, they represent only a small proportion of the total land area. This habitat type is typically associated with the crests of Hillcrest/ Hillslope habitats and often contain microhabitats such as crevices, overhangs, and caves that may provide denning, roosting, and sheltering opportunities, and represent critical habitat to northern quoll, Pilbara leaf-nosed bat, ghost bat and Pilbara olive python. However, the Breakaway/ Cliff habitat within the survey area was located on the opposing side of an active mining area (Figure F.1.1, Appendix F) and it is highly likely that due to the heavy disturbance, this habitat would only provide limited (i.e. non-critical) supporting habitat for MNES species Pilbara leaf-nosed bat (roosting and foraging), ghost bat (roosting), and Pilbara olive python (denning and forging). Breakaway/ Cliff habitat comprised approximately 0.2% (9.5 ha) of the survey area.

Table 8: Fauna habitats recorded within the survey area.

Fauna habitat	Extent in survey area (proportion)	Broad habitat description	Microhabitats	Sites	Habitat condition	Significant fauna habitat suitability for species likely to occur	Representative photo
Stony Plain	962.7 ha (18.4%)	Broad flat low-lying plains to undulating plain in soft loamy soils. Scattered *Acacia* stands over *Triodia* hummock and tussock grassland.	• Logs • Tree hollows • Crevices • Thick undergrowth • Soft soil (burrows) • Old *Triodia* • Leaf litter	• OB35-BAT04 • OB35-BTS01 • OB35-HA05, 06, 07, 09, 12, 22, 26, 32	Good to Excellent	**MNES critical habitat** ghost bat (*Macroderma gigas*) - foraging where proximal (<12 km) to roosting habitat **MNES supporting habitat** ghost bat (*Macroderma gigas*) - foraging Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) – foraging **Other significant species** Western pebble-mound mouse (*Pseudomys chapmani*) - foraging	

Fauna habitat	Extent in survey area (proportion)	Broad habitat description	Microhabitats	Sites	Habitat condition	Significant fauna habitat suitability for species likely to occur	Representative photo
Sandy/ Stony Plain	831.2 ha (15.9%)	Stands of *Acacia* or other shrubs over *Triodia* hummock grassland over clay or stony substrates.	• Logs • Tree hollows • Thick undergrowth • Crevices • Soft soil (burrows) • Old *Triodia* • Leaf litter	• OB35-AUDIO01, 02 • OB35-BP01, 02 • OB35-BTS02 • OB35-HA10, 11, 15, 20, 30	Good to Excellent	**MNES critical habitat** ghost bat (*Macroderma gigas*) - foraging where proximal (<12 km) to roosting habitat **MNES supporting habitat** ghost bat (*Macroderma gigas*) - foraging Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) – foraging	
Undulating Low Hills	760.2 ha (14.5%)	Low stony hills and slopes with dissected valleys and drainage on stony soils. Scattered *Acacia* and *Hakea* spp. over low *Triodia* hummock grassland.	• Crevices • Logs • Tree hollows • Old *Triodia* • Thick undergrowth • Rock piles • Leaf Litter	• OB35-BAT06 • OB35-HA16, 17, 29, 33	Good to Excellent	**MNES supporting habitat** Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) – foraging **Other significant species** Gane's blind snake (*Anilios ganei*) - foraging Western pebble-mound mouse (*Pseudomys chapmani*) - foraging and shelter	

Fauna habitat	Extent in survey area (proportion)	Broad habitat description	Microhabitats	Sites	Habitat condition	Significant fauna habitat suitability for species likely to occur	Representative photo
Hillcrest/ Hillslope	245.5 ha (4.7%)	Characterised by large open rocky areas with open grasslands, predominantly *Triodia* hummock grasslands with emergent *Eucalyptus* trees, *Acacia* stands and mixed shrubs.	• Caves • Overhangs • Crevices • Logs • Tree hollows • Rock piles • Thick undergrowth • Old *Triodia* • leaf litter	• OB35-BAT02 • OB35-CAM01 • OB35-HA03, 04, 13, 19, 21, 23, 36	Very Good to Excellent	**MNES supporting habitat** ghost bat (*Macroderma gigas*) – roosting (limited) Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) – roosting (limited) Pilbara olive python (*Liasis olivaceus barroni*) - foraging and dispersal **Other significant species** Gane's blind snake (*Anilios ganei*) - foraging and shelter Western pebble-mound mouse (*Pseudomys chapmani*) - foraging and shelter	
Drainage Area/ Floodplain	153.5 ha (2.9%)	Flat plains next to drainage lines, often grasslands and or woodlands with soft/clay soils. Often mixed shrubland with emergent *Eucalyptus/ Corymbia* sp. over *Triodia* hummock grassland.	• Logs • Tree hollows • Thick undergrowth • Soft soil (burrows) • Old *Triodia* • Pools • Semi-permanent water • Leaf litter	• OB35-HA25, 28, 38	Good to Very Good	**MNES supporting habitat** ghost bat (*Macroderma gigas*) - foraging Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) - foraging	

Fauna habitat	Extent in survey area (proportion)	Broad habitat description	Microhabitats	Sites	Habitat condition	Significant fauna habitat suitability for species likely to occur	Representative photo
Major Drainage Line	51.5 ha (1.0%)	Large drainage channel over 10 m in width. Rocky substrate often washed away. Presence of mature *Eucalyptus/ Corymbia* trees over mixed shrubs and tussock and *Triodia* spp. grasses.	• Logs • Tree hollows • Crevices • Thick undergrowth • Soft soil (burrows) • Pools • Semi-permanent water • Rock piles • Leaf litter	• OB35-BAT01, 03 • OB35-NQ1.1-5, 3.1-5	Poor to Very Good	**MNES critical habitat** Pilbara olive python (*Liasis olivaceus barroni*) - foraging and dispersal ghost bat (*Macroderma gigas*) - foraging where proximal (<12 km) to roosting habitat **MNES supporting habitat** ghost bat (*Macroderma gigas*) - foraging Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) - foraging **Other significant species** peregrine falcon (*Falco peregrinus*) - foraging	

Fauna habitat	Extent in survey area (proportion)	Broad habitat description	Microhabitats	Sites	Habitat condition	Significant fauna habitat suitability for species likely to occur	Representative photo
Mulga Woodland	42.9 ha (0.8%)	Stands of mulga over clay or stony substrate.	• Logs • Tree hollows • Soft soil (burrows) • Rock piles • Thick undergrowth • Old *Triodia* • Leaf litter	• OB-BAT07 • OB35-HA08, 14, 24, 31, 35, 37	Good to Excellent	**MNES critical habitat** ghost bat (*Macroderma gigas*) - foraging where proximal (<12 km) to roosting habitat **MNES supporting habitat** ghost bat (*Macroderma gigas*) - foraging Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) - foraging	
Wetland	41.6 ha (0.8%)	Permanent water, often reeds present. Presence of large *Eucalyptus and Corymbia* spp.	• Logs • Tree hollows • Crevices • Soft soil (burrows) • Permanent water • Pools • Leaf litter	• OB35-BAT05 • OB35-NQ2.1-5	Very Good	**MNES critical habitat** Pilbara olive python (*Liasis olivaceus barroni*) - foraging and breeding **MNES supporting habitat** ghost bat (*Macroderma gigas*) - foraging Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) – foraging Migratory bird species - foraging	

Fauna habitat	Extent in survey area (proportion)	Broad habitat description	Microhabitats	Sites	Habitat condition	Significant fauna habitat suitability for species likely to occur	Representative photo
Minor Drainage Line	34.0 ha (0.7%)	Small drainage channel less than 10 m in width. Often with thick *Acacia* growth along banks and is less likely to support surface water or long following rainfall.	• Logs • Tree hollows • Thick undergrowth • Soft soil (burrows) • Old *Triodia* • Leaf litter	• OB35-HA01, 02, 27, 34	Good to Excellent	**MNES critical habitat** ghost bat (*Macroderma gigas*) - foraging where proximal (<12 km) to roosting habitat **MNES supporting habitat** Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) - foraging Pilbara olive python (*Liasis olivaceus barroni*) - foraging and dispersal	
Medium Drainage Line	18.3 ha (0.4%)	Medium drainage channel often with thick *Acacia* growth along banks.	• Logs • Tree hollows • Crevices • Thick undergrowth • Soft soil (burrows) • Semi-permanent water • Leaf litter	• OB35-BAT08 • OB35-HA39	Good to Very Good	**MNES supporting habitat** ghost bat (*Macroderma gigas*) - foraging Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) - foraging Pilbara olive python (*Liasis olivaceus barroni*) - foraging and dispersal **Other significant species** peregrine falcon (*Falco peregrinus*) - foraging	

Fauna habitat	Extent in survey area (proportion)	Broad habitat description	Microhabitats	Sites	Habitat condition	Significant fauna habitat suitability for species likely to occur	Representative photo
Breakaway / Cliff	9.5 ha (0.2%)	Exposed rock formations often associated with Hillcrest/ Hillslope, Gorge/ Gully, or Drainage lines.	• Overhangs • Rock Piles	• No sites	Degraded to Highly Degraded	**MNES supporting habitat** ghost bat (*Macroderma gigas*) – roosting (limited) Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) – roosting Pilbara olive python (*Liasis olivaceus barroni*) - foraging and dispersal **Other significant species** Gane's blind snake (*Anilios ganei*) - foraging peregrine falcon (*Falco peregrinus*) - breeding and foraging	N/A
Cleared/ Disturbed	2,078.5 ha (39.7%)	Areas where the natural vegetation and microhabitats have been disrupted.	• None present	• No sites	Degraded to Highly Degraded	**None**	N/A

Note: MNES = Matters of National Environmental Significance. Habitat suitability (critical and supporting habitat) evaluation based on BHP (2023a) and Table B.8 (Appendix B).

4.2.1.2 Habitat Features

None of the fauna habitats within the survey area were synonymous with listed Priority Ecological Communities or Threatened Ecological Communities relating to terrestrial fauna in the Pilbara region (Department of Biodiversity, Conservation and Attractions 2023c).

Five natural caves were recorded within the survey area (Figure F.2 and Table F.1, Appendix F), all of which were assessed as Category 4 (opportunistic use) caves for both ghost bat and Pilbara leaf-nosed bat. One cave, CWER-02, was previously assessed with ghost bat scats present on multiple occasions (Biologic Environmental Survey 2011, 2020); however, no ghost bat scat was present on revisitation during the current survey, and no calls were identified on an echolocation unit placed at the cave opening. One cave, CWBK-04, was previously surveyed by ENV (2011) (site AnaBat 4) and no ghost bat and Pilbara leaf-nosed bat calls or other evidence were recorded. The other three caves are assumed to be known but no prior assessment information was available. No current evidence of ghost bat or Pilbara leaf-nosed bat usage was noted in any of the identified caves. Microbats and/or microbat scats were present in all caves.

Two water features were identified within the survey area (Figure F.2 and Table F.1, Appendix F), with one of these considered to be of high significance. This feature was a large body of water comprising of a section of Ophthalmia dam. This large water body has created a Wetland habitat, which is considered to be of high importance to a suite of fauna species including MNES species like Pilbara olive python (critical habitat) and a number of migratory birds (supporting habitat). The second water feature was located within a Major Drainage Line and was a localised pool, likely to be semi-permanent and containing remnant water from the last major rainfall.

4.2.2 Vertebrate Fauna Species

One-hundred and one vertebrate fauna species were recorded within the survey area during the current survey (Table 9). A complete list of recorded species is provided in Tables D.1 to D.4 (Appendix D). The following sections summarise results for each major taxonomic group sampled.

Table 9: Number of vertebrate fauna species recorded during the survey.

Fauna taxonomic group	No. of species recorded	No. of MNES species recorded	No. of BC Act or DBCA Priority fauna species recorded	No. of introduced species recorded
Amphibians	0	0	0	0
Reptiles	8	0	0	0
Birds	77	0	0	0
Mammals	16	0	0	5
Total	**101**	**0**	**0**	**5**

4.2.2.1 Herpetofauna

No amphibian species were recorded during the survey.

Eight reptile species were recorded during the survey, comprising three dragons, two cosmopolitan geckos, one varanid, one diplodactylid gecko, and one elapid (Table D.2, Appendix D). The low number of reptiles is not unexpected given the survey focused on the presence/absence of MNES and other significant species without the use of pitfall trapping implemented in Detailed fauna assessments. No MNES or other significant reptile species were recorded during the survey.

4.2.2.2 Birds

Seventy-seven bird species were recorded during the survey. The most speciose family was Anatidae (ducks) with six species, followed by both Meliphagidae (honeyeaters) and Columbidae (pigeons) with five species, and Adreidae (egrets) with four species (Table D.3, Appendix D). The relatively high level of bird diversity can be attributed to the expansive wetland region near Ophthalmia Dam that overlaps the eastern part of the survey area. No MNES or other significant bird species were recorded during the survey.

4.2.2.3 Mammals

Sixteen species of mammal were recorded during the survey, including five introduced species: cat (**Felis catus*), dog/dingo (**Canis familiaris*), European cattle (**Bos taurus*), house mouse (**Mus musculus*), and rabbit (**Oryctolagus cuniculus*) (Table D.4, Appendix D). Eight bat species were identified from ultrasonic acoustic recordings within the survey area. No MNES or other significant mammal species were recorded during the survey.

4.2.3 Significant Species Recorded

No MNES or other significant vertebrate fauna species were recorded within the survey area during the current survey. The locations of previously recorded MNES and significant species are shown in Figure H.1 (Appendix H).

4.2.4 Significant Species Likely to Occur in the Survey Area

A summary of the home range, habitat availability, and likelihood of occurrence for the MNES and other significant species identified as occurring (previously recorded), or potentially occurring (high or moderate likelihood) within the survey area is presented in Table 10. Table B.8 (Appendix B) describes the habitat suitability attributes (critical habitat, supporting habitat, and limited foraging and dispersal habitat) used for MNES species.

4.2.4.1 High Likelihood of Occurrence

Ten species not recorded in the survey area during the current survey are considered to have a high post-survey likelihood of occurrence (Table E.1, Appendix E). Of these, seven species are MNES species.

Pilbara olive python (*Liasis olivaceus barroni*) (VU)

The Pilbara olive python prefers escarpments, deep gorges, water holes, and rocky piles associated with permanent pools in rocky areas in the ranges of the Pilbara region (Pearson 1993, Wilson and Swan 2017). Microhabitat preferences of the Pilbara olive python are under rock piles, on top of rocks or under spinifex (Tutt et al. 2004). Individuals spend the cooler months within caves and rock crevices away from water sources. In the warmer summer months, the pythons are found to move around widely, usually in close proximity to water and rocky outcrops (Wilson and Swan 2017).

