Basic and Targeted Vertebrate Fauna Survey and Risk Assessment

Katanning Gold Project

Prepared for: Ausgold Exploration Pty Ltd

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EXECUTIVE SUMMARY

Ausgold Exploration Ltd (Ausgold) is planning additional exploration followed by mining on its tenements which are ~35km east-north-east of Katanning in Western Australia (WA). The survey area was ~4,366ha, but because of access issues to some areas, the Black-Cockatoo habitat trees assessment and camera trapping were confined to much smaller area.

Most of the survey area is farmland and was cleared many decades ago. The most substantial patch of native bushland is around and to the south-east of the Woorgabup Nature Reserve (R24072) and the Rifle Range Reserve (R2423 and R2425). This area was assessed by Western Wildlife (2018) who reduced Mattiske Consulting's (2018) 10 vegetation communities to four fauna habitats:

- Wandoo woodland;
- York Gum Woodland;
- Mallet woodland; and
- Banksia heath.

There are multiple small areas of remnant native vegetation patches on farming properties across the survey area and multiple ephemeral drainage lines and creeks that run in a north-westerly direction, with many of these having remnant vegetation along both banks. There is a disused mining pit in care and maintenance, and farm housing and sheds in the survey area.

The bushland area around the Woorgabup Nature and Rifle Range Reserves contains a recently active Carnaby's Black-Cockatoo nest, as well as foraging and roosting sites. These two reserves and the large remnant block of native vegetation on M70/1426, support a population of Red-tailed Phascogales, which is listed as conservation dependent at the State level and Vulnerable at the Commonwealth level. The inland form of the Western Rosella was observed infrequently in the bushland area, indicating that it likely forages there and possibly breeds in tree hollows in this region.

Overall, Terrestrial Ecosystems recorded 8,396 significant trees in the survey area, and of those 740 were assessed from the ground level to have at least one hollow that could potentially be used as a nesting site for Black-Cockatoos. Within a 12km radius of the survey area, there is more than 6,700ha of good quality nesting habitat and 360ha of foraging habitat.

The Woorgabup Nature Reserve and Rifle Range Reserve, and many of the larger blocks of remnant vegetation support Western Grey Kangaroos and Common Brush-tailed Possums, and the loss of vegetation could negatively impact these species. Foxes and feral cats are also widespread across the survey area.

Based on the type of vegetation Ausgold plans to disturb, it will assess the potential significant impacts on Carnaby's Black-Cockatoo and Red-tailed Phascogale and determine if a referral under the *EPBC Act* is necessary.

1. INTRODUCTION

1.1 BACKGROUND

Ausgold Exploration Ltd (Ausgold) is planning additional exploration followed by mining on its tenements, which are ~35km east-northeast of Katanning in Western Australia (WA; Figure 1). This project is on the Katanning Greenstone Belt in the southwest corner of the Yilgarn Craton.

Terrestrial Ecosystems (2021, 2022a, b, c, 2024) has undertaken numerous surveys and assessments for Ausgold's tenements, however, Ausgold had yet to obtain access to some of the land it had proposed would be in its development envelope. This situation recently changed, and Ausgold acquired land access to two additional areas and amended its development envelope as follows:

- Parcel of land to the east;
- The corridor down Wolyaming Rd to Badgebup and then along Nyabing Rd to South Bore; and
- A parcel of land owned by Ausgold that has been moved into the development envelope.

This report provides information on the November 2024 survey of parts of the additional areas, and updates the earlier report (Terrestrial Ecosystems 2024).

1.2 SURVEY OBJECTIVES AND SCOPE OF WORKS

Terrestrial Ecosystems was commissioned by Ausgold to undertake a Basic and targeted vertebrate fauna survey of the additional areas, using data collected from camera trapping and a targeted Black-Cockatoo habitat tree assessment of areas of native vegetation in the survey area to support an environmental impact assessment, and with these data, update the earlier report. The fauna risk assessment methodology broadly followed that described in the Environmental Protection Authority's (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*.

The objectives of this vertebrate fauna assessment were to:

- indicate the vertebrate fauna assemblage (reptiles, amphibians, small mammals and birds) on and near the survey area so that potential impacts on the fauna might be adequately assessed;
- assess whether the survey area supports species of conservation significance;
- assess the impact and environmental risks associated with the proposed development on the fauna assemblage; and
- make recommendations for mitigating potential impacts on the vertebrate fauna associated with exploration and mining activity.

To achieve these objectives, Terrestrial Ecosystems has:

- reviewed Terrestrial Ecosystems fauna survey database [includes WA Museum, Atlas of Living Australia (AoLA)] to identify potential vertebrate fauna within the survey area and surrounds;
- searched the Commonwealth government's online database to identify fauna species of national environmental significance that are protected under the *EPBC Act* potentially occurring in the survey area and surrounds;
- reviewed previous fauna surveys conducted in the vicinity of the survey area in the bioregion to provide a context;
- undertaken multiple site visits;
- undertaken multiple camera trapping surveys and a nocturnal survey of remnant vegetation within the survey area;
- undertaken an assessment of Black-Cockatoo habitat trees in the survey area and the surrounds;

- provided a discussion on the likelihood of *EPBC Act 1999* and the *Biodiversity Conservation Act 2016* (*BC Act*) listed species being present in the survey area; and
- provided recommendations on mitigating and minimising potential impacts on species of conservation significance.

2. EXISTING ENVIRONMENT

2.1 LOCATION OF SURVEY AREA

The survey area is located within the Avon Wheatbelt 2 (AW2 - Rejuvenated Drainage) sub-bioregion. This subregion has a gently undulating landscape of low-relief (Beecham 2001). The native vegetation in the subregion includes proteaceous scrub-heaths, Rock Sheoak, Wandoo, York and Salmon Gum with Jam, Casuarina and Banksia woodlands. The landforms and soils vary from granites to laterite gravels, interacting with varying sands and loams.

The survey area includes the Woorgabup Nature Reserve (R24072) and Rifle Range Reserve (R2423 and R2425) and is within the sheep farming area of the south-west of Western Australia (WA).

Mattiske Consulting (2018, 2020) has undertaken two flora and vegetation assessments for parts of the Ausgold tenements and Western Wildlife (2018) reported on the vertebrate fauna in the bushland in and around the Woorgabup Nature Reserve (R24072) and the Rifle Range Reserve (R2423 and R2425). Terrestrial Ecosystems (2021, 2022a, b, c, 2024) has undertaken a camera trapping program and Black-Cockatoo habitat tree assessment in portions of the survey area.

2.2 CLIMATE

The climate in the survey area is characterised as warm Mediterranean (Beecham 2001). Katanning, located ~35km to the west-south-west, has an annual rainfall of around 480mm, although this amount varies considerably from year to year. The highest mean maximum and minimum temperatures in Katanning are in January (Bureau of Meteorology 20224). The lowest mean daily maximum temperatures occur in July (Chart 1). Rainfall predominantly occurs between May and August, and winter rains result from low-pressure cells moving easterly.

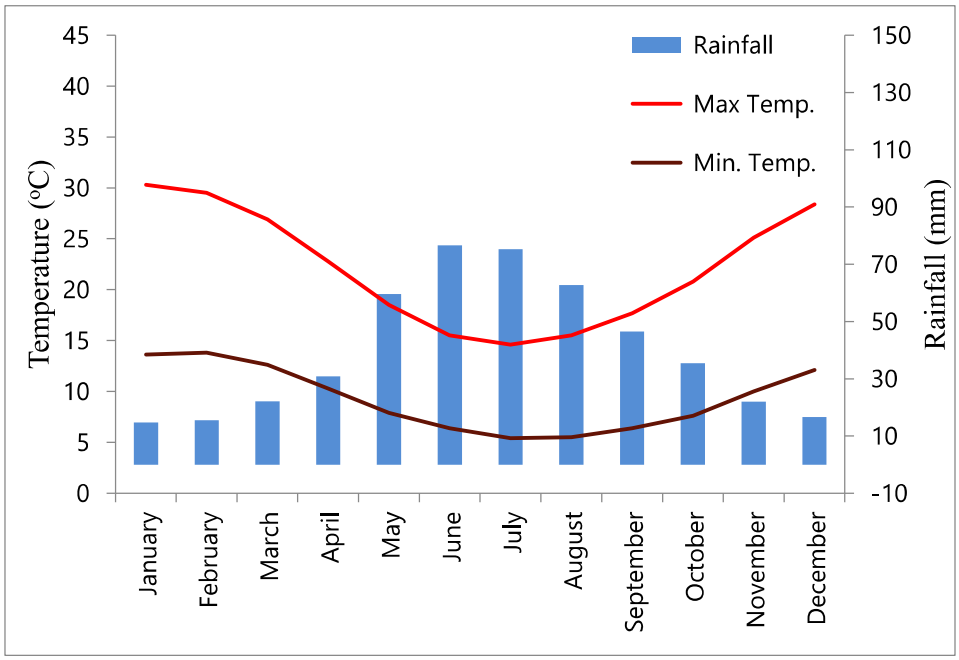

Chart 1. Climatic averages for Katanning

2.3 REGIONAL BIOLOGICAL FAUNA CONTEXT OF SURVEY AREA

The frogs, reptiles, mammals, and birds in the vicinity of the survey area have been surveyed for other environmental assessments and research purposes and are therefore well-known. Fauna surveys and assessments undertaken in the vicinity of the survey area that have been reviewed for this assessment include:

- Burbidge, A.H., Rolfe, J.K., McKenzie, N.L. and Roberts, J.D. (2004). Biogeographic patterns in small ground-dwelling vertebrates of the Western Australian wheatbelt, *Records of the Western Australian Museum*, Supplement No 67, 109-137.
- Mattiske Consulting Pty Ltd and Molloch Fauna Consultants (1996) *Flora, Vegetation and Vertebrate Fauna Survey Wishbone, Moulyinning and Candlelight Town and Railway Siding Reserves*. Unpublished report for Dumbleyung Land Conservation District Committee, Perth.
- Short, J., Hide, A. and Stone, M. (2011) Habitat requirements of the endangered red-tailed phascogale, *Phascogale calura*. *Wildlife Research*, 38, 359-369.
- Western Wildlife (2018) *Katanning Gold Project Level 1 Vertebrate Fauna Survey and Carnaby's Black-Cockatoo Habitat Survey, October 2017,* Unpublished report for Ausgold Exploration Pty Ltd, Perth.

Data in the Atlas of Living Australia and the Western Australian Museum have also been added to the information contained in Appendix B, and the compilation of the species lists for the survey area.

2.4 FAUNA SPECIES AT RISK

Beecham (2001) reported multiple vertebrate fauna species of conservation significance at risk in the subregion, including Red-tailed Phascogale (*Phascogale calura*), Western Brush Wallaby (*Notamacropus irma*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Carnaby's Black-Cockatoo (*Zanda latirostris*) and Baudin's Black-Cockatoo (*Zanda baudinii*).

3. METHODOLOGY

3.1 DATABASE SEARCHES

A search of the *EPBC Act 1999* matters of national environmental significance (MNES) was undertaken for the survey area and surrounds to prepare a list of species of conservation significance of interest to the Commonwealth Government (Appendix A). Additionally, a desktop search of the Terrestrial Ecosystems' fauna survey database was conducted to develop an understanding of the vertebrate fauna assemblages in the relevant section of the bioregion near the survey area.

Other, more general texts were also used to provide supplementary information on the vertebrate fauna in the bioregion, including Tyler et al. (2000) for frogs, Storr et al. (1983, 1990, 1999, 2002) for reptiles, Johnstone and Storr (1998, 2004) for birds, and Van Dyck and Strahan (2008) for mammals.

Collectively, these sources of information were used to create lists of species expected to utilise the survey area and similar habitats near the survey area. It should be noted that these lists will include species that have been recorded in the subregion but are possibly vagrants, and they will not generally be found in the survey area due to a lack of suitable habitat (e.g. wetland and water birds). Vagrants can be recorded almost anywhere. Many bird, mammal, reptile and amphibian species have specific habitat requirements that may be present in the subregion but not in the survey area. Additionally, the ecology of many species is often poorly understood, and it can sometimes be challenging to identify those species whose specific habitat requirements are not met in a particular portion of the subregion due to differences in habitat. Consequently, many species will be included in the lists produced from database searches but will not be present in the actual survey area.

There are errors in most databases, including the Atlas of Living Australia and the Western Australian Museum (WAM) collection. These errors occur due to misidentification of individuals, taxonomic name changes, and incorrect coordinates entered into the database. Terrestrial Ecosystems could not verify the primary records, so it used the provided information. Obvious errors have been removed; however, readers should be aware that species lists and fauna surveys reported in the appendices may still contain these errors.

