



Significant Species Management Plan

Miralga Creek

27/10/2022

180-LAH-EN-PLN-0001 v4



Significant Species Management Plan

Miralga Creek



Authorisation

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Abbreviations

AER	Annual Environmental Report
Atlas	Atlas Iron Pty Ltd
BC Act	<i>Biodiversity Conservation Act 2016</i>
Biologic	Biologic Environmental Survey Pty Ltd
DAWE	(former) Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity and Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environment Regulation
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDP	Ground Disturbance Permit
GIS	Geographic Information System
MNES	Matters of National Environmental Significance
SSMP	Significant Species Management Plan



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1 Introduction

1.1 Project Overview

The Miralga Creek DSO Project (the Project) is located approximately 100 km southeast of Port Hedland (Figure 1-1). Mining is conducted via conventional open cut, crushing and screening mining methods above the groundwater table. The Project includes five open pits, waste rock dumps and other supporting infrastructure.

The Project has been approved under the Western Australian *Environmental Protection Act 1986* (EP Act) under Ministerial Statement No. 1154 (MS 1154) and the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2019/8601).

1.2 Purpose

The purpose of this Significant Species Management Plan (SSMP) is to mitigate potential impacts to conservation significant fauna species and to ensure that the Project is developed in an environmentally acceptable manner.

The specific objective of this SSMP is to avoid where possible, and otherwise minimise, direct and indirect impacts to significant fauna and their habitat. Significant fauna includes the following conservation significant species, which the Project has the potential to impact:

- Northern Quoll.
- Ghost Bat.
- Pilbara Leaf-nosed Bat.
- Pilbara Olive Python.
- Northern Brushtail Possum.
- Grey Falcon.

This SSMP focuses particularly on the Ghost Bat (*Macroderma gigas*) and Northern Quoll (*Dasyurus hallucatus*). These two species were considered to be at risk of significant impact from development of the Project (Biologic, 2020c).

No invertebrate fauna of conservation significance were considered likely to be significantly impacted by development of the Project (Biologic, 2020b) so this SSMP considers vertebrate fauna only.

The key conditions of Ministerial Statement No. 1154 and EPBC 2019/8601 relating to this SSMP are shown in Table 1-1 and Table 1-2 respectively. Refer to the approvals documentation for definitions of particular terms and other administrative requirements.

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Table 1-1: Key Conditions of Ministerial Statement No. 1154 Relating to this SSMP

No.	Condition Text
6	Significant Species Management Plan
6-1	<p>The proponent shall ensure implementation of the proposal achieves the following environmental objective:</p> <p>(1) avoid where possible, otherwise minimise direct and indirect impacts to significant fauna and their habitat, including:</p> <ul style="list-style-type: none"> (a) northern quoll (<i>Dasyurus hallucatus</i>); (b) ghost bat (<i>Macroderma gigas</i>); (c) Pilbara leaf-nosed bat (<i>Rhinonictis aurantia</i>); (d) Pilbara olive python (<i>Liasis olivaceus barroni</i>); (e) northern brushtail possum (<i>Trichosurus vulpecula arnhemensis</i>); and (f) grey falcon (<i>Falco hypoleucos</i>).
6-2	<p>To achieve the objective in condition 6-1 and prior to ground disturbing activities, the proponent shall update and submit a revision of the Significant Species Management Plan (180-LAH-EN-PLN-0001, Rev 0, April 2020) to the requirements of the CEO. The Plan shall:</p> <ul style="list-style-type: none"> (1) specify trigger criteria; threshold criteria; trigger level actions; threshold contingency actions; monitoring locations, methodologies, indicators and timing; investigations in the event of a failure to meet a criteria or action; and reporting to demonstrate that the objective in condition 6-1(1) will be met; (2) specify management actions and reporting to demonstrate that the objective in condition 6-1(1) will be met; (3) show significant fauna monitoring sites presented in a figure; (4) design blasts to perform to the blast criteria at threshold 100 mm/s at caves CMRC-13, CMRC-14 and CMRC-15, and any other category 1 and 2 caves in the development envelope where ghost bats are found to roost; (5) avoid blasting within 100 metres of the lateral extent of caves CMRC-13, CMRC-14 and CMRC-15 until the results of monitoring validate predictions with a reasonable degree of confidence; (6) ensure no significant damage to caves CMRC-13, CMRC-14 and CMRC-15, or any other diurnal roosting cave, such that the caves remain viable as habitat (including for diurnal roosting) for ghost bats and Pilbara leaf-nosed bats in the future once mining has ceased; (7) minimise disturbance to significant fauna habitats; hillcrest/hillslope, gorge/gully and low stony hills; (8) include a trigger criterion that, during any annual monitoring period, any decline in northern quoll abundance at any monitoring site does not exceed 50% of baseline abundance at that site; and (9) include a threshold criterion that northern quoll is not absent from more than 50% of monitoring sites for more than two consecutive annual monitoring periods;
6-3	The proponent shall not implement the proposal until the CEO has confirmed in writing that the Significant Species Management Plan satisfies the requirements of condition 6-2.
6-4	<p>The proponent:</p> <ul style="list-style-type: none"> (1) may review and revise the Significant Species Management Plan; or (2) shall review and revise the Significant Species Management Plan as and when directed by the CEO by a notice in writing.
6-5	The proponent shall implement the latest revision of the Significant Species Management Plan approved by the CEO.



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No.	Condition Text
6-6	The proponent shall continue to implement the Significant Species Management Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated that the objective in condition 6-1 has been met.
6-7	Where monitoring or investigations indicate a failure to meet or implement management action(s) or target(s) detailed in the approved Significant Species Management Plan, the proponent shall meet the requirements of condition 4-5 (Compliance Reporting) and shall implement the measures outlined in the approved Significant Species Management Plan, including, but not limited to, actions and investigations to be undertaken.
6-8	The proponent shall provide the results of ongoing monitoring to the agency responsible for the administration of the <i>Biodiversity Conservation Act 2016</i> (being at the time of this Statement to the Department of Biodiversity, Conservation and Attractions).

Source: Ministerial Statement No. 1154 dated 23 November 2020

Table 1-2: Key Conditions of EPBC 2019/8601 Relating to this SSMP

No.	Condition Text
Significant Species Management Plan	
2	To minimise the impacts to the Ghost Bat and Northern Quoll , the approval holder must implement the Significant Species Management Plan , including, but not limited to the following: <ul style="list-style-type: none"> (a) the approval holder must comply with all the requirements of the Ghost Bat monitoring procedure provided at Appendix B of the Significant Species Management Plan. In addition to the measures specified in the Ghost Bat monitoring procedure, the approval holder must also record microclimate data for cave CMRC-15 during baseline, operational and post-mining monitoring for the Ghost Bat; and (b) the approval holder must comply with all the requirements of the Northern Quoll monitoring procedure provided at Appendix A of the Significant Species Management Plan.
3	Should the action result in exceedance of threshold criteria for the Ghost Bat and Northern Quoll specified in the Significant Species Management Plan , the approval holder must: <ul style="list-style-type: none"> a) within 24 hours of becoming aware of an exceedance of the threshold criteria, implement the threshold contingency actions specified in the Significant Species Management Plan and notify the Department of the exceedance; b) investigate the cause of the exceedance of the threshold criteria and notify the Department of the cause or, if the cause is still being established, the most likely cause as soon as practicable, and no later than 5 business days after becoming aware of the exceedance; c) continue implementing the threshold contingency actions until such time as the Department has confirmed in writing that the approval holder has demonstrated that the threshold contingency actions are no longer required; d) investigate potential environmental harm or alteration of the environment that occurred due to threshold criteria being exceeded; and e) provide a report to the Department within 21 business days of the exceedance being reported as required by condition 3(a). The report must include: <ul style="list-style-type: none"> i. details of threshold contingency actions implemented; ii. the effectiveness of the threshold contingency actions implemented, against the threshold criteria; iii. the findings of the investigations required by condition 3(b) and 3(d); iv. measures to prevent the threshold criteria being exceeded in the future;



No.	Condition Text
	v. measures to prevent, mitigate and remedy the environmental harm which may have occurred; and
	vi. justification of whether the threshold criteria should remain, or be adjusted, based on any better understanding having been developed, while demonstrating that environmental outcomes will continue to be met.

Source: EPBC 2019/8601 dated 18 February 2021

1.3 Environmental Legislation

Environmental legislation relevant to this management plan includes the EPBC Act, EP Act, *Biodiversity Conservation Act 2016* (BC Act) and *Mining Act 1978* (Mining Act).

1.3.1 Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act provides for the protection of Matters of National Environmental Significance (MNES). Actions likely to cause a significant impact to MNES require assessment and approval under the EPBC Act. The EPBC Act is administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

Threatened species and migratory species have been confirmed as present in the vicinity of the Project. The Project was referred under the EPBC Act in December 2019 and was considered a Controlled Action. Approval was granted on 18 February 2021 (EPBC 2019/8601).

Atlas is required by EPBC 2019/8601 to minimise impacts to two MNES (Ghost Bat and Northern Quoll) by implementing this SSMP. This SSMP also targets two further MNES (Pilbara Leaf-nosed Bat and Pilbara Olive Python) and two species nominated to be listed as MNES (Northern Brushtail Possum and Grey Falcon).

1.3.2 Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act) is the primary legislation that governs environmental impact assessment and protection in Western Australia. The aim of this Act is to prevent, control and abate environmental pollution for the conservation, preservation, protection, enhancement, and management of the environment. Authorities under this Act include the Department of Water and Environment Regulation (DWER) and the independent Environmental Protection Authority (EPA).

Atlas referred the Project to the EPA in April 2020 for the Project's potential impacts to the environment. It was determined under Part IV of the EP Act to require formal assessment. The EPA published its assessment of the Project on 30 September 2020, recommending approval subject to conditions. Approval was granted on 23 November 2020 (Ministerial Statement No. 1154).

1.3.3 Biodiversity Conservation Act 2016

The BC Act provides for the protection of native flora and fauna if they are under identifiable threat of extinction, rare, or generally in need of protection. The principal authority under this Act is the Department of Biodiversity and Conservation and Attractions (DBCA).

Threatened fauna are declared in the Government Gazette as Specially Protected Fauna, including the following species targeted by this SSMP: Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Northern Brushtail Possum and Grey Falcon.



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1.3.4 Mining Act 1978

The Mining Act regulates mineral exploration and mining in Western Australia. The principal authority under this Act is the Department of Mines, Industry Regulation and Safety (DMIRS). Under this Act, DMIRS prescribes environmental protection conditions on mining tenure through the assessment of Mining Proposals and Mine Closure Plans, which outline the potential environmental impacts and management practices for individual projects.

1.4 Terminology and Definitions

1.4.1 Conservation Significant

When discussing the general assemblage of fauna in this SSMP, species of conservation significance refers to species that are:

- Listed under federal or state legislation.
- Listed as priority species by DBCA.
- Considered by qualified specialists to be locally important; e.g., populations at the edge of their known distribution.