Within the survey area, this species is most likely to be found within Wetland and Major Drainage Line habitats, particularly around water sources and rocky outcrops that provide denning sites and ambush locations. The pools, thick vegetation, and log piles/woody debris found in these areas may act as refuges and provide shelter and ambush locations. There were eight previous records of this species from within 20 km of the survey area, including one recent record within 5 km (Department of Biodiversity, Conservation and Attractions 2023a), and this species was previously recorded on six surveys within the vicinity of the current survey area (Biologic Environmental Survey 2011, 2020,

2022b, ENV Australia Pty Ltd 2011a, Onshore Environmental 2013, GHD Pty Ltd 2021). Approximately 93 ha (2%) of the survey area, consisting of Major Drainage Line and Wetland habitat, was considered critical habitat for the Pilbara olive python (Figure G.1, Appendix G).

Medium Drainage Line, Minor Drainage Line, Hillcrest/ Hillslope, and Breakaway/ Cliff habitats within the survey area were considered to be supporting habitat, covering approximately 307 ha (6%). Note, the Breakaway/ Cliff habitat present within the survey area (approximately 0.2% (9.5 ha)) was associated with Disturbed habitat along the opposing face of an active mining area and was considered to provide limited value to the species. The remaining 4,829 ha (92%) of the survey area, consisting of Drainage Areas/ Floodplain, Mulga Woodland, Sandy/ Stony Plain, Stony Plain, Undulating Low Hills and Cleared/ Disturbed habitats, was considered to provide limited foraging and dispersal habitat (Figure G.1, Appendix G).

Ghost bat (*Macroderma gigas*) (VU)

The ghost bat is found across 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 2021a). Critical habitat for ghost bat comprises of Gorge/ Gully and Breakaway/ Cliff habitats with the presence of maternity and/or diurnal roost caves, and foraging habitat within 12 km of such caves (Bat Call WA 2021a) (Table B.8, Appendix B).

Whilst no diurnal roost caves or critical roosting habitat was present within the survey area, five Category 4 caves (potential feed caves) were identified during the survey (Figure F.2, Appendix F). Five scats were identified within one of these caves (CWER-02) during a previous survey, with a follow up assessment also yielding two fresh scat records (Biologic Environmental Survey 2011, 2020); however, no further scats or evidence of ghost bat usage was identified during the current survey. A Category 2 cave (CWER-03) is situated less than 1 km to the south of the survey area, as such all foraging habitats within a 12 km radius of this cave are categorised as critical habitat (Bat Call WA 2021a, BHP 2023a). Ghost bats have relatively broad foraging habits, ranging across 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 2021a).

Two-hundred and fifty-nine previous records within 20 km of the survey area were outlined in DBCA's Threatened and Priority database search (Department of Biodiversity, Conservation and Attractions 2023a). Very High Frequency and GPS/satellite tracking studies have shown that ghost bats forage up to 12 km from their diurnal roosts (Augusteyn et al. 2018), with round trips of up to 30 km being recorded (Bat Call WA 2021a). No evidence of ghost bat usage was recorded in any cave during the survey, and no calls were detected on the ARUs. However, due to the previous records within, and in the vicinity of, the survey area, and the presence of critical and supporting foraging and dispersal habitat, this species has a 'high' likelihood of occurrence.

Approximately 821.6 ha (15.7%) of the survey area was identified as critical foraging habitat consisting of Major Drainage Line, Minor Drainage Line, Mulga Woodland, Sandy/ Stony Plain and Stony Plain habitats within a 12 km radius of CWER-03 (Figure G.2, Appendix G). Approximately 1,569.15 ha (30%) of the survey area was identified as supporting habitat for the ghost bat, consisting of Breakaway/ Cliff, Drainage Area/ Floodplain, Hillcrest/ Hillslope, Medium Drainage Line and Wetland habitats, and the Major Drainage Line, Minor Drainage Line, Mulga Woodland, Sandy/ Stony Plain and Stony Plain foraging habitats outside of the 12 km radius of CWER-03 (Figure G.2, Appendix G).

The remaining approximately 2,839 ha (54%) of the survey area was considered to provide limited foraging and dispersal habitat, consisting of Undulating Low Hills and Cleared/ Disturbed habitats (Figure G.2, Appendix G).

Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) (VU)

The Pilbara leaf-nosed bat roosts in deep, warm, humid caves or rock cracks near water pools, and forages in a range of habitats, including along watercourse and over *Triodia* grasslands (Bat Call WA 2021b). All five identified caves within the survey area were considered Category 4 (potential nocturnal refuge) caves for this species. Over 300 previous records within 20 km of the survey area were detailed on database search returns, including three records from 2022 within 5 km of the survey area (Department of Biodiversity, Conservation and Attractions 2023a). Due to the proximate records and the presence of supporting foraging and dispersal habitat within the survey area, this species has a 'high' likelihood of occurrence.

No critical habitat was identified for this species within the survey area. The Pilbara leaf-nosed bat requires deep, humid, climatically stable caves for diurnal and maternal roost sites, which are typically associated with Gorge/ Gully and Breakaway/ Cliff habitats (Bat Call WA 2021b). While Breakaway/ Cliff habitat was present within the survey area, no suitable (Category 1-3) caves were identified. Moreover, the highly disturbed nature of this habitat type within the survey area would likely discourage usage from this species.

The Pilbara leaf-nosed bat is known to forage across a wide variety of habitats, typically along vegetated gullies and ridgelines, water courses and drainage lines, and across plains and low hills with complex vegetation structure (Bat Call WA 2021b). As such, the entire survey area, excluding Cleared/ Disturbed areas (approximately 2,079 ha (40%)), was considered as supporting habitat for the Pilbara leaf-nosed bat (Figure G.3, Appendix G).

Common sandpiper (*Actitis hypoleucos*), wood sandpiper (*Tringa glareola*), common greenshank (*Tringa nebularia*) and marsh sandpiper (*Tringa stagnatilis*) (MI)

The common sandpiper (*Actitis hypoleucos*) (MI; MI), wood sandpiper, common greenshank and marsh sandpiper are all widespread migrant birds, typically arriving from the mid-latitudes of Asia from August and departing around March. Although not particularly common, these species are often found utilising sheltered habitats, such as inland lakes, swamps, and reservoirs, as well as sewage ponds. All four species are represented by recent records within 5 km of the survey area (Department of Biodiversity, Conservation and Attractions 2023a) and are likely to utilise habitats present within Wetland areas. Due to the proximate recent records, presence of suitable foraging Wetland habitat (approximately 42 ha (<1%)), and a tendency for these species to utilise inland water sources, the common sandpiper, wood sandpiper, common greenshank, and marsh sandpiper were assessed as having a 'high' likelihood of occurrence.

Gane's blind snake (*Anilios ganei*) (P1)

Gane's blind snake is often poorly collected in vertebrate fauna surveys. This species has been associated with moist gorges and gullies (Wilson and Swan 2017) but potentially occurs over a wide range of other stony habitats. Given its cryptic fossorial habit, this species is rarely encountered. There were three records from within 5 km of the survey area (Department of Biodiversity, Conservation and Attractions 2023a) and this species was previously recorded on two surveys within the vicinity of the current survey area (Biologic Environmental Survey 2011, Onshore Environmental 2013). Potential habitat for this species, including Breakaway/ Cliff and Hillcrest/ Hillslope, is present throughout the survey area (approximately 255 ha (5%)) (Figure F.1, Appendix F). The Breakaway/ Cliff habitat present within the survey area (approximately 0.2% (9.5 ha)) was associated with Disturbed habitat along the opposing face of an active mining area and was considered to provide limited value for the species.

Peregrine falcon (*Falco peregrinus*) (OS)

The peregrine falcon occurs throughout Australia and in most habitat types, with the exception of treeless and waterless desert, and dense forests (Birdlife Australia 2012). The peregrine falcon utilises ledges, cliff faces, and large hollows/broken spouts of trees for nesting. It occasionally uses the abandoned nests of other birds of prey (Johnstone and Storr 1998). The closest record outlined in the database searches occurs within 5 km of the survey area (Department of Biodiversity, Conservation and Attractions 2023a) and this species was previously recorded on three surveys within the vicinity of the current survey area (Biologic Environmental Survey 2011, 2020, Onshore Environmental 2013). Potential habitat, including Major Drainage Line and Breakaway/ Cliff, for this species is present throughout the survey area (approximately 61 ha (1%)) (Figure F.1, Appendix F).

Western pebble-mound mouse (*Pseudomys chapmani*) (P4)

The western pebble-mound mouse is endemic to the Pilbara and confined to the central and eastern Pilbara in Western Australia. They are found on stony hillsides with hummock grassland, and shelter in complex burrow systems under a mound, which they construct on the surface using pebbles collected in the vicinity (Menkhorst and Knight 2011). There were over 50 records from within 20 km of the survey area (Department of Biodiversity, Conservation and Attractions 2023a), and this species was previously recorded on five surveys overlapping or within the vicinity of the current survey area (Biologic Environmental Survey 2011, 2020, 2022a, ENV Australia Pty Ltd 2011a, Onshore Environmental 2013). This species is considered as having a 'high' likelihood of occurrence due to these proximate records and the presence of suitable Stony Plain, Undulating Low Hills and Hillcrest/ Hillslope habitats within the survey area (approximately 1,968 ha (38%)).

4.2.4.2 Moderate Likelihood of Occurrence

Four species not recorded in the survey area during the current survey are considered to have a moderate post-survey likelihood of occurrence (Table E.1, Appendix E). Three of these species are MNES species.

Northern quoll (*Dasyurus hallucatus*) (EN)

The northern quoll is common in a range of habitats within its distribution, including rocky habitats and watercourses. One record of this species was outlined in a previous report, with this (unconfirmed) record being attributed to a prior reporting of a deceased individual found on the road within the Mt Whaleback mining footprint (Onshore Environmental 2009). Moreover, old (> 12 months) scats were identified in a cave less than 5 km to the west of the current survey area (Biologic Environmental Survey 2020). These records represent some of the most southern records of this species, with the nearest database records located over 20 km to the north-west of the survey area (Department of Biodiversity, Conservation and Attractions 2023a). Critical habitat for northern quoll typically consists of rocky environments of high relief supporting diverse microhabitats for foraging and denning, including caves, crevices, and rock piles. No critical habitat for northern quoll was identified within the survey area (Figure G.4, Appendix G).

Approximately 400 ha (8%) of the survey area, comprising of Breakaway/ Cliff, Hillcrest/ Hillslope, Major Drainage Line, Medium Drainage Line, Minor Drainage Line, and Wetland habitats, was considered supporting habitat (Figure G.4, Appendix G).

The remaining approximately 4,829 ha (92%) of the survey area, consisting of Drainage Area/ Floodplain, Mulga Woodland, Sandy/ Stony Plain, Stony Plain, Undulating Low Hills, and Cleared/

Disturbed habitats, was considered to provide limited foraging and dispersal habitat (Figure G.4, Appendix G).

Glossy ibis (*Plegadis falcinellus*) (MI)

The glossy ibis (*Plegadis falcinellus*) (MI; MI) is a migratory listed waterbird inhabiting wetlands and freshwater marshes at the edges of lakes, rivers, and wet swamp areas. One previous record, from 2000, was detailed on database searches from within the survey area (Department of Biodiversity, Conservation and Attractions 2023a) and, due to suitable habitat being present in the form of Wetland, Major Drainage Line, and Medium Drainage Line habitats (approximately 111 ha (2%)) , there is a 'moderate' likelihood of this species occurring.

Fork-tailed swift (*Apus pacificus*) (MI)

The fork-tailed swift (*Apus pacificus*) (MI; MI) is a migratory listed bird and occurs in low to very high airspace, largely independent of terrestrial habitats and landforms. One record from 2022 was detailed on the DBCA Threatened and Priority Fauna Database (Department of Biodiversity, Conservation and Attractions 2023a) from within 5 km from the survey area. Given suitable habitat for this species is also present in the form of all habitats (excluding Cleared/ Disturbed), there is a 'moderate' likelihood of occurrence for this species.

Long-tailed dunnart (*Antechinomys longicaudata*) (P4)

The long-tailed dunnart is a specialist rock-dwelling species (Freeland et al. 1988) associated with rocky landscapes that support low, open, Mulga woodland or shrubland with a spinifex hummock understorey (Pavey 2006a). There are two previous records for this species within 5 km of the survey area, and potential habitat in the form of Hillcrest/ Hillslope and Undulating Low Hills is present (approximately 1,006 ha (19%)).

Table 10: Comparison of home range and habitat availability for Matters of National Environmental Significance (MNES) species identified as occurring (previously recorded), or possibly occurring (high or moderate likelihood), in the survey area. Migratory birds have been excluded.

MNES species	Home range	Nearest record from survey area (km)	Critical habitat		Supporting habitat		Likelihood of occurrence	
			Type	Area within survey area (ha, %)	Type	Area within survey area (ha, %)	Pre-survey	Post-survey
Pilbara olive python (*Liasis olivaceus barroni*) (VU; VU)	88 to 450 ha	Approximately 5 km	Rocky outcrops in proximity to gorges and water holes. Such features are typically associated with Gorge/ Gully and Breakaway/ Cliff habitats (represented within the survey area by Major Drainage Line and Wetland habitat).	93.06 ha (1.8%)	Gullies, drainage lines, and water courses (represented within the survey area by Medium Drainage Line, Minor Drainage Line, Hillcrest/ Hillslope and Breakaway/ Cliff habitat).	307.33 ha (5.88%)	High	High
Northern quoll (*Dasyurus hallucatus*) (EN; EN)	35 ha, up to 100 ha during breeding season	Previously recorded	Low rocky hills, gorges, major drainage lines, and woodland within home ranges (not represented within the survey area).	0 ha (0%)	Major drainage line systems facilitating foraging and dispersal (represented within the survey area by Breakaway/ Cliff, Hillcrest/ Hillslope, Major Drainage Line, Medium Drainage Line, Minor Drainage Line and Wetland habitat).	400.40 ha (7.66%)	**Recorded**	Moderate

MNES species	Home range	Nearest record from survey area (km)	Critical habitat		Supporting habitat		Likelihood of occurrence	
			Type	Area within survey area (ha, %)	Type	Area within survey area (ha, %)	Pre-survey	Post-survey
Ghost bat (*Macroderma gigas*) (VU; VU)	>12 to 30 km	Previously recorded	Deep, humid caves generally in select geological formations, such as Gorge/ Gully and Breakaway/ Cliff habitats (not represented within the survey area). Foraging habitat within 12 km of Category 1 or 2 roost caves, or Category 3 caves if adjacent to one or more Category 2 caves.	821.63 ha (15.7%)	Productive plains areas, isolated trees on plain outskirts, and tree lined water courses (represented within the survey area by Breakaway/ Cliff, Drainage Area/ Floodplain, Hillcrest/ Hillslope, Major Drainage Line, Medium Drainage Line, Minor Drainage Line, Mulga Woodland, Sandy/ Stony Plain, Stony Plain and Wetland habitat).	1,569.15 ha (30%)	**Recorded**	High
Pilbara leaf-nosed bat (*Rhinonicteris aurantia* (Pilbara form)) (VU; VU)	>10 to 30 km for permanent/semi-permanent roosts	Approximately 4 km	Deep, humid caves generally in select geological formations, such as Gorge/ Gully and Breakaway/ Cliff habitats (not represented within the survey area).	0 ha (0%)	Nocturnal refuge caves (Priority 4). Plains and low hills with moderate two-layer non-complex vegetation structure (represented within the survey area by all habitats excluding Cleared/ Disturbed).	3,151.02 ha (60.25%)	High	High

4.2.4.3 Low Likelihood of Occurrence

An additional 27 species, including 22 MNES species, were considered to have a low post-survey likelihood of occurrence due to a lack of historical records in the vicinity of the survey area and lack of suitable habitats (Table E.1, Appendix E). Nine migratory birds had a pre-survey likelihood of 'high,' as they had been recorded within 20 km of the survey area but were downgraded to 'low' post-survey due to a lack of suitable habitat observed and these species' preference for coastal, saltwater and/or brackish water habitats. The bilby, brush-tailed mulgara, and *Ctenotus uber johnstonei* (P2) were also given pre-survey likelihoods of 'high' due to historical proximate records but were also downgraded post-survey to 'low' due to a lack of suitable habitat observed. Both the princess parrot and southern whiteface were given a pre-survey likelihood of 'moderate' as the EPBC Act Protected Matters Report assessed that the species or species habitat is known to occur within the survey area (Department of Climate Change, Energy, the Environment and Water 2023b); however post-survey assessment downgraded both these species to 'low' as suitable habitat for either species was not present.