3.2 TARGETED SURVEYS AND ASSESSMENTS

3.2.1 Black-Cockatoos

A Black-Cockatoo significant habitat tree assessment was undertaken in and around the bushland surrounding Woorgabup Nature Reserve (R24072), Rifle Range Reserve (R2423 and R2425), the remnant bushland in Jackson, Jinkas and Olympia areas (Terrestrial Ecosystems 2021, 2022a, b, c, 2024) and other bushland patches on farming properties, accessible road verges and paddocks in the survey area. The presence of Black-Cockatoos was assessed based on evidence of foraging in the survey area, roosting by being present in the survey area at dawn and dusk, breeding by examining trees for suitable breeding hollows, and when hollows were present by knocking on the tree trunk and observing the hollow entrance to see whether Black-Cockatoos appeared at the entrance or left the tree hollow. Significant Black-Cockatoo habitat trees were recorded following the Commonwealth Government's guidelines (Department of Agriculture Water and the Environment 2022) as follows:

- the GPS location;
- the diameter at breast height (DBH) and the tree's approximate height;
- photograph the tree;
- any hollows had the entrance dimensions estimated from ground level, the hollow's height above the ground estimated, and hollow orientation recorded. Other notable observations of each tree hollow (i.e. historical use for breeding/feeding, presence of bees etc) will also be recorded;
- each tree had a numbered metal tag attached;

- recorded evidence a tree hollow has been or is being used for breeding from ground level;
- record evidence of Black Cockatoos in the survey area; and
- investigate evidence that any of the trees support a roosting site.

Plate 1. Metal tree tag

3.2.2 Black-Cockatoo foraging habitat assessment to support an EPBC referral

The Commonwealth Government's (Department of Agriculture Water and the Environment 2022) referral guidelines indicate that an assessment of foraging opportunities for Black-Cockatoos is required within a 12km radius of a survey area if a referral under the *EPBC Act* is to be submitted. To meet this requirement, a search of all remnant bushland within a 12km radius of the project area was previously undertaken to map areas that provided foraging and potential breeding habitat for Black-Cockatoos. Habitat areas are classified into three types:

- Good quality nesting habitat (GQ) – presence of suitable nesting trees in high abundance;
- Poor quality nesting habitat (PQ) – none to sporadic presence of potentially suitable nesting trees; and
- Foraging habitat (FH) – appropriate habitat containing foraging species for Carnaby's Black-Cockatoos.

This visual survey was conducted from a vehicle using binoculars on publicly accessible roads as required. Areas that could not be visually assessed were classified by inference based on visual representations in aerial photography and confirmed by nearby habitats.

Singular trees and small clumps within paddocks were mainly excluded from the assessment, however, a few were included during the mapping assessment if they were located within an appropriate area of good-quality nesting habitat.

Most areas that provided foraging habitats consisted of groves of introduced Pinus species and trees along the edges of nearby roadways, as well as vegetation in remnant blocks of native vegetation. Several blocks of native vegetation, which provided foraging areas, comprised a mixture of native Banksia and Hakea shrubs (i.e., not large trees).

Poor quality nesting habitat included vegetation not appropriate for nesting or foraging, planted vegetation on properties, riparian vegetation not suitable for nesting, mallee and other inappropriate Eucalypt species, as

well as possible future nesting tree species that were smaller than the specified diameter at breast height (DBH) ranges (i.e. immature trees, etc).

Good-quality nesting habitats were those with tree species known to be used by Carnaby's Black-Cockatoos that were over 300mm or 500mm DBH, depending on the tree species, located within large patches of vegetation as well as on the edges of roads.

3.2.3 Chuditch, Western Grey Kangaroos, Western Brush Wallaby, Quenda, Red-tailed Phascogales, foxes and feral cats

Camera traps can provide a non-invasive assessment method for determining the presence of a threatened species in a survey area, however, they do not confirm the absence of a species. To determine whether the conservation-significant Chuditch, Western Brush Wallaby, Quenda, and Red-tailed Phascogale, or common species such as Western Grey Kangaroos, were present, camera trapping was conducted. Camera trapping has been undertaken in and around the Woorgabup Nature Reserve, the Rifle Range Reserve, and remnant bushland in the Jackson, Jinkas, and Olympia projects, as well as in other relatively large remnant patches of native vegetation on the Harris and Ramm farms.

Camera traps (Reconyx HC600) were attached to a star picket approximately 600mm above the ground (Plate 2) or a tree and had a non-reward lure of universal bait (oats, peanut butter, sardines and fish oil; Plate 3) placed ~3-5m in front of the camera. The non-reward lure increased the propensity for fauna to be recorded by a camera trap. Seventy-five camera traps were deployed in the Woorgabup Nature Reserve and Rifle Range Reserve, seven in the Jinkas area, three in the Olympia area, 10 in the Jackson area, 15 on E70/3952 and 11 on M70/1426. Camera trapping has been conducted at 144 locations, with most camera traps remaining on site for approximately 30 days. A total of 5597 nights of camera trapping have been completed, and the locations are shown in Figures 3-9.

Plate 2. Camera trap

Plate 3. Non-reward bait pod

3.2.4 Nocturnal survey

On the evening of 27 August 2021, Terrestrial Ecosystems staff spent ~3 hours walking through the Woorgabup Nature Reserve and Rifle Range Reserve with thermal binoculars and spotlights.

3.3 STAFFING

Dr Scott Thompson was the team leader and coordinated the overall survey. A team of Terrestrial Ecosystems zoologists undertook the habitat assessments, Black Cockatoo surveys and assessment, and camera trapping (Table 1). Dr. G. Thompson undertook the data analysis, and Drs. G. and S. Thompson prepared this report.

Senior scientists possess relevant postgraduate qualifications, extensive experience in conducting fauna assessments in Western Australia, and have published research articles on biodiversity, fauna assemblages, species of conservation significance, trapping techniques, and temporal variations in trapped fauna assemblages. They are, therefore, appropriately trained and experienced to undertake the survey and prepare the assessment.

Dr Scott Thompson is the only environmental practitioner in Western Australia who holds independent specialist certification (CEnvP – Ecology Specialist) in combination with postgraduate tertiary qualifications and is a licenced pest management technician (LPMT). This unique set of skills and qualifications ensures that Scott undertakes fauna surveys, assessments, and control programs to the highest standard and with quality assurance. The qualifications and experience of the survey personnel are shown in Table 1.

Table 1. Survey personnel and their qualifications

Name	Qualifications	Experience	Role
Dr Scott Thompson	BSc. (Env. Sc.), MSc. (Env. Mngt.), PhD (Env. Sc./Mngt). Cert III (Vert Pest Mgt), CEnvP (Ecology Specialist)	> 20 years	Survey coordinator and Principal zoologist
Dr Graham Thompson	Post Grad. Dip. (Zool.), PhD (Zoology), Cert III (Vert Pest Mgt),	> 20 years	Principal zoologist
Ray Turnbull	BNat Res, Grad Dip (Ornith), Grad Cert (Ornith), Cert III (Vert Pest Mgt),	> 10 years	Senior Zoologist
Dr James Barr	BSc (Zool Biochem), Cert IV (Vet nursing), PhD (Behav Eco), Cert III (Env and Rural Pest Mgt)	> 10 years	Zoologist
Georgia Ford	BSc, MSc (Zoology)	> 6 years	Zoologist
Will Purser	BSc (Zoology), MSc	> 5 years	Zoologist
Joel Wilson	BSc (Zoology)	> 4 years	Zoologist
Ella Carstens	BSc (Env Sci)	> 2 years	Zoologist
Brody Altus	BSc (Zoology), M (Biol Sci), Cert III (Env and Rural Pest Mgt)	> 3 year	Zoologist
Tom Raymond	BSc (Hons; Zool), Cert III (Env and Rural Pest Mgt)	> 3 year	Zoologist
Stelleena Wipp	BSc (Hons; Env Agri), BSc (Env Biol)	> 3 year	Zoologist
Isaac Cable	BSc (Cons Wildlife Biol)	> 1 year	Zoologist
Lauren Hayles	BSc (Zoology)	> 1 year	Zoologist
Mitch Plozza	BSc (Cons Wildlife Biol), Cert IV (Cons Land Mgt), Cert IV (Hort), Cert III (Env and Rural Pest Mgt)	> 3 years	Zoologist
Michael Walsh	BSc (Cons Wildlife Biol), MSc (Biol)	> 3 years	Zoologist

3.4 FIELD ASSESSMENT TIMING

There have been extensive field assessments conducted over several periods. Table 2 provides details of the dates, activity and zoologists who undertook the work.

Table 2. Field work dates

Field assessment activity	Zoologist staff	Dates
Black cockatoo tree assessment	Georgia Ford; Ray Turnbull	23-31 August 2021
Spotlighting	Georgia Ford; Ray Turnbull	27 August 2021
Black-Cockatoo roost assessment	Georgia Ford; Ray Turnbull	27 and 29 August 2021
Camera trapping	Georgia Ford; Ray Turnbull; Ella Carstens; Will Purser	23 August – 24 September 2021
Black-Cockatoo tree assessment	Georgia Ford; Ray Turnbull; Ella Carstens; Will Purser	19-24 September 2021
Camera trapping	Georgia Ford; Ray Turnbull; Ella Carstens; Will Purser	22 September – 3 November 2021
Black-Cockatoo tree assessment	Dr Scott Thompson; Joel Wilson	8-12 August 2022
Black-Cockatoo tree assessment	Brody Altus; Joel Wilson	23-28 October 2022
Regional habitat assessment	Dr James Barr	6-10 February 2023
Black-Cockatoo tree assessment	Stelleena Mackay; Isaac Cable	7-11 August 2023
Black-Cockatoo tree assessment	Stelleena Mackay; Isaac Cable	14-18 August 2023
Black-Cockatoo tree assessment	Stelleena Mackay; Isaac Cable	22-25 August 2023
Black-Cockatoo tree assessment	Stelleena Mackay; Isaac Cable	28 August – 5 September 2023
Black-Cockatoo tree assessment	Tom Raymond; Brody Altus; Mitch Plozza; Isaac Cable; Joel Wilson	9-16 October 2023
Black-Cockatoo tree assessment	Brody Altus; Stelleena Mackay	27 November – 1 December 2023
Black-Cockatoo tree assessment	Mitch Plozza; Isaac Cable; Michael Walsh; Lauren Hayles	18-19 December 2023
Camera trapping	Tom Raymond; Brody Altus; Mitch Plozza; Isaac Cable; Joel Wilson	9 October – 20 November 2023
Black cockatoo tree assessment	Brody Altus; Stelleena Mackay	18-23 November 2024
Camera trapping	Brody Altus; Stelleena Mackay	22 November 2024 – 14 January 2025

3.5 ANIMAL ETHICS AND FAUNA LICENCING

Wildlife Animal Ethics Committee (WAEC) has approved an animal ethics application (WAEC 22-07-73) for surveying Black-Cockatoos, and generic fauna surveys are covered under WAEC 24-05-28.

The survey methods utilised by Terrestrial Ecosystems comply with our standard operating procedures (SOP) for animal trapping, handling, and management (Terrestrial Ecosystems 2023a) take into consideration the information in the SOPs developed by DBCA (Department of Biodiversity Conservation and Attractions 2023). On all occasions, the purpose is the humane and lawful use of fauna. All fauna camera trapping was conducted

under a DBCA issued Regulation 27 licence #BA27000488, #BA27000872, and #BA27001134 issued to Dr Scott Thompson.

3.6 TAXONOMY AND NOMENCLATURE

Taxonomy and nomenclature for fauna species used in this report are generally based on the WA Museum species lists. Terrestrial Ecosystems has presumed that the identifications referred to in the appendices or in reports used to provide local and regional comparative data are correct, and we have only corrected obvious records where the nomenclature was known to be incorrect.

3.7 LIMITATIONS

There were farming areas within the survey area that the client did not have permission from the landowner to enter, and these areas were not assessed. These areas are shown as 'Excluded Areas' in the attached Figures.

This vertebrate fauna risk assessment is based on information contained in the Commonwealth Government database, as well as other published and unpublished fauna survey data for the bioregion, and multiple site visits conducted as part of targeted searches for species of conservation significance. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years, are necessary to appreciate the fauna assemblage in the survey area fully.

The EPA's (2020) Technical Guidance on Terrestrial Fauna Surveys suggests that several variables may limit fauna surveys. Limitations associated with each of these variables are assessed in Table 3.

Table 3. Fauna survey limitations and constraints

Possible limitations	Constraint	Comment
Availability of data and information	Yes, moderate	There is a lack of recent, detailed trapping data in similar habitats in the region, however, incidental records and historical reports are available for the region, with some of these data accessible in the Atlas of Living Australia.
Competency/experience of the survey team, including experience in the bioregion surveyed	No	The field zoologists and authors of this report possess appropriate undergraduate or postgraduate qualifications, have conducted multiple surveys and assessments in Western Australia, and are familiar with the vertebrate fauna in this bioregion.
Scope of the survey, e.g. where faunal groups were excluded from the survey	No	Targeted surveys achieved the stated objectives of identifying the presence of vertebrate fauna of conservation significance in the survey area.
Timing, weather and season	No	The weather was suitable for the various site visits.
Disturbance that may have affected results, e.g. fire, flood	No	Disturbances in the survey area have been considered in this assessment.
The proportion of fauna identified, recorded or collected	No	Targeted surveys were adequate to identify species of conservation significance in the survey area.
Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent to which the area was surveyed	No	Targeted surveys were adequate to identify species of conservation significance in the survey area.
Access problems	No, moderate	Most sites were accessible, however, some farms were excluded from the assessment. All Black-Cockatoo foraging assessments within a

Possible limitations	Constraint	Comment
		12km radius were conducted from roads and private properties where we had permission to enter.
Problems with data and analysis, including sampling biases	No	Data were collected in a format that enabled it to be properly analysed.