1.4.2 Likelihood of Occurrence

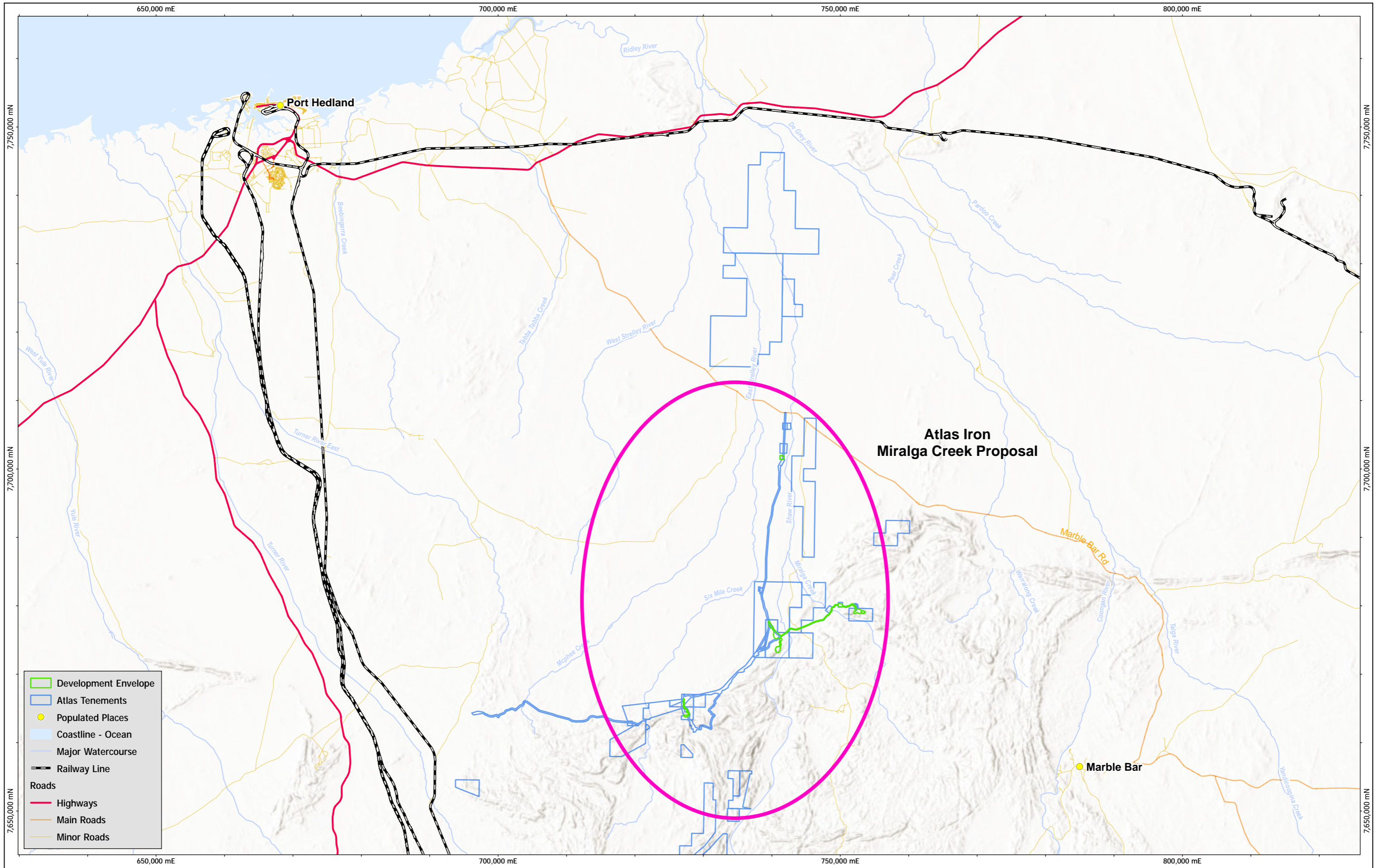
The likelihood of occurrence for fauna of conservation significance within the Study Area was determined using a matrix based on known information relating to species' distribution, habitat preferences, locality records and previous studies (Biologic, 2020a). The fauna assessments assigned each species to one of six categories as follows:

- Confirmed.
- Highly Likely.
- Likely.
- Possible.
- Unlikely.
- Highly Unlikely.

1.4.3 Project Terminology

Project terminology is as follows:

- 'Project' refers to the Miralga Creek DSO Project.
- 'Development Envelope' refers to the 556.8 ha area within which Atlas will clear no more than 219.8 ha (Figure 1-1).
- 'Study Area' is defined as the area over which field surveys for terrestrial fauna have been conducted (8,124.3 ha), as described in Section 2 and depicted in Figure 2-1.



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 Project Location

Figure No:
 1-1



2 Environmental Context

Biologic Environmental Survey Pty Ltd (Biologic) conducted a two-season Level 2 vertebrate and short-range endemic (SRE) invertebrate fauna survey (hereafter referred to as the “initial dual-phase baseline fauna survey”) for the Project in May and July 2019 (Biologic, 2020a). The purpose of the survey was to identify the occurrence of vertebrate and SRE invertebrate fauna species within the Study Area and their supporting habitats. A smaller area around the camp and explosives magazine surveyed previously by Outback Ecology (2012) was resurveyed in August 2020 to extend the existing habitat mapping (Biologic, 2020d). Baseline monitoring for Northern Quoll and Ghost Bat was conducted in August 2020 (Biologic, 2022a; Biologic, 2022b). The first round of operational monitoring for Northern Quoll and Ghost Bat was conducted in August 2021 (Biologic, 2022c; Biologic, 2022d).

2.1 Habitats

Seven vertebrate fauna habitat types were recorded and mapped within the Study Area. These comprised, in decreasing order of extent:

- Low Stony Hills.
- Stony Plain.
- Sandy Plain.
- Major Drainage Line.
- Hillcrest/Hillslope.
- Spinifex Sandplain.
- Gorge/Gully.

Additionally, a small portion of the Study Area comprised cleared areas from previous clearing and tracks.

In the Study Area, a number of caves and water sources were recorded. These features are recognised for providing sources of shelter, food and water for species of conservation significance. Many of these features were recorded within the Gorge/ Gully and Hillcrest/ Hillslope habitats.

A total of 20 caves have been recorded across the Study Area to date (Biologic, 2020a, 2022a, c), with an additional 4 caves (CMRC-20, CMRC-21, CMRC-22, and CMRC-23) recorded since the previous version of this SSMP. Ghost Bats or evidence of their occurrence have been recorded at 14 of these caves (Biologic, 2020a, 2022a, c), with occasional usage by Pilbara Leaf-nosed Bat recorded at 13 caves to date.

A total of 15 natural water sources (other than creeks and rivers) were recorded by Biologic, plus one turkey's nest dam. All water sources in the Study Area provide foraging habitat for fauna when water is present, however only two permanent water sources were recorded, approximately 1 km south of Miralga East.

2.2 Conservation Significant Species

The desktop component of the initial dual-phase baseline fauna survey identified 38 vertebrate species of conservation significance which had been recorded in the vicinity of the Study Area or whose distribution overlapped with the Study Area, comprising ten mammals, 24 birds and four reptiles (Biologic, 2020a). Seven of these species were recorded during the associated surveys (Table 2-1). This comprised five mammals (Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Northern Brushtail Possum and Western Pebble-mound Mouse) and two birds (Grey Falcon and Peregrine Falcon).



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A vertebrate fauna impact assessment completed for the Project highlighted the potential for a significant impact to the Ghost Bat and Northern Quoll (Biologic, 2020c). Hence, this SSMP focuses on mitigating and monitoring impacts to these two species. Importantly, however, the controls to be implemented will also assist in mitigating impacts to other conservation significant species which were not predicted to be significantly impacted by the Project.

Table 2-1: Conservation Significant Species Confirmed Present

Common Name (Species Name)	Conservation Status	
	EPBC Act	In WA ¹
Northern Quoll (<i>Dasyurus hallucatus</i>)	Endangered	Endangered
Northern Brushtail Possum (<i>Trichosurus vulpecula arnhemensis</i>)	Vulnerable	Vulnerable
Pilbara Leaf-nosed Bat (<i>Rhinioncteris aurantius</i>)	Vulnerable	Vulnerable
Ghost Bat (<i>Macroderma gigas</i>)	Vulnerable	Vulnerable
Pilbara Olive Python (<i>Liasis olivaceus barroni</i>)	Vulnerable	Vulnerable
Grey Falcon (<i>Falco hypoleucos</i>)	(Vulnerable ²)	Vulnerable

¹ Western Australian conservation status codes.

2.2.1 Northern Quoll (*Dasyurus hallucatus*) (Endangered – EPBC Act; Vulnerable – BC Act)

The presence of Northern Quoll within the Study Area was confirmed from 89 records during the initial dual-phase baseline fauna survey, including 44 trapped individuals (comprising 28 unique individuals), 35 captures on motion camera (comprising 10 or 11 unique individuals) and ten observations from secondary evidence (six scats and four tracks) (Biologic, 2020a).

Two young males were captured at Phase 1 systematic trapping sites in Low Stony Hills and Sandy Plain habitats. Due to the timing of their capture coinciding with the early stages of the breeding season (when males are most active and mobile), it is most likely they were dispersing or traversing the habitat while migrating from other areas of more suitable habitat rather than using those habitat types as a key refuge (Hernandez-Santin et al., 2019).

During the Phase 2 survey, 18 individuals were captured at one site in Hillcrest/ Hillslope habitat at Miralga West. The high number of females captured (11 individuals) highlighted the significant value of denning/shelter habitat for the species in the area.

Evidence of the Northern Quoll was recorded within a range of fauna habitats within the Study Area, including Gorge/ Gully, Hillcrest/ Hillslope, Low Stony Hills, and Sandy Plain habitats. Northern Quoll are likely to occur throughout the Study Area, particularly within Gorge/ Gully and Hillcrest/ Hillslope habitats, where suitable denning/shelter and/or foraging habitat is present, in addition to Major Drainage habitat for foraging and/or dispersal. These habitats form part of the core habitats critical to the survival of Northern Quoll (DoE, 2016). To a lesser extent, all habitats occurring within the Study Area may be utilised by the species to forage and or during dispersal activities; however, other habitats' significance to the species will vary depending on resource availability and connectivity. Foraging habitat within the Study Area is likely to vary depending on resource availability and recent fires (estimated 2018 or 2019) within large sections of the Study Area.

Baseline monitoring for Northern Quoll was completed at four impact sites and four control sites in August 2020 (Biologic, 2022b). Northern Quoll were recorded by 152 detection events across six of the eight sites assessed. A detection event is defined as an instance in which a northern quoll is



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recorded on camera (Biologic, 2022b). Where detected, the number of detection events ranged between four and 57. A total of 45 individuals were identified based on spot patterning, with 23 across the impact sites and 22 across the control sites. Where individuals were identified, the number of individuals ranged between three and 16.

The first round of operational monitoring for Northern Quoll was completed in August 2021 at four impact and five control sites (Biologic, 2022d). The fifth control site was assessed in 2021 as a potential replacement for a control site that recorded no detections of Northern Quoll during the August 2020 baseline monitoring. No critical differences in quality of habitat for the eight sites established during the baseline monitoring were observed during the 2021 survey. Northern Quoll were recorded by 100 detection events across eight of the nine sites assessed, and where detected, the number of detection events ranged between one and 38. A total of 45 individuals were identified based on spot patterning, with 19 identified across the impact sites and 26 across the control sites. Where individuals were identified, the number of individuals ranged between one and 17.

Note that the first round of operational monitoring completed in August 2021 was only considered operational for impact sites within the vicinity of the Miralga West mining area. Impact sites relevant to the Miralga East and Sandtrax mining areas were still within the baseline monitoring phase as operations in those areas were yet to commence.

2.2.2 Ghost Bat (*Macroderma gigas*) (Vulnerable – EPBC Act / BC Act)

Ghost Bats roost in deep, complex caves beneath bluffs of low, rounded hills, granite rock piles and abandoned mines (Armstrong & Anstee, 2000). These features often occur within habitats including gorges, gullies, ridgelines and low hills (Armstrong & Anstee, 2000). Ghost Bats have previously been recorded within the Study Area, near Sulphur Springs within the Sandtrax deposit (DBCA, 2019). The species has also been recorded on numerous occasions within 10 km of the Study Area, including at the Lalla Rookh roost site and in the vicinity of the Abydos DSO Project during annual monitoring of the species at the site (Biologic, 2019).

The Ghost Bat was recorded a total of 25 times within the Study Area during the initial dual-phase baseline fauna survey (Biologic, 2020a). The species was recorded five times from direct observation (individuals observed at night and within or flushed from caves), ten times from ultrasonic call recordings and ten times from secondary evidence (scats). The species was recorded within Major Drainage, Hillcrest/ Hillslope, Gorge/ Gully and Stony Plain habitat within the Study Area.

Timing of calls from most sites were consistent with bats from both species originating from Lalla Rookh (Armstrong & Anstee, 2000). Lalla Rookh is a permanent bat roost which lies outside of the Development Envelope, approximately 700 m south of the existing Abydos Link Road, which connects Sandtrax to Miralga West. From Lalla Rookh, Sandtrax is approximately 9 km southwest, Miralga West 3 km northeast and Miralga East 19 km northeast. Any bats exhibiting short-term abandonment from the caves in the Project area are expected to use Lalla Rookh as their preferred location (Bat Call, 2020).

During the baseline monitoring, Ghost Bat were recorded a total of 22 times within the Study Area: four times from direct observation, eight times from ultrasonic call recordings, and 10 times from secondary evidence (scats) (Biologic, 2022a). The first round of operational monitoring for Ghost Bat, conducted in August 2021, recorded Ghost Bat a total of 25 times: three times from direct observation, 12 times from ultrasonic recordings, and 10 sites from secondary evidence (scats) (Biologic, 2022c). No physical changes were observed at any of the monitoring sites during the 2021 operational monitoring event.



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Note that the first round of operational monitoring completed in August 2021 was only considered operational for impact sites within the vicinity of the Miralga West mining area. Impact sites relevant to the Miralga East and Sandtrax mining areas were still within the baseline monitoring phase as operations in those areas were yet to commence.