5 Discussion

5.1 Fauna Habitats

The eleven broad habitats observed within the survey area are considered representative of each habitat type within the Pilbara and Gascoyne bioregions, and likely to support faunal assemblages that are generally common and widespread. Habitats within the survey area are not restricted at the local or sub-regional scale, with the exception of Wetland habitat as permanent water bodies like these are not common in the Pilbara region, and they are of high value to many species, including MNES. The Wetland habitat within the survey area was associated with the most south-western reaches of Ophthalmia Dam.

Within the survey area, Wetland (41.6 ha, 0.8%) and Major Drainage Line (51.48 ha, 1%) habitat represent critical habitats for Pilbara olive python and ghost bat (areas within 12 km of Category 2 roost cave CWER-03), and supporting habitats for northern quoll, ghost bat, Pilbara leaf-nosed bat and some (Wetland only) migratory birds. All ghost bat foraging habitat within 12 km of CWER-03, including some Major Drainage Line, Minor Drainage Line, Mulga Woodland, Sandy/ Stony Plain and Stony Plain habitats within the survey area, represent critical foraging ghost bat habitat. No other critical fauna habitats for MNES with high likelihood of occurrence were present in the survey area.

There were two water features recorded as significant habitats, as semi-permanent and permanent water sources are not particularly common in the Pilbara. Wetland habitat was present within the survey area through a section of Ophthalmia Dam overlapping the eastern edge of the survey area, comprising approximately 0.8% of the survey area. Wetlands differ from permanent and semi-permanent pools as they are generally a large body of water that supports their own distinct ecosystem and aquatic fauna assemblages (waterfowl, fish etc.). Due to their rarity in the Pilbara region these habitats generally have elevated significance, particularly when associated with Gorge/ Gully systems or rocky terrain. As the surrounding habitat consists of Drainage Lines and plains, the Wetland habitat with the survey area represents supporting habitat for MNES species such as the northern quoll and Pilbara olive python, as well as some Migratory listed bird species.

A second water feature was identified within Major Drainage Line habitat within a stretch of the Fortescue River system and was likely residual water remnant from the last major rainfall within the region. Major and Medium Drainage Line habitats (approximately 1.5% of the survey area) were of moderate value to a large selection of vertebrate fauna and are of high value to the target MNES species as they provide supporting habitat for northern quoll, ghost bat, Pilbara leaf-nosed bat, Pilbara olive python and some Migratory bird species. Both Major and Medium Drainage Lines, although not necessarily large in area, are common habitats within the immediate vicinity of the survey area and within the Pilbara region.

Hillcrest/ Hillslope habitat (approximately 4.7% of the survey area) is one of the more common habitats within the vicinity of the survey area and the wider Pilbara bioregion. This habitat is usually of moderate to low value to the target MNES species largely due to limited microhabitat availability. The Hillcrest/ Hillslope habitat was present within the survey area; however, it was considered to be of increased value to the target MNES species due to microhabitats present such as caves/overhangs and rock shelters which may provide supporting habitat for northern quoll, ghost bat (roosting), Pilbara leaf-nosed bat (roosting) and, when associated with Major Drainage Line habitat, Pilbara olive python. The five caves identified within the survey area were all present within Hillcrest/ Hillslope habitat on mid-slopes of relatively low hills. This is relatively uncommon with caves in the Pilbara region typically forming within Gorge/ Gully or open Breakaway/ Cliff habitats, which were either not present or highly disturbed within the survey area. Caves present within the survey area are considered Category 4 caves and may be opportunistically used as nocturnal roosts or feeding caves

by ghost bat and Pilbara leaf-nosed bat None of the caves are considered critical as they do not provide deep, humid environments necessary for diurnal roosting and continuous occupancy, and no evidence of current usage by either species was observed.

Minor Drainage Line habitat (approximately 1% of the survey area) is of moderate value to a wide spectrum of vertebrate fauna and provides supporting habitat for the MNES species Pilbara olive python, northern quoll, ghost bat (critical habitat within 12 km of CWER-03), and Pilbara leaf-nosed bat. Minor Drainage Lines, although not necessarily large in area, are common habitats within the vicinity of the survey area and wider Pilbara bioregion.

Drainage Area/ Floodplain habitat (approximately 3% of the survey area) is of moderate value to a variety of fauna species, but generally low value to the target MNES species. However, they may be utilised for foraging by ghost bat, Pilbara leaf-nosed bat, and grey falcon on occasion. Soft soils present opportunities for burrowing species, like bilby, although no signs of this species were observed, and likelihood of occurrence is considered low.

The Stony Plain, Sandy/ Stony Plain, and Undulating Low Hills habitats were the three most common habitats, collectively accounting for approximately 2,554 ha (49%) of the survey area. These habitats are of low value generally to the target MNES and significant species, with the exception of the western pebble-mound mouse, and ghost bat (critical habitat within 12 km of CWER-03). Stony Plain, Sandy/ Stony Plain, and Undulating Low Hills habitats are common within the vicinity of the survey area and wider Pilbara bioregion.

Mulga Woodland habitat comprised approximately 0.8% of the survey area and was relatively disconnected from similar habitat within the vicinity of the survey area. The Mulga Woodland present within the survey area is thought to provide limited opportunities for target MNES or other significant species, with the exception of the ghost bat (critical habitat within 12 km of CWER-03).

Cleared/ Disturbed areas made up the largest single habitat proportion of the survey area (2,078.51 ha, 39.8%) comprising parts of the Newman townsite, Great Northern Highway, and Mt Whaleback mine site. These areas are considered to have no value to MNES or other significant species. Moreover, the Breakaway/ Cliff habitat present within the survey area was associated with this Disturbed habitat along the opposing face of a mining pit and waste dump, and was considered heavily disturbed and degraded, and therefore to provide only non-critical supporting habitat for target MNES.

5.2 Vertebrate Fauna Species

One-hundred and one vertebrate fauna species, comprising eight reptiles, 77 birds, and 16 mammals (including five introduced species) were recorded within the survey area during the current survey. The fauna assemblage recorded during the survey is considered typical of the Hammersley subregion and the broader Pilbara bioregion. This is a comparatively higher diversity of species when compared to other fauna assessments of the same surveying intensity in the area (Ecologia Environment 2008, Onshore Environmental 2009, Eco Logical Australia 2011, 2012, ENV Australia Pty Ltd 2011a, Biologic Environmental Survey 2022a) which ranged from 31 to 93 species.

5.2.1 Significant Species

No significant species were recorded during the current survey. Of the 40 significant species identified in the desktop assessment as occurring or potentially occurring in the survey area, ten species were considered to have a 'high' post-survey likelihood of occurrence within the survey area. These species include the Pilbara olive python, ghost bat (previously recorded), Pilbara leaf-nosed bat, common

sandpiper, wood sandpiper, common greenshank, marsh sandpiper, Gane's blind snake, western pebble-mound mouse, and peregrine falcon (Table E.1, Appendix E).

5.2.1.1 Target MNES Species

Extensive survey effort was undertaken to provide an indication of MNES species presence within the survey area, including 78 camera trap nights, 24 echolocation recording nights, 12 acoustic recording nights, four targeted bilby searches, targeted cave searches, and one targeted nocturnal search. Despite the survey effort, no evidence of any MNES species was identified during the survey.

No previous Pilbara olive python records were identified within the survey area. The closest Pilbara olive python record occurs less than 5 km from the survey area (Department of Biodiversity, Conservation and Attractions 2023a), and this species has been recorded on numerous proximate fauna surveys (e.g. Biologic Environmental Survey 2011, 2020, ENV Australia Pty Ltd 2011, Onshore Environmental 2013, GHD Pty Ltd 2021). Critical Wetland and Major Drainage Line habitat is present within the survey area and provides microhabitats favourable for denning and ambushing, including permanent water, pools, thick vegetation, and log piles/woody debris. Moreover, the permanent water features present within Wetland habitats may provide year-round refugia and hunting opportunities for the Pilbara olive python. Substantial supporting habitat, including Medium Drainage Line, Minor Drainage Line, Breakaway/ Cliff, and Hillcrest/ Hillslope was also present throughout the survey area. This species has a 'high' likelihood of occurring in the survey area, due to a number of previous records in the vicinity and preferential habitat including permanent water bodies occurring within the survey area.

Extensive survey effort for both ghost bat and Pilbara leaf-nosed bat has been undertaken across the greater OB35 and Western Ridge region (e.g. Biologic Environmental Survey 2011, 2020, 2022a, 2022b, GHD Pty Ltd 2021). Numerous records of both species within 20 km of the survey area were outlined through database searches including two-hundred and fifty-nine ghost bat records, including records within the survey area boundary, and over 300 Pilbara leaf-nosed bat records with the closest being within 5 km of the survey area (Department of Biodiversity, Conservation and Attractions 2023a). Ghost bat scat was identified on two previous surveys within the survey area from within the same cave (CWER-02) (Biologic Environmental Survey 2011, 2020); however, no further scats or evidence of ghost bat usage was identified within cave CWER-02 or across the survey area during the current survey. A Category 2 ghost bat cave (CWER-03) is situated less than 1 km to the south of the survey area. No evidence of Pilbara leaf-nosed bat was observed during the current survey or within the survey area on previous surveys. Both MNES bat species utilise deep, humid, climatically stable caves for diurnal and maternal roost sites (Bat Call WA 2021b, 2021a). None of the five caves identified within the survey area exhibited features suitable for diurnal or maternal roosts. The identified caves within the survey area could potentially be used opportunistically by ghost bats as nocturnal roosts or feeding caves (Category 4), while both species are likely to forage over a wide range of habitats present throughout the survey area on occasion. Due to the proximate roost cave CWER-03, all ghost bat foraging habitat within a 12 km radius of the cave is considered critical habitat. Within the survey area this includes sections of Major Drainage Line, Minor Drainage Line, Mulga Woodland, Sandy/ Stony Plain and Stony Plain habitats. No critical Pilbara leaf-nosed bat habitat was considered to be present within the survey area. As critical habitat for the ghost bat and supporting habitat for the ghost bat and Pilbara leaf-nosed bat is present, and both species have recently been identified from within or proximate to the survey area, they are both considered to have a 'high' likelihood of occurrence but not to be reliant on any of the habitats within.

Extensive survey effort was undertaken to provide an indication of northern quoll presence within the survey area, including 78 camera trap nights at 16 locations, across suitable Major Drainage Line and Wetland habitats. Despite the survey effort, no evidence of northern quoll was identified within the

survey area. The survey area is situated towards the southern boundary of the northern quoll distribution (Department of the Environment and Energy 2016). One (unconfirmed) record of a deceased individual on a road within the Mt Whaleback mining footprint was outlined on a previous survey report (Onshore Environmental 2009), while old (> 12 months) scats were identified in rocky habitat less than 5 km to the west of the current survey area (Biologic Environmental Survey 2020). The nearest database records were located over 20 km to the north-west of the survey area (Department of Biodiversity, Conservation and Attractions 2023a). Rocky habitats such as ranges, escarpments, mesas, gorges, and breakaways provide critical habitat for the northern quoll. Although there was some Breakaway/ Cliff habitat present in the survey area, it was highly disturbed and not considered to represent critical habitat. Wide-reaching Hillcrest/ Hillslope and Major Drainage Line habitats within the survey area and surrounding area may provide suitable dispersal pathways, and Wetland habitat offers suitable foraging opportunities. The northern quoll was considered to have a 'moderate' likelihood of occurrence due to habitat availability; however, the survey area is considered unlikely to currently support a resident population, reflective of the exceptionally low number of recent and/or reliable records of this species in the general Newman area.

Four targeted searches (two 2 ha plot searches and two 1.5 km x 200 m targeted plots) covering Sandy/ Stony Plain, Stony Plain, and Drainage Area/ Floodplain habitats were undertaken to provide an indication of bilby presence within the survey area. No evidence of bilby occupation or critical habitat was identified within the survey area. The nearest record was identified 150 m from the survey area; however, this observation was from 1979 (Department of Biodiversity, Conservation and Attractions 2023a), and although bilby are known to disperse in response to foraging opportunities (Southgate et al. 2007, Southgate and Carthew 2008), it is considered highly unlikely that bilby occur or utilise the survey area or immediate surrounds. The nearest contemporary record (from 2018) is located approximately 55 km east of the survey area (Department of Biodiversity, Conservation and Attractions 2023a).

None of the habitats within the survey area were considered critical habitat for the night parrot and no calls attributed to the night parrot were recorded from 12 ARU recording nights, or during previous surveys within the survey area and surrounds. The most prospective habitats, Stony Plain, Sandy/ Stony Plain, Drainage Area/ Floodplains, and Undulating Low Hills, did not support old, large and unburnt *Triodia* clumps that are considered primary requirements of roosting and nesting habitat (Department of Parks and Wildlife 2017). It is considered unlikely that this species occurs in the survey area or immediate surrounds.

Habitats considered critical for the princess parrot and southern whiteface were not present within the survey area. The EPBC Protected Matters Report identified that both species and/or species habitat was known to occur within the survey area (Department of Climate Change, Energy, the Environment and Water 2023b), thus giving each species a pre-survey likelihood of 'moderate.' The post-survey likelihood for both species was downgraded to 'low' due to a lack of critical habitat present. Southern whiteface utilise relatively undisturbed open woodlands with a herbaceous understorey that provides essential foraging habitat (Department of Climate Change, Energy, the Environment and Water 2023a), while the princess parrot is typically seen in swales between sand dunes through much of the central and western arid zone (Threatened Species Scientific Committee 2018). It is unlikely that either species occurs in the survey area.