N/A = not applicable, Significant = major impact on outcome of the assessment, Moderate = impacted parts of the assessment, Negligible = almost no impact on the assessment

4. RESULTS

4.1 FAUNA HABITAT

Most of the survey area is farmland and was cleared many decades ago. The most substantial patch of native bushland outside the survey area is located to the south-east of the Woorgabup Nature Reserve and the Rifle Range Reserve. Western Wildlife (2018) assessed the vertebrate fauna in this area and reduced Mattiske Consulting's (2018) 10 vegetation communities to the following four fauna habitats:

- Wandoo woodland;
- York Gum Woodland;
- Mallet woodland; and
- Banksia heath.

These four faunal habitats have been mapped in Figure 2. Mattiske Consulting (2020) described the vegetation communities for a larger area including tenements E70/2928, M70/211, M70/488 that includes the Woorgabup Nature Reserve and Rifle Range Reserve as the following 10 communities. The many remnant patches of vegetation on farming land and in road reserves supported York Gums, Salmon Gums, Wandoo, Red Morell, *Banksia* sp., Brown Mallet, Sheoak and a variety of exotic trees.

Table 4. Vegetation communities (taken from Table 5 in Mattiske Consulting 2020)

CODE	Description	Vegetation condition
W1	Open Woodland of *Eucalyptus wandoo* and *Eucalyptus longicornis* with occasional *Eucalyptus salmonophloia* over *Acacia acuminata* over *Vittadinia gracilis, Stackhousia monogyna* and a range of herbs and grasses on lower slopes and valley floors with sandy loams and some clays.	Very Good - Excellent
W2	Open Woodland of *Eucalyptus loxophleba* over *Acacia acuminata* and *Allocasuarina huegeliana* over a range of herbs and grasses on slopes and broader valley floors with sandy loams and some clays.	Completely Degraded – Degraded, Very Good
W3	Woodland of *Eucalyptus wandoo* over dense stands of *Allocasuarina huegeliana* with patches of *Banksia sessilis* and *Acacia acuminata* over *Hakea lissocarpha*, *Xanthorrhoea drummondii* and *Stackhousia monogyna* over a range of herbs and grasses on slopes and undulating hills with sandy-clays and gravels.	Excellent
W4	Open Woodland of *Eucalyptus wandoo* and *Eucalyptus longicornis* over *Allocasuarina huegeliana* over *Dodonaea humifusa*, *Rhagodia preissii* subsp. *preissii* over *Neurachne alopecuroidea*, *Austrostipa hemipogon* and a wide range of herbs and grasses on mid and upper slopes of undulating hills with sandy-clays and gravels.	Completely Degraded – Very Good – Excellent
W5	Open Woodland of *Eucalyptus wandoo* over *Allocasuarina huegeliana* over *Gastrolobium trilobum*, *Dodonaea humifusa* and *Xanthorrhoea drummondii* over *Neurachne alopecuroidea*, *Austrostipa hemipogon, Velleia trinervis* and a wide range of herbs and grasses on upper slopes and ridges of undulating hills with sandy-clays and gravels.	Excellent
W6	Open Woodland of *Eucalyptus loxophleba* over *Acacia acuminata* and dense stands of *Allocasuarina huegeliana* over *Acacia erinacea* over *Stackhousia monogyna, Stypandra glauca, Neurachne alopecuroidea* and a wide range of herbs and grasses on slopes and broader valley floors with sandy loams and some clays.	Completely Degraded – Very Good, Excellent
W7	Open Woodland of *Eucalyptus wandoo* and *Eucalyptus longicornis* over *Gastrolobium trilobum, Acacia acuminata, Acacia erinacea, Acacia lasiocarpa* var. *sedifolia*, *Hakea lissocarpha, Billardiera fusiformis* and patches of *Melaleuca atroviridis* and *Xanthorrhoea drummondii* over *Austrostipa hemipogon, Dampiera lavandulacea, Neurachne alopecuroidea, Desmocladus asper, Lomandra* spp. and a wide range of herbs and grasses on slopes and broader valley floors with sandy loams and some clays.	Excellent
W8	Woodland of *Eucalyptus astringens* subsp. *astringens* and *Eucalyptus kondininensis* with some *Eucalyptus gardneri* subsp. *gardneri* and occasional *Eucalyptus wandoo* and *Eucalyptus longicornis* over dense thickets of *Melaleuca atroviridis* over *Gastrolobium trilobum*, *Acacia lasiocarpa* var. *sedifolia, Beaufortia bracteosa* and *Daviesia ?incrassata* subsp. *teres* over a range of herbs and grasses on upper slopes and ridges with sandy gravels and clays.	Completely Degraded, Good - Excellent

CODE	Description	Vegetation condition
S1	Closed Heath of *Banksia armata* var. *ignicida*, *Banksia squarrosa* subsp. *squarrosa*, *Allocasuarina humilis, Gastrolobium trilobum, Grevillea insignis* subsp. *insignis* over *Hibbertia exasperata, Melaleuca subtrigona, Melaleuca pungens, Petrophile seminuda, Xanthorrhoea drummondii* and *Tetrapora preissiana* with patches of emergent *Eucalyptus incrassata, Eucalyptus dorrienii* and *Eucalyptus hebetifolia* over *Stackhousia monogyna* over a range of herbs and grasses on shallow upper slopes and ridges with sandy gravels and clays.	Excellent
S2	Open Heath of *Acacia lasiocarpa* var. *sedifolia*, *Banksia sessilis, Banksia armata* var. *ignicida, Banksia squarrosa* subsp. *squarrosa, Beaufortia bracteosa, Calothamnus quadrifidus* subsp. *quadrifidus, Dodonaea caespitosa, Dodonaea humifusa, Hakea lissocarpha, Hakea trifurcata, Melaleuca atroviridis* and *Xanthorrhoea drummondii* with patches of emergent *Eucalyptus kondininesis, Eucalyptus ?thamnoides, Eucalyptus wandoo* and *Allocasuarina huegeliana* over dense shrub layer and a range of herbs and grasses on shallow upper slopes and ridges with sandy gravels and clays.	Excellent

Multiple ephemeral creeks run mostly in a north-westly direction in the survey area, with many of these having remnant native vegetation along both banks. There is a mining pit in care and maintenance, as well as multiple farming houses and sheds within the survey area.

4.2 BLACK-COCKATOOS

Overall, Terrestrial Ecosystems recorded 8,396 significant trees in the survey area, and of those 740 were assessed from the ground level to have at least one hollow that could potentially be used as a nesting site for Black-Cockatoos.

4.2.1 Woorgabup Nature Reserve and the Rifle Range Reserve

The bushland surrounding Woorgabup Nature Reserve (R24072) and Rifle Range Reserve (R2423 and R2425) supported multiple significant trees many with at least one hollow, and many with multiple hollows. Carnaby's Black-Cockatoos (*Zanda latirostris*) were seen and heard on most days in this area in 2021-2022. Most sightings were of single males or pairs but a flock of ~20 birds was observed flying across the north-west corner of the reserve out over the adjacent canola fields (24/8/2021; 0750hrs). On the 27/8/2021 the surveyors conducted an evening roost watch to determine if and where any Black-Cockatoos may be roosting. At 1722hrs a male cockatoo flew in from the south-west towards the centre of the reserve and was lost from view. The bird, however, could still be heard calling, so the zoologists attempted to locate the bird. The bird was eventually located sitting in a large dead Wandoo north of the Dingo mine pit, near the northern boundary of the reserve. At 1735hrs this bird, along with a previously undetected female, flew away to the southwest. Over the next several days, calls were often heard from this general area late in the day and a male bird (presumably the same bird) was seen flying around the reserve. As a result of this behaviour, the surveyors conducted a second evening roost watch in this area to find his roost/nest location. On 29/8/2021 at 1715hrs a male cockatoo flew in and landed in a large Wandoo. The bird stayed sitting in this tree but was alert and constantly scanning its surrounds. After about 15 minutes it was seen climbing down the branch to a large fork in the tree into which it put its head. It is highly likely that this fork contained a hollow. After several minutes of this behaviour the male departed. On 31/8/2021 zoologists conducted tree assessments in this area to see if the male could be recorded again. The male bird was not sighted that morning and tapping of the tree in which the male was seen putting his head resulted in nothing emerging from the hollow. However, whilst nailing the tag number into an adjacent Wandoo, a female cockatoo was seen to emerge from another hollow (0950hrs). These trees are ~50m apart and it suggests that one nest hollow was in use, and it is likely that a second was as well. There was evidence of Carnaby's Black-Cockatoos feeding in the Banksia heathland in the southern section of the reserve and one male was observed foraging in the area (Plates 4 and 5).

Plate 4. Carnaby's Black-Cockatoo emerging from a tree hollow

Plate 5. Carnaby's Black-Cockatoo feeding in the Banksia woodland

4.2.2 Jinkas

The Jinkas project area contains 15 significant trees, and one tree contained two hollows that may provide a suitable nesting site for Black-Cockatoos (Terrestrial Ecosystems 2022b). No Black-Cockatoos were nesting in the Jinkas area.

4.2.3 Jackson

The Jackson project area contains 429 significant trees, with 82 of these trees containing at least one hollow, and many with two or more hollows (Terrestrial Ecosystems 2022a). No Black-Cockatoos were nesting in the Jackson area.

4.2.4 Olympia

The Olympia project area contains 13 significant trees, and no trees contained hollows that would provide a suitable nesting site for Black-Cockatoos (Terrestrial Ecosystems 2022c). No Black-Cockatoos were nesting in the Olympia area.

4.2.5 Other areas

Multiple significant trees have been identified and mapped along road verges and paddocks in 2021, 2023 and 2024. The location of significant Black-Cockatoo habitat trees are shown in Figures 10-21 with details of each tree provided in Appendix D and images of trees provided in Appendix E.

4.2.6 Black-Cockatoo foraging habitat within a 12km radius

The assessment of foraging and potential breeding habitats within a 12km radius of the project area yielded the areas shown in Table 5 (see Figure 28).

Table 5. Black-Cockatoo habitat types within 12km radius of the survey area

Black-Cockatoo habitat type	Area (ha) within 12km radius
Good quality nesting habitat (GQ) – presence of suitable nesting trees in high abundance	6,706.9
Poor quality nesting habitat (PQ) – no to sporadic presence of potential suitable nesting trees	5,673.3
Foraging habitat (FH) – appropriate habitat containing foraging species for Carnaby's Cockatoos.	364.4
Total	12,745

4.3 RED-TAILED PHASCOGALE

Red-tailed Phascogale were recorded on the camera traps in the bushland in the Woorgabup Nature Reserve, Rifle Range Reserve, M70/1426, and three separate areas on E70/3952. One of these habitat fragments could be a potential land swap to facilitate an environment offset and one area of bushland could possibly be included in a predatory-proof fenced area. The location of Red-tailed Phascogale records are shown in Figures 24, 25, 27 and 28. They were not recorded in the Jinkas, Jackson or Olympia areas (Terrestrial Ecosystems 2021, 2022c, b, a).

4.4 CAMERA TRAPPING

During the November 2024 camera trapping survey, Western Grey Kangaroos (*Macropus fuliginosus:* Plate 6) where recorded on 23 camera traps, foxes (*Vulpes vulpes:* Plate 9) on 13, rabbits (*Oryctolagus cuniculus*: Plate 12) on 8 and feral cats (*Felis catus:* Plate 8) on four camera traps. The Red-tailed Phascogale (*Phascogale calura*: Plate 10) was recorded on two camera traps in November 2024.

Earlier camera trapping in other bushland parcels of land recorded multiple species, including Western Grey Kangaroo (Plate 6), Australia Raven (*Corvus coronoides*), Rabbits, and Common Brushtail Possum (*Trichosurus vulpecula*; Plate 7) being among the most abundant (Table 6). Feral cats and foxes were the next most common (Terrestrial Ecosystems 2021, 2022c, b, a). The Red-tailed Phascogale were recorded on six camera traps in the Woorgabup Nature Reserve, Rifle Range Reserve and surrounding bush block, large remnant block of native vegetation on M70/1426 and three areas on E70/3952. The Red-tailed Phascogale is listed under the *EPBC Act* as Vulnerable and under the WA *BC Act 2016* as a 'species of special conservation interest (conservation dependent fauna)'.