Within the Study Area, Ghost Bat are likely to occur and forage within all mapped broad fauna habitat types, with roosting more likely to be concentrated in areas of significant habitat where suitable caves are present, such as in Hillcrest/ Hillslope and Gorge/ Gully habitats. The species' occurrence is likely to be regular, particularly when roosting occurs within the Study Area. Gorge/ Gully represent significant habitat for the Ghost Bats as caves are often formed within this habitat type, which can be utilised for roosting and foraging. Drainage areas provide suitable foraging habitat for Ghost Bats. Water features are also important for the species as foraging and drinking sources.

To date, 20 caves have been confirmed or identified as potential roost caves for Ghost Bat within the Study Area. Cave locations are summarised in Table 2-2 and shown in Figure 1 of Appendix B.

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Table 2-2: Ghost Bat Caves Recorded in the Study Area and their Distance to Nearest Proposed Pit

Cave	Habitat Value to and Use by Ghost Bat	Roost Category ¹				Distance From Cave Entrance to Nearest Proposed Pit ²
		1	2	3	4	
Sandtrax						
CMRC-03	Nocturnal roost			P		185 m
CMRC-07	Diurnal roost			P		225 m
CMRC-19	Night roost				P	385 m
CMRC-21	Diurnal roost				P	335 m
Miralga West						
CMRC-02	Potential nocturnal roost				P	Within pit
CMRC-04	Nocturnal roost				P	340 m
CMRC-06	Diurnal roost		P			400 m
CMRC-08	Nocturnal roost			P		470 m
CMRC-10	Nocturnal roost			P		450 m
CMRC-12	No usage				P	340 m
Miralga East (near pits 2 and 3)						
CMRC-01	Nocturnal roost				P	50 m
CMRC-13	Nocturnal roost				P	95 m
CMRC-14	Diurnal roost			P		117 m
CMRC-15	Diurnal roost / possible maternity roost		P			55 m
CMRC-20	Diurnal roost			P		150 m
CMRC-22	Diurnal roost			P		250 m
CMRC-23	Diurnal roost / possible maternity roost		P			75 m
Miralga East (west of pits)						
CMRC-16	No usage				P	~1,000 m
CMRC-17	No usage				P	~1,000 m
CMRC-18	Potential diurnal roost			P		~1,000 m

Sources: Bat call (2022).

1 Roost category definitions (full definitions in Appendix A of Bat Call WA (2020)):

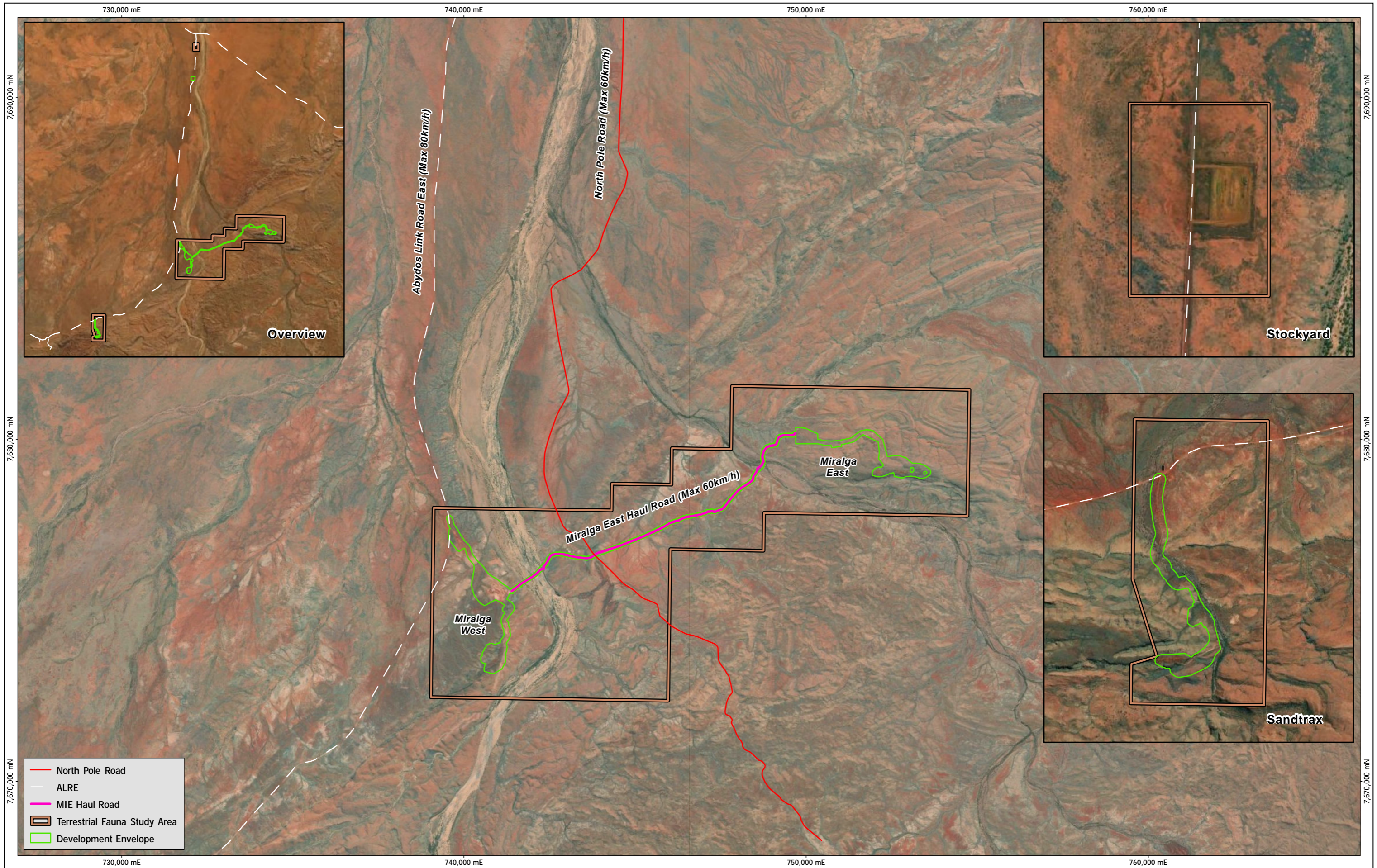
Category 1 – maternity/diurnal roosts with permanent occupancy

Category 2 – maternity/diurnal roosts with regular occupancy

Category 3 – roosts with occasional occupancy

Category 4 – nocturnal roosts with opportunistic usage

2 Distance is measured from nearest edge of proposed pit disturbance to the cave entrance.



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Significant Species Management Plan
 Miralga Creek Study Area

Figure No:
 2-1



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2.3 Potential Impacts and Key Threats

Eight potential impact sources were identified during the impact assessment (Biologic, 2020c) as having the potential to impact upon terrestrial fauna of conservation significance as part of the Project's development, comprising:

- Removal, fragmentation or modification of habitat.
- Vehicle strike.
- Introduced species.
- Increased light.
- Noise and vibration.
- Dust.
- Changed fire regimes.
- Modification of water regimes.

Each of these impacts will be managed as part of this SSMP.

Key threatening processes listed under the EPBC Act were also considered. The EPBC Act defines a threatening process as a "key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community". The key threatening processes listed under the EPBC Act that are most relevant to this Project are:

- Land clearance.
- Predation by feral cats.
- Predation by European Red Fox.
- The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo marinus*).

The Threat Abatement Plans associated with each of these processes were reviewed during the preparation of this SSMP.

Threats to the Northern Quoll and Ghost Bat have been identified in a range of external documents including guidelines, conservation advices and recovery plans, including:

- National Recovery Plan for the Northern Quoll (*Dasyurus hallucatus*) (Hill & Ward, 2010).
- The Action Plan for Australian Mammals 2012 (Woinarski et al., 2014).
- EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus* (DoE, 2016).
- Conservation Advice: *Macroderma gigas*, Ghost Bat. (TSSC, 2016).
- A review of ghost bat ecology, threats and survey requirements (Bat Call WA, 2021).
- Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (DSEWPaC, 2011).
- Threat abatement plan for predation by the European Red Fox (DEWHA, 2008).
- Threat Abatement Plan for Predation by Feral Cats (DoE, 2015).
- Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPaC, 2012).

The threats identified in these documents are listed in Table 2-3.

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Table 2-3: Recognised Threats and Potential Impacts to Northern Quoll and Ghost Bat

Species	Recognised Threats to the Species	Potential Impacts Addressed in This SSMP ¹
Northern Quoll	<ul style="list-style-type: none"> Habitat clearing, modification or land use change (DoE, 2016) Habitat degradation (Hill & Ward, 2010) Habitat destruction (Hill & Ward, 2010) Habitat loss and fragmentation (Woinarski et al., 2014) 	<ul style="list-style-type: none"> Removal, fragmentation and modification of habitat Modification of water regimes
	<ul style="list-style-type: none"> Urbanisation 	<ul style="list-style-type: none"> Interactions with fauna
	<ul style="list-style-type: none"> Introduction and increases of invasive species (DoE, 2016), including grasses <i>Andropogon gayanus</i>, <i>Urochloa mutica</i>, <i>Hymenachne amplexicaulis</i>, <i>Cenchrus polystachios</i>, and <i>C. pedicellatus</i> (DSEWPaC, 2012). Note that none of these grasses have been found in the Miralga Creek area, and the only grass recorded in the Pilbara (Roebourne) subregion to date is <i>A. gayanus</i>. Cane toads (Hill & Ward, 2010) Feral predators (Hill & Ward, 2010) Weeds (Hill & Ward, 2010) Poisoning by cane toads (Woinarski et al., 2014) Predation by feral cats (Woinarski et al., 2014) Predation by wild dogs (Woinarski et al., 2014) Habitat degradation due to invasive pasture grasses (Woinarski et al., 2014) Predation by Red Fox (Woinarski et al., 2014) 	<ul style="list-style-type: none"> Introduced species
	<ul style="list-style-type: none"> Pastoralism (DoE, 2016) Habitat degradation caused by livestock (Woinarski et al., 2014) 	Not applicable
	<ul style="list-style-type: none"> Traffic (DoE, 2016) 	<ul style="list-style-type: none"> Vehicle strike Removal, fragmentation, or modification of habitat
	<ul style="list-style-type: none"> Inappropriate fire regimes (Hill & Ward, 2010; Woinarski et al., 2014) 	<ul style="list-style-type: none"> Changed fire regimes
	<ul style="list-style-type: none"> Disease (Hill & Ward, 2010) Disease and parasitism (Woinarski et al., 2014) 	Not applicable
	<ul style="list-style-type: none"> Hunting (Hill & Ward, 2010) 	Not applicable
	<ul style="list-style-type: none"> Population isolation (Hill & Ward, 2010) 	<ul style="list-style-type: none"> Removal, fragmentation, or modification of habitat
	<ul style="list-style-type: none"> Poisoning (Woinarski et al., 2014) 	<ul style="list-style-type: none"> Introduced species
Ghost Bat	<ul style="list-style-type: none"> Habitat loss (destruction of, or disturbance to, roost sites and nearby areas) due to mining (Bat Call WA, 2021; TSSC, 2016; Woinarski et al., 2014) 	<ul style="list-style-type: none"> Removal, fragmentation, or modification of habitat Noise and vibration



Species	Recognised Threats to the Species	Potential Impacts Addressed in This SSMP ¹
	<ul style="list-style-type: none"> Disturbance of (human visitation at) breeding sites (Bat Call WA, 2021; TSSC, 2016; Woinarski et al., 2014) 	<ul style="list-style-type: none"> Interactions with fauna
	<ul style="list-style-type: none"> Modification to foraging habitat (TSSC, 2016) Loss of foraging habitat (Bat Call WA, 2021) 	<ul style="list-style-type: none"> Removal, fragmentation, or modification of habitat Modification of water regimes
	<ul style="list-style-type: none"> Collision with fences, especially those with barbed wire (Bat Call WA, 2021; TSSC, 2016; Woinarski et al., 2014) 	<ul style="list-style-type: none"> Interactions with fauna
	<ul style="list-style-type: none"> Collapse or reworking of old mine adits (TSSC, 2016; Woinarski et al., 2014) 	Not applicable
	<ul style="list-style-type: none"> Contamination by mining residue at roost sites (Bat Call WA, 2021; TSSC, 2016; Woinarski et al., 2014) 	Not applicable
	<ul style="list-style-type: none"> Traffic (Bat Call WA, 2021) 	<ul style="list-style-type: none"> Vehicle strike
	<ul style="list-style-type: none"> Inappropriate fire regimes (Bat Call WA, 2021) 	<ul style="list-style-type: none"> Changed fire regimes
	<ul style="list-style-type: none"> Presence of artificial lighting (Bat Call WA, 2021) 	<ul style="list-style-type: none"> Increased light
	<ul style="list-style-type: none"> Airborne dust as a result of mining operations (Bat Call WA, 2021) 	<ul style="list-style-type: none"> Dust
	<ul style="list-style-type: none"> Changed water regimes as a result of mining activities (Bat Call WA, 2021) 	<ul style="list-style-type: none"> Modification of water regimes
	<ul style="list-style-type: none"> Disease (Bat Call WA, 2021; TSSC, 2016; Woinarski et al., 2014) 	Not applicable
	<ul style="list-style-type: none"> Poisoning by cane toads (Bat Call WA, 2021; TSSC, 2016) 	<ul style="list-style-type: none"> Introduced species
	<ul style="list-style-type: none"> Competition for prey with foxes and feral cats (Bat Call WA, 2021; TSSC, 2016) 	<ul style="list-style-type: none"> Introduced species

¹ This SSMP addresses only the threats that are associated with potential impacts of the Project.