5.2.1.2 Other Significant Species

While no western pebble-mound mouse mounds were recorded during the current survey, previous surveys overlapping the survey area have confirmed the presence of this species within the survey area (Biologic Environmental Survey 2011, 2020, 2022a) and surrounds (ENV Australia Pty Ltd 2011a, Biologic Environmental Survey 2022b). The western pebble-mound mouse prefers stony hillsides with

hummock grasslands and shelters within complex burrow systems under a mound, which they construct using pebbles collected in the vicinity (Menkhorst and Knight 2011). Suitable habitat for this species is widespread throughout the survey area and the wider Pilbara bioregion, thus the likelihood of occurrence of the western pebble-mound mouse is considered 'high.'

The migratory shorebirds: common sandpiper, wood sandpiper, common greenshank and marsh sandpiper are all widespread migrants inhabiting the northern and mid latitudes of Australia typically between late August through to March. Although more commonly associated with sheltered bays, inlets, and coastal regions, these migratory bird species are well known to utilise sheltered inland waters, including lakes, reservoirs and dams, swamps, and sewerage ponds. Recent records of each species were detailed from within 5 km of the survey area from the Ophthalmia Dam vicinity. The common sandpiper, wood sandpiper, common greenshank, and marsh sandpiper were all assessed as having a 'high' likelihood of occurrence due to suitable foraging and sheltering habitat present within the survey area Wetland habitats, combined with proximate recent records.

Peregrine falcon occur throughout Australia, with the exception of treeless deserts and dense forest (Birdlife Australia 2012). *Eucalyptus* lined drainage lines provide suitable perching and hunting habitat for this species, where they feed primarily on small to medium sized birds. Pairs of peregrine falcon typically defend home ranges of 20 to 30 km^2 (Birdlife Australia 2012). Previous records of this species were identified in the desktop assessment less than 5 km from the survey boundary (Department of Biodiversity, Conservation and Attractions 2023a), and this species was recorded on three surveys within the vicinity of the current survey area (Biologic Environmental Survey 2011, 2020, Onshore Environmental 2013). Suitable nesting, shelter and foraging habitat is present in Major and Medium Drainage Line habitats within the survey area and, although the species was not recorded during the current survey, the likelihood of occurrence is considered 'high'.

Gane's blind snake is often poorly collected in vertebrae fauna surveys largely due to this species' cryptic fossorial habit. This species has commonly been associated with moist gorges and gullies (Wilson and Swan 2017) but potentially occurs across a suite of other stony habitats, including Breakaway/ Cliff, Hillcrest/ Hillslope, and Undulating Low Hills. Ten records of this species were identified from within 20 km of the survey area, including three records within 5 km (Department of Biodiversity, Conservation and Attractions 2023a). This species was also recorded on two surveys within the vicinity of the current survey area (Biologic Environmental Survey 2011, Onshore Environmental 2013), and suitable habitat is present in Hillcrest/ Hillslope and Undulating Low Hills habitats within the survey area. This species was not recorded during the current survey; however, the likelihood of occurrence of Gane's blind snake is considered 'high'.

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Appendix A: Background Information Figures

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765000 770000 775000 780000 785000 790000 795000

7420000 7415000 7410000 7405000

Survey Area

QUATERNARY
- Qa
- Qrc - colluvium 38491
- Qsm

CENOZOIC
- Czk
- Czl
- Czs

PALEOPROTEROZOIC
- Lch
- Lchk - Brockman Iron Formation
- Lfhw - Woongarra Rhyolite
- Lchw - Weeli Wolli Formation
- Lchb - Boolgeeda Iron Formation

ARCHEAN
- Abfb
- Alhw
- Ashm
- Adf
- Awf
- Awfj - Jeerinah Formation
- Achm - Marra Mamba Iron Formation

Newman

BHP Western Australian Iron Ore
OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure A.1: Geological units of the survey area

Scale: 1:80,000 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: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigA1_Geo

765000 770000 775000 780000 785000 790000 795000

7420000
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Pilbara
Newman
Gascoyne

Survey Area

IBRA Bioregion

- Gascoyne
- Pilbara

Land System

- Boolgeeda System
- Divide System
- Elimunna System
- McKay System
- Newman System
- Platform System
- Prairie System
- River System
- Robe System
- Rocklea System
- Spearhole System
- Sylvania System
- Wannamunna System
- Washplain System

BHP Western Australian Iron Ore
OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure A.2: Land systems of the survey area

Scale: 1:80,000 at A3
Coordinate System: GDA 1994 MGA Zone 50
0 1 2 3 4 5 Kilometres

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an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigA2_LS

765000 770000 775000 780000 785000 790000 795000

7420000

7415000

7410000

7405000

Newman

Survey Area

Pre-European Vegetation

- FORTESCUE VALLEY_216
- FORTESCUE VALLEY_29
- FORTESCUE VALLEY_82
- HAMMERSLEY_18
- HAMMERSLEY_82
- KUMARINA HILLS_216
- KUMARINA HILLS_29

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

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

Scale: 1:80,000 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: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigA3_PEV

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

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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) 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.
MI	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 *Environment Protection and Biodiversity Conservation Act 1999* (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 (BHP 2023)	Post-survey
Recorded	Individuals or signs of individuals recorded in the survey area during previous surveys.	Species or evidence of species recorded during survey.
High	Suitable habitat is or has the potential to be present within the survey area. OR Species is cryptic and suitable habitat is present but may not have been previously recorded. OR Species has been recorded within 20 km of the survey area.	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	Suitable habitat for the species is, or has the potential to be, present but is in poor condition, limited in extent or isolated and discontinuous.	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	Suitable habitat is not present within the survey area. OR Species has not been previously recorded within 20 km of survey area despite adequate survey effort. OR Survey area is not within the species' known distribution and/or the species is considered locally extinct.	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.

Reference: BHP, 2023, *Vertebrate Fauna Surveys in Western Australia – Technical Process Instruction*.

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 affected 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 the seven target Matters of National Environmental Significance (MNES) species based on BHP (2023).

Species	Critical habitat (a)	Supporting habitat (b)	Limited foraging and dispersal habitat (c)
Greater 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, saltlake 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). • Dense riparian vegetated sites in association with permanent wetlands (spring-fed) within the home range of the individual.	• 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.

Species	Critical habitat (a)	Supporting habitat (b)	Limited foraging and dispersal habitat (c)
Great desert skink (*Liopholis kintorei*)	Incomplete distribution data makes it currently impossible to define critical habitat; it is possible to describe commonalities in the habitats occupied by know populations. • Generally, occur on hummock grass sandplains and some adjacent dunefield swales. • Tanami Desert and parts of the Great Sandy Desert; paleodrainage lines characterised by lateritic soils, giant termite mounds, and tea tree (*Melaleuca* spp.) shrubs. • Watarru (in northern South Australia) was located in an area of open mulga (*Acacia aneura*) and minyura (*Acacia minyura*) woodland over woollybutt grass (*Eragrostis eriooda*) and spinifex. • Habitat that has been burnt within the previous 3 to 15 years.	Habitat that is under 3 years since burnt and over 15 years burnt.	Habitat that has limited sheltering and foraging capacity.
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.	• 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 foraging and dispersal 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 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. • Gully or gorge system that opens onto a plain or riparian line.	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 Category 1 cave - Permanent diurnal roost and maternity roost with seasonal presence of young. o 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 Category 3 - Transitory diurnal roosts, occupied part of the year only, outside the breeding season (i.e. April to June) that facilitate long distance dispersal. • Permanent water sources within 8.7 km of known Priority/Category 1-3 roosts. • Foraging habitat within a 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.	• 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 (45° 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 three-layer vegetation structure.	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 foraging and dispersal habitat (c)
	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 two vertical walls. Complex three-layer, dense vegetation structure. Semi-permanent or permanent water pools present. (Priority 1 foraging habitat type). • Rocky outcrop geological formations such as the following: o banded Iron Formations (Hamersley Group ironstone terrain) o dolerite/gabbro formations. • Granite top rockpiles in the eastern Pilbara.	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 riverbed, 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	

Species	Critical habitat (a)	Supporting habitat (b)	Limited foraging and dispersal habitat (c)
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, and 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 sized 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. • Hunting in treeless areas, particularly tussock grassland and open woodland.	Habitat that has limited nesting, roosting and foraging potential for the grey falcon.

Species	Critical habitat (a)	Supporting habitat (b)	Limited foraging and dispersal habitat (c)
Southern whiteface (*Aphelocephala leucopsis*)	• Relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both. • Habitat with low tree densities and a herbaceous understorey litter cover, which provides essential foraging habitat. • Living and dead trees with hollows and crevices, which are essential for roosting and nesting	• Wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both. • Habitats dominated by *Acaica* of *Eucalyptus* spp. on ranges, foothills and lowlands, and plains	Habitat that has limited nesting, roosting and foraging potential for the southern whiteface.

Reference: BHP, 2023, *Vertebrate Fauna Surveys in Western Australia – Technical Process Instruction*. Department of Climate Change, Energy, the Environment and Water. 2023. Conservation Advice for *Aphelocephala leucopsis* (southern whiteface).

Appendix C: Survey Sampling Locations

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770000 772000 774000 776000 778000

7414000 7412000 7410000

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

C.1.1 C.1.2 C.1.3

OB35-HA01
OB35-NQ3.1
OB35-NQ3.2
OB35-NQ3.3
OB35-BAT03
OB35-NQ3.4
OB35-NQ3.5
OB35-HA35
OB35-HA36
OB35-BAT06
OB35-HA13
OB35-HA14
OB35-HA16
OB35-HA15
OB35-HA04
OB35-BAT02
OB35-CAM01
OB35-HA02
OB35-HA03
OB35-HA29
OB35-BAT07
OB35-HA33
OB35-HA31
OB35-HA32
OB35-HA30

GPS Tracklog
Survey Area
Sample Sites
Echolocation Recording
Motion Camera
Habitat Assessment
Northern Quoll Camera
Northern Quoll Transect

BHP Western Australian Iron Ore
OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure C.1.1: Fauna sampling location

Scale: 1:25,000 at A3
Coordinate System: GDA 1994 MGA Zone 50

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

N

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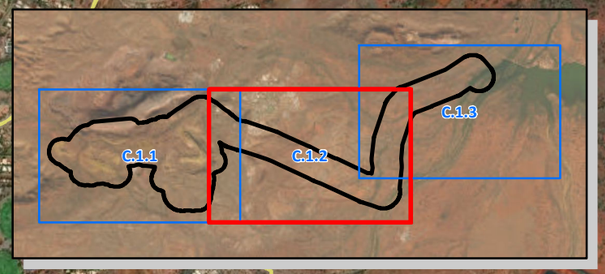
Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigC1

778000 780000 782000 784000 786000

7414000 7412000 7410000



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

GPS Tracklog
Survey Area

Sample Sites

- Echolocation Recording
- Acoustic Recording
- Bilby Targeted Search
- Bilby Plot
- Habitat Assessment
- Northern Quoll Camera
- Northern Quoll Transect

OB35-HA01
OB35-HA13
OB35-HA14
OB35-BAT06
OB35-HA17
OB35-HA21
OB35-HA23
OB35-HA24
OB35-BP01
OB35-HA20
OB35-HA16
OB35-HA15
OB35-HA18
OB35-AUDIO02
OB35-HA19
OB35-HA11
OB35-HA12
OB35-HA10
OB35-HA09
OB35-HA08
OB35-BTS01
OB35-HA04
OB35-BTS02
OB35-HA34
OB35-HA07
OB35-HA06
OB35-HA22
OB35-HA05
OB35-BAT04
OB35-BP02
OB35-HA38
OB35-HA39
OB35-HA28
OB35-BAT08
OB35-HA27
OB35-HA37
OB35-NQ1.4
OB35-NQ1.3
OB35-BAT01
OB35-NQ1.2
OB35-NQ1.5
OB35-NQ1.1

BHP Western Australian Iron Ore
OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure C.1.2: Fauna sampling location

Scale: 1:25,000 at A3
Coordinate System: GDA 1994 MGA Zone 50

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

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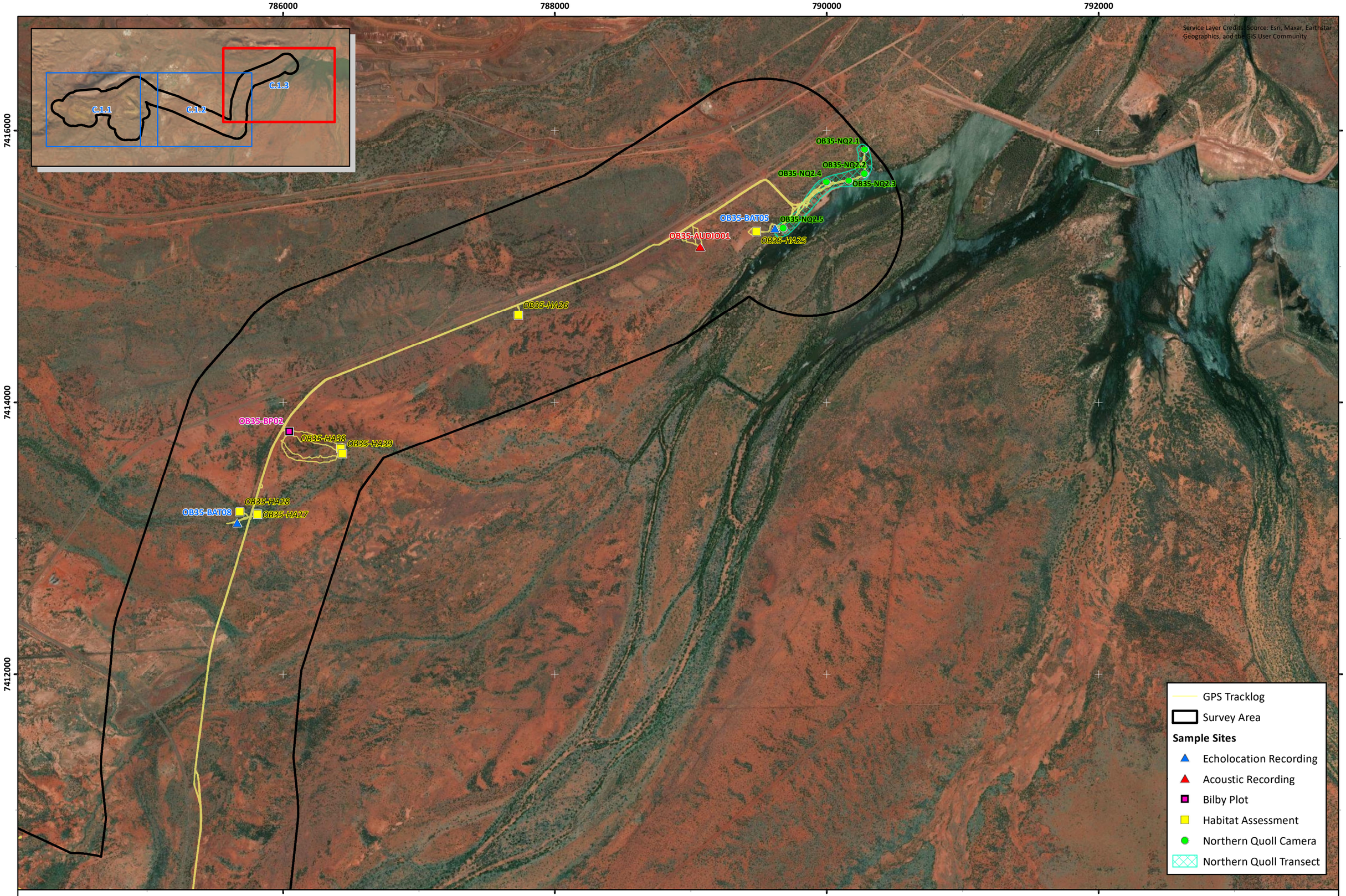
Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigC1



BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure C.1.3: Fauna sampling location

Scale: 1:25,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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

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astron an ecocene company

Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigC1

Table C.1: Fauna sampling locations.