Plate 6. Western Grey Kangaroo

Plate 7. Common Brushtail Possum

Plate 8. Feral cat

Plate 9. Fox

Plate 10. Red-tailed Phascogale

Plate 11. Gould's Goanna

Plate 12. Rabbit

Plate 13. Carnaby's Black-Cockatoo

Table 6. Camera trap results on Woorgabup Nature Reserve, Rifle Range Reserve, and the remnant bushland in Jackson, Jinkas and Olympia

Camera #	Western Grey Kangaroo	Cat	Fox	Australian Raven	Phascogales	Possum	Echidna	Rabbit	Magpie	Common Bronzewing	Australian Ringneck Parrot	Bobtail	Currawong	Galah	Carnaby Black-Cockatoo	Elegant Parrot
C1	X			X		X										

Camera #	Western Grey Kangaroo	Cat	Fox	Australian Raven	Phascogales	Possum	Echidna	Rabbit	Magpie	Common Bronzewing	Australian Ringneck Parrot	Bobtail	Currawong	Galah	Carnaby Black-Cockatoo	Elegant Parrot
C2	X			X			X									
C3							X									
C4	X															
C5	X					X	X									
C6	X			X		X										
C7	X		X	X		X										
C8	X	X		X	X	X	X									
C9	X					X	X									
C10	X		X	X		X			X		X					
C11	X			X		X										
C12	X			X		X				X						
C13	X			X			X									
C14	X		X	X		X					X					
C15	X		X				X									
C16	X		X	X		X	X									
C17	X		X	X		X										
C19	X	X	X	X		X										
C20	X		X	X	X	X					X	X				
C21	X			X		X	X					X				
C22	X			X	X	X					X					
C23	X			X		X							X			
C24	X		X	X		X										
C25	X			X												
C26	X			X												
C27	X			X		X						X	X			
C28	X		X	X												
C29				X		X	X									

Camera #	Western Grey Kangaroo	Cat	Fox	Australian Raven	Phascogales	Possum	Echidna	Rabbit	Magpie	Common Bronzewing	Australian Ringneck Parrot	Bobtail	Currawong	Galah	Carnaby Black-Cockatoo	Elegant Parrot
C30	X			X		X										
C31	X			X		X										
C32	X			X		X										
C33	X		X	X		X	X									
C34	X			X		X	X									
C35	X	X		X		X	X									
C36	X			X		X	X			X			X			
C37	X			X			X									
C38	X			X		X	X									
C39	X		X	X		X	X						X			
C40	X		X	X												
C41	X		X	X		X										
C42	X			X							X	X				
C43	X		X	X												
C44	X		X	X		X		X								
C45	X		X	X		X										
C46	X			X									X			
C47	X		X	X						X						
C48	X		X	X		X										
C49	X			X						X						
C50	X			X		X							X	X		
C51	X		X								X					
C52	X		X													
C53	X					X										
C54	X				X	X	X	X								
C55	X			X												
C56	X															

Camera #	Western Grey Kangaroo	Cat	Fox	Australian Raven	Phascogales	Possum	Echidna	Rabbit	Magpie	Common Bronzewing	Australian Ringneck Parrot	Bobtail	Currawong	Galah	Carnaby Black-Cockatoo	Elegant Parrot
C57	X					X										
C58	X															
C59	X			X	X	X										
C60	X					X	X									
C61	X			X		X										
C62	X			X			X			X						
C63	X			X												
C64	X					X	X									
C65	X		X	X	X	X							X			
C66	X	X				X										
C67	X					X	X		X	X	X					
C68	X			X												
C69	X															
C70	X			X		X										
C71	X		X												X	
C72	X			X			X				X		X			
C73	X		X	X									X			
C74	X			X		X	X						X			
C75	X			X		X										
C76			X	X												
C77		X		X			X	X								
C78			X	X				X		X						X
C79		X	X	X		X		X								
C80		X	X	X		X		X			X					
C81		X	X	X		X			X							
C82		X	X	X		X		X	X		X					
C83			X	X				X		X						

Camera #	Western Grey Kangaroo	Cat	Fox	Australian Raven	Phascogales	Possum	Echidna	Rabbit	Magpie	Common Bronzewing	Australian Ringneck Parrot	Bobtail	Currawong	Galah	Carnaby Black-Cockatoo	Elegant Parrot
C84		X	X	X							X					
C85			X	X							X					
C86			X	X												
C87			X	X		X										
C88			X	X		X										X
C89			X	X		X				X						
C90	X		X			X					X					
C91	X		X								X					
C92				X		X				X	X			X		
C93				X		X			X		X			X		
C94			X	X					X	X						
C95			X	X		X				X	X	X				

Table 7. Camera trap results for the other large native vegetation blocks

Camera #	Western Grey Kangaroo	Cat	Fox	Australian Raven	Red-tailed Phascogale	Possum	Magpie	Common Bronzewing	Australian Ringneck Parrot	Bobtail	Grey Currawong	Galah	Willie Wagtail	Yellow-throated Miner	Grey Butcherbird	Yellow-footed Antechinus	Gould's Goanna	Dugite	Red Wattlebird	Magpie-lark	White-browed Babbler	Australian Owlet-nightjar	Crested Pigeon	Skink	Black-faced Cuckoo-shrike	Carpet Python	House Mouse	Black Rat	Western Pygmy Possum
C96	X	X	X			X	X			X			X	X	X	X													
C97			X			X	X			X				X	X														
C98					X	X	X	X							X		X	X											
C99		X	X			X	X		X	X									X										
C100		X				X	X			X																	X		
C101			X	X		X		X		X				X													X		
C102			X			X	X																				X		

Camera #	Western Grey Kangaroo	Cat	Fox	Australian Raven	Red-tailed Phascogale	Possum	Magpie	Common Bronzewing	Australian Ringneck Parrot	Bobtail	Grey Currawong	Galah	Willie Wagtail	Yellow-throated Miner	Grey Butcherbird	Yellow-footed Antechinus	Gould's Goanna	Dugite	Red Wattlebird	Magpie-lark	White-browed Babbler	Australian Owlet-nightjar	Crested Pigeon	Skink	Black-faced Cuckoo-shrike	Carpet Python	House Mouse	Black Rat	Western Pygmy Possum
C103			X	X		X	X	X	X	X		X		X						X									
C104	X	X		X		X		X		X							X												
C105	X		X	X		X	X	X						X						X									
C106				X		X				X				X															
C107			X			X								X			X												
C108			X	X		X	X			X				X						X								X	X
C109		X	X	X		X		X			X										X						X		
C110	X	X	X	X	X	X	X															X							
C111		X		X		X		X				X															X		
C112	X			X	X	X	X	X						X									X						
C113			X																										
C114						X	X							X	X		X										X		
C115	X		X	X		X									X		X							X					
C116				X		X	X			X				X															
C117				X		X	X	X		X				X													X		X
C118		X		X		X	X	X					X							X				X					
C119		X		X		X	X	X		X			X							X									
C120		X		X		X			X	X					X											X			
C121			X	X	X	X	X												X										

Table 8. Camera trapping results for the November 2024 survey

Camera #	Western Grey Kangaroo	Cat	Rabbit	Fox	Australian Raven	Red-tailed Phascogale	Possum	Magpie	Common Bronzewing	Bobtail	Grey Currawong	Willie Wagtail	Yellow-throated Miner	Gould's Goanna	Magpie-lark	White-browed Babbler	Skink	Black-faced Cuckoo-shrike	Australian Pipit	Carnaby Back-Cockatoo	Gray shrike thrush	Dwarf Bearded dragon	Yellow rumped thornbill	Owl sp
122	X			X																				
123	X			X		X																		
124			X		X							X			X									
125	X			X	X		X																	
126	X		X		X	X						X												
127	X	X	X							X		X		X				X	X	X	X			
128	X	X	X	X																		X		
129	X			X																				
130	X		X							X		X												
131	X		X										X		X								X	
132	X			X							X													
133	X			X							X													
134	X			X													X							
135	X			X						X														
136	X				X			X																
137	X	X	X							X						X								
138	X			X					X		X													
139	X																							
140	X										X													
141	X										X													
142	X			X																				
143	X			X							X													X
144	X	X	X	X								X	X	X										

4.5 FERAL PREDATORS AND INTRODUCED SPECIES

The fox was recorded in multiple areas, including the Woorgabup Nature Reserve, Rifle Range Reserve, Jinkas, Olympia, Jackson, M70/1426 and E70/3952 and in both habitat remnants surveyed in November 2024. Foxes are widespread and abundant.

The feral cat was also recorded in all areas and is widespread and abundant.

4.6 SPOTLIGHTING SURVEY

The nocturnal survey recorded beehives, one Common Brushtail Possum and several Southern Boobooks, and a Tawny Frogmouth and Australian Owlet-nightjar were heard calling.

4.7 BIOREGIONAL VERTEBRATE FAUNA ASSEMBLAGE

Appendix B provides a summary of the fauna survey data that are available near the survey area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys. These differences are partially due to the low survey effort deployed by some of the surveys and they also reflect variations in soils and vegetation as well as temporal variations in the fauna assemblages.

Tables 9-13 provide a list of vertebrate species potentially found near the survey area that have been compiled based on the fauna survey report results shown in Appendix B.

Table 9. Fish potentially found near the survey area

Family	Species	Common name
Atherinidae	*Leptatherina wallacei*	Western Hardyhead
Percichthyidae	*Bostockia porosa*	Nightfish
	Nannoperca vittata	Western Pygmy Perch
Galaxiidae	*Galaxias occidentalis*	Western Galaxias

Table 10. Birds potentially found near the survey area

Family	Species	Common Name
Anatidae	*Anas superciliosa*	Pacific Black Duck
	Anas gracilis	Grey Teal
Columbidae	*Phaps chalcoptera*	Common Bronzewing
	Ocyphaps lophotes	Crested Pigeon
Cuculidae	*Chrysococcyx lucidus*	Shining Bronze-Cuckoo
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar
Ardeidae	*Egretta novaehollandiae*	White-faced Heron
Accipitridae	*Aquila audax*	Wedge-tailed Eagle
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra
Falconidae	*Falco berigora*	Brown Falcon
	Falco peregrinus	Peregrine Falcon
Timaliidae	*Zosterops lateralis*	Silvereye
Cacatuidae	*Eolophus roseicapilla*	Galah
Psittaculidae	*Polytelis anthopeplus*	Regent Parrot
	Neophema elegans	Elegant Parrot
	Barnardius zonarius	Australian Ringneck
	Glossopsitta porphyrocephala	Purple-crowned Lorikeet
Climacteridae	*Climacteris rufus*	Rufous Treecreeper
Maluridae	*Malurus pulcherrimus*	Blue-breasted Fairywren
	Malurus splendens	Splendid Fairywren
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater

Family	Species	Common Name
	Anthochaera lunulata	Western Wattlebird
	Anthochaera carunculata	Red Wattlebird
	Gavicalis virescens	Singing Honeyeater
	Ptilotula ornata	Yellow-plumed Honeyeater
	Epthianura albifrons	White-fronted Chat
	Gliciphila melanops	Tawny-crowned Honeyeater
	Lichmera indistincta	Brown Honeyeater
	Phylidonyris novaehollandiae	New Holland Honeyeater
	Phylidonyris niger	White-cheeked Honeyeater
	Nesoptilotis leucotis	White-eared Honeyeater
	Melithreptus chloropsis	Gilbert's Honeyeater
	Melithreptus brevirostris	Brown-headed Honeyeater
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote
	Pardalotus striatus	Striated Pardalote
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren
	Calamanthus campestris	Rufous Fieldwren
	Acanthiza inornata	Western Thornbill
	Acanthiza apicalis	Inland Thornbill
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Acanthiza uropygialis	Chestnut-rumped Thornbill
	Smicrornis brevirostris	Weebill
	Gerygone fusca	Western Gerygone
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckooshrike
	Lalage tricolor	White-winged Triller
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella

Family	Species	Common Name
Falcunculidae	*Falcunculus frontatus*	Crested Shrike-tit (Western)
Pachycephalidae	*Colluricincla harmonica*	Grey Shrikethrush
	Pachycephala pectoralis	Golden Whistler
	Pachycephala rufiventris	Rufous Whistler
Artamidae	*Artamus cinereus*	Black-faced Woodswallow
	Artamus cyanopterus	Dusky Woodswallow
	Cracticus torquatus	Grey Butcherbird
	Cracticus nigrogularis	Pied Butcherbird
	Gymnorhina tibicen	Australian Magpie
	Strepera versicolor	Grey Currawong
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail
	Rhipidura albiscapa	Grey Fantail
Monarchidae	*Grallina cyanoleuca*	Magpie-lark
	Myiagra inquieta	Restless Flycatcher
Corvidae	*Corvus coronoides*	Australian Raven
Petroicidae	*Microeca fascinans*	Jacky Winter
	Petroica boodang	Scarlet Robin
	Petroica goodenovii	Red-capped Robin
	Melanodryas cucullata	Hooded Robin
	Eopsaltria griseogularis	Western Yellow Robin
	Drymodes brunneopygia	Southern Scrub-Robin
Locustellidae	*Poodytes gramineus*	Little Grassbird
	Cincloramphus cruralis	Brown Songlark
	Cincloramphus mathewsi	Rufous Songlark
Hirundinidae	*Hirundo neoxena*	Welcome Swallow
	Petrochelidon ariel	Fairy Martin
	Petrochelidon nigricans	Tree Martin
Zosteropidae	*Zosterops lateralis*	Silvereye
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit

Table 11. Amphibians potentially found near the survey area

Family	Species	Common Name
Limnodynastidae	*Heleioporus albopunctatus*	Western Spotted Frog
	Limnodynastes dorsalis	Western Banjo Frog
	Neobatrachus pelobatoides	Humming Frog
Myobatrachidae	*Crinia georgiana*	Quacking Frog
	Crinia insignifera	Sin-bearing Froglet
	Crinia pseudinsignifera	Bleating Froglet
	Myobatrachus gouldii	Turtle Frog
	Pseudophryne guentheri	Gunther's Toadlet
Pelodryadidae	*Litoria adelaidensis*	Slender Tree Frog
	Litoria cyclorhyncha	Spotted-thighed Frog
	Litoria moorei	Motorbike Frog