2.3.1 Northern Quoll

The Northern Quoll is likely to be mostly affected by removal, fragmentation and modification of habitat, but also potentially vehicle strike and the increased threat of introduced species (Biologic, 2020c). Low level impacts may also be experienced by the Northern Quoll due to increased light and noise and changed fire regimes (Biologic, 2020a).

2.3.2 Ghost Bat

The Ghost Bat is likely to be impacted primarily by removal, fragmentation and modification of habitat (including caves), but also potentially noise and vibration and dust (Biologic, 2020b). Low level impacts may also potentially be experienced due to vehicle strike, introduced species and changed fire regimes.

The caves considered to be used by Ghost Bat are detailed in Table 2-2. Of these, only CMRC-02 will be removed by the Project. The most important cave complex in the area is the grouping of CMRC-13, -14, -15, and -23, which are also the caves closest to impact areas. Following the identification of



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the initial complex (CMRC-13, -14, and -15) during the initial fauna survey (Biologic, 2020a), Atlas commissioned a number of specialist investigations to help better understand this cave complex (in particular CMRC-15, a potential maternity roost) to tailor management and mitigation, which involved consultation with leading experts including Bob Bullen of Bat Call WA. Bat Call WA was engaged to guide the scoping of additional studies by geotechnical and blasting consultants to ensure Atlas has the ability to protect CMRC-15. Geotechnical studies were commissioned to understand the pre-mining geotechnical stability of caves to assist understanding the potential sensitivity of caves to blast vibrations. These geotechnical studies were used to aid the preparation of blast impact assessments. Cave CMRC-23 (another potential maternity roost) was identified later in 2020 (Biologic, 2022a), subsequent to the initial fauna survey and after the previous version of this SSMP was prepared. CMRC-23 falls within the CMRC-13, -14, and -15 cave complex, and is described as “multiple inaccessible cavities formed in rocky obstructions extending from cliff face... [of] which [the] cavities support roosting and the internal structure of cavities is not known” (Biologic, 2022a). The habitat value of the cave complex for Ghost Bat is not expected to be significantly impacted by the Project. Ghost Bat are expected to return to the complex after mining is completed (Bat Call, 2020).



3 Key Measures

3.1 Management Frameworks

To ensure that management provisions are proportionate to the risk, Atlas has developed an **outcome-based** management framework for species at higher risk. A **management action-based** framework has been developed to target both the higher risk species and other species. Table 3-1 outlines these two frameworks.

Table 3-1: Overview of Management Frameworks in This SSMP

Species	Management Framework	Key Elements of Framework
Species at higher risk: <ul style="list-style-type: none"> Northern Quoll Ghost Bat 	Outcome-based	Trigger criteria, threshold criteria, trigger level actions, threshold contingency actions, monitoring, indicators and timing, investigations, reporting.
Species at higher risk: <ul style="list-style-type: none"> Northern Quoll Ghost Bat Other species, including: <ul style="list-style-type: none"> Pilbara Leaf-nosed Bat Pilbara Olive Python Northern Brushtail Possum Grey Falcon 	Management action-based	Management actions.

Key terms used in the **outcome-based** management framework are explained in Table 3-2. The trigger and threshold concept is illustrated in Figure 3-1.

Key terms used in the **management action-based** management framework are explained in Table 3-3.

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Table 3-2: Framework for Outcome-based Management

Environmental objectives	Overarching objectives or goals for environmental values managed by this SSMP.
Threshold criteria	Criteria representing the limit of acceptable impact beyond which there is likely to be a significant effect on the environment and the environmental outcome is not being met.
Trigger criteria	Criteria that provide advance indication that the threshold criteria are being approached and trigger level actions need to be taken to ensure the threshold criteria are not reached.
Threshold contingency actions Trigger level actions	Actions that are taken in response to the trigger or threshold criteria being reached or exceeded, in order to avoid the threshold criteria being reached (in the case of the trigger criteria being exceeded) or to ensure that the environmental outcome will be met (in the case of the threshold criteria being exceeded).
Monitoring Methods	Monitoring to determine whether the trigger and threshold criteria have been exceeded, and in turn whether the environmental outcome is being met. The monitoring requirements proposed for each set of potential impacts and key threats are detailed in Table 3-3. Additionally, detailed monitoring procedures for Northern Quoll and Ghost Bat are detailed in Appendix A and Appendix B, respectively.
Indicators	The parameters that will be monitored to provide the data for evaluating whether the trigger and threshold criteria have been exceeded.
Timing	The timing of monitoring, including when and how often monitoring will be undertaken. The timing of reporting.

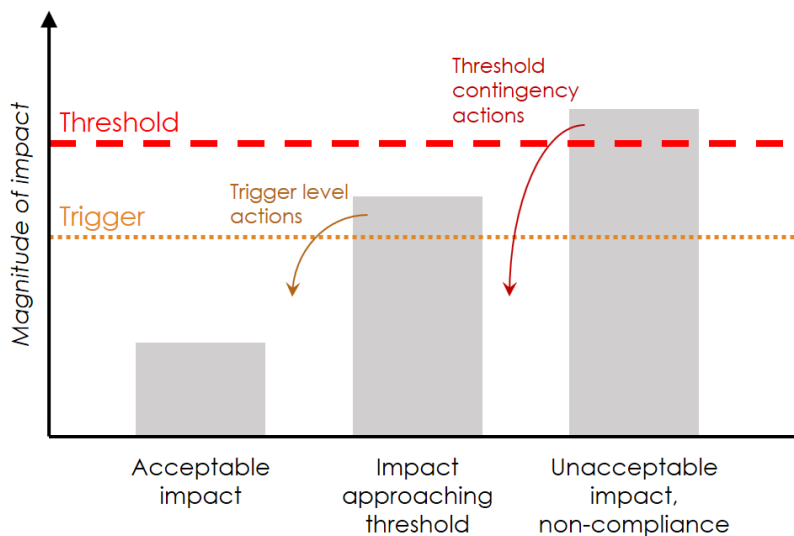


Figure 3-1: Triggers and Thresholds in the Outcome-based Management Framework

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Table 3-3: Framework for Management Action-based Management

Environmental objectives	Overarching objectives or goals for environmental values managed by this SSMP.
Potential impacts and key threats	Identifies potential impacts to conservation significant species which will be the target of management in this SSMP. This includes potential impacts outlined in Section 2.3, which includes key threats identified in relevant guidelines or other documents including conservation advices, recovery plans and threat abatement plans.
Management measures	Management commitments that Atlas will implement as part of the Project. Management measures are targeted at addressing the identified potential impacts, which includes key threats. They have been developed in consideration of the conservation significant species present or potentially present (Section 2.2), identified potential impacts of the Project (Section 2.3), specialist advice and industry best practices. Note that the implementation of management measures will also benefit species other than those explicitly listed in the environmental objectives.

3.2 Provisions of This SSMP

The **outcome-based** provisions of this SSMP are set out in Table 3-4.

The **management action-based** provisions of this SSMP are set out in Table 3-5.

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Table 3-4: Outcome-based Provisions



Environmental Objective	Threshold Criteria	Trigger Criteria	Monitoring Method	Indicators	Monitoring Timing	Threshold Contingency Actions	Trigger Level Actions	Reporting
<p>Avoid where possible, otherwise minimise direct and indirect impacts to significant fauna and their habitat, including:</p> <ul style="list-style-type: none"> Northern Quoll. Ghost Bat. 	<p>Actual clearing totals more than 219.8 ha.</p> <p>Note: criterion is directly linked to maximum clearing authorised by Ministerial Statement No. 1154 and EPBC 2019/8601.</p>	<p>Actual and planned clearing totals more than 210 ha.</p> <p>Note: value is derived by subtracting 10 ha from the threshold criterion and rounding to the nearest whole number.</p>	<p>For actual clearing – determine extent of ground disturbance in accordance with the Impact Reconciliation Procedure (180-LAH-EN-PLN-0004).</p> <p>For planned clearing – using GIS, determine (i) extent of clearing authorised by GDPs but not yet undertaken, plus (ii) extent of clearing under GDP application.</p>	<p>Actual clearing (i.e. existing ground disturbance). Clearing authorised by a GDP but not yet undertaken. Clearing under GDP application.</p>	<p>Actual clearing – in accordance with the Impact Reconciliation Procedure (180-LAH-EN-PLN-0004).</p> <p>Planned clearing – each time a GDP is applied for or closed out.</p>	<ul style="list-style-type: none"> Cease all clearing activities. Do not authorise any further GDPs, and cancel all active GDPs. Report occurrence to DWER and DCCEEW. Investigate causes. Undertake corrective rehabilitation, and/or seek amendment to approvals, in consultation with DWER and DCCEEW. 	<ul style="list-style-type: none"> Confirm extent of existing ground disturbance via audit of clearing records. Do not authorise any further GDPs if threshold criterion would be exceeded. Notify Registered Manager for forward planning purposes. Consider whether approvals require amending. 	<p>Performance against criteria – annually in MS 1154 Compliance Assessment Report (CAR) and EPBC 2019/8601 Compliance Report (CR).</p> <p>Exceedance of trigger criteria – in CAR and CR.</p> <p>Exceedance of threshold criteria – report to DWER within 7 days, notification to DCCEEW within 5 business days, report to DCCEEW within 21 business days.</p> <p>Clearing – every two years to DWER (relevant to MS 1154) in accordance with the Impact Reconciliation Procedure (180-LAH-EN-PLN-0004) and annually to DCCEEW (relevant to EPBC 2019/8601) in accordance with the Impact Reconciliation Procedure (180-LAH-EN-PLN-0004)</p>



Environmental Objective	Threshold Criteria	Trigger Criteria	Monitoring Method	Indicators	Monitoring Timing	Threshold Contingency Actions	Trigger Level Actions	Reporting
<p>Avoid where possible, otherwise minimise direct and indirect impacts to significant fauna and their habitat, including:</p> <ul style="list-style-type: none"> Ghost Bat. <p>Ensure no significant damage to caves CMRC-13, CMRC-14, CMRC-15 and CMRC-23, such that the caves remain viable as diurnal roosts for Ghost Bat in the future once mining has ceased.</p>	<p>Blast vibration is 100 mm/s or more.</p>	<p>Blast vibration is 85 mm/s or more.</p>	<p>Operational – Blast vibration measured at the closest cave(s) to each blast located within 400 m of CMRC-13, CMRC-14, CMRC-15 and/or CMRC-23.</p>	<p>Blast vibration velocity.</p>	<p>Operational – For each blast occurring within 400 m of CMRC-13, CMRC-14, CMRC-15 and/or CMRC-23.</p>	<ul style="list-style-type: none"> Identify likely cause. Cease blasting near the relevant cave and review blasting parameters. 	<ul style="list-style-type: none"> Inspect cave for signs of damage. Review against predicted and recorded blast vibration. Recalibrate blast vibration model and/or design next blast to achieve lower blast vibration at relevant caves. 	<p>Performance against criteria – annually in CAR and CR.</p> <p>Exceedance of trigger criteria – in CAR and CR.</p> <p>Exceedance of threshold criteria – report to DWER within 7 days, notification to DCCEEW within 5 business days, report to DCCEEW within 21 business days.</p>
	<p>Significant deterioration in potential value of cave to Ghost Bat, i.e., blocked entrance, new entrance created, cave collapsed.</p>	<p>Fallen rock observed during monitoring event.</p>	<p>Operational – Inspection of caves CMRC-13, CMRC-14, CMRC-15 and/or CMRC-23. Inspections may be conducted in person or remotely (e.g. via cameras) and will look for changes in rock fall on the cave floor as well as any other damage incurred.</p>	<p>Rock fall. Changes to cave structure, i.e. blocked entrance, new entrance created, cave collapsed.</p>	<p>Operational – Each cave to be inspected:</p> <ul style="list-style-type: none"> Once before the first blast within 400 m. After each top bench blast within 400 m. After any blast where vibration at the cave exceeds the 85 mm/s trigger criterion. At least every month starting from the month of the first blast within 400 m. <p>Each cave to be laser scanned annually.</p>	<ul style="list-style-type: none"> Recalibrate blast vibration model and design next blast to achieve lower blast vibration at relevant caves. Review blast management. Review blast monitoring procedure, frequency and methods. Increase cave inspection and monitoring frequency. Report occurrence to DWER and DCCEEW. For fallen rock or significant deterioration in potential value of cave to Ghost Bat—Undertake corrective actions, e.g. if possible clear rock fall to ensure roosting area is accessible to bats. 	<ul style="list-style-type: none"> Investigate extent and severity of rock fall. Review observed rock fall or other damage against predicted and recorded blast vibration. Inspect cave for any signs of significant deterioration in potential value to Ghost Bat. Review and, if necessary, recalibrate blast vibration model. Recalibrate blast vibration model and/or design next blast to achieve lower blast vibration at relevant caves. 	<p>Performance against criteria – annually in CAR and CR.</p> <p>Exceedance of trigger criteria – in CAR and CR.</p> <p>Exceedance of threshold criteria – report to DWER within 7 days, notification to DCCEEW within 5 business days, report to DCCEEW within 21 business days.</p>