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA01	-23.3612	119.7123	Habitat Assessment	27/09/2023	Minor Drainage Line	0.8	Active mining, roads/access tracks, weed invasion	Logs, thick undergrowth, leaf litter	
OB35-HA02	-23.3940	119.6660	Habitat Assessment	28/09/2023	Minor Drainage Line	1.0	Cattle grazing, mining exploration, weed invasion	Logs, tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA03	-23.3934	119.6674	Habitat Assessment	28/09/2023	Hillcrest/ Hillslope	0.8	Mining exploration	Caves, overhangs, crevices, rock piles, old *Triodia*, leaf litter	
OB35-HA04	-23.3864	119.7119	Habitat Assessment	28/09/2023	Hillcrest/ Hillslope	1.0	Mining exploration, roads/access tracks	Logs, tree hollows, thick undergrowth, rock piles, old *Triodia*, leaf litter	
OB35-HA05	-23.3913	119.7681	Habitat Assessment	28/09/2023	Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, thick undergrowth, old *Triodia*, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA06	-23.3890	119.7779	Habitat Assessment	29/09/2023	Stony Plain	0.8	Roads/access tracks, rubbish/litter, weed invasion	Old *Triodia*	
OB35-HA07	-23.3882	119.7719	Habitat Assessment	29/09/2023	Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, soft soil (burrows), leaf litter	
OB35-HA08	-23.3838	119.7520	Habitat Assessment	29/09/2023	Mulga Woodland	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, soft soil (burrows), leaf litter	
OB35-HA09	-23.3838	119.7513	Habitat Assessment	29/09/2023	Stony Plain	0.8	Cattle grazing, rubbish/litter, weed invasion	Logs, soft soil (burrows), old *Triodia*	
OB35-HA10	-23.3841	119.7506	Habitat Assessment	29/09/2023	Sandy/Stony Plain	0.6	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Soft soil (burrows)	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA11	-23.3816	119.7434	Habitat Assessment	29/09/2023	Sandy/ Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, thick undergrowth, soft soil (burrows), rock piles, old *Triodia*, leaf litter	
OB35-HA12	-23.3817	119.7526	Habitat Assessment	29/09/2023	Stony Plain	0.6	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Soft soil (burrows), old *Triodia*	
OB35-HA13	-23.3695	119.7157	Habitat Assessment	29/09/2023	Hillcrest/ Hillslope	0.8	Mining exploration, roads/access tracks, rubbish/litter, Newman townsite	Tree hollows, rock piles, old *Triodia*	
OB35-HA14	-23.3704	119.7143	Habitat Assessment	29/09/2023	Mulga Woodland	0.8	Cattle grazing, mining exploration, roads/access tracks, rubbish/litter, weed invasion	Logs, thick undergrowth, soft soil (burrows), rock piles, old *Triodia*, leaf litter	
OB35-HA15	-23.3769	119.7213	Habitat Assessment	29/09/2023	Sandy/ Stony Plain	0.8	Mining exploration, roads/access tracks, rubbish/litter, weed invasion	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA16	-23.3766	119.7193	Habitat Assessment	29/09/2023	Undulating Low Hills	0.8	Mining exploration, roads/access tracks, rubbish/litter, Newman townsite	Crevices, rock piles, old *Triodia*	
OB35-HA17	-23.3747	119.7290	Habitat Assessment	29/09/2023	Undulating Low Hills	0.6	Roads/access tracks, rubbish/litter, weed invasion, Newman townsite	Crevices, rock piles, old *Triodia*	
OB35-HA18	-23.3768	119.7364	Habitat Assessment	29/09/2023	Sandy/ Stony Plain	0.8	Mining exploration, roads/access tracks, rubbish/litter, weed invasion	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA19	-23.3789	119.7354	Habitat Assessment	29/09/2023	Hillcrest/ Hillslope	0.8	Roads/access tracks, rubbish/litter, Newman townsite	Rock piles, old *Triodia*	
OB35-HA20	-23.3755	119.7360	Habitat Assessment	29/09/2023	Sandy/ Stony Plain	0.8	Mining exploration, roads/access tracks, rubbish/litter, weed invasion	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA21	-23.3738	119.7352	Habitat Assessment	29/09/2023	Hillcrest/ Hillslope	1.0	Roads/access tracks	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA22	-23.3907	119.7535	Habitat Assessment	29/09/2023	Stony Plain	1.0	Roads/access tracks	Soft soil (burrows), leaf litter	
OB35-HA23	-23.3735	119.7415	Habitat Assessment	30/09/2023	Hillcrest/ Hillslope	1.0	Roads/access tracks	Rock piles, old *Triodia*, leaf litter	
OB35-HA24	-23.3739	119.7417	Habitat Assessment	30/09/2023	Mulga Woodland	0.8	Roads/access tracks, rubbish/litter	Crevices, rock piles, old *Triodia*, leaf litter	
OB35-HA25	-23.3468	119.8312	Habitat Assessment	30/09/2023	Drainage Area/ Floodplain	0.8	Cattle grazing, weed invasion	Soft soil (burrows), pools, semi-permanent water	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA26	-23.3526	119.8142	Habitat Assessment	30/09/2023	Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA27	-23.3662	119.7958	Habitat Assessment	30/09/2023	Minor Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA28	-23.3660	119.7945	Habitat Assessment	30/09/2023	Drainage Area/ Floodplain	0.6	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Tree hollows, tick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA29	-23.3962	119.6660	Habitat Assessment	01/10/2023	Undulating Low Hills	1.0	Mining exploration, roads/access tracks, weed invasion	Rock piles, old *Triodia*	
OB35-HA30	-23.4062	119.7035	Habitat Assessment	01/10/2023	Sandy/ Stony Plain	1.0	Cattle grazing, mining exploration, roads/access tracks, weed invasion	Logs, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA31	-23.4051	119.7014	Habitat Assessment	01/10/2023	Mulga Woodland	1.0	Cattle grazing, mining exploration, roads/access tracks, weed invasion	Logs, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA32	-23.4054	119.7002	Habitat Assessment	01/10/2023	Stony Plain	1.0	Weed Invasion	Logs, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-HA33	-23.4043	119.7050	Habitat Assessment	01/10/2023	Undulating Low Hills	1.0	Roads/access tracks	Logs, thick undergrowth, rock piles, old *Triodia*, leaf litter	
OB35-HA34	-23.3892	119.7650	Habitat Assessment	02/10/2023	Minor Drainage Line	0.6	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, soft soil (burrows), leaf litter	
OB35-HA35	-23.3695	119.7059	Habitat Assessment	03/10/2023	Mulga Woodland	0.6	Cattle grazing, mining exploration, roads/access tracks, rubbish/litter, weed invasion	Logs, soft soil (burrows), leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-HA36	-23.3697	119.7076	Habitat Assessment	03/10/2023	Hillcrest/ Hillslope	0.8	Mining exploration, active mining, roads/access tracks	Caves, overhangs, logs, tree hollows, crevices, rock piles, old *Triodia*, leaf litter	
OB35-HA37	-23.3979	119.7871	Habitat Assessment	04/10/2023	Mulga Woodland	0.6	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Tree hollows, soft soil (burrows), leaf litter	
OB35-HA38	-23.3617	119.8017	Habitat Assessment	04/10/2023	Drainage Area/ Floodplain	0.6	Cattle grazing, , rubbish/litter, weed invasion	Logs, tree hollows, soft soil (burrows)	
OB35-HA39	-23.3620	119.8018	Habitat Assessment	04/10/2023	Medium Drainage Line	0.6	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, soft soil (burrows), rock piles, leaf litter	
OB35-AUDIO01	-23.3478	119.8272	Acoustic Recording	27/09/2023 – 03/10/2023	Sandy/ Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, soft soil (burrows), old *Triodia*, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-AUDIO02	-23.3777	119.7429	Acoustic Recording	27/09/2023 – 03/10/2023	Sandy/ Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, soft soil (burrows), old *Triodia*, leaf litter	
OB35-BAT01	-23.4018	119.7936	Bat Detector	27/09/2023 – 30/09/2023	Major Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), semi-permanent water, leaf litter	
OB35-BAT02	-23.3923	119.6663	Bat Detector	28/09/2023 – 01/10/2023	Hillcrest/ Hillslope	0.8	Mining exploration, active mining, roads/access tracks	Caves, overhangs, logs, tree hollows, crevices, old *Triodia*	
OB35-BAT03	-23.3671	119.6958	Bat Detector	28/09/2023 – 01/10/2023	Major Drainage Line	0.6	Cattle grazing, roads/access tracks, mining exploration, rubbish/litter, weed invasion	Logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), semi-permanent water, leaf litter	
OB35-BAT04	-23.3919	119.7679	Bat Detector	28/09/2023 – 01/10/2023	Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-BAT05	-23.3465	119.8325	Bat Detector	30/09/2023 – 03/10/2023	Wetland	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, soft soil (burrows), permanent water, pools, leaf litter	
OB35-BAT06	-23.3709	119.7111	Bat Detector	01/10/2023 – 04/10/2023	Undulating Low Hills	0.6	Mining exploration, active mining, roads/access tracks, rubbish/litter, Newman townsite	Overhangs, logs, tree hollows, crevices, rock piles, old *Triodia*	
OB35-BAT07	-23.4048	119.7012	Bat Detector	01/10/2023 – 04/10/2023	Mulga Woodland	1.0	Cattle grazing, roads/access tracks, weed invasion	Logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), leaf litter	
OB35-BAT08	-23.3668	119.7943	Bat Detector	01/10/2023 – 04/10/2023	Medium Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), leaf litter	
OB35-BP01	-23.3755	119.7349	Targeted Bilby Plot	30/09/2023	Sandy/ Stony Plain	0.8	Mining exploration, roads/access tracks, rubbish/litter, weed invasion	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-BP02	-23.3606	119.7979	Targeted Bilby Plot	04/10/2023	Sandy/ Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Soft soil (burrows), leaf litter	
OB35-BTS01	-23.3852	119.7554	Targeted Bilby Search	29/09/2023	Stony Plain	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, soft soil (burrows), leaf litter	
OB35-BTS02	-23.3881	119.7633	Targeted Bilby Search	02/10/2023	Sandy/ Stony Plain	0.6	Roads/access tracks, rubbish/litter, weed invasion	Thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
OB35-CAM01	-23.3923	119.6663	Motion Camera	28/09/2023 – 01/10/2023	Hillcrest/ Hillslope	0.8	Mining exploration, active mining, roads/access tracks	Caves, overhangs, logs, crevices, old *Triodia*	
OB35-NQ1.1	-23.4036	119.7930	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Major Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), semi-permanent water, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-NQ1.2	-23.4023	119.7941	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Major Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), semi-permanent water, leaf litter	
OB35-NQ1.3	-23.3999	119.7965	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Major Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), semi-permanent water, leaf litter	
OB35-NQ1.4	-23.3983	119.7980	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Major Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), semi-permanent water, leaf litter	
OB35-NQ1.5	-23.4033	119.7922	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Major Drainage Line	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), semi-permanent water, leaf litter	
OB35-NQ2.1	-23.3412	119.8389	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Wetland	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-NQ2.2	-23.3428	119.8389	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Wetland	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	
OB35-NQ2.3	-23.3433	119.8378	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Wetland	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	
OB35-NQ2.4	-23.3434	119.8362	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Wetland	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	
OB35-NQ2.5	-23.3465	119.8331	Motion Camera – Camera Transect	27/09/2023 – 02/10/2023	Wetland	0.8	Cattle grazing, roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	
OB35-NQ3.1	-23.3630	119.7029	Motion Camera – Camera Transect	28/09/2023 – 03/10/2023	Major Drainage Line	0.8	Cattle grazing, active mining roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	

Site ID	Latitude	Longitude	Sampling method	Date	Habitat	Condition ^	Disturbance	Microhabitats	Photo
OB35-NQ3.2	-23.3637	119.7029	Motion Camera – Camera Transect	28/09/2023 – 03/10/2023	Major Drainage Line	0.8	Cattle grazing, active mining roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	
OB35-NQ3.3	-23.3654	119.6992	Motion Camera – Camera Transect	28/09/2023 – 03/10/2023	Major Drainage Line	0.8	Cattle grazing, active mining roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	
OB35-NQ3.4	-23.3675	119.6949	Motion Camera – Camera Transect	28/09/2023 – 03/10/2023	Major Drainage Line	0.8	Cattle grazing, active mining roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	
OB35-NQ3.5	-23.3691	119.6938	Motion Camera – Camera Transect	28/09/2023 – 03/10/2023	Major Drainage Line	0.8	Cattle grazing, active mining roads/access tracks, rubbish/litter, weed invasion	Logs, tree hollows, crevices, soft soil (burrows), permanent water, leaf litter	

^ 1.0 (Excellent); 0.8 (Very Good); 0.6 (Good); 0.4 (Poor); 0.2 (Very Poor); 0.1 (Completely Degraded).

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Appendix D: Fauna Species Lists

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

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Pelodryadidae											
Cyclorana maini	Sheep frog					X	X			X	
Litoria rubella	Little red tree frog					X	X			X	
Limnodynastidae											
Neobatrachus kunapalari	Kunapalari frog						X				
Notaden nichollsi	Desert spadefoot					X	X				
Platyplectrum spenceri	Centralian burrowing frog					X	X				
Myobatrachidae											
Pseudophryne douglasi	Gorge toadlet						X				
Uperoleia russelli	Northwest toadlet						X				
Uperoleia saxatilis	Pilbara toadlet					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 D.2: Reptile species list – results of database searches, literature reviews and Astron survey results.