Table 12. Mammals potentially found near the survey area

Family	Species	Common Name
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna
Bovidae	*Ovis aries*	Sheep
Suidae	*Sus scrofa*	Pig
Canidae	*Felis catus*	Cat
	Vulpes vulpes	Red Fox
Molossidae	*Austronomus australis*	White-striped Freetail Bat
	Mormopterus planiceps	Southern Free-tail Bat
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat
	Chalinolobus morio	Chocolate Wattled Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Nyctophilus major	Greater Long-eared Bat
	Vespadelus finlaysoni	Finlayson's Cave Bat
	Vespadelus regulus	Southern Forest Bat
Dasyuridae	*Antechinus flavipes*	Yellow-footed Antechinus
	Dasyurus geoffroii	Chuditch
	Phascogale calura	Red-tailed Phascogale
	Sminthopsis crassicaudata	Fat-tailed Dunnart
	Sminthopsis granulipes	White-tailed Dunnart
	Sminthopsis murina	Slender-tailed Dunnart
Myrmecobiidae	*Myrmecobius fasciatus*	Numbat
Burramyidae	*Cercartetus concinnus*	Southwestern Pygmy Possum
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo
	Notamacropus irma	Western Brush Wallaby
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum
Potoroidae	*Bettongia penicillata*	Woylie
Tarsipedidae	*Tarsipes rostratus*	Honey Possum
Leporidae	*Oryctolagus cuniculus*	Rabbit
Muridae	*Mus musculus*	House Mouse
	Rattus rattus	Black Rat

Table 13. Reptiles potentially found near the survey area

Family	Species	Common Name
Agamidae	*Ctenophorus cristatus*	Crested Dragon
	Ctenophorus maculatus	Spotted Dragon
	Ctenophorus ornatus	Ornate Crevice Dragon
	Pogona minor	Western Bearded Dragon
Carphodactylidae	*Underwoodisaurus milii*	Barking Gecko
Diplodactylidae	*Crenadactylus ocellatus*	Clawless Gecko

Family	Species	Common Name
	Diplodactylus granariensis	Wheatbelt Stone Gecko
	Diplodactylus pulcher	Beautiful Gecko
	Hesperoedura reticulata	Reticulated Velvet Gecko
	Strophurus spinigerus	South-western Spiny-tailed Gecko
Elapidae	*Echiopsis curta*	Bardick
	Neelaps calonotos	Black-striped Burrowing Snake
	Notechis scutatus	Tiger Snake
	Suta gouldii	Gould's Snake
	Suta nigriceps	Short-tailed Snake
	Pseudonaja affinis	Dugite
	Pseudonaja mengdeni	Western Brown Snake
	Simoselaps bertholdi	Jan's Banded Snake
	Suta fasciata	Rosen's Snake
Gekkonidae	*Christinus marmoratus*	Marbled Gecko
	Gehyra variegata	Variegated Gehyra
Pygopodidae	*Aprasia repens*	Southwest Sandplain Worm Lizard
	Delma australis	Marble-faced Delma
	Delma fraseri	Fraser's Delma
	Lialis burtonis	Burton's Legless Lizard
	Pygopus lepidopodus	Common Scaly-foot
Pythonidae	*Morelia spilota*	Carpet Python
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink
	Ctenotus impar	Odd-stripped Ctenotus
	Ctenotus schomburgkii	Barred Wedgesnout Ctenotus
	Egernia kingii	King's Skink
	Hemiergis peronii	Lowlands Earless Skink
	Lerista distinguenda	South-western Orange-tailed Slider
	Menetia greyii	Common Dwarf Skink
	Morethia obscura	Shrubland Pale-flecked Morethia
	Tiliqua occipitalis	Western Blue-tongued Lizard
	Tiliqua rugosa	Bobtail
Typhlopidae	*Anilios australis*	Austral Blind Snake
Varanidae	*Varanus gouldii*	Gould's Goanna
	Varanus rosenbergi	Heath Monitor
Chelidae	*Chelodina oblonga*	Oblong Turtle

4.8 FAUNA OF CONSERVATION SIGNIFICANCE

Vertebrate fauna of conservation significance are protected by the Commonwealth *EPBC Act 1999*, and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA), and the Western Australia (WA) *BC Act 2016*. The *BC Act 2016* provides for the publication of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. In addition, DBCA maintains a list of fauna that require monitoring under four priority categories based on current knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *BC Act 2016* impose legislative requirements for managing anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, except that the DBCA wishes to monitor potential impacts on these species. Environmental consultants and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the *BC Act 2016* are provided in Appendix C.

The fauna species that have special status in either State or Commonwealth government legislation or are on the DBCA Priority species list and are potentially present in the vicinity of the survey area are listed in Table 14. Although they were recorded in the search of the MNES online database of migratory species, waders and shorebirds that typically would be found around the edge of salt lakes, clay pans, estuaries, marshes and wetlands have been excluded from Table 14 as there is no suitable habitat within the survey area.

Two threatened species of fauna were identified under the *EPBC Act 1999* and the *BC Act 2016*, as well as a specially protected species under the *BC Act 2016,* as occurring in the survey area. One species on the DBCA's Threatened and Priority Fauna List also occurs in the survey area. There are two other species that may be infrequently recorded in the survey area. The following assessment evaluates the likelihood of each species listed in Table 14 being present in the survey area.

Table 14. Assessment of the potential presence of species of conservation significance in the survey area

Species	Status under the *BC Act* and DBCA priority species list	Status under Commonwealth *EPBC Act*	Comment on the potential presence of a species
Australasian Bittern *Botaurus poiciloptilus*	Endangered	Endangered	Not present in the survey area due to a lack of suitable habitat.
Night Parrot *Pezoporus occidentalis*	Critically Endangered	Endangered	Not present in the survey area due to a lack of suitable habitat.
Dibbler *Parantechinus apicalis*	Endangered	Endangered	It was not recorded in the survey area or the surroundings, so it is unlikely to be present.
Carnaby's Black-Cockatoo *Zanda latirostris*	Endangered	Endangered	Forages and breeds in the survey area.
Numbat *Myrmecobius fasciatus*	Endangered	Endangered	Not present in the survey area.
Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso*	Vulnerable	Vulnerable	Not observed in the survey area or recorded in the adjacent area, so it is unlikely to be present.
Red-tailed Phascogale *Phascogale calura*	Conservation dependent	Vulnerable	Present in the survey area.
Malleefowl *Leipoa ocellata*	Vulnerable	Vulnerable	Locally extinct from this area.
Chuditch *Dasyurus geoffroii*	Vulnerable	Vulnerable	It was not recorded in the survey area or the surroundings, so it is unlikely to be present.
Grey Falcon *Falco hypoleucos*	Vulnerable	Vulnerable	It was not recorded in the survey area or the surroundings, so it is unlikely to be present.
Southern Whiteface *Aphelocephala leucopsis*	Vulnerable	Vulnerable	It was not recorded in the survey area or the surroundings, so it is unlikely to be present.
Fork-tailed Swift *Apus pacificus*	Migratory	Migratory	It may infrequently be seen flying in the region.
Grey Wagtail *Motacilla cinerea*	Migratory	Migratory	Highly unlikely to be seen in the survey area.
Western Rosella (inland form) *Platycercus icterotis xanthogenys*	P4		Present in the survey area.
Western Brush Wallaby *Notamacropus irma*	P4		It was not recorded in the survey area or the surroundings, so it is unlikely to be present.
Peregrine Falcon *Falco peregrinus*	OS		It may be seen very infrequently in the survey area.

Results of the Commonwealth *EPBC Act 1999* protected matters database search are provided in Appendix A.

Australasian Bittern (*Botaurus poiciloptilus*) – Endangered under the *BC Act* 2016 and *EPBC Act 1999*

The Australasian Bittern is distributed from Moora through much of the southwest and east to Mt Arid; however, it is rarely recorded. It is almost always found in dense *Typha*, *Baumea* and sedges in freshwater or brackish swamps (Johnstone and Storr 1998). Garnett *et al*. (2011) reported its population across Australia as less than 2,000 and in decline. Most of the Western Australian records come from Lake Muir.

It is highly unlikely to be present in or near the survey area due to the lack of semi-permanent water, surrounded by dense stands of Typha, Baumea, and sedges.

Night Parrot (*Pezoporus occidentalis*) – Critically endangered under the *BC Act 2016* and Endangered under the *EPBC Act 1999*

The Night Parrot is a small, arid-adapted, nocturnal, ground-feeding parrot (Johnstone and Storr 1998, Threatened Species Scientific Committee 2016). Its length is 22-25cm, with a body mass of approximately 104g (Threatened Species Scientific Committee 2016), although it was suggested that they were semi-nomadic, the Night Parrots in south-western Queensland appear to be sedentary (Murphy 2015).

The Night Parrot was probably distributed initially over much of semi-arid and arid Australia (Garnett et al. 1993, Threatened Species Scientific Committee 2016). Records in north-west and western Queensland in the early 1990-2000s were in a broad cross section of the habitats available (Garnett et al. 1993, Cupitt and Cupitt 2008, Boles et al. 2016). There have been recent sightings in the Pilbara in 1980, 2005 and 2017, central WA in 1979, north-eastern South Australia in 1979, western Queensland (including Pullen-Pullen-Mt Windsor-Diamantina population) in 1980, 1990, 1993, 2006 and 2013-17 (Davis and Metcalf 2008, Garnett et al. 2011, Charalambous 2016, Pickrell 2016, AG staff 2017, Palaszxzuk and Miles 2017, Rykers 2017, AG staff 2018), Pilbara in 2017 (Jones 2017) and the northern Goldfields (Jackett et al. 2017). Garnett et al. (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range.

Wilson's (1937) summary of observations provided information on the early records of Night Parrots' preferred habitat and breeding sites. Recent information indicates its preferred habitat appears to be in Triodia grasslands, chenopod shrublands, shrubby samphire and floristically diverse habitats dominated by large-seeded species (Threatened Species Scientific Committee 2016, McCarthy 2017, Murphy et al. 2017b). At Pullen Pullen Reserve it nests in large, more or less ring-shaped Triodia, and the nest consists of a tunnel (25-30° and 0° to the ground; 20-33cm long) through an apron of dead spinifex leaves that leads to a chamber under a live hummock, with a shallow depression (3-4cm) excavated into the gravelly/sandy soil (Murphy et al. 2017a). In the northern Goldfields the nest was again in a spinifex hummock, it was circular, with an excavated depression (~1.5-2.0cm) in sandy substrate (Hamilton et al. 2017, Jackett et al. 2017). The entrance tunnel was 62cm long, and was downward sloping (27°) with the entrance 28cm above the ground (Hamilton et al. 2017). It has clutches of two to four sub-elliptical, white eggs with a lustrous appearance (Murphy et al. 2017a). Breeding followed significant rains in March for the observations in Pullen-Pullen Reserve and in April in the northern Goldfields (Hamilton et al. 2017, Murphy et al. 2017a), but it is thought that breeding generally occurs between April and October (Murphy et al. 2017a).

Murphy et al. (2017b) placed a GPS tag on Night Parrots and reported that the two birds called at dusk from their diurnal roosts among spinifex hummocks and then flew to more floristically diverse habitats dominated by large-seeded, prolifically seeding species to feed.

The survey area is in the medium priority area for Night Parrots based on the Department of Parks and Wildlife (2017) assessment of where they might be found.

There are no large spinifex hummocks in the survey area that could provide roosting and nesting sites for this species, and no recent Night Parrot records are available near the survey area, making it highly unlikely for the species to be present in the area.

Carnaby's Black-Cockatoo (*Zanda latirostris*) - Endangered under the *BC Act 2016* and *EPBC Act 1999*

Carnaby's Black-Cockatoo (*Zanda latirostris*) is a large, pied, cockatoo. Garnett et al. (2011) and the DSEWPaC (2011) reported that Carnaby's Black-Cockatoo inhabits the south-west of Western Australia, from Kalbarri to as east on the south coast as Esperance. It breeds inland and moves to the coastal areas when chicks have fledged (Saunders et al. 1985). Carnaby's Black-Cockatoos are highly gregarious, usually seen in trios, small parties or large flocks (up to 5000 birds)(Perry 1948). These flocks typically consist of males, females, and immature birds.

Carnaby's Black-Cockatoos are partly migratory and partly sedentary (Higgins 1999). In the drier regions of their geographic range, where most of the native vegetation has been cleared (e.g. wheatbelt), Carnaby's Black-Cockatoos are postnuptial migrants (Saunders 1980, Saunders and Ingram 1995). After breeding, individuals in these areas migrate to feed in higher rainfall areas, including the Swan Coastal Plain, and to a lesser extent, forests dominated by *E. marginata* (Jarrah), *C. calophylla* (Marri) and *E. diversicolor* (Karri; Saunders 1980). On the Swan Coastal Plain, Carnaby's Black-Cockatoos have been recorded foraging in most suburbs and in pine plantations within the greater Perth metropolitan area (Perry 1948). Vagrants have been recorded on Rottnest Island (Winnett 1989) and Garden Island (Wykes et al. 1999). These latter two sightings clearly indicate that Carnaby's Black-Cockatoo will fly considerable distances over non-vegetated areas to forage.