Environmental Objective	Threshold Criteria	Trigger Criteria	Monitoring Method	Indicators	Monitoring Timing	Threshold Contingency Actions	Trigger Level Actions	Reporting
<p>Maintain existing microclimate conditions of Ghost Bat cave CMRC-15.</p> <p>Note: this row gives visibility to the requirements of EPBC 2019/8601 condition 2(a) in this SSMP. It does not apply to Ministerial Statement No. 1154.</p>	<p>Average temperature and humidity are outside baseline levels for more than 14 days.</p> <p>Note: threshold criterion is not applicable if microclimate is altered during or immediately following cave closure – see Table 3-5.</p>	<p>Average temperature or humidity is outside baseline levels.</p> <p>Note: trigger criterion is not applicable if microclimate is altered during or immediately following cave closure – see Table 3-5.</p>	<p>Recording of microclimate using microclimate loggers placed inside cave CMRC-15.</p>	<p>Temperature (°C) and relative humidity (%).</p>	<p>Every six hours, commencing from the start of ground disturbance at Miralg East.</p>	<ul style="list-style-type: none"> Review microclimate data in statistical context of baseline and external weather data. Identify likely cause. Allow time for microclimate to re-establish if during or following the cave closure specified in Table 3-5. Increase cave inspection and monitoring frequency. Review blast management. Assess compliance with EPBC 2019/8601 condition 4(b). 	<ul style="list-style-type: none"> Review microclimate data in statistical context of baseline and external weather data. Check whether caves have been disturbed. Identify likely cause. Allow time for microclimate to re-establish if during or following the cave closure specified in Table 3-5. 	<p>Performance against criteria – annually in CAR and CR.</p> <p>Exceedance of trigger criteria – in CAR and CR.</p> <p>Exceedance of threshold criteria – notification to DCCEEW within 5 business days and report to DCCEEW within 21 business days.</p>
<p>Avoid where possible, otherwise minimise direct and indirect impacts to significant fauna and their habitat, including:</p> <ul style="list-style-type: none"> Ghost Bat. 	<p>Ghost Bat are recorded at fewer than 6 of the 12 Ghost Bat impact monitoring sites in each of two consecutive monitoring events during or following operations.</p>	<p>Ghost Bat are recorded at fewer than 6 of the 12 Ghost Bat impact monitoring sites in a single monitoring event during or following operations.</p>	<p>12 caves (impact sites) plus 1 control site (Lalla Rookh).</p> <p>Operational – to monitor Ghost Bat trends during operations.</p> <p>Post-mining – to monitor Ghost Bat post-closure to confirm ongoing occupation and use of Study Area.</p> <p>Refer to the Ghost Bat Monitoring Procedure (180-LAH-EN-PLN-0003) for detailed method and locations (Appendix B).</p>	<p>Ghost Bat presence, recorded via:</p> <ul style="list-style-type: none"> Scats. Calls (e.g. from recording on an SM-4). Visual observations. 	<p>Operational – annually during mining.</p> <p>Post-mining – for a minimum of 3 monitoring events, the first event being in the first year after mining of pits ceases, and subsequent events occurring every 2 years thereafter.</p>	<ul style="list-style-type: none"> Identify likely cause. Check whether caves have been disturbed. Compare results with control site or other impact sites where mining is not occurring to determine if decline may be attributable to the project. Review monitoring procedure, frequency and methods. Review Ghost Bat management within this plan. Review training and induction programs. Review number and locations of fauna signposts. Report to DWER and DCCEEW. 	<ul style="list-style-type: none"> Identify likely cause. Check whether caves have been disturbed. Compare results with control site or other impact sites where mining is not occurring to determine if decline may be attributable to the project. Review monitoring procedure, frequency and methods. Review Ghost Bat management within this plan. Review training and induction programs. Review number and locations of fauna signposts. 	<p>Performance against criteria – annually in CAR and CR.</p> <p>Baseline – monitoring report.</p> <p>Operational – monitoring reports.</p> <p>Post-mining – monitoring reports.</p> <p>Exceedance of trigger criteria – in CAR and CR.</p> <p>Exceedance of threshold criteria – report to DWER within 7 days, notification to DCCEEW within 5 business days, report to DCCEEW within 21 business days.</p>



Environmental Objective	Threshold Criteria	Trigger Criteria	Monitoring Method	Indicators	Monitoring Timing	Threshold Contingency Actions	Trigger Level Actions	Reporting
<p>Avoid where possible, otherwise minimise direct and indirect impacts to significant fauna and their habitat, including:</p> <ul style="list-style-type: none"> Northern Quoll. 	<p>Northern Quoll are recorded at fewer than 2 of the 4 Northern Quoll impact monitoring sites for more than two consecutive monitoring events.</p>	<p>Northern Quoll numbers at a site are less than half of the baseline numbers for that site.</p>	<p>4 impact sites and 5 control sites. Operational – to monitor Northern Quoll trends during operations. Post-mining – to monitor Northern Quoll post-closure to confirm ongoing occupation and use of Study Area. Refer to the Northern Quoll Monitoring Procedure (180-LAH-EN-PLN-0002) for detailed method and locations (Appendix A).</p>	<p>Northern Quoll presence, recorded via:</p> <ul style="list-style-type: none"> Camera traps. Scats and tracks. Visual observations. 	<p>Operational – annually during mining. Post-mining – for a minimum of 3 monitoring events, the first event being in the first year after mining of pits ceases, and subsequent events occurring every 2 years thereafter.</p>	<ul style="list-style-type: none"> Identify likely cause. Compare results with control sites or other impact sites where mining is not occurring to determine if decline may be attributable to the project. Review monitoring procedure, frequency and methods. Review the implementation of Northern Quoll management actions within this plan. Review training and induction programs. Review number and locations of fauna signposts. Report to DWER and DCCEEW. Investigate additional actions, e.g. additional habitat features that could function as daytime den sites or refugia (e.g. hollow logs and potentially piles of boulders) could be placed in suitable areas. 	<ul style="list-style-type: none"> Identify whether trigger criteria exceedance is due to sampling variability (e.g. influence of variations in numbers recorded against low baseline numbers). Identify likely cause. Compare results with control sites or other impact sites where mining is not occurring to determine if decline may be attributable to the project. Review monitoring procedure, frequency and methods. Review the implementation of Northern Quoll management actions within this plan. Review training and induction programs. Review number and locations of fauna signposts. 	<p>Performance against criteria – annually in CAR and CR. Baseline – monitoring report. Operational – monitoring reports. Post-mining – monitoring reports. Exceedance of trigger criteria – in CAR and CR. Exceedance of threshold criteria – report to DWER within 7 days, notification to DCCEEW within 5 business days, report to DCCEEW within 21 business days.</p>



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Table 3-5: Management Action-based Provisions

Environmental Objective	Potential Impacts and Key Threats (Where Applicable)	Management Actions
<p>Avoid where possible, otherwise minimise direct and indirect impacts to significant fauna and their habitat, including:</p> <ul style="list-style-type: none"> • Northern Quoll. • Ghost Bat. • Pilbara Leaf-nosed Bat. • Pilbara Olive Python. • Northern Brushtail Possum. • Grey Falcon. 	<p>Removal, fragmentation, or modification of habitat</p> <ul style="list-style-type: none"> • <i>Land clearance</i> regarded as a Key Threatening Process under the EPBC Act. • <i>Habitat clearing, modification or land use change</i> identified in the Northern Quoll referral guidelines (DoE, 2016). • <i>Habitat degradation</i> is listed as a threat to the Northern Quoll in the National Recovery Plan for the Northern Quoll (<i>Dasyurus hallucatus</i>) (Hill & Ward, 2010) and the Northern Quoll referral guidelines (DoE, 2016). • <i>Habitat loss (destruction of, or disturbance to, roost site and nearby areas) due to mining; and Modification to foraging habitat</i> regarded as a threat to the Ghost Bat by Bat Call WA (2021), TSSC (2016) and Woinarski et al. (2014). • <i>Modification to foraging habitat</i> listed as a threat to the Ghost Bat within the <i>Conservation Advice Macroderma gigas Ghost Bat</i> (TSSC, 2016). • <i>Loss of foraging habitat</i> listed as a direct threat to the Ghost Bat by Bat Call WA (2021). <p>Vehicle strike</p> <ul style="list-style-type: none"> • <i>Traffic</i> identified as a threat and key impact to Northern Quoll in the species referral guidelines (DoE, 2016). 	<ul style="list-style-type: none"> • Clearing will occur in accordance with Atlas's Ground Disturbance Permit (GDP) Procedure (950-HSE-PRO-0006). No clearing will occur without prior authorisation from Atlas's Ground Disturbance Permitting System. • Clearing in/of sensitive habitats including caves, gorges and drainage lines may only occur in accordance with the relevant approvals (EPBC 2019/8601 and MS 11154), and will be kept to the minimum necessary for safe construction and operation of the Project. • New borrow pits and turkey's nests will be designed and constructed to permit egress of fauna. (See Appendix D for indicative locations of existing and proposed borrow pits and turkey's nests.) • Fauna egress matting shall be installed in all lined dams / ponds / turkey's nests. • Turkey's nests will be fenced. • Retention of all cave features identified by Biologic (2020a; 2022a, 2022c) apart from one cave (CMRC-02), with a 30 m buffer to be demarcated around the entrance of caves that are within 100 m of planned disturbance. • All caves recorded by Biologic (2020a) will be recorded in a site database and mapped on all mine plans. The database will be accessible to all Atlas departments. • Implementation of a blast monitoring program including recommendations for cave protection provided by Blast It Global (2020) (Appendix B). • Speed limits will be enforced across the site. The maximum speeds allowable on all Project roads will be 60 km/h with the exception of the existing Abydos Link Road East, which will be 80 km/h. The



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Environmental Objective	Potential Impacts and Key Threats (Where Applicable)	Management Actions
	<ul style="list-style-type: none"> • <i>Traffic</i> identified as an indirect threat to Ghost Bat by Bat Call WA (2021). • <i>Urbanisation</i>, including road kill and misadventure, identified as a threat and key impact to the Northern Quoll in the species referral guidelines (DoE, 2016). <p>Introduced species</p> <ul style="list-style-type: none"> • Predation by European red fox listed as a Key Threatening Process under the EPBC Act, and for which a Threat Abatement Plan has been developed: Threat Abatement Plan for Predation by the European Red Fox (DEWHA, 2008). • Predation by European red fox listed as a Key Threatening Process under the EPBC Act, and for which a Threat Abatement Plan has been developed: Threat Abatement Plan for Predation by Feral Cats (DoE, 2015). • The biological effects, including lethal toxic ingestion, caused by Cane Toads (<i>Bufo marinus</i>) listed as a Key Threatening Process under the EPBC Act, and for which a Threat Abatement Plan has been developed: Threat Abatement Plan for the Biological Effects, including Lethal Toxic Ingestion caused by Cane Toads (DSEWPac, 2011). • Introduction and increases of invasive species identified as a threat and key impact to the Northern Quoll in the species referral guidelines (DoE, 2016); 	<p>Miralga East Haul Road (between Miralga West and the Miralga East ROM) will be 60 km/hr.</p> <ul style="list-style-type: none"> • Where areas of high significant species activity are identified, signage will be installed to alert drivers (e.g. if several reports of animal sightings are received in an area in a relatively short period of time). • Off-road driving will be prohibited unless otherwise authorised by senior management to minimise potential vehicle strikes. • Night-time vehicle movements will be restricted where possible to minimise potential vehicle strikes. <p>For introduced fauna:</p> <ul style="list-style-type: none"> • All bins storing putrescible waste will have tightly secured lids to avoid fauna attraction and entry. • The landfill will be operated and managed in accordance with the Environmental Protection (Rural Landfill) Regulations 2002. This will include fencing to reduce the potential for attracting fauna. • Domestic pets are prohibited to avoid interactions with or disturbance to conservation significant fauna. • Implementation of Atlas's Pest and Invasive Species Procedure (950-EN-PRO-0009) at all times, including recording all introduced fauna sightings and the implementation of a feral animal control program, as required (i.e., where sightings are regular, if nuisance or dangerous individuals are recorded and/or evidence that native species have been preyed on by introduced predators is found). <p>For introduced flora:</p> <ul style="list-style-type: none"> • Implementation of the following procedures to ensure weeds are controlled, as far as practicable:



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Miralga Creek

Environmental Objective	Potential Impacts and Key Threats (Where Applicable)	Management Actions
	<ul style="list-style-type: none"> Consistent with 'Specific Objective 7 Reduce the impact of feral predators on Northern Quolls' from the National Recovery Plan for the Northern Quoll (<i>Dasyurus hallucatus</i>) (Hill & Ward, 2010); Weeds are listed as a threat in the National Recovery Plan for the Northern Quoll (<i>Dasyurus hallucatus</i>) (Hill & Ward, 2010); Competition for prey with foxes and feral cats listed as a threat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016) and as an indirect threat by Bat Call WA (2021). Poisoning by cane toads listed as a threat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016) and as an indirect threat by Bat Call WA (2021). Modification to foraging habitat, including the simplification of vegetation due to weeds, listed as a threat to the Ghost Bat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016). 	<ul style="list-style-type: none"> Flora Management Procedure (950-EN-PRO-0005). Weed Hygiene Procedure (950-EN-PRO-0015).
	<p>Increased light</p> <ul style="list-style-type: none"> Regarded as a potential impact source for native wildlife and for which national guidelines have been produced: National Light Pollution Guidelines for Wildlife (DoEE, 2020). Listed as an indirect threat to Ghost Bat by Bat Call WA (2021). 	<ul style="list-style-type: none"> Light emissions will be controlled where practicable, including directing lights to working areas and shielding lights to reduce glow.
	<p>Noise and vibration</p> <ul style="list-style-type: none"> Habitat loss (destruction of, or disturbance to, roost site and nearby areas) due to mining, listed as a threat to the Ghost Bat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016) and as a direct threat by Bat Call WA (2021). 	<ul style="list-style-type: none"> Blasting operations will be limited to daytime only to limit disturbance to fauna including bats. Blasting will not occur within 100 m of caves CMRC-13, CMRC-14, CMRC-15 and CMRC-23 until the results of vibration monitoring validate vibration predictions with a reasonable degree of confidence. The entrance to cave CMRC-15 is to be closed during initial blasting and drilling activities at



Significant Species Management Plan Miralgá Creek

Environmental Objective	Potential Impacts and Key Threats (Where Applicable)	Management Actions
		<p>Miralgá East pits 2 and 3. The process of closure should be designed and implemented with the aid of a suitably qualified specialist and in consideration of the cave disturbance guidelines (Appendix C). The specialist will need to demonstrate that no bats remain in the cave once closed and that no bats have entered the cave for three nights after the closure apparatus is installed, prior to blasting commencing. The closure apparatus design should consider access for monitoring purposes. The cave may be reopened when the results of blast vibration monitoring validate the blast vibration predictions.</p>
	<p>Dust</p> <ul style="list-style-type: none"> Airborne dust generated by mining operations listed as an indirect threat to Ghost Bat by Bat Call WA (2021). 	<ul style="list-style-type: none"> Dust will be controlled where possible to avoid excessive disturbance to native fauna, including using conventional dust suppression techniques (i.e. water trucks), through implementation of the Dust Management Procedure (950-EN-PRO-0003).
	<p>Changed fire regimes</p> <ul style="list-style-type: none"> Inappropriate fire regimes is listed as a threat in the National Recovery Plan for the Northern Quoll (<i>Dasyurus hallucatus</i>) (Hill & Ward, 2010); Inappropriate fire regimes identified as a threat and key impact to the Northern Quoll in the species referral guidelines (DoE, 2016); Modification to foraging habitat, including the simplification of vegetation due to fire, listed as a threat to the Ghost Bat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016). Changed fire regimes listed as an indirect threat to Ghost Bat by Bat Call WA (2021). 	<ul style="list-style-type: none"> Minimise the risk of Project related fire occurring through implementation of the Hydrocarbon Management Procedure (950-EN-PRO-0008), Hydrocarbon (and Chemical) Spill Management Procedure (950-EN-PRO-0007) and Hot Work Standard (950-HS-POL-0018).
	<p>Modification of water regimes</p> <ul style="list-style-type: none"> Land clearance regarded as a Key Threatening Process under the EPBC Act. 	<ul style="list-style-type: none"> Clearing will occur in accordance with Atlas's Ground Disturbance Permit Procedure (GDP) (950-HSE-PRO-0006). No clearing will occur without prior



Significant Species Management Plan

Miralga Creek

Environmental Objective	Potential Impacts and Key Threats (Where Applicable)	Management Actions
	<ul style="list-style-type: none"> Habitat degradation is listed as threat to the Northern Quoll in the species Recovery Plan, and Habitat clearing, modification or land use change identified in the species referral guidelines (DoE, 2016). Habitat degradation is listed as a threat to the Northern Quoll in the National Recovery Plan for the Northern Quoll (<i>Dasyurus hallucatus</i>) (Hill & Ward, 2010). Habitat loss (destruction of, or disturbance to, roost site and nearby areas) due to mining; and Modification to foraging habitat regarded as a threat to the Ghost Bat by TSSC (2016) and Woinarski et al. (2014). Modification to foraging habitat listed as a threat to the Ghost Bat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016) and as a direct threat by Bat Call WA (2021). Changed water regimes listed as a direct threat to Ghost Bat by Bat Call WA (2021). 	<p>authorisation from Atlas's Ground Disturbance Permitting System.</p> <ul style="list-style-type: none"> Retention of all water features identified by Biologic (2020a). Culverts installed under roads at creeklines in Development Envelope where required to maintain surface water flow. Clearing of sensitive habitats including drainage lines will be kept to the minimum necessary.
	<p>Interactions with fauna</p> <ul style="list-style-type: none"> Disturbance of (human visitation at) breeding sites, listed as a threat to the Ghost Bat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016) and Bat Call WA (2021) Collision with fences, especially those with barbed wire, listed as a threat to the Ghost Bat within the Conservation Advice <i>Macroderma gigas</i> Ghost Bat (TSSC, 2016) and as a direct threat by Bat Call WA (2021). 	<ul style="list-style-type: none"> Awareness training will identify conservation significant fauna and habitat and discuss relevant management measures, personnel/ contractor responsibilities, and incident reporting requirements (i.e. reporting of fauna observations and/or incidents). Where required, fauna will be handled and transported in accordance with the relevant procedures outlined in the DBCA Standard Operating Procedure Transport and Temporary Holding of Wildlife (DBCA, 2017). Interactions with fauna (e.g. feeding, harassment, capture, killing) are not permitted unless specifically authorised by the Senior Environmental Advisor. Such interactions with fauna will not be allowed unless in the best interest of the individual



Significant Species Management Plan Miralga Creek

Environmental Objective	Potential Impacts and Key Threats (Where Applicable)	Management Actions
		<p>animal(s) or species. Acceptable reasons could include capturing an injured animal for veterinary attention or for approved research.</p> <ul style="list-style-type: none"> • All sightings of conservation significant fauna will be reported to the Miralga Creek Environmental Advisor. • All fauna mortalities and injuries will be reported to the Miralga Creek Environmental Advisor within 24 hours and recorded within Atlas's incident reporting system. • The Miralga Creek Environmental Advisor will report all conservation significant fauna injuries and mortalities to DBCA within one week. • Access will be prohibited within 30 m of the entrance of any cave known to be occupied by Ghost Bats, except where access is required for survey or monitoring purposes. • Barbed wire fences that could cause bat entanglements will not be used except where lawfully required. The Magazine facility is required by law to comply with Australian Standard 2187.1 (Explosives – Storage, transport and use) which states aboveground magazines must be surrounded by fencing that includes three strands of barbed wire spaced 150 mm apart. Reflectors will be installed on the barbed wire to prevent bats from coming close to the barbed wire at the Magazine facility.



4 Implementation

4.1 Roles and Responsibilities

Atlas is committed to managing its activities in an environmentally and socially responsible manner, as reflected in Atlas's Health, Safety and Environment Policy (950-HSE-POL-0001). This policy is based on the recognition that mining projects affect the environment. Through prudent planning and excellence in management, most significant impacts can be avoided or mitigated.

Atlas's indicative roles and responsibilities for the implementation of this SSMP are outlined in Table 4-1.

Table 4-1: Roles and Responsibilities for SSMP Implementation

Role	Responsibility
Environmental Superintendent	<ul style="list-style-type: none"> Implement and maintain the SSMP. Review the SSMP. Annual Audit of Compliance. Review and update, where applicable, the conservation status of fauna occurring within the Study Area annually.
Miralga Creek Environmental Advisor	<ul style="list-style-type: none"> Implement monitoring programs. Maintain monitoring records. Deliver monitoring/reporting data to the DCCEE, DBCA, DMIRS and DWER. Implement and deliver awareness training programs to personnel, contactors, and visitors. Record all sightings of or incidents involving conservation significant fauna. Assess ground disturbance and access applications. Ensure all personnel involved in fauna surveys are appropriately licensed and qualified. Investigate any incidents involving conservation significant species and implement findings where relevant.
Registered Manager	<ul style="list-style-type: none"> Endorse implementation of the SSMP by Project personnel and contractors.
All personnel, contractors and visitors	<ul style="list-style-type: none"> Participate in awareness training prior to commencing duties. Implement SSMP in daily activities, where relevant. Report all sightings and/or incidents involving conservation significant fauna.

4.2 Reporting

This section provides details of Atlas's reporting requirements by this SSMP. A summary of reporting requirements is provided in Table 4-2.

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Table 4-2: Reporting Requirements

Reporting	Report To	Timing
MS 1154 Compliance Assessment Report (CAR)	DWER	Annually
EPBC 2019/8601 Compliance Report (CR)	DCCEEW	Annually
Tenement Annual Environmental Report (AER)	DMIRS	Annually
Incident reporting <i>Note: refer to specific approval conditions for definitions of incidents and non-compliances required to be reported</i>	Atlas internal	As required
	DCCEEW	Notification within 5 business days of identifying the incident or non-compliance (not including fauna mortalities) Report within 21 business days of identifying the incident or non-compliance (not including fauna mortalities) As part of the EPBC 2019/8601 CR
	DWER	Notification within 7 days of identifying the non-compliance (not including fauna mortalities) As part of the MS 1154 CAR
	DMIRS	As part of the tenement AER
Opportunistic reporting of significant fauna species	Atlas internal	As required
	DWER	As part of the MS 1154 CAR
	DMIRS	As part of the tenement AER
Fauna specialist reports: <ul style="list-style-type: none"> Northern Quoll monitoring report Ghost Bat monitoring report 	Atlas internal	Annually
	DBCA	Annually
	DCCEEW	As part of the EPBC 2019/8601 CR
	DWER	As part of the MS 1154 CAR
	DMIRS	As part of the tenement AER
Fauna injury or mortality report	DBCA	As required
Exceedance of threshold criteria	DCCEEW	Notification within 5 business days of identifying the exceedance report within 21 business days of identifying the exceedance As part of the EPBC 2019/8601 CR
	DWER	Within 7 days of identifying the exceedance As part of the MS 1154 CAR
Exceedance of trigger criteria	DCCEEW DWER	As part of the MS 1154 CAR As part of the EPBC 2019/8601 CR



4.3 Internal Reporting

4.3.1 Incident Reporting

All fauna injuries and mortalities within the Project area will be reported to the Miralga Creek Environmental Advisor, in accordance Atlas's HSE Incident Management Procedure.

All incidents, including fauna incidents, are reported and recorded through Atlas's Incident Reporting System (InControl) and will be investigated appropriately with additional management measures implemented where required to prevent reoccurrences.

4.3.2 Opportunistic Reporting

All fauna sightings are reported and recorded in a significant fauna register and will be investigated appropriately with additional management measures implemented where required.

4.3.3 Fauna Specialist Reports

The fauna specialist conducting monitoring for conservation significant species for which species-specific management has been implemented will report to Atlas on each monitoring event. The specialist reports will be reviewed internally to ensure compliance with the SSMP objectives and performance criteria.