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Chelidae											
Chelodina steindachneri	Flat-shelled turtle					X	X			X	
Carphodactylidae											
Nephrurus wheeleri	Southern banded knob-tailed gecko						X				
Diplodactylidae											
Diplodactylus conspicillatus	Variable fat-tailed gecko					X	X			X	
Diplodactylus laevis	Desert fat-tailed gecko					X					
Diplodactylus mitchelli							X				
Diplodactylus pulcher							X				
Diplodactylus savagei	Southern Pilbara beak-faced gecko					X	X			X	
Lucasium stenodactylus						X	X			X	
Lucasium wombeyi						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				
Strophurus wellingtonae						X	X			X	
Gekkonidae											

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Christinus marmoratus	Marbled gecko					X					
Gehyra crypta	Western cryptic gehyra					X					
Gehyra fenestrula	Hamersley Range spotted gehyra					X					
Gehyra micra	Small Pilbara spotted rock gehyra					X					
Gehyra montium						X					X
Gehyra pilbara						X	X				
Gehyra punctata						X	X			X	
Gehyra purpurascens						X					
Gehyra variegata						X	X			X	X
Heteronotia binoei	Bynoe's gecko					X	X			X	
Heteronotia planiceps						X	X				
Heteronotia spelea	Pilbara cave gecko					X	X			X	
Pygopodidae											
Delma butleri						X	X			X	
Delma elegans						X	X			X	
Delma haroldi	Neck-barred delma						X				
Delma nasuta						X	X			X	
Delma pax						X	X			X	
Delma tincta							X				
Lialis burtonis						X	X			X	

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Pygopus nigriceps						X	X			X	
Agamidae											
Ctenophorus caudicinctus	Western ring-tailed dragon					X	X			X	X
Ctenophorus isolepis isolepis	Central military dragon					X	X			X	X
Ctenophorus maculatus							X				
Ctenophorus nuchalis	Central netted dragon					X	X			X	
Ctenophorus reticulatus	Western netted dragon					X	X				
Diporiphora amphiboluroides	Mulga dragon					X	X				
Diporiphora valens	Southern Pilbara tree dragon						X				
Gowidon longirostris	Long-nosed dragon					X	X			X	X
Lophognathus gilberti	Gilbert's dragon					X					
Moloch horridus	Thorny devil					X					
Pogona minor minor	Western bearded dragon					X	X			X	
Tympanocryptis cephalus	Coastal pebble-mimic dragon						X				
Tympanocryptis diabolicus	Hamersley pebble-mimic dragon					X					
Scincidae											
Carlia munda						X	X			X	
Carlia triacantha						X	X			X	

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Cryptoblepharus buchananii							X			X	
Cryptoblepharus ustulatus						X	X			X	
Ctenotus ariadnae						X	X				
Ctenotus duricola	Eastern Pilbara lined ctenotus					X	X			X	
Ctenotus grandis grandis							X				
Ctenotus helenae						X	X			X	
Ctenotus inornatus						X					
Ctenotus leonhardii						X	X			X	
Ctenotus pallasotus	Western Pilbara lined ctenotus					X					
Ctenotus pantherinus						X	X			X	
Ctenotus quattuordecimlineatus						X					
Ctenotus rubicundus						X	X				
Ctenotus rutilans						X	X				
Ctenotus saxatilis	Rock ctenotus						X			X	
Ctenotus schomburgkii							X			X	
Ctenotus serventyi										X	
Ctenotus uber johnstonei					P2		X		X		
Ctenotus uber uber						X	X				

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Cyclodomorphus melanops melanops						X	X				
Egernia cygnitos	Western Pilbara spiny-tailed skink					X	X				
Egernia depressa	Southern pygmy spiny-tailed skink					X	X			X	
Egernia formosa						X	X			X	
Eremiascincus richardsonii	Broad-banded sand swimmer					X	X				
Lerista bipes							X				
Lerista chalybura						X	X			X	
Lerista flammicauda							X				
Lerista macropisthopus remota					P2		X				
Lerista muelleri						X	X			X	
Lerista neander						X	X			X	
Liopholis kintorei	Great desert skink		VU	VU				X			
Menetia greyii						X	X			X	
Menetia surda surda						X	X				
Morethia ruficauda exquisita						X	X			X	
Proablepharus reginae										X	
Tiliqua multifasciata	Central bluetongue					X	X			X	

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Varanidae											
Varanus acanthurus	Spiny-tailed goanna					X	X			X	
Varanus brevicauda	Short-tailed pygmy goanna					X	X			X	
Varanus bushi	Pilbara mulga goanna					X	X				
Varanus caudolineatus						X	X			X	
Varanus eremius	Pygmy desert goanna						X				
Varanus giganteus	Perentie						X			X	
Varanus gouldii	Bungarra or sand goanna					X	X			X	
Varanus hamersleyensis	Southern Pilbara rock goanna					X					
Varanus panoptes rubidus						X	X			X	
Varanus pilbarensis	Northern Pilbara rock goanna					X	X				
Varanus tristis	Racehorse goanna					X	X			X	X
Typhlopidae											
Anilios ammodytes							X				
Anilios ganei					P1	X	X		X	X	
Anilios grypus						X	X			X	
Anilios hamatus						X	X			X	
Anilios pilbarensis							X				
Pythonidae											
Antaresia childreni	Children's python					X	X			X	

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Antaresia perthensis	Pygmy python					X	X			X	
Aspidites melanocephalus	Black-headed python					X	X			X	
Liasis olivaceus barroni	Pilbara Olive python		VU	VU		X	X	X	X	X	
Elapidae											
Acanthophis wellsi	Pilbara death adder					X	X			X	
Brachyurophis approximans						X	X			X	
Demansia psammophis cupreiceps						X	X			X	
Demansia rufescens	Rufous whipsnake					X	X			X	
Furina ornata	Moon snake					X	X			X	
Pseudechis australis	Mulga snake					X	X			X	
Pseudonaja mengdeni	Gwardar, western brown snake					X	X				
Pseudonaja modesta	Ringed brown snake					X	X			X	
Pseudonaja nuchalis	northern brown snake						X				
Suta fasciata	Rosen's snake					X	X			X	
Suta gaikorstorum						X	X			X	
Suta punctata	Spotted Snake					X	X				
Vermicella snelli						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; VU = Vulnerable.

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

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	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	X	
Anseranatidae												
Anseranas semipalmata	Magpie goose					X	X			X		
Anatidae												
Anas gracilis	Grey teal					X	X			X	X	X
Anas superciliosa	Pacific black duck					X	X			X	X	X
Aythya australis	Hardhead					X	X			X	X	X
Biziura lobata	Musk duck					X	X			X		
Chenonetta jubata	Australian wood duck					X	X			X	X	X
Cygnus atratus	Black swan					X	X			X	X	X
Dendrocygna arcuata	Wandering whistling duck					X	X			X		X
Dendrocygna eytoni	Plumed whistling duck					X	X			X		
Malacorhynchus membranaceus	Pink-eared duck					X	X			X	X	
Spatula rhynchotis	Australasian shoveler					X	X			X		
Stictonetta naevosa	Freckled duck					X	X			X		
Tadorna tadornoides	Australian shelduck					X	X			X	X	

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Phasianidae												
Coturnix pectoralis	Stubble quail					X	X					
Synoicus ypsilophora	Brown quail					X	X			X		
Podicipedidae												
Podiceps cristatus	Great crested grebe					X	X			X	X	X
Poliocephalus poliocephalus	Hoary-headed grebe					X	X			X		
Tachybaptus novaehollandiae	Australasian grebe (black-throated grebe)					X	X			X	X	
Ciconiidae												
Ephippiorhynchus asiaticus	Black-necked stork					X	X			X		
Threskiornithidae												
Platalea flavipes	Yellow-billed spoonbill					X	X			X		
Platalea regia	Royal spoonbill					X	X			X		
Plegadis falcinellus	Glossy ibis		MI	MI		X	X		X	X		
Threskiornis moluccus	Australian white ibis					X	X			X	X	X
Threskiornis spinicollis	Straw-necked ibis					X	X			X	X	X
Ardeidae												
Ardea alba	Eastern great egret					X	X			X	X	X
Ardea intermedia	Intermediate egret					X	X			X		
Ardea pacifica	White-necked heron					X	X			X	X	X

Family Name *Species Name*	**Common Name**	**Introduced**	**Conservation Codes**			**ALA**	**Nature Map**	**EPBC PMST**	**DBCA T and P**	**Birdata**	**Previous Surveys**	**Current Survey**
			EPBC Act	**BC Act**	**DBCA Priority Fauna list**							
Bubulcus coromandus	Cattle egret					X	X	X		X		
Egretta garzetta	Little egret					X	X			X		
Egretta novaehollandiae	White-faced heron					X	X			X	X	X
Nycticorax caledonicus	Nankeen night-heron					X	X			X	X	X
Pelecanidae												
Pelecanus conspicillatus	Australian pelican					X	X			X	X	
Phalacrocoracidae												
Phalacrocorax melanoleucos	Little pied cormorant					X	X			X	X	X
Phalacrocorax carbo	Great cormorant					X	X			X	X	
Phalacrocorax sulcirostris	Little black cormorant					X	X			X	X	X
Phalacrocorax varius	Pied cormorant (Australian pied cormorant)					X	X			X	X	
Anhingidae												
Anhinga novaehollandiae	Australasian darter					X	X			X	X	X
Accipitridae												
Accipiter cirrocephalus	Collared sparrowhawk					X	X			X		
Accipiter fasciatus	Brown goshawk					X	X			X	X	

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Aquila audax	Wedge-tailed eagle					X	X			X	X	
Circus approximans	Swamp harrier					X	X			X		
Circus assimilis	Spotted harrier					X	X			X		X
Elanus axillaris	Australian black-shouldered kite					X	X			X	X	
Erythrotriorchis radiatus	Red goshawk		VU	VU				X				
Haliaeetus leucogaster	White-bellied sea-eagle					X	X			X		
Haliastur sphenurus	Whistling kite					X	X			X	X	X
Hamirostra melanosternon	Black-breasted buzzard					X	X			X	X	
Hieraaetus morphnoides	Little eagle					X	X			X	X	
Lophoictinia isura	Square-tailed kite					X	X			X	X	
Milvus migrans	Black kite					X	X			X	X	X
Otididae												
Ardeotis australis	Australian bustard					X	X			X	X	X
Rallidae												
Fulica atra	Eurasian coot					X	X			X	X	X
Gallinula tenebrosa	Dusky moorhen					X						
Hypotaenidia philippensis	Buff-banded rail						X			X		
Porphyrio melanotus	Purple swamphen					X	X			X		

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Porzana fluminea	Australian spotted crake					X						
Tribonyx ventralis	Black-tailed native-hen					X	X			X	X	
Zapornia pusilla	Baillon's crake					X	X			X		
Zapornia tabuensis	Spotless crake					X	X			X		
Turnicidae												
Turnix velox	Little button-quail					X	X			X	X	X
Burhinidae												
Burhinus grallarius	Bush stone-curlew					X	X			X	X	
Recurvirostridae												
Cladorhynchus leucocephalus	Banded stilt					X	X			X		
Himantopus himantopus	Black-winged stilt					X	X			X	X	
Recurvirostra novaehollandiae	Red-necked avocet					X	X			X		
Charadriidae												
Charadrius leschenaultii	Greater sand plover		VU & MI	VU & MI						X		
Charadrius ruficapillus	Red-capped plover					X	X			X	X	
Charadrius veredus	Oriental plover		MI	MI		X		X	X			
Elseyornis melanops	Black-fronted dotterel					X	X			X	X	X
Erythrogonys cinctus	Red-kneed dotterel					X				X		

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Vanellus miles	Masked lapwing					X						
Vanellus tricolor	Banded lapwing					X	X					
Rostratulidae												
Rostratula australis	Australian painted snipe		EN	EN				X				
Scolopacidae												
Actitis hypoleucos	Common sandpiper		MI	MI		X	X	X	X	X		
Calidris acuminata	Sharp-tailed sandpiper		MI	MI		X	X	X	X	X		
Calidris ferruginea	Curlew sandpiper		CR & MI	CR & MI		X	X	X	X	X		
Calidris melanotos	Pectoral sandpiper		MI	MI		X	X	X	X			
Calidris ruficollis	Red-necked stint			MI		X	X		X	X		
Calidris subminuta	Long-toed stint		MI	MI		X	X		X	X		
Tringa glareola	Wood sandpiper		MI	MI		X	X		X	X	X	
Tringa nebularia	Common greenshank		MI	MI		X	X		X	X	X	
Tringa stagnatilis	Marsh sandpiper		MI	MI		X	X		X	X	X	
Tringa totanus	Common redshank		MI	MI			X		X		X	
Glareolidae												
Stiltia isabella	Australian pratincole					X	X			X		
Laridae												
Chlidonias hybrida	Whiskered tern					X				X		

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Chroicocephalus novaehollandiae	Silver gull					X	X			X		
Gelochelidon nilotica	Gull-billed tern		MI	MI		X	X		X	X		
Hydroprogne caspia	Caspian tern		MI	MI		X	X		X	X		
Columbidae												
Geopelia cuneata	Diamond dove					X	X			X	X	X
Geopelia humeralis	Bar-shouldered dove					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												
Centropus phasianinus	Pheasant coucal					X	X				X	
Chrysococcyx basalis	Horsfield's bronze cuckoo					X	X			X		X
Chalcites osculans	Black-eared cuckoo					X	X	X		X	X	
Heteroscenes pallidus	Pallid cuckoo					X	X			X	X	X
Tytonidae												
Tyto javanica delicatula	Eastern barn owl					X	X			X	X	X
Strigidae												

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Ninox boobook	Southern boobook					X	X			X	X	
Ninox connivens	Barking owl					X	X				X	X
Podargidae												
Podargus strigoides	Tawny frogmouth					X	X			X	X	
Caprimulgidae												
Eurostopodus argus	Spotted nightjar					X	X			X	X	
Aegothelidae												
Aegotheles cristatus	Australian owlet-nightjar					X	X			X	X	X
Apodidae												
Apus pacificus	Fork-tailed swift (pacific swift)		MI	MI		X		X	X			
Coraciidae												
Eurystomus orientalis	Dollarbird					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	X

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
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	VU		X		X				
Falco longipennis	Australian hobby					X	X			X	X	
Falco peregrinus	Peregrine falcon			OS		X	X		X	X	X	
Falco subniger	Black falcon					X						
Cacatuidae												
Cacatua sanguinea	Little corella					X	X			X	X	X
Calyptorhynchus banksii	Red-tailed black cockatoo					X						
Cacatua roseicapilla	Galah					X	X			X	X	X
Nymphicus hollandicus	Cockatiel					X	X			X	X	
Psittacidae												
Barnardius zonarius zonarius	Australian ringneck					X	X			X	X	X
Melopsittacus undulatus	Budgerigar					X	X			X	X	X
Neophema elegans	Elegant parrot										X	
Neopsephotus bourkii	Bourke's parrot					X	X			X		
Pezoporus occidentalis	Night parrot		EN	CR				X				