Garnett *et al*. (2011) estimated there were between 10,000 and 60,000 birds in the population.

Saunders (1980) recorded non-breeding cockatoos at Coomallo Creek foraging within a 50km radius of their breeding area, whereas, cockatoos at Manmanning moved a much greater distance to the coastal plain during their non-breeding season. These data suggest that Carnaby's Black-Cockatoo move from areas where there is little food to southern and western coastal areas where food is presumably more plentiful during summer and autumn (Davies 1966, Saunders 1980).

Carnaby's Black-Cockatoo breeds between July and November, mostly in eucalypt woodland (Saunders 1980, 1986). Carnaby's Black-Cockatoo nest in tree hollows that are created by fire, fungi, termites or old age, with hollows between 2.5 and 12m above the ground (Saunders 1979, Higgins 1999). Hollows are large, ranging from 10 to over 250cm in depth (Higgins 1999). These hollows are usually in live or dead smooth-barked *Eucalyptus salmonophloia* (Salmon Gum) or *Eucalyptus wandoo* (Wandoo). However, Carnaby's Black-Cockatoo will also nest in *E. longicornis* (Red Morrell), *E. loxophleba* (York Gum), *E. gomphocephala* (Tuart), *E. rudis* (Flooded Gum), *E. salubris* (Gimlet), *E. occidentalis* (Swamp Yate) and *C. calophylla* (Higgins 1999, Cale 2003). When breeding, they most often forage in the surrounding shrubland and kwongan heath (Higgins 1999). On the Swan Coastal Plain, breeding could occur in *E. gomphocephala*, *E. rudis*, *E. occidentalis* and *C. calophylla*. Adults return to the same breeding area each year (Saunders 1977) and some use the same tree hollow for many years in succession to raise their chicks, others shift their nests among a number of trees in the same area (Saunders and Ingram 1998).

At Coomallo Creek, Carnaby's Black-Cockatoo travelled on average 1.4km from their nests to forage, whereas at Manmanning they foraged more widely and travelled an average of 2.5km from their nest to forage (Saunders 1980). At Manmanning, road and railway reserves were extensively used for foraging, presumably as this was the closest food source to their nests. The availability of food near the nest influenced the time spent incubating eggs and fledging body mass (Saunders 1980). At Manmanning, Carnaby's Black-Cockatoo traversed agricultural land to forage in remnant plots of uncleared land.

Saunders (1980) reported Carnaby's Black-Cockatoo at Coomallo Creek (breeding area) foraged mostly on native plants, with the only exception being *Erodium* sp.. Higgins (1999) reported the habitat of Carnaby's Black-Cockatoo was uncleared or remnant woodlands dominated by *Eucaly*ptus, particularly *E. wandoo* and *E. salmonophloia* and often in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea and seasonally in Pinus plantations and less often in *C. calophylla*, *E. diversicolor* or *E. marginata*.

Carnaby's Black-Cockatoo breeds, roosts, and forages in the survey area.

There are numerous significant Black-Cockatoo habitat trees within the survey area (Appendices D and E). One active and one probable Carnaby's Black-Cockatoo nesting site were recorded in the Rifle Range Reserve.

Within a radius of 12km, there are 6,706.9ha of habitat that provide mature trees, some of which would provide suitable nesting hollows and another 5,673.3ha that provide poor quality nesting habitat. In addition, there is >350ha of vegetation that would provide a suitable foraging habitat. There is good quality foraging habitat for Black-Cockatoos in the survey area and within a 12km radius. The removal of Black-Cockatoo foraging habitat within the survey area will reduce foraging opportunities, as it will require Carnaby's Black-Cockatoo to travel further to forage.

Numbat (*Myrmecobius fasciatus*) - Endangered under the *BC Act 2016* and *EPBC Act 1999*

The Numbat is a small marsupial, measuring up to 45cm in length and weighing up to 700g. Numbats were once present across southern semi-arid and arid Australia, including parts of NSW, SA and southern NT, as well as the south-west of Western Australia. In Western Australia, there are small residual populations at Dryandra and Perup, with recent translocations at Boyagin Nature Reserve, Tutanning Nature Reserve, Batalling block and Karroun Hill Nature Reserve. Numbats are essentially solitary, forage during the day in winter and in the early morning and late afternoon in summer.

Major threats are listed as predation by foxes, feral cats and raptors and changed fire regimes (Woinarski and Burbidge 2016).

The numbat has not been recorded in the vicinity of the survey area for many years and was not recorded in the camera trapping program, so it is not present in the survey area.

Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the *BC Act* 2016 and *EPBC Act 1999*

The Forest Red-tailed Black-Cockatoo is one of three large black-cockatoos found in Western Australia. *Calyptorhynchus banksii naso* frequents the humid to sub-humid south-west of Western Australia from Gingin in the north, to Albany in the south and west to Cape Leeuwin and Bunbury (Department of Sustainability Environment Water Population and Communities 2011). It was mostly seen in the Perth hills, but small numbers of birds were seen at Mundijong, Baldivis, Karnup, Stakehill, Pinjarra, Coolup and in the Lake Clifton area (Johnstone et al. 2011). In 2011, the number of Forest Red-tailed Black-Cockatoos on the coastal strip north from Rockingham to the northern metropolitan suburbs increased. The reason for the recent increase in abundance is unknown.

Forest Red-tailed Black-Cockatoo nest hollows have been recorded between 6.5 and 33m above the ground, with entrance sizes ranging from 10 x 12cm to 44 x 150cm and a depth of 0.3-8.2m (Johnstone et al. 2013b, a). Breeding occurs throughout the year, but peaks in April-June and August-October, with an incubation period of 29-31 days. A female broods her hatchling for the first 3-10 days after hatching and then leaves the nest each day at dawn, returning to feed the chick at dusk. Hatchlings are fully feathered at about 48 days. Most nests are in Marri, but they have also been recorded in Jarrah, Blackbutt, Bullich and Wandoo. Nest sites are often clustered in an area.

Johnstone and Kirkby (2011) reported the Forest Red-tailed Black-Cockatoo to feed mostly on seeds from *C. calophylla*, *E. marginata*, but also on *Allocasuarina fraseriana* (Sheoak), *Persoonia longifolia* (Snottygobble), *Eucalyptus patens* (Blackbutt) and introduced species such as *M. azedarach* (Cape Lilac) and *Corymbia citriodora* (Lemon-scented Gum).

Loss of breeding habitat in the form of suitable hollows and adequate feeding resources in the vicinity of nesting hollows to enable adults to feed chicks is a primary threat. Abbott (1998) reported that trees within its known breeding distribution were not a factor in limiting breeding. He estimated there were about 15,000 birds and Garnett *et al.* (2011) thought about 10% of these birds bred each year. Competition for nesting hollows by

other cockatoos, Wood Ducks, Galahs and feral Honeybees appears to be a significant threat (Garnett et al. 2011).

The Forest Red-tailed Black-Cockatoo has not recently been recorded in or near the survey area, and it is outside the geographic distribution as indicated by the Commonwealth Government (Department of Agriculture Water and the Environment 2022) referral guidelines, so it is unlikely to be in the survey area.

Red-tailed Phascogale (*Phascogale calura*) – Vulnerable under the *EPBC Act 1999* and conservation dependent under the *BC Act 2016*

Kitchener (1981) indicated that the Red-tailed Phascogale was once widely distributed in Western Australia, but is now confined to the Wheatbelt. It is a nocturnal, arboreal, carnivore that feeds on the ground, and like many dasyurids there is a post-mating mortality for males. Kitchener (1981) and Short et al. (2011) indicated that it was most abundant in remnant patches of native vegetation with suitable upland wandoo–rock sheoak vegetation and lowland habitat of riverine fringing vegetation of swamp sheoak (*Casuarina obesa*), York gum (*E. loxophleba*) and wandoo.

Red-tailed Phascogales were recorded in the bushland surrounding the Woorgabup Nature Reserve and Rifle Range Reserve, and other bushland fragments on M70/1426 and E70/3952. In the Woorgabup Nature Reserve and Rifle Range Reserves, the Red-tailed Phascogales were recorded in or very near wandoo and banksia woodland but could be using a variety of areas where trees contain suitable-sized retreats and nesting hollows.

Malleefowl (*Leipoa ocellata*) – Vulnerable under the *BC Act 2016* and *EPBC Act 1999*

Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed or are perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Prior to vegetation clearing for agriculture, Malleefowl were abundant in the WA Wheatbelt. Vegetation clearing for agriculture also opened adjacent bushland to predators, and in the south-west of WA, Malleefowl often only persist in isolated remnant patches of native vegetation. Sheep and other herbivores (e.g. goats, kangaroos) grazing in remnant vegetation remove or thin the undergrowth, and they also compete with Malleefowl for herbaceous foods and can cause changes to the structure and floristic diversity of foraging habitats (Benshemesh 2007).

Malleefowl and their eggs are vulnerable to predation by foxes, and newly hatched chicks are vulnerable to foxes, cats and raptors (Priddel and Wheeler 1990, 1997, Benshemesh and Burton 1999, Benshemesh 2007, Lewis and Hines 2014). Their abundance in the Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated. Malleefowl build distinctive nests that comprise a large mound of soil or rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous and once breeding commences, they pair for life. The presence of nest mounds indicates the presence of Malleefowl in the area.

Malleefowl is not present in the survey area.

Chuditch (*Dasyurus geoffroii*) – Vulnerable under the *BC Act 2016* and *EPBC Act 1999*.

The Chuditch is the largest extant carnivorous marsupial in WA. It is usually active from dusk to dawn. Formally known from over 70% of Australia, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of southwest WA and other isolated areas. Chuditch are solitary animals for most of their life and den in hollow logs, burrows, culverts, etc. and have also been recorded in tree hollows and rock cavities. Chuditch are opportunistic feeders and forage primarily on the ground at night. Their diet can include other mammals, birds, lizards, and bird and reptile eggs, but the majority is a mixture of large invertebrates (e.g. spiders, scorpions and crickets).

Chuditch was not recorded in the survey area or its surrounds, so it is unlikely to be present.

Grey Falcon (*Falco hypoleucos*) - Vulnerable under the *BC Act 2016* and *EPBC Act 1999*

The Grey Falcon is a moderately large raptor found primarily in the northern half of Western Australia, particularly in lightly wooded, coastal, or riverine areas.

There are no records of this falcon in the Atlas of Living Australia near the survey area, and very few records exist in the southwest of Australia; therefore, it is highly improbable that it would be seen in the survey area.

Southern Whiteface (*Aphelocephala leucopsis*) - Vulnerable under the *EPBC Act 1999*

The Southern Whiteface is a recent addition to the EPBC Act's listing of vulnerable species. It is a small bird found in the arid and semi-arid interior from the WA coast near Hamelin Bay through the Great Victoria Desert into the arid areas of South Australia, Victoria, NSW and Queensland (Johnstone and Storr 2004, Department of Climate Change Energy the Environment and Water 2023).

It is found in open woodlands and shrublands with an understorey of grasses and low shrubs (Department of Climate Change Energy the Environment and Water 2023). It forages on the ground, feeding on insects, spiders and seeds, mostly found in the leaf litter (Johnstone and Storr 2004, Department of Climate Change Energy the Environment and Water 2023).

It has not been recorded in the other fauna surveys reported in the adjacent areas, nor did Western Wildlife (2018) record it in the Woorgabup Nature and Rifle Range Reserves. It is, therefore, unlikely to be in the survey area.

Fork-tailed Swift (*Apus pacificus*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

This species breeds in northeast and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, arriving in the Kimberley in late September, the Pilbara in November, and the southwest land division in mid-December, and departing by late April. The Fork-tailed Swift is an almost exclusively aerial species, foraging and sleeping in flight. It rarely comes to ground, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the wheatbelt.

Terrestrial Ecosystems assess that the Fork-tailed Swift may very infrequently be seen flying over the survey area, however, the Fork-tailed Swift is essentially an aerial species and would be highly unlikely to land in the survey area (Plate 14).

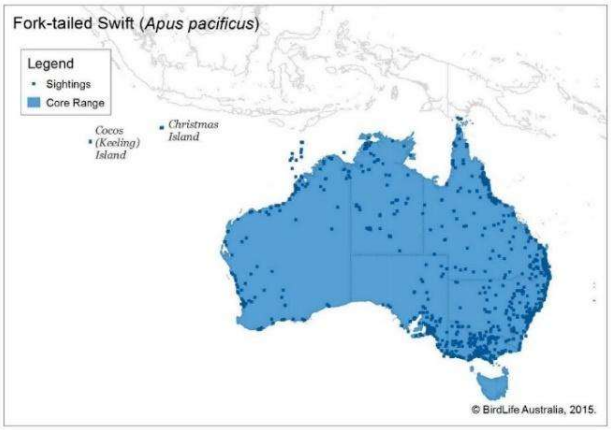

Plate 14. Range and actual reported sightings of the Fork-tailed Swift

(taken from http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds)

Grey Wagtail (*Motacilla cinerea*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

The Grey Wagtail is a small, yellow-breasted bird with a grey back and head. Johnstone and Storr (2004) reported this migratory species to breed in the Palearctic from western Europe and north-west Africa to eastern Asia and wintering in Africa, south-east Asia, Indonesia, the Philippines, New Guinea and Australia. Its preferred habitat in Australia is banks and rocks in fast-running fresh water, including rivers, streams and creeks, where it feeds on insects. The Atlas of Living Australia records two sightings on the south coast of Western Australia and none around the survey area (Plate 15).