4.4 External Reporting

4.4.1 Department of Water and Environmental Regulation

The MS 1154 CAR provided annually to DWER will include a summary of incidents including fauna injuries and mortalities and conservation significant fauna sightings within the Project area, as well as performance in accordance with the threshold and trigger criteria listed in Table 3-4 and implementation of the management actions in Table 3-5.

The CAR will report on the results of the following monitoring programs:

- Northern Quoll Monitoring Program (detailed in Appendix A).
- Ghost Bat Monitoring Program (detailed in Appendix B).

Relevant fauna specialist reports relating to the Northern Quoll and Ghost Bat monitoring programs will be appended to the MS 1154 CAR.

If this SSMP has been revised during the reporting period (see Section 4.6), significant changes (material changes (e.g. not including typographical, formatting, minor editorial changes) that alter Atlas' obligations under the relevant approvals) will also be noted in the MS 1154 CAR.

Any non-compliances or exceedances of threshold criteria will be notified to DWER in accordance with Table 4-2.

4.4.2 Department of Climate Change, Energy, the Environment and Water

The EPBC 2019/8601 CR provided annually to DCCEEW will include Atlas's performance in accordance with the threshold and trigger criteria listed in Table 3-4 and implementation of the management actions in Table 3-5, and will also include details of any fauna mortalities. Any incidents, non-compliances or exceedances of threshold criteria for Ghost Bat or Northern Quoll will be notified and reported to DCCEEW in accordance with Table 4-2.

The EPBC 2019/8601 CR will report on the results of the following monitoring programs:

- Northern Quoll Monitoring Program (detailed in Appendix A).



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- Ghost Bat Monitoring Program (detailed in Appendix B).

Relevant fauna specialist reports relating to the Northern Quoll and Ghost Bat monitoring programs will be appended to the EPBC 2019/8601 CR.

If this SSMP has been revised during the reporting period (see Section 4.6), significant changes (material changes (e.g. not including typographical, formatting, minor editorial changes) that alter Atlas' obligations under the relevant approvals) will also be noted in the EPBC 2019/8601 CR.

4.4.3 Department of Mining, Industry Regulation and Safety

The tenement AER provided annually to DMIRS will include summaries of fauna incidents and opportunistic significant fauna records within the relevant tenements, as well as a summary of the significant fauna monitoring results and compliance with approval conditions. Relevant fauna specialist reports relating to the Northern Quoll and Ghost Bat monitoring programs (detailed in Appendix A and Appendix B respectively), will be appended to the tenement AER.

4.4.4 Department of Biodiversity, Conservation and Attractions

Any mortality to conservation significant fauna will be reported to the DBCA, with their standard Fauna Report Form. This will determine if further actions are appropriate.

The results of ongoing monitoring via relevant fauna specialist reports relating to the Northern Quoll and Ghost Bat monitoring programs will be provided to the DBCA as required by condition 6-8 of Ministerial Statement No. 1154, generally on an annual basis as set out in Table 4-2.

4.4.5 Scientific Community

The results of ongoing monitoring (as provided to the DBCA) will also be made available to the science community.

4.5 Auditing

The Environmental Superintendent will be responsible for ensuring a compliance audit against the requirements of this SSMP is conducted every 12 months over the life of the Project while this SSMP is required to be implemented.

4.6 Review

Atlas will undertake an initial review of the SSMP once the Project has received final environmental approvals to ensure all approval conditions and commitments are captured in operational procedures. The SSMP will then be reviewed every 12 months and as required.

All reviews will consider:

- Outcomes of monitoring programs.
- Implementation and effectiveness of management measures and monitoring programs.
- Threshold/trigger criteria and threshold/trigger level actions.
- Changes to relevant legislation, policy, guidelines, management plans and industry practices.
- Changes to the conservation status of fauna species.
- The identification of a conservation significant fauna species not previously confirmed within the Project area.
- Recurring incidents of death/injury to a conservation significant fauna species.
- Specialist advice.
- Stakeholder consultation.
- Any changes or variation to approval conditions.



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Changes or variations to approval conditions stated in MS 1154 and EPBC 2019/8601 does not automatically result in a revision of the SSMP. Atlas may revise the SSMP in accordance with condition 6-4 of Ministerial Statement No. 1154 and/or condition 26 of EPBC 2019/8601. Under each approval, the current version of the SSMP must continue to be implemented until the relevant authority approves the revised version, after which time the approved revised SSMP must be implemented instead.



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Appendix A. Northern Quoll Monitoring Procedure



Northern Quoll Monitoring Procedure

Miralga Creek

27/10/2022

180-LAH-EN-PLN-0002 v4



Northern Quoll Monitoring Procedure

Miralga Creek



Authorisation

Version	Reason for Issue	Prepared	Checked	Authorised	Date
A	Internal review	F. Jones	D. Morley M. Goggin		30/03/2020
B	Internal review	F. Jones	D. Morley	M. Goggin	02/04/2020
0	Issued for use	F. Jones	D. Morley	M. Goggin	06/04/2020
0A	Revised draft	C. Knuckey	D. Morley		29/06/2020
1	Address regulator comments	D. Morley	N. Bell	N. Bell	16/10/2020
2	Revised to align to Ministerial Statement 1154 and EPBC 2019/8601	D. Morley	K. Stanbury	H. Nielssen	03/03/2021
3	Updated to align with SSMP v3	K. Stanbury	D. Morley	S. Shute	04/08/2022
4	Address regulator (DCCEEW) comments	K. Stanbury	D. Morley	S. Shute	27/10/2022



Northern Quoll Monitoring Procedure

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Northern Quoll Monitoring Procedure

Miralga Creek

1 Background

The Northern Quoll (*Dasyurus hallucatus*) was recorded during the initial dual-phase baseline fauna survey for the Miralga Creek DSO Project (the Project) from 89 records including 44 captured individuals (comprising 28 unique individuals), 35 times from motion camera captures (comprising 10–11 unique individuals) and ten times from secondary evidence (six scats and four tracks) (Biologic, 2020a). Prior to that survey (conducted in May and July 2019), Northern Quoll had previously been recorded both within and in close proximity to the Project Area (confirmed in the desktop assessment component of Biologic, 2020a). The species was recorded in the Project Area from a range of fauna habitats, however suitable denning and/or foraging habitat was represented by the Hillcrest/Hillslope, Gorge/Gully and Major Drainage Line habitats (Biologic, 2020a). The large number of records within the vicinity of the Project Area (confirmed via the desktop assessment component of Biologic, 2020a) suggests that the species is relatively common in the local region (Biologic, 2020a).

An impact assessment arising from the initial dual-phase baseline fauna survey indicated that the Northern Quoll population occurring within the Project Area was likely to receive a Low to Moderate level of impact at the local scale (Biologic 2020b) due to the development of the Project. Low impact was defined by Biologic (2020b) as 'Loss of individuals by no measurable change in population size'; whilst moderate impact was defined as 'demonstrable change in population'. This impact was primarily from removal, fragmentation and/or modification of habitat, vehicle strike and the increased threat of introduced predators (Biologic 2020b). The impacts relating to the removal, fragmentation and/or modification of habitat were deemed permanent and likely to occur in areas where core habitat intersects areas planned for development; i.e. the habitats Hillcrest/Hillslope, Gorge/Gully and Major Drainage Line (Biologic 2020b). The threat of introduced predators was also determined to be permanent, while the impact of vehicle strike was likely to span only the duration of mining activities (Biologic 2020b).

One of the outcomes from the impact assessment was the recommendation for the Significant Species Management Plan (SSMP; 180-LAH-EN-PLN-0001) and the monitoring of species likely to be significantly impacted by the Project. Atlas will therefore implement the following monitoring procedure for Northern Quoll.

2 Overview and Timing

This monitoring program aims to monitor the presence of Northern Quoll throughout the life of the Project (including its post-mining phase) and to ensure the effectiveness of Atlas Iron Pty Ltd's (Atlas's) management measures for the species. The program will also assist Atlas to build on the knowledge of the species across its operations for future management planning and approvals.

This monitoring program comprises three components:

- **Baseline monitoring:** The aim of this component is to establish the monitoring program, monitoring sites and, in conjunction with the results of the initial dual—phase baseline fauna survey (Biologic, 2020a), define the pre-mining population against which the results of the operational monitoring can be compared. A minimum of one baseline monitoring survey will be undertaken prior to the commencement of mining-related clearing for the Project.
- **Operational monitoring:** The aim of this component is to monitor Northern Quoll population trends during the operational life of the Project. Results of the operational monitoring are to be compared with the results of the baseline monitoring and measured against the performance



Northern Quoll Monitoring Procedure Miralga Creek

criteria defined in the SSMP. Operational monitoring will be undertaken annually during mining, in line with the recommendations of Department of Climate Change, Energy, the Environment and Water (DCCEE) (DEE, 2016).

- **Post-mining monitoring:** This component will monitor Northern Quoll population trends once mining activity has ceased and the Project is considered to be in the closure phase. Results of the post-closure monitoring will be compared with the baseline and operational monitoring and measured against the performance criteria defined in the SSMP. The aim of this component is to assess the long-term viability of the Northern Quoll population within the Project area. Post-mining monitoring will be undertaken for at least three monitoring events, the first event being in the first year after mining of pits ceases, and subsequent events occurring every two years thereafter until the performance criteria defined in the SSMP have been met.

Due to the large distances between the three mining areas and the differing timeframes for mining at each mining area, monitoring has occurred (and will occur) at different phases (i.e. baseline, operational or post-mining) for each mining area, as detailed in Table 1.

Table 1: Monitoring Survey Classification Across Mining Areas

Mining Areas	Monitoring Surveys		
	May & July 2019 (Biologic 2020a)	August 2020 (Biologic 2022a)	August 2021 (Biologic 2022b)
Miralga West	Initial dual-phase baseline fauna survey	Baseline	Operational
Miralga East	Initial dual-phase baseline fauna survey	Baseline	Baseline
Sandtrax	Initial dual-phase baseline fauna survey	Baseline	Baseline

3 Monitoring Method

3.1 Timing

Monitoring will be undertaken between April and September in line with relevant guidelines (DEE 2016). The timing (i.e. the month) of the monitoring surveys should be identical or aligned as closely as possible between monitoring years, with timing also accounting for when northern quoll are most likely to be active and detectable.

3.2 Sites

Four 'impact' sites are located near (<1,000 m) the Project's disturbance footprint, where Northern Quoll have previously been recorded and/or within core habitat (Hillcrest/Hillslope, Gorge/Gully, Major Drainage Line, as defined by Biologic 2020a). At least one site is located near each of the main mining areas: Sandtrax, Miralga East and Miralga West. An additional five 'control' sites are monitored outside of potential impact areas (> 2,000 m), to provide regional and contextual information against which results from the impact sites can be compared, specifically changes in estimated population size. Current monitoring sites are listed in Table 2 and shown in Figure 1.

Where possible, the same sampling sites will be monitored each monitoring survey to maximise consistency between monitoring events. In the event sites cannot be adequately surveyed (e.g. due to access limitations) suitable alternatives meeting the criteria above will be identified. To date, one



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additional control site (VMCM-10) has been included in the monitoring program. No Northern Quoll were detected at VMCM-08 during baseline monitoring surveys in August 2020 or August 2021, and as such an alternative control location (VMCM-10) was identified and monitored during the August 2021 monitoring survey. Subsequent monitoring surveys will include monitoring at VMCM-10 in the event Northern Quoll continue to not be detected at VMCM-08.

Table 2: Northern Quoll Monitoring Sites

Site	Site Type	Area
VMCM-01	Impact	Sandtrax
VMCM-02	Impact	Miralga West
VMCM-03	Impact	Miralga West / Shaw River
VMCM-04	Impact	Miralga East
VMCM-05	Control	Sandtrax
VMCM-06	Control	Lalla Rookh
VMCM-07	Control	Miralga Creek
VMCM-08	Control	North Pole Road
VMCM-10*	Control	Northeast of Miralga East

*VMCM-10 was not originally part of the monitoring program, and only entered the monitoring program in August 2021.



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Northern Quoll Monitoring Locations

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3.3 Motion Cameras

Ten motion cameras, spaced 50–100 m apart following the contours of suitable habitat, will be deployed for a period of four consecutive nights at each site. Each camera will be mounted on a permanent post, setup during the baseline monitoring survey, ensuring consistent camera locations between each monitoring survey. Each motion camera will be baited with a non-reward lure containing universal bait as the attractant. Cameras will be oriented to allow for the differentiation of individuals using spot patterning (Hohnen et al. 2012). After four consecutive nights, cameras are retrieved and photos are downloaded for use in spot analysis. Spot analysis will be used to differentiate individuals and determine a population estimate for each site. Population estimates obtained at each site will be compared against those obtained during the baseline monitoring survey to ensure adherence with the performance criteria defined in the SSMP.