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Polytelis alexandrae	Princess parrot		VU		P4			X				
Psephotus varius	Mulga parrot					X					X	
Ptilonorhynchidae												
Chlamydera guttatus	Western bowerbird					X	X			X	X	
Climacteridae												
Climacteris melanurus	Black-tailed treecreeper					X	X			X		
Maluridae												
Amytornis whitei whitei	Pilbara grasswren					X	X			X	X	X
Malurus assimilis assimilis	Purple-backed fairy-wren					X	X			X	X	X
Malurus leucopterus leucopterus	White-winged fairy-wren					X	X			X	X	X
Malurus melanocephalus	Red-backed fairy-wren					X						
Malurus splendens	Splendid fairy-wren					X	X			X	X	
Stipiturus ruficeps	Rufous-crowned emu-wren					X	X			X		
Meliphagidae												
Acanthagenys rufogularis	Spiny-cheeked honeyeater					X	X			X	X	X
Certhionyx variegatus	Pied honeyeater					X	X			X		
Epthianura aurifrons	Orange chat					X	X					

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Epthianura tricolor	Crimson chat					X	X			X	X	
Gavicalis virescens virescens	Singing honeyeater					X	X			X	X	X
Lacustroica whitei	Grey honeyeater					X	X			X		
Lichmera indistincta	Brown honeyeater					X	X			X	X	
Manorina flavigula	Yellow-throated miner					X	X			X	X	X
Melithreptus gularis	Black-chinned honeyeater					X	X			X	X	
Ptilotula keartlandi	Grey-headed honeyeater					X	X			X	X	X
Ptilotula penicillata	White-plumed honeyeater					X	X			X	X	X
Ptilotula plumula	Grey-fronted honeyeater					X						
Purnella albifrons	White-fronted honeyeater					X	X			X	X	
Stomiopera unicolor	White-gaped honeyeater									X		
Sugomel niger	Black honeyeater					X	X			X	X	
Pardalotidae												
Pardalotus rubricatus	Red-browed pardalote					X	X			X	X	X
Pardalotus striatus murchisoni	Striated pardalote					X	X			X	X	X

Family Name *Species Name*	**Common Name**	**Introduced**	**Conservation Codes**			**ALA**	**Nature Map**	**EPBC PMST**	**DBCA T and P**	**Birdata**	**Previous Surveys**	**Current Survey**
			EPBC Act	**BC Act**	**DBCA Priority Fauna list**							
Acanthizidae												
Acanthiza apicalis	Broad-tailed thornbill (inland thornbill)					X	X			X	X	
Acanthiza chrysorrhoa	Yellow-rumped thornbill					X	X			X		
Acanthiza robustirostris	Slaty-backed thornbill					X	X			X		
Acanthiza uropygialis	Chestnut-rumped thornbill					X	X			X	X	
Aphelocephala leucopsis	Southern whiteface		VU			X	X	X				
Aphelocephala nigricincta	Banded whiteface					X						
Gerygone fusca	Western gerygone					X	X			X	X	
Pyrrholaemus brunneus	Redthroat					X	X				X	
Smicrornis brevirostris	Weebill					X	X			X	X	X
Pomatostomidae												
Pomatostomus superciliosus	White-browed babbler					X	X			X	X	
Pomatostomus temporalis rubeculus	Grey-crowned babbler					X	X			X	X	X
Psophodidae												

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Psophodes occidentalis	Western wedgebill (chiming wedgebill)					X	X			X		
Cinclosomatidae												
Cinclosoma marginatum	Western quail-thrush					X	X					
Artamidae												
Artamus cinereus	Black-faced woodswallow					X	X			X	X	X
Artamus cyanopterus	Dusky woodswallow					X	X			X		
Artamus minor	Little woodswallow					X	X			X	X	X
Artamus personatus	Masked woodswallow					X	X			X	X	
Artamus superciliosus	White-browed woodswallow					X	X			X	X	
Cracticus nigrogularis	Pied butcherbird					X	X			X	X	X
Cracticus torquatus	Grey butcherbird					X	X			X	X	
Gymnorhina tibicen	Australian magpie					X	X			X	X	
Campephagidae												
Coracina maxima	Ground cuckoo-shrike					X	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												

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Daphoenositta chrysoptera	Varied sittella					X					X	
Oreoidae												
Oreoica gutturalis	Crested bellbird					X	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	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		
Corvus orru cecilae	Torresian crow					X	X			X	X	X
Petroicidae												
Melanodryas cucullata	Hooded robin					X	X			X	X	X
Petroica goodenovii	Red-capped robin					X	X			X	X	
Alaudidae												
Mirafra javanica	Horsfield's bushlark					X	X			X	X	

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	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			X		
Hirundo neoxena	Welcome swallow					X	X			X		
Hirundo rustica	Barn swallow		MI	MI				X				
Petrochelidon ariel	Fairy martin					X	X			X	X	X
Petrochelidon nigricans	Tree martin					X	X			X	X	X
Acrocephalidae												
Acrocephalus australis	Australian reed warbler					X	X			X	X	X
Locustellidae												
Cincloramphus cruralis	Brown songlark					X	X			X	X	
Cincloramphus mathewsi	Rufous songlark					X	X			X	X	X
Eremiornis carteri	Spinifexbird					X	X			X	X	X
Poodytes gramineus	Little grassbird					X	X			X		
Nectariniidae												
Dicaeum hirundinaceum	Mistletoebird					X	X			X	X	X
Estrildidae												
Emblema pictum	Painted finch					X	X			X	X	X
Neochmia ruficauda	Star finch					X	X			X	X	X

Family Name *Species Name*	Common Name	Introduced	Conservation Codes			ALA	Nature Map	EPBC PMST	DBCA T and P	Birdata	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list							
Taeniopygia castanotis	Zebra finch					X	X			X	X	X
Motacillidae												
Anthus australis	Australian pipit					X	X			X	X	X
Motacilla cinerea	Grey wagtail		MI	MI				X				
Motacilla tschutschensis	Yellow wagtail		MI	MI				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; EN = Endangered; MI = Migratory; VU = Vulnerable; CR = Critically Endangered; OS = Specially Protected.

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

Family Name *Species Name*	Common name	Introduced	Conservation Codes			ALA	NatureMap	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											
Antechinomys longicaudata	Long-tailed dunnart				P4	X	X		X		
Dasycercus blythi	Brush-tailed mulgara, ampurta				P4		X		X		
Dasykaluta rosamondae	Kaluta					X	X				
Dasyurus hallucatus	Northern quoll		EN	EN				X	X	X	

Family Name *Species Name*	Common name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCAT and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Ningaui timealeyi	Pilbara ningaui					X	X				
Planigale species 1'	Pilbara planigale						X			X	
Pseudantechinus woolleyae	Woolley's pseudantechinus					X	X			X	
Sminthopsis crassicaudata	Fat-tailed dunnart						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	X
Petrogale lateralis lateralis	Black-footed rock-wallaby		EN	EN		X	X		X		
Petrogale rothschildi	Rothschild's rock-wallaby					X	X			X	
Muridae											
Mus musculus	House mouse	*				X	X			X	X

Family Name *Species Name*	Common name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCAT and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Notomys alexis alexis	Spinifex hopping-mouse					X	X			X	
Pseudomys chapmani	Western pebble-mound mouse				P4	X	X		X	X	
Pseudomys desertor	Desert mouse					X	X			X	
Pseudomys hermannsburgensis	Sandy inland mouse					X	X			X	
Zyzomys argurus	Common rock-rat					X	X			X	
Leporidae											
Oryctolagus cuniculus	Rabbit	*				X	X			X	X
Rhinonycteridae											
Rhinonicteris aurantia (Pilbara form)	Pilbara leaf-nosed bat		VU	VU			X	X	X		
Megadermatidae											
Macroderma gigas	Ghost bat		VU	VU		X	X	X	X	X	
Emballonuridae											
Saccolaimus flaviventris	Yellow-bellied sheath-tailed bat						X			X	
Taphozous georgianus	Common sheath-tailed bat					X	X			X	X
Taphozous hilli	Hill's sheath-tailed bat					X	X			X	X
Molossidae											

Family Name *Species Name*	Common name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Austronomus australis	White-striped free-tailed bat						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
Nyctophilus geoffroyi geoffroyi	Lesser long-eared bat						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	Dog/Dingo	*				X	X			X	X
Vulpes vulpes	Red fox	*								X	
Felidae											
Felis catus	Cat	*				X	X			X	X
Equidae											
Equus asinus	Donkey	*					X			X	
Equus caballus	Horse	*					X			X	
Camelidae											

Family Name *Species Name*	Common name	Introduced	Conservation Codes			ALA	NatureMap	EPBC PMST	DBCA T and P	Previous Surveys	Current Survey
			EPBC Act	BC Act	DBCA Priority Fauna list						
Camelus dromedarius	Dromedary, camel	*				X	X				
Bovidae											
Bos taurus	European cattle	*				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; EN = Endangered; VU = Vulnerable.

Appendix E: Threatened and Priority Fauna Species Likelihood of Occurrence within the Survey Area

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Table E.1: Likelihood of occurrence of significant vertebrate fauna species listed as potentially occurring in the vicinity of the survey area.

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						
Spotted ctenotus (northeast) (*Ctenotus uber johnstonei*)			P2	This subspecies is only known from chenopod shrubland at the base of a sandstone hill, near Balgo. One recent (2018) fauna record was detailed on the DBCA threatened and priority fauna database search result, over 15 km from the survey area.	High	Low
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. This species was identified on the NatureMap database search only.	Low	Low
Great desert skink (*Liopholis kintorei*)	VU	VU		Red sandplains and sand ridges. Prefers a mosaic landscape of different aged vegetation and inhabits sites that have been burnt (3-15 years). Sparsely distributed across arid sand flats and clay-based or loamy soils vegetated with spinifex. The EPBC Act protected matters report assessed that this species or species habitat may occur within the area.	Low	Low
Gane's bind snake (*Anilios ganei*)			P1	Little information is available on this species, but it is believed to be associated with moist gorges and gullies. Ten previous records were detailed on the DBCA threatened and priority fauna database search result, with three records within 5 km of the survey area.	High	High
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. Nine previous records were detailed on the DBCA threatened and priority fauna database search result, including one recent (2019) record within 5 km of the survey area.	High	High
Birds						

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			
Glossy ibis (*Plegadis falcinellus*)	MI	MI		Wetland habitats, such as freshwater marshes at the edges of lakes, rivers and wet swamp areas. This species is occasionally found in coastal locations, such as estuaries, deltas, saltmarshes, and coastal lagoons. Twelve previous records were detailed on the DBCA threatened and priority fauna database result, with one record from 2000 from within the survey area.	**Recorded**	Moderate
Red goshawk (*Erythrotriorchis radiatus*)	VU	VU		The red goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riparian vegetation also provided significant nesting and foraging opportunities. The EPBC Act protected matters report assessed that this species or species habitat may occur within the area.	Low	Low
Greater sand plover (*Charadrius leschenaultia*)	VU & MI	VU & MI		Mainly sandy beaches and tidal mud, reef and sand flats. Vagrant to Australia. This species was identified on the Birdata database search only.	Low	Low
Oriental plover (*Charadrius veredus*)	MI	MI		This species inhabits sparsely vegetated plains, beaches and tidal flats, and saltworks and sewage ponds. The EPBC Act protected matters report assessed that this species or species habitat may occur within the survey area. One historical record was detailed on the DBCA threatened and priority fauna database results, within 5 km from the survey area	High	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*). The EPBC Act protected matters report assessed that this species or species habitat may occur within the area.	Low	Low

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			
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. Nineteen previous records were detailed on the DBCA threatened and priority fauna database result, with fifteen records within 5 km of the survey area.	High	High
Sharp-tailed sandpiper (*Calidris acuminata*)	MI	MI		Muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass, and low vegetation. Seven previous records were detailed on the DBCA threatened and priority fauna database result, with four historical and one recent record within 5 km of the survey area.	High	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. Also, around non-tidal swamps, lakes and lagoons near the coast. One record from 2005 was detailed on the DBCA threatened and priority fauna database result, within 5 km from the survey area.	High	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. One historical record was detailed on the DBCA threatened and priority fauna database result, within 5 km from the survey area.	High	Low
Red-necked stint (*Calidris ruficollis*)		MI		The edge of sheltered waters, including estuaries, beaches, near-coastal salt lakes, swamps, lakes, sewerage ponds, and bore overflows. Two recent records were detailed on the DBCA threatened and priority fauna database result, within 5 km from the survey area.	High	Low
Long-toed stint (*Calidris subminuta*)	MI	MI		Generally found in coastal environments, such as coastal margins, lagoons, beaches, and tidal flats. Three previous records were detailed on the DBCA threatened and priority fauna database result, all within 5 km from the survey area.	High	Low

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			
Wood sandpiper (*Tringa glareola*)	MI	MI		Generally open areas, such as the margins of inland freshwater lakes and reservoirs. This species rarely occurs in coastal habitats but may be found along the creeks of saltmarshes and mangrove swamps. Four previous records were detailed on the DBCA threatened and priority fauna database result, including one recent (2007) record within 5 km from the survey area.	High	High
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. Five previous records were detailed on the DBCA threatened and priority fauna database result, including three recent records from within 5 km of the survey area.	High	High
Marsh sandpiper (*Tringa stagnatilis*)	MI	MI		Found at the margins of inland freshwater and brackish wetlands, such as rice paddy-fields, swamps, saltpans, salt marshes, sewage works, and marshy lake edges. Although it is rare on open coastlines, it can occasionally be found on estuaries, lagoons and intertidal mudflats. One recent record was detailed on the DBCA threatened and priority fauna database result, within 5 km from the survey area.	High	High
Common redshank (*Tringa totanus*)	MI	MI		Found at sheltered coastal wetlands such as bays, river estuaries, lagoons, inlets and saltmarsh (with bare open flats and banks of mud or sand). They are also found around saltlakes, freshwater lagoons, artificial wetlands and saltworks and sewage farms. One record from 2012 was detailed on the DBCA threatened and priority database result, within 5 km from the survey area.	High	Low
Gull-billed tern (*Gelochelidon 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. Seven previous records were detailed on the DBCA threatened and priority fauna database result, including 5 records from within 5 km of the survey area.	High	Low

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			
Caspian tern (*Hydroprogne caspia*)	MI	MI		Mainly sheltered seas, estuaries and tidal creeks. Three previous records were detailed on the DBCA threatened and priority fauna database result, within 5 km from the survey area.	High	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. One record from 2022 was detailed on the DBCA threatened and priority fauna database result, within 5 km from the survey area.	High	Moderate
Grey falcon (*Falco hypoleucos*)	VU	VU		Open habitats: semi-deserts, grassy inland plains, timbered watercourses, and pastoral lands. The EPBC Act protected matters report assessed that this species or species habitat may occur within the survey area. The EPBC Act protected matters report assessed that this species or species habitat is likely to occur within the survey area.	Low	Low
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. Seven previous records were detailed on the DBCA threatened and priority fauna database result, including four recent records less than 5 km from the survey area.	High	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. The EPBC Act protected matters report assessed that this species or species habitat is likely to occur within the survey area.	Low	Low