It is highly unlikely to be observed in the survey area due to a lack of records and suitable habitat.

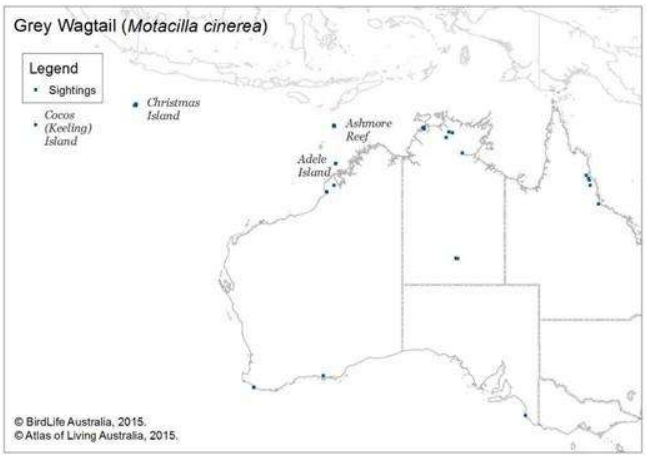

Plate 15. Reported sightings of the Grey Wagtail

(taken from http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds)

Western Rosella (inland form) (*Platycercus icterotis xanthogenys*) – Priority 4 species with DBCA

The mallee form of the Western Rosella is mainly found in eucalypt and *Casuarina* woodland and shrublands, especially Wandoo, Flooded Gums and Salmon Gums (Johnstone and Storr 1998). Terrestrial Ecosystems (2021) sighted this species in the bushland surrounding the Woorgabup Nature and Rifle Range Reserves and again in the December 2023 field survey of significant trees so they may breed in the survey area. It will use a suitable-sized tree hollow as a nest site.

Western Brush Wallaby (*Notamacropus irma*) – Priority 4 species with the DBCA

The Western Brush Wallaby's geographic range has contracted due to vegetation clearing and predation by foxes (Woinarski et al. 2014). This species is found in a wide variety of habitats. Favouring open grassy areas, it is now often restricted to areas of denser vegetation to avoid predators.

The Western Brush Wallaby is not present in the survey area.

Peregrine Falcon (*Falco peregrinus*) – Other specially protected fauna under the *BC Act 2016*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia, excluding the extremely dry areas, and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the survey area. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years. This falcon was recorded by Mattiske Consulting Pty Ltd and Molloch Fauna Consultants (1996), so it may infrequently be recorded in the survey area, but it will readily move if disturbed.

5. DISCUSSION

5.1 ADEQUACY OF THE FAUNA SURVEY DATA FOR FAUNA HABITATS REPRESENTED IN THE SURVEY AREA

The EPA's (2020) technical guidance on terrestrial fauna surveys indicated that the type of survey should be determined based on:

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

The survey area is ~4,366ha and comprises farmland and remnant patches of native bushland, including conservation areas. The level of knowledge of the vertebrate fauna in the vicinity of the survey area is limited due to a lack of surveys, with most of the recent data coming from Western Wildlife's Level 1 vertebrate fauna survey (2018), the Atlas of Living Australia and Terrestrial Ecosystems' camera trapping program (Terrestrial Ecosystems 2021, 2022a, b, c, 2024). The fauna species of conservation significance in the survey area have been identified, and additional surveys are unlikely to provide new information that will alter the impact assessment.

5.2 AMPHIBIANS

Amphibians typically found in the surroundings of the survey area are listed in Table 11. The lack of permanent freshwater in the survey area means that only those species able to survive away from permanent water on porous sandy soil (e.g. *Limnodynastes dorsalis* and *Myobatrachus gouldii*) are likely to be present in the survey area. Frogs in this area are normally only detected after rainfall. There are no amphibian species of conservation significance in the vicinity of the survey area.

5.3 REPTILES

Reptile species richness in the survey area will be depleted due to vegetation clearing many decades ago in much of the area, and the presence of foxes and feral cats in the bushland areas. The list provided in Table 13 represents species likely to be found over a large area of diverse habitat types. The herpetofauna assemblage in the survey area is expected to be like adjacent areas. There are no reptile species of conservation significance in the survey area.

It was pleasing to record a large Carpet Python in one of the bushland remnant bush blocks (Terrestrial Ecosystems 2024).

5.4 BIRDS

Avian species richness in the survey area has been influenced by vegetation clearing for farming. The Wandoo, York Gum, Mallet Woodland, and Banksia heath in the surrounds of the Woorgabup Nature Reserve and Rifle Range Reserve are likely to support the highest diversity of avifauna, followed by a few other large remnant bush blocks. The abundance of farmland around the survey area will be a significant factor in determining the avifauna in the survey area.

The list provided in Table 10 represents species likely to be found over a large area of diverse habitat types.

Carnaby's Black-Cockatoo (Endangered), forages and breeds in the survey area and the inland form of the Western Rosella (Priority 4), also forages and potentially breeds in the woodlands within the survey area. The Peregrine Falcon, which is likely to be seen infrequently in the survey area, is listed as otherwise specially protected species under the *BC Act* and will normally have a very large home range, so it is unlikely to be impacted by the proposed exploration or mining.

5.5 MAMMALS

The diversity of small terrestrial mammals potentially caught in the survey area would be low, given the highly disturbed nature of most of the area and the abundance of foxes and feral cats. Red-tailed Phascogales were recorded on the camera traps in the bushland in the Woorgabup Nature Reserve, Rifle Range Reserve, and other bushland fragments on M70/1426 and E70/3952. Western Grey Kangaroos, Common Brushtail Possums, Mardo and echidnas were also recorded. Feral cats and foxes were widespread and abundant.

5.6 FAUNA OF CONSERVATION SIGNIFICANCE

The endangered Carnaby's Black-Cockatoo is breeding, foraging, and roosting in the surrounds of the Woorgabup Nature Reserve and Rifle Range Reserve. The Red-tailed Phascogale is present in this same area, plus remnant bush fragments on M70/1426 and E70/3952.

An assessment of the available breeding and foraging opportunities for Carnaby's Black-Cockatoo within a 12km radius of the survey area demonstrates that many other areas have a similar habitat. To mitigate the loss of breeding hollows, it is recommended that for each tree with a hollow suitable for a Black-Cockatoo nest that is removed, three Cockatubes are erected at a suitable nearby location. Clearing trees outside Carnaby's Black-Cockatoo breeding season (i.e. July to mid-December) will ensure that eggs and chicks are not impacted by vegetation clearing.

The loss of habitat for the Red-tailed Phascogale will need to be addressed in the vertebrate fauna management and mitigation plan. If habitats containing Red-tailed Phascogales are being impacted, it is recommended that they be trapped immediately before vegetation clearing and moved to secure habitats. In addition, for each mature Wandoo, Red Morell and York Gum removed, one Red-tailed Phascogale nest box is erected in a nearby suitable habitat and location. Clearing trees outside the breeding season (i.e. July – October) will further reduce direct impacts on this species. If a habitat fragment containing Red-tailed Phascogales is to be involved in a land swap to achieve an environmental offset, then individuals in this area should be trapped and translocated to a more secure parcel of suitable native vegetation. Red-tailed Phascogales are vulnerable to predation by foxes and feral cats, which are abundant in the area. An effective fox and feral cat reduction plan would significantly contribute to an increase in the local Red-tailed Phascogale population.

The Priority 4 inland form of the Western Rosella was observed in the surroundings of the Woorgabup Nature Reserve and Rifle Range Reserve and is likely to occur occasionally in other large trees in remnant bush blocks and roadside verges, indicating foraging and potentially breeding in the survey area.

The Peregrine Falcon may be rarely recorded in the survey area, but given its large home range, it will forage in a wide range of areas. Clearing vegetation is unlikely to have a significant impact on this species.

6. POTENTIAL ENVIRONMENTAL IMPACTS

Further exploration and mine development in the survey area may potentially affect vertebrate fauna in numerous ways, including the death or injury of fauna during vegetation clearing, impacts from vehicles, and habitat loss.

6.1 ANIMAL DEATHS DURING THE CLEARING PROCESS AND DISPLACEMENT OF FAUNA

This loss of vegetation, particularly mature trees with hollows, in the area is likely to have an impact on Carnaby's Black-Cockatoo and the inland form of the Western Rosella. Clearing of mature trees may also impact low density, undetected populations of the Vulnerable Red-tailed Phascogale. If sufficient bushland is cleared, common species such as the Western Grey Kangaroo and Common Brushtail Possum will also be forced to move to other areas.

Foxes and feral cats are present in the bushland and the surrounds of the remnant bush blocks and reserves, and are likely to regularly move through the paddocks from one bushland area to another. Both of these predators are known to search recently cleared vegetation for animals that the vegetation clearing has exposed. They will regularly prey on small reptiles and mammals in the survey area, including the Red-tailed Phascogale.

6.2 REDUCTION OR LOSS OF ACTIVITY AREAS AND CLOSURE OF BURROWS

Clearing native vegetation is likely to remove reptile and mammal burrows or foraging habitats that are currently in use or could be used again. Clearing vegetation that forms part of the activity area of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources, placing individuals under survival pressure, and if it is farmland, then it will almost certainly be lost. It could also cause individuals to encroach on the territories of others, thereby increasing competition for resources. Forced relocations could increase the possibility of predation.

6.3 EDGE EFFECTS

Clearing linear corridors and other large areas increases the habitat edges for fauna. Small mammals can respond both positively and negatively to edges depending on their ecological traits (Laurance 1991, 1994, Goosem and Marsh 1997, Goosem 2000). Edge and disturbance effects can lead to altered and, most often, higher levels of predation, restricting or increasing fauna movements and altering assemblage structure (Oxley et al. 1974, Paton 1994, Baker et al. 1998, Temple 1998, Luck et al. 1999, Goosem et al. 2001).

Goldingay and Whelan (1997) and Clarke and Oldland (2007) reported that edge effects can extend up to 150-200m from the edge for some species, meaning the impact area on vertebrate fauna is likely larger than the cleared footprint. Edge effects can disrupt ecological processes, such as predation, dispersal, and animal movements, and alter assemblage structure. Consequently, the impact area will always be much larger than the cleared area.

As large intact patches of remnant vegetation are not being cleared, the impact of edge effects is not likely to be significant.

6.4 HABITAT FRAGMENTATION

In addition to the direct impacts of vegetation clearing, the clearing of vegetation can isolate sections of established fauna communities. It may also alter long and medium-term patterns of movement around established home ranges, particularly for small mammals and reptiles. Moving the vegetation boundary in a westerly and north-westerly direction is unlikely to result in further fragmentation of the fauna habitat.

Clearing vegetation in any of the remaining patches of native bushland or along roadside verges will reduce the size of the native vegetation areas available for native fauna and further fragment the survey area. The consequence is that it will be more difficult for many species to sustain a viable population, so species will be progressively lost from these areas.

6.5 INTRODUCED FAUNA AND WEEDS

Foxes and feral cats were recorded on camera traps in all large bush blocks of native vegetation and were also observed during tree assessments. Tracks and scats were regularly recorded, and fresh roadkill was observed during the field surveys. Foxes are, therefore, well-established in the area. Feral cats were recorded in most large remnant bush blocks where camera traps were deployed. Foxes and cats harm native fauna and can disrupt the natural balance of functioning ecosystems.

Introduced plant species can successfully and rapidly invade areas of cleared native vegetation or those that are otherwise disturbed by humans. Introduced plant species may replace native species that provide shelter or foraging areas for native fauna. Significant changes to vegetation structure will alter the habitats of fauna and, consequently, may influence the composition of fauna species. Preparing and implementing a weed management plan will reduce their threat to native fauna species.

6.6 FIRE

Increased human activity is often associated with an altered fire regime, which leads to a degradation of natural ecosystems. Fire has been identified as one of the threatening processes for some species of conservation significance as numerous small mammal and bird species rely on long unburnt vegetation.

The sparseness of the undergrowth in most remnant patches of vegetation would suggest that these areas would not easily carry a wildfire. Still, if they did burn, the fragmented nature of the bushland means that faunal recolonisation would be very slow.

6.7 ANTHROPOGENIC ACTIVITY

Unnatural noises, vibrations, and vehicle and human movement in an area may be sufficient to force individuals or species of fauna to move from adjacent areas or alter their activity periods. This form of disturbance is likely to occur during the initial vegetation clearing.

6.8 DUST

Dust generated from shifting topsoil can potentially degrade surrounding vegetation, reducing its ability to absorb sunlight and influencing photosynthetic rates. Degradation of these areas may potentially render habitats unsuitable for fauna.

7. VERTEBRATE FAUNA RISK ASSESSMENT

7.1 RISK ASSESSMENT

Fauna surveys to support environmental approvals are part of the environmental risk assessment undertaken to consider the potential impacts a development may have on biodiversity in a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 15, 16 and 17 summarise the risk assessment associated with this survey.

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood X consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing impact the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 17. The risk assessment in Table 17 is based on clearing all vegetation within the disturbance envelope. However, this is not proposed, but the area of native vegetation to be cleared remains unknown until mine planning is further advanced.

Table 15. Fauna impact risk assessment descriptors

Likelihood		
Level	Description	Criteria
A	Rare	The environmental event may occur, or one or more species of conservation significance may be present in exceptional circumstances.
B	Unlikely	The environmental event could occur, or one or more species of conservation significance could be present at some time.
C	Moderate	The environmental event should occur, or one or more species of conservation significance should be present at some time.
D	Likely	The environmental event will probably occur, or one or more species of conservation significance will be present in most circumstances.
E	Almost certain	The environmental event is expected to occur, or one or more species of conservation significance is expected to be present in most circumstances.
Consequences		
Level	Description	Criteria
1	Insignificant	Insignificant impact on fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar fauna or fauna assemblages in the area.
2	Minor	The impact on fauna is localised, and no significant impact on species of conservation significance in the survey area. Loss of species at the local scale.
3	Moderate	An appreciable loss of fauna in a regional context or a limited impact on species of conservation significance in the survey area.
4	Major	Significant impact on species of conservation significance or their habitat in the survey area and/or regional biodiversity and/or a significant loss in biodiversity at the landscape scale.
5	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as 'vulnerable' or 'endangered' under the EPBC Act (1999) at a regional scale.
Acceptability of Risk		
Level of risk	Management action required	
Low	No action required.	
Moderate	Avoid if possible, routine management with internal audit and review of monitoring results annually.	
High	Externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually.	
EXtreme	Unacceptable, project should be redesigned or not proceed.	

Table 16. Levels of acceptable risk

		Likelihood				
		Rare or very low (A)	Unlikely or low (B)	Moderate (C)	Likely (D)	Almost certain (E)
Consequence	Insignificant (1)	Low	Low	Low	Low	Low
	Minor (2)	Low	Low	Low	Moderate	Moderate
	Moderate (3)	Low	Moderate	Moderate	High	High
	Major (4)	Moderate	Moderate	High	High	Extreme
	Catastrophic (5)	Moderate	High	High	Extreme	Extreme

Table 17. A risk assessment of the impact of ground disturbance activity on fauna

			Before management				With management		
	Potential impacts		**Inherent risk**			**Risk controls**	**Residual risk**		
Factor			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Fauna survey data	Inadequate survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	B	2	Low				
	Inadequacy of comparative data	Limits on the availability of comparative data reduced the capacity to assess the uniqueness of the fauna assemblages in the survey area.	B	2	Low				
Clearing vegetation	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the survey area.	E	3	High	Follow recommended protocols in the Vertebrate Fauna Management and Mitigation Plan	E	2	Mod
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	D	3	High	Follow recommended protocols in the Vertebrate Fauna Management and Mitigation Plan	D	2	Mod
	Loss of fauna habitat – regional scale	A small loss of some fauna in the region.	B	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	3	Low				
	Habitat fragmentation	Fauna movement is restricted, resulting in the death of fauna and biodiversity loss.	E	3	High				
Death or loss of species of conservation significance	Loss of a unique terrestrial fauna ecosystem	Loss of an ecosystem containing fauna with high species richness, abundance, and numerous top-of-the-food-chain predators.	B	3	Mod				
	Carnaby's Black-Cockatoo	Disturbance of Carnaby's Black-Cockatoo breeding and foraging habitat.	B	3	Mod	Follow recommended protocols in the Vertebrate Fauna Management and Mitigation Plan	B	2	Low

			Before management				With management		
	Western Rosella	Loss of a Western Rosella or small population of Western Rosella	B	3	Mod				
	Red-tailed Phascogale	Loss of a Red-tailed Phascogale or small population of Red-tailed Phascogales	D	3	High	Follow recommended protocols in the Vertebrate Fauna Management and Mitigation Plan	B	2	Low
	Peregrine Falcon	Loss of a Peregrine Falcon or small population of Peregrine Falcon	A	2	Low				
Human impacts	Increase or spread of weeds	Changes in vegetation and a resulting loss of habitat for fauna.	E	2	Mod				
	Road kills	Animals being killed by vehicles as they cross roads	C	2	Low				
	Increase in feral fauna, specifically the fox and cat	Increased predation on the native fauna	C	3	Low	Implementation of a feral predator management program.			
	Dust	Increased potential for dust	B	2	Low	Implementation of a dust management plan.	B	1	Low

7.2 NATIVE VEGETATION CLEARING PRINCIPLES AS THEY PERTAIN TO VERTEBRATE FAUNA

The *Environmental Protection Act (1986)* outlines 10 principles that are to be used in the assessment of native vegetation clearing permit applications, which are also applicable for other assessments and approvals (Table 18). Where possible, native vegetation should not be cleared if the following principles are compromised.

Table 18. Assessment of impact using the native vegetation clearing principles

Principle	Response
It comprises a high level of biological diversity.	The presence of the Carnaby's Black-Cockatoo, Red-tailed Phascogale, and the Western Rosella requires that effective active management is implemented to protect these species. The potential level of impact will depend on the location and extent of the proposed vegetation clearing, exploration and mining operations.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Any loss of eggs or chicks of Carnaby's Black-Cockatoo or Western Rosella would be regrettable, and every effort should be made to minimise the possibility of this occurring. The unnecessary loss of Red-tailed Phascogales would be of concern, and appropriate management is required to protect these species.
It includes, or is necessary for the continued existence or, rare flora.	N/A
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The survey area does not include habitat, which, if lost, would threaten the species' survival of Carnaby's Black-Cockatoo, Red-tailed Phascogale, or Western Rosella. However, given their low abundance, all populations should be managed and protected.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The survey area contains several remnant bushland areas and bushland corridors. Due to the historical habitat clearing across the Wheatbelt, all remaining areas of intact bushland are considered significant and should be avoided if possible.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	Ephemeral creeks and drainage exist in the survey area. They typically run through farm paddocks and have vegetation on either side of the creek bed. Some of these tree-lined creeks will contain trees with hollows that could provide nesting sites for Black-Cockatoos and the Western Rosella.
The clearing of the vegetation is likely to cause appreciable land degradation.	The potential level of impact will depend on the location and extent of the proposed vegetation clearing and development.
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Clearing vegetation will further reduce the availability of native bushland in this area. The loss of any remnant bushland in the Wheatbelt area is of concern.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	N/A
The clearing of the vegetation is likely to cause, or exacerbate the incidence of flooding.	The available native bushland in the region is progressively diminishing. The area is not flood-prone due to its porous soil.

7.3 REFERRAL UNDER THE *EPBC ACT*

7.3.1 Carnaby's Black-Cockatoo

Clearing vegetation in the survey area could potentially impact Carnaby's Black-Cockatoo's foraging, roosting, and breeding habitat. The level and extent of impact can only be determined when more details are available on the potential areas of disturbance.

Department of Agriculture Water and the Environment (2022) provided thresholds for when a referral is required in a tabular form that has been reproduced in Table 19.

Table 19. Thresholds for when a referral is unlikely to be required (taken from Department of Agriculture Water and the Environment 2022)

Attribute	Referral threshold	Reasons
Night roosting habitat	Limited pruning or trimming of trees within night roosting sites is unlikely to require a referral to the minister.	These types of impacts are considered low intensity when black cockatoos are still able to use the site for roosting.
Foraging habitat	Clearing of any quality of foraging habitat under 1 hectare is unlikely to require a referral to the minister.	This patch size is similar to minimum patch size for other *EPBC Act* listed entities.
Foraging habitat	Clearing of low-quality foraging habitat (habitat scoring 1-4) that is less than 10 hectare is unlikely to require a referral to the minister.	Habitat on a site that scores 1-4 using the foraging quality scoring tool is not considered to provide significant foraging value or be critical to the survival of any of the species. This habitat will either not be known to be used for foraging, be highly impacted by plant disease, be highly isolated or be a considerable distance from known breeding or roosting areas.
Bushfire management	Responses to fire emergency management do not require a referral to the minister.	Refer to the Bushfire management and national environment law web page.
Forestry	Certain actions are exempt from the requirement for assessment and approval under the *EPBC Act*.	Sections 38-42, 43A and 43B of the *EPBC Act*.
Exotic foraging habitat	Removal of individual or multiple (up to 1 hectare) of predominantly exotic tree species (e.g. Cape Lilac trees, pine trees).	The importance of these trees is only considered significant when they are in native vegetation patches or forming patches greater than 1 hectare.

The Commonwealth Government (Department of Agriculture Water and the Environment 2022) has published referral guidelines that include criteria to determine whether a referral is required based on the quality of the foraging habitat. A preliminary assessment of whether clearing vegetation in the survey area triggers a referral based on foraging habitat quality is provided in Table 20.

Table 20. Black-Cockatoo foraging quality scoring tool

	Carnaby's Black-Cockatoo	
	Start at a score of 10 if your site is native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as *Banksia* spp. (including Dryandra spp.), *Hakea* spp. and *Grevillea* spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation. This tool only applies to sites equal to or larger than 1 hectare in size.	The survey area contains a foraging habitat. Score 10
Attribute		
Foraging potential	Subtract 2 from your score if there is no evidence of feeding debris on your site.	Foraging was recorded in multiple areas during the surveys. Score 0
Connectivity	Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12km of your site.	There are other foraging opportunities within 12km. Score 0
Proximity to breeding	Subtract 2 if you have evidence to conclude that your site is more than 12km from breeding habitat.	Breeding occurs in the survey area. Score 0
Proximity to roosting	Subtract 1 if you have evidence to conclude that your site is more than 20km from a known night roosting habitat.	Carnaby's Black-Cockatoo was recorded roosting in Woorgabup Nature Reserve and Rifle Range Reserve. Score 0
Impact from significant plant disease	Subtract 1 if your site has disease present (e.g. Phytophthora spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	Dieback has not been recorded in the survey area. Score 0
		10

Based on Tables 19 and 20, clearing vegetation in the survey area could trigger a referral for the Carnaby's Black-Cockatoo. However, until information is known about the proposed vegetation clearing program and mining development, this rating system cannot be confirmed to determine whether a referral is required.

7.3.2 Red-tailed Phascogale

The Red-tailed Phascogale is a small, agile arboreal mammal; therefore, camera traps can often fail to record their presence in areas where they are in low abundance. Therefore, they may be present in other bushland areas, particularly those that were not surveyed with camera traps. Clearing vegetation in the survey area could potentially impact Red-tailed Phascogales. The level and extent of impact can only be determined when more details are available on the potential areas of disturbance.

7.3.3 Western Rosella (inland form)

Although a referral is not required for this species, impacts on this species will be of interest to State Government. This will almost certainly involve active management to mitigate the potential impacts consistent with other avifauna.

8. SUMMARY

Ausgold Exploration Ltd (Ausgold) is planning additional exploration followed by mining on its tenements which are ~35km east-north-east of Katanning in Western Australia (WA). The survey area was ~4,366ha, but because of access issues to some areas, the Black-Cockatoo habitat trees assessment and camera trapping were confined to much smaller area.

Most of the survey area is farmland and was cleared many decades ago. The most substantial patch of native bushland is around and to the south-east of the Woorgabup Nature Reserve (R24072) and the Rifle Range Reserve (R2423 and R2425). This area was assessed by Western Wildlife (2018) who reduced Mattiske Consulting's (2018) 10 vegetation communities to four fauna habitats:

- Wandoo woodland;
- York Gum Woodland;
- Mallet woodland; and
- Banksia heath.

There are multiple small areas of remnant native vegetation patches on farming properties across the survey area and multiple ephemeral drainage lines and creeks that run in a north-westerly direction, with many of these having remnant vegetation along both banks. There is a disused mining pit in care and maintenance, and farm housing and sheds in the survey area.

The bushland area around the Woorgabup Nature and Rifle Range Reserves contains a recently active Carnaby's Black-Cockatoo nest, as well as foraging and roosting sites. These two reserves and the large remnant block of native vegetation on M70/1426, support a population of Red-tailed Phascogales, which is listed as conservation dependent at the State level and Vulnerable at the Commonwealth level. The inland form of the Western Rosella was observed infrequently in the bushland area, indicating that it likely forages there and possibly breeds in tree hollows in this region.

Overall, Terrestrial Ecosystems recorded 8,396 significant trees in the survey area, and of those 740 were assessed from the ground level to have at least one hollow that could potentially be used as a nesting site for Black-Cockatoos. Within a 12km radius of the survey area, there is more than 6,700ha of good quality nesting habitat and 360ha of foraging habitat.

The Woorgabup Nature Reserve and Rifle Range Reserve, and many of the larger blocks of remnant vegetation support Western Grey Kangaroos and Common Brush-tailed Possums, and the loss of vegetation could negatively impact these species. Foxes and feral cats are also widespread across the survey area.

Based on the type of vegetation Ausgold plans to disturb, it will assess the potential significant impacts on Carnaby's Black-Cockatoo and Red-tailed Phascogale and determine if a referral under the *EPBC Act* is necessary.

It is recommended that the Vertebrate Fauna Management and Mitigation Plan (Terrestrial Ecosystems 2023b) is implemented, and if a referral under the *EPBC Act* is deemed necessary, then this plan is appended to this referral.

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