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	Inhabits sand dunes and sand flats in the arid zone. Occurs in savanna woodlands and shrublands that usually consist of scattered stands of *Eucalyptus* spp, *Casuarina/Allocasuarina* trees, an understorey of shrubs, and a ground cover dominated by *Triodia* ssp. The EPBC Act protected matters report assessed that this species or species habitat is known to occur within the survey area.	Moderate	Low
Southern whiteface (*Aphelocephala leucopsis*)	VU			Critical habitat includes relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both, habitat with low tree densities and a herbaceous understory litter cover which provides essential foraging habitat, and living and dead trees with hollows and crevices which are essential for roosting and nesting. The EPBC Act protected matters report assessed that this species or species habitat is known to occur within the survey area.	Moderate	Low
Barn swallow (*Hirundo rustica*)	MI	MI		Coastal open country generally, especially near surface water and man-made structures such as bridges and power wires. The EPBC Act protected matters report assessed that this species or species habitat may occur within the survey area. The EPBC Act protected matters report assessed that this species or species habitat may occur within the area.	Low	Low
Yellow wagtail (*Motacilla tschutschensis*)	MI	MI		Damp short-grass flats, edges of swamps, sewage ponds, grazed or mowed grass and irrigated areas. Vagrant to Australia. The EPBC Act protected matters report assessed that this species or species habitat may occur within the survey area. The EPBC Act protected matters report assessed that this species or species habitat may occur within the area.	Low	Low

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 wagtail (*Motacilla cinerea*)	MI	MI		Mainly banks and rocks in fast flowing fresh water. Vagrant to Australia. The EPBC Act protected matters report assessed that this species or species habitat may occur within the survey area. The EPBC Act protected matters report assessed that this species or species habitat may occur within the area.	Low	Low
Mammals						
Long-tailed dunnart (*Antechinomys longicaudata*)			P4	Found in rocky scree and plateau areas, generally with little vegetation or in areas of spinifex hummock grassland, shrubs and open woodland. Seven previous records were detailed on the DBCA threatened and priority fauna database result, including two records within 5 km from the survey area.	High	Moderate
Brush-tailed mulgara (*Dasycercus blythi*)			P4	Common in a range of habitats – tussock / hummock grasslands and sparse shrubs and low open woodlands on ridge tops, cliffs, scree slopes, hills, and valley floors. Two recent records were detailed on the DBCA threatened and priority fauna database result, over 15 km from the survey area.	High	Low
Northern quoll (*Dasyurus hallucatus*)	EN	EN		Occurs in a variety of habitats, but commonly found in rocky escarpments and open lowland savanna forest. Also, in areas associated with rocky areas, but also along watercourses. One previous unconfirmed record was identified within the boundary of the current survey area.	**Recorded**	Moderate
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. They require sandy or loamy soils in which to burrow. Six historical records were detailed on the DBCA threatened and priority fauna database result, including one record within 5 km from the survey area.	High	Low

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			
Spectacled hare–wallaby (mainland) (*Lagorchetes conspicullatus leichardti*)			P4	Tussock or hummock grassland with mid-dense/sparse tree and shrub cover. This species was identified on the NatureMap database search only.	Low	Low
Black-footed rock-wallaby (*Petrogale lateralis lateralis*)	EN	EN		Occurs in cliffs, rock-piles, talus or escarpment refuge and other steep substrates with grassland feeding habitat nearby. Also occurs on limestone outcrops, coastal cliffs and granite outcrops. Four historic records were detailed on the DBCA threatened and priority fauna database result, over 15 km from the survey area.	Low	Low
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. One hundred and eighteen previous records were detailed on the DBCA threatened and priority fauna database result, including two recent (2009 and 2012) records within the survey area.	**Recorded**	High
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. Three-hundred and twenty-nine previous records were detailed on the DBCA threatened and priority fauna database results, including three records from 2022 within 5 km of the survey area.	High	High
Ghost bat (*Macroderma gigas*)	VU	VU		A wide range from rainforest, monsoon and vine scrub in the tropics to open woodlands and arid areas. Two-hundred and seventy-five previous records were detailed on the DBCA threatened and priority fauna database search result, including one record from 2012 within the survey area.	**Recorded**	High

Note: EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*, BC Act = *Biodiversity and Conservation Act 2016*, DBCA = Department of Biodiversity, Conservation and Attractions, VU = Vulnerable, P = Priority, MI = Migratory, CR = Critically Endangered, OS = Specially Protected, EN = Endangered.

Appendix F: Fauna Habitat Mapping and Significant Areas

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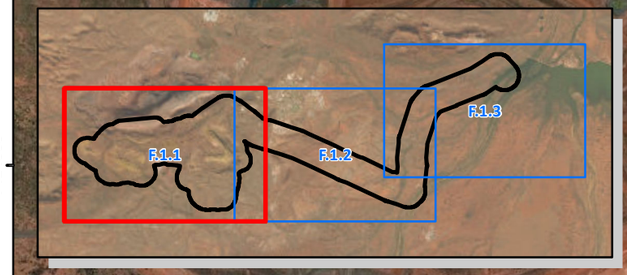
7414000 7412000 7410000



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

OB35-HA01
OB35-NQ3.1
OB35-NQ3.2
OB35-NQ3.3
OB35-BAT03
OB35-NQ3.4
OB35-NQ3.5
OB35-HA35
OB35-HA36
OB35-HA13
OB35-BAT06
OB35-HA14
OB35-HA16
OB35-HA15
OB35-HA04
OB35-BAT02
OB35-CAM01
OB35-HA02
OB35-HA03
OB35-HA29
OB35-BAT07
OB35-HA33
OB35-HA31
OB35-HA32
OB35-HA30

Survey Area

Sample Sites
- Echolocation Recording
- Motion Camera
- Habitat Assessment
- Northern Quoll Camera
- Northern Quoll Transect

Habitat Type
- Breakaway/ Cliff
- Hillcrest/ Hillslope
- Major Drainage Line
- Minor Drainage Line
- Stony Plain
- Undulating Low Hills
- Cleared/ Disturbed

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure F.1.1: Fauna habitat mapping

Scale: 1:25,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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

N

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Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigF1

778000 780000 782000 784000 786000

7414000 7412000 7410000

F.1.1 F.1.2 F.1.3

Survey Area

Sample Sites

- Echolocation Recording
- Acoustic Recording
- Bilby Targeted Search
- Bilby Plot
- Habitat Assessment
- Northern Quoll Camera
- Northern Quoll Transect

Habitat Type

- Breakaway/ Cliff
- Drainage Area/ Floodplain
- Hillcrest/ Hillslope
- Major Drainage Line
- Medium Drainage Line
- Minor Drainage Line
- Mulga Woodland
- Sandy/ Stony Plain
- Stony Plain
- Undulating Low Hills
- Cleared/ Disturbed

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

OB35-HA01 OB35-HA13 OB35-HA14 OB35-BAT06 OB35-HA16 OB35-HA15 OB35-HA17 OB35-BP01 OB35-HA21 OB35-HA23 OB35-HA24 OB35-HA20 OB35-HA18 OB35-AUDIO02 OB35-HA19 OB35-HA04 OB35-HA11 OB35-HA12 OB35-HA10 OB35-HA09 OB35-HA08 OB35-BTS01 OB35-BTS02 OB35-HA34 OB35-HA07 OB35-HA06 OB35-HA22 OB35-HA05 OB35-BAT04 OB35-BP02 OB35-HA38 OB35-HA39 OB35-HA28 OB35-BAT08 OB35-HA27 OB35-HA37 OB35-NQ1.4 OB35-NQ1.3 OB35-BAT01 OB35-NQ1.2 OB35-NQ1.5 OB35-NQ1.1

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure F.1.2: Fauna habitat mapping

Scale: 1:25,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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

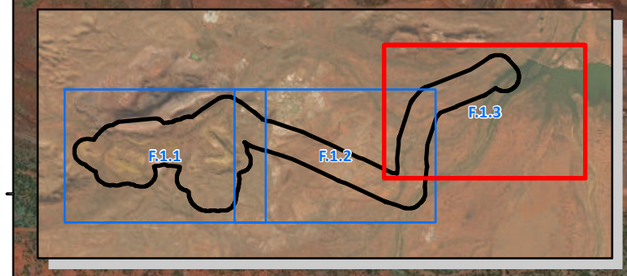
N

astron an ecocene company

Author: S. Smithies Drawn: C. Dyde Date: 11-03-2024 Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigF1

786000 788000 790000 792000

7416000 7414000 7412000



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

OB35-NQ2.1
OB35-NQ2.2
OB35-NQ2.4
OB35-NQ2.3
OB35-BAT05
OB35-NQ2.5
OB35-AUDIO01
OB35-HA25
OB35-HA26
OB35-BP02
OB35-HA38
OB35-HA39
OB35-HA28
OB35-BAT03
OB35-HA27

Survey Area

Sample Sites

- Echolocation Recording
- Acoustic Recording
- Bilby Plot
- Habitat Assessment
- Northern Quoll Camera
- Northern Quoll Transect

Habitat Type

- Drainage Area/ Floodplain
- Medium Drainage Line
- Mulga Woodland
- Sandy/ Stony Plain
- Stony Plain
- Wetland
- Cleared/ Disturbed

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure F.1.3: Fauna habitat mapping

Scale: 1:25,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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

N

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Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigF1

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7420000 7415000 7410000 7405000

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

CWBK-01
CWBK-02
CWBK-03
CWBK-04

Newman

WWBK-02

WWBK-01

CWER-02

Survey Area

Significant Area

- Cave / Overhang (Category 4)
- Water feature (Permanent pool/Wetland)
- Water feature (Pool)

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure F.2: Significant area locations within the study area

Scale: 1:60,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 Kilometres

N

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Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigF2_SigArea

Table F.1: Locations of significant areas within the survey area

Site ID	Feature	Latitude	Longitude	Category rating for ghost bat usage	Description	Photograph
CWER-02	Cave	-23.3923	119.6663	4	**Entrance:** Round opening (1 m high x 2 m wide) **Orientation:** South facing **Internal:** One chamber (5 m high x 4 m wide x 10 m deep) **Conditions:** Bat scat, microbats present.	
CWBK-01	Cave	-23.3690	119.7073	4	**Entrance:** Horizontal opening (1 m high x 5 m wide) **Orientation:** South-west facing **Internal:** One chamber (2 m high x 5 m wide x 10 m deep) **Conditions:** Bat scat.	

Site ID	Feature	Latitude	Longitude	Category rating for ghost bat usage	Description	Photograph
CWBK-02	Cave	-23.3691	119.7077	4	**Entrance:** Horizontal opening (2 m high x 10 m wide) **Orientation:** South-west facing **Internal:** Two chambers (1.5 m high x 2 m wide x 10 m deep and 2 m high x 1 m wide x 20 m deep) **Conditions:** Bat scat, microbats present.	
CWBK-03	Cave	-23.3692	119.7077	4	**Entrance:** Horizontal opening (1.5 m high x 9 m wide) **Orientation:** South-west facing **Internal:** One chamber (1.8 m high x 15 m wide x 20 m deep) **Conditions:** Bat scat, microbats present.	

Site ID	Feature	Latitude	Longitude	Category rating for ghost bat usage	Description	Photograph
CWBK-04	Cave	-23.3702	119.7099	4	**Entrance:** Round opening (1.5 m high x 6 m wide) **Orientation:** South-west facing **Internal:** Two chambers (2.5 m high x 12 m wide x 5 m deep and 1.5 m high x 5 m wide x 11 m deep) **Conditions:** Bat scat, microbats present.	
WWBK-01	Water Feature	-23.3979	119.7983	N/A	Semi-permanent pool, 20 m x 1 m wide and approximately 0.5 m deep.	

Site ID	Feature	Latitude	Longitude	Category rating for ghost bat usage	Description	Photograph
WWBK-02	Water Feature	-23.3441	119.8355	N/A	Permanent wetland, 2,000 m x 200 m wide and up to 5 m deep (estimated).	

Note: N/A = not applicable.

Appendix G: MNES Fauna Habitat Suitability Mapping

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7420000 7415000 7410000 7405000

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

Newman

Survey Area

Pilbara olive python habitat suitability

Critical habitat

Supporting habitat

Limited foraging and dispersal habitat

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure G.1: Pilbara olive python habitat suitability mapping

Scale: 1:60,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 Kilometres

N

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Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigG1_POP

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7420000 7415000 7410000 7405000

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

Newman

CWER-03 (Cat 2 Ghost Bat Roost)
CWER-03 - 12km Buffer
Survey Area

Ghost bat habitat suitability

Critical habitat
Supporting habitat
Limited foraging and dispersal habitat

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OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure G.2: Ghost bat habitat suitability mapping

Scale: 1:60,000 at A3
Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 Kilometres

N

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Author: S. Smithies | Drawn: C. Dyde | Date: 15-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigG2_GB

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7420000 7415000 7410000 7405000

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

Newman

Survey Area

Pilbara Leaf-nosed Bat Habitat Suitability

Supporting habitat

Limited foraging and dispersal habitat

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure G.3: Pilbara leaf-nosed bat habitat suitability mapping

Scale: 1:60,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 Kilometres

N

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Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigG3_PLNB

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7420000 7415000 7410000 7405000

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

Newman

Survey Area

Northern Quoll Habitat Suitability

Supporting habitat

Limited foraging and dispersal habitat

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure G.4: Northern quoll habitat suitability mapping

Scale: 1:60,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 Kilometres

N

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Author: S. Smithies | Drawn: C. Dyde | Date: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigG4_NQ

Appendix H: Significant Fauna Locations

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7430000 7420000 7410000 7400000

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

Newman

Survey Area

BHP Database

- Ghost Bat
- Northern Quoll
- Pilbara Olive Python
- Western Pebble-mound Mouse or Ngadji

DBCA Threatened and Priority Fauna Database

- Gane's Blind Snake (Pilbara)
- Pilbara leaf-nosed bat
- Pilbara Olive Python
- Bilby
- Black-flanked Rock-wallaby
- Brush-tailed Mulgara
- Caspian Tern
- Common Greenshank
- Common Redshank
- Common Sandpiper
- Curlew Sandpiper
- Fork-tailed Swift
- Ghost Bat
- Glossy Ibis
- Gull-billed Tern
- Long-tailed Dunnart
- Long-toed Stint
- Marsh Sandpiper
- Oriental Plover
- Pectoral Sandpiper
- Peregrine Falcon
- Red-necked Stint
- Sharp-tailed Sandpiper
- Spotted Ctenotus (northeast)
- Western Pebble-mound Mouse
- Wood Sandpiper

BHP Western Australian Iron Ore

OB29, 30 and 35 Expansion and Newman Surplus Water Targeted Significant Fauna Survey

Figure H.1: Previous significant vertebrate fauna locations

Scale: 1:150,000 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: 11-03-2024 | Figure Ref: 2400-17-23-BIDR-1RevB_240311_FigH1_PrevFauna

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