3.4 Active Searching

Active searching will be undertaken at each of the monitoring sites for a total of one person-hour to obtain supplementary information of Northern Quoll occurrence. Such data will include direct visual records of Northern Quolls, or indirect records such as bones, carcasses, tracks and scats. Other species of conservation significance or introduced predators will also be recorded, if observed.

3.5 Habitat Assessments

Formal habitat assessments will be conducted at each monitoring site to characterise the quality and complexity of habitat provided for Northern Quoll. The monitoring sites will be revisited during subsequent surveys and assessed for disturbance and condition (e.g. fire, cracking, rock falls and/or dust accumulation).

Assessments will be undertaken at each monitoring site each survey to document changes at and surrounding the monitoring site, which may explain changes to Northern Quoll presence and activity. The location of the assessment (including photo points) will be established and permanently marked during the baseline monitoring survey, or whenever the site is first established. This location will be revisited each monitoring survey thereafter to allow comparisons to be made over time. Each assessment will record the characteristics set out below.

In the landscape surrounding each monitoring site:

- Landform and soil features.
- Condition, structure, and composition of vegetation.
- Presence or absence of habitat structures such as caves and/or rocky crevices which act as suitable denning habitat.
- Presence or absence of water, such as drainage lines, seasonal pooling.
- Presence of any other disturbances, including nature and extent of any new disturbance.

4 Reporting

A standalone report at the conclusion of each annual monitoring period will be prepared documenting Northern Quoll occurrence and abundance within the Project area. This report will include the following sections: methods, results, discussion and recommendations. This report will be appended to Atlas's external reports as detailed in Table 4-2 of the SSMP.



Northern Quoll Monitoring Procedure Miralga Creek

5 References

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Appendix B. Ghost Bat Monitoring Procedure



Ghost Bat Monitoring Procedure

Miralga Creek

27/10/2022

180-LAH-EN-PLN-0003 v4



Ghost Bat Monitoring Procedure

Miralga Creek



Authorisation

Version	Reason for Issue	Prepared	Checked	Authorised	Date
A	Internal review	F. Jones	D. Morley M. Goggin		30/03/2020
B	Internal review	F. Jones	D. Morley	M. Goggin	02/04/2020
0	Issued for use	F. Jones	D. Morley	M. Goggin	06/04/2020
0A	Revised draft	C. Knuckey	D. Morley		29/06/2020
1	Address regulator comments	D. Morley	N. Bell	N. Bell	16/10/2020
2	Revised to align to Ministerial Statement 1154 and EPBC 2019/8601	D. Morley	K. Stanbury	H. Nielssen	03/03/2021
3	Updated to align with SSMP v3	K. Stanbury	D. Morley	S. Shute	04/08/2022
4	Address regulator (DCCEEW) comments	K. Stanbury	D. Morley	S. Shute	27/10/2022

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1 Background

The Ghost Bat (*Macroderma gigas*) was recorded on 25 occasions during the initial dual-phase baseline fauna survey for the Miralga Creek DSO Project (the Project) (Biologic, 2020a). The species was recorded five times from direct observation (individuals observed at night and within or flushed from caves), 10 times from ultrasonic call recordings and 10 times from secondary evidence (scats) (Biologic, 2020a). Sixteen caves or cave-like structures such as overhangs (hereafter referred to as caves) were recorded in the Project Area during the initial dual-phase baseline fauna survey, including 10 which were confirmed as being used by the Ghost Bat. Thirteen caves were confirmed or identified as a potential habitat feature for the species, comprising one potential night roost, seven confirmed night roosts, one potential day roost, three confirmed day roosts and one potential maternity roost (Biologic, 2020a).

An impact assessment arising from the initial dual-phase baseline fauna survey indicated that the Ghost Bat population occurring within the Project Area was likely to receive a Low to Moderate level of impact at the local scale (Biologic, 2020b) due to development of the Project. Low impact was defined by Biologic (2020b) as 'Loss of individuals by no measurable change in population size'; whilst moderate impact was defined as 'demonstrable change in population'. The source of this impact was primarily due to the removal, fragmentation and/or modification of habitat, but also noise, vibration, dust and changes in water regimes (Biologic, 2020b). Low level impacts may also be experienced by vehicle strike, introduced species, increased light and altered fire regimes (Biologic, 2020b). Of primary concern to the species is the potential impact to caves CMRC-15 and CMRC-23, two caves identified as potential maternity roosts for the species.

One of the outcomes from the impact assessment, was the recommendation for the Significant Species Management Plan (SSMP; 180-LAH-EN-PLN-0001) and the monitoring of species likely to be significantly impacted by the Project. Atlas Iron will therefore implement the following monitoring procedure for Ghost Bat.

2 Overview and Timing

This monitoring program aims to monitor the presence of Ghost Bat throughout the life of the Project (including its post-mining phase) and to ensure the effectiveness of Atlas Iron Pty Ltd's (Atlas's) management measures for the species. The program will also assist Atlas to build on the knowledge of the species across its operations for future management planning and approvals.

This monitoring program comprises four components:

- **Baseline monitoring of Ghost Bat:** The aim of this component is to establish the monitoring program, monitoring sites and, in conjunction with the results of the initial dual-phase baseline fauna survey (Biologic, 2020a), define the pre-mining activity patterns at monitoring caves against which the results of the operational monitoring can be compared. A minimum of one baseline monitoring survey will be undertaken prior to the commencement of mining-related clearing for the Project.
- **Operational monitoring of Ghost Bat:** The aim of this component is to monitor Ghost Bat activity throughout the operational life of the Project. Results of the operational monitoring will be compared with the results of the baseline monitoring and measured against the performance criteria defined in the SSMP. Operational monitoring will be undertaken annually during mining.
- **Post-mining monitoring of Ghost Bat:** This component will monitor Ghost Bat activity at the Project once mining activity has ceased and the Project is considered to be in the closure phase. Results



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of the post-mining monitoring will be compared to the baseline and operational monitoring and measured against the performance criteria defined in the SSMP. The aim of this component is to determine whether the Project area still supports a viable Ghost Bat population once mining has ceased. Post-mining monitoring will be undertaken for at least three monitoring events, the first event being in the first year after mining of pits ceases, and subsequent events occurring every two years thereafter until the performance criteria defined in the SSMP have been met.

- **Blast monitoring:** The aim of this component is to monitor vibrations received at caves within the vicinity of blasting activities so that vibration can be managed to the performance criteria defined in the SSMP. The monitoring also includes inspections of caves (as per Table 3-4 of the SSMP) to identify whether any damage is occurring.

Due to the large distances between the three mining areas and the differing timeframes for mining at each mining area, monitoring has occurred (and will occur) at different phases (i.e. baseline, operational or post-mining) for each mining area, as detailed in Table 1.

Table 1: Monitoring Survey Classification Across Mining Areas

Mining Areas	Monitoring Surveys		
	May & July 2019 (Biologic 2020a)	August 2020 (Biologic 2022a)	August 2021 (Biologic 2022b)
Miralga West	Level 2	Baseline	Operational
Miralga East	Level 2	Baseline	Baseline
Sandtrax	Level 2	Baseline	Baseline

3 Monitoring Method

3.1 Baseline, Operational and Post-mining Monitoring of Ghost Bat

Monitoring will be undertaken between April and September to align with Northern Quoll monitoring. This timing also ensures minimal disturbance to reproducing females and their young during the most important part of their reproductive cycle (October to December). The timing (i.e. the month) of the monitoring surveys should be identical or aligned as closely as possible between monitoring years, with timing also accounting as necessary for seasonal conditions and moon phase. Guidelines on cave entry are provided in Appendix C of the SSMP.

Due to the variability frequently recorded in the species' use of caves (Armstrong & Anstee, 2000), an array of caves will be monitored to demonstrate presence across the Project. Monitoring will be undertaken at 12 impact caves (hereafter referred to as monitoring sites) which have previously been confirmed to be utilised by Ghost Bat (Biologic, 2020a, 2022a, b): CMRC-01, CMRC-06, CMRC-07, CMRC-08, CMRC-13, CMRC-14, CMRC-15, CMRC-18, CMRC-20, CMRC-21, CMRC-22, CMRC-23 and one control site Lalla Rookh (VLRM-02). The Lalla Rookh mine, a permanently occupied Ghost Bat maternity roost, will provide regional and contextual information for which to compare results obtained from the 13 impact monitoring sites closer to the Project. Where possible, the same sites will be monitored each monitoring survey to maximise consistency between monitoring events (Figure 1). In the event that a site cannot be adequately monitored (e.g. due to access limitations) suitable alternatives will be identified. To date, one cave (CMRC-03) has been removed from the monitoring program due to geotechnical access issues making it unsafe for personnel to access. A suitable alternative has been identified (CMRC-07, another Category 3 roost in the Sandtrax area) and has been part of the monitoring program since the 2022 monitoring survey. As data on Ghost Bat activity



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and roosting is collected over time, it may be desirable to adjust monitoring sites adaptively to account for new information or changes in Ghost Bat roost usage in future. To date, an additional four caves (CMRC-20, CMRC-21, CMRC-22, and CMRC-23) have been added to the monitoring program, to account for the discovery of these roosts post the baseline monitoring survey. Figure 1 therefore also shows other potential roosting locations that have potential to be used as monitoring locations if the need arises.

Monitoring sites are listed in Table 2 and shown in Figure 1. Other potential monitoring sites are listed in Table 3 and shown in Figure 1; however, these are not currently required to be monitored. Other potential monitoring sites would only be considered for monitoring should a cave specified as part of the Ghost Bat Monitoring Program becomes unsuitable or unsafe for monitoring.

A variety of monitoring techniques will be used to monitor the species, including scat counts, ultrasonic recordings, microclimate recording, and censuses (Table 4). However, not all monitoring techniques will be used at all caves, with the specific techniques employed at each cave at the discretion of the fauna specialist consultant engaged by Atlas to undertake monitoring in accordance with the requirements of the SSMP. All attempts will be made to keep monitoring methods employed at a cave consistent across monitoring events.



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Table 2: Ghost Bat Monitoring Sites

Area	Monitoring Site	Roost Category ¹	Distance From Cave Entrance to Nearest Pit ²	Control Site For ³
Sandtrax	CMRC-07	Category 3	225 m	Miralga West, Miralga East
	CMRC-21	Category 4	335 m	
Lalla Rookh	VLRM-02	Category 1	~5,000 m	Sandtrax, Miralga West, Miralga East
Miralga West	CMRC-06	Category 2	400 m	Sandtrax, Miralga West
	CMRC-08	Category 3	470 m	
Miralga East (near pits 2 and 3)	CMRC-01	Category 4	50 m	Sandtrax, Miralga West
	CMRC-13	Category 4	95 m	
	CMRC-14	Category 3	117 m	
	CMRC-15	Category 2	55 m	
	CMRC-20	Category 3	150 m	
	CMRC-22	Category 3	250 m	
Miralga East (west of pits)	CMRC-18	Category 3	~1,000 m	Sandtrax, Miralga West, Miralga East

Sources: Bat Call (2022).

- 1 Cave category definitions (full definitions in Appendix A of Bat Call WA (2020)):
 - Category 1 – maternity/diurnal roosts with permanent occupancy
 - Category 2 – maternity/diurnal roosts with regular occupancy
 - Category 3 – roosts with occasional occupancy
 - Category 4 – nocturnal roosts with opportunistic usage
- 2 Distance is measured from nearest edge of proposed pit disturbance to the cave entrance.
- 3 Due to the large distances between the mining areas and that a staged approach will be taken to mining each area, it is possible for sites at an area to act as control sites if no mining has occurred yet at that area at the time of monitoring. This column identifies which areas a site can act as a control for if mining is not occurring nearby the site.

Table 3: Other Potential Ghost Bat Monitoring Sites

Area	Cave	Roost Category ¹	Distance From Cave Entrance to Nearest Proposed Pit ²	Potential Limitations as a Monitoring Site
Sandtrax	CMRC-19	Category 4	385 m	Lower usage
	CMRC-03	Category 3	185 m	Geotechnical access issues – unsafe for personnel access
Miralga West	CMRC-04	Category 4	340 m	Lower usage
	CMRC-10	Category 3	450 m	Lower usage
	CMRC-12	Category 4	340 m	No recorded usage
Miralga East (west of pits)	CMRC-16	Category 4	~1,000 m	No recorded usage
	CMRC-17	Category 4	~1,000 m	No recorded usage

Sources: Bat Call (2022).

- 1 See footnotes to Table 2 for cave category definitions.
- 2 Distance is measured from nearest edge of proposed pit disturbance to the cave entrance.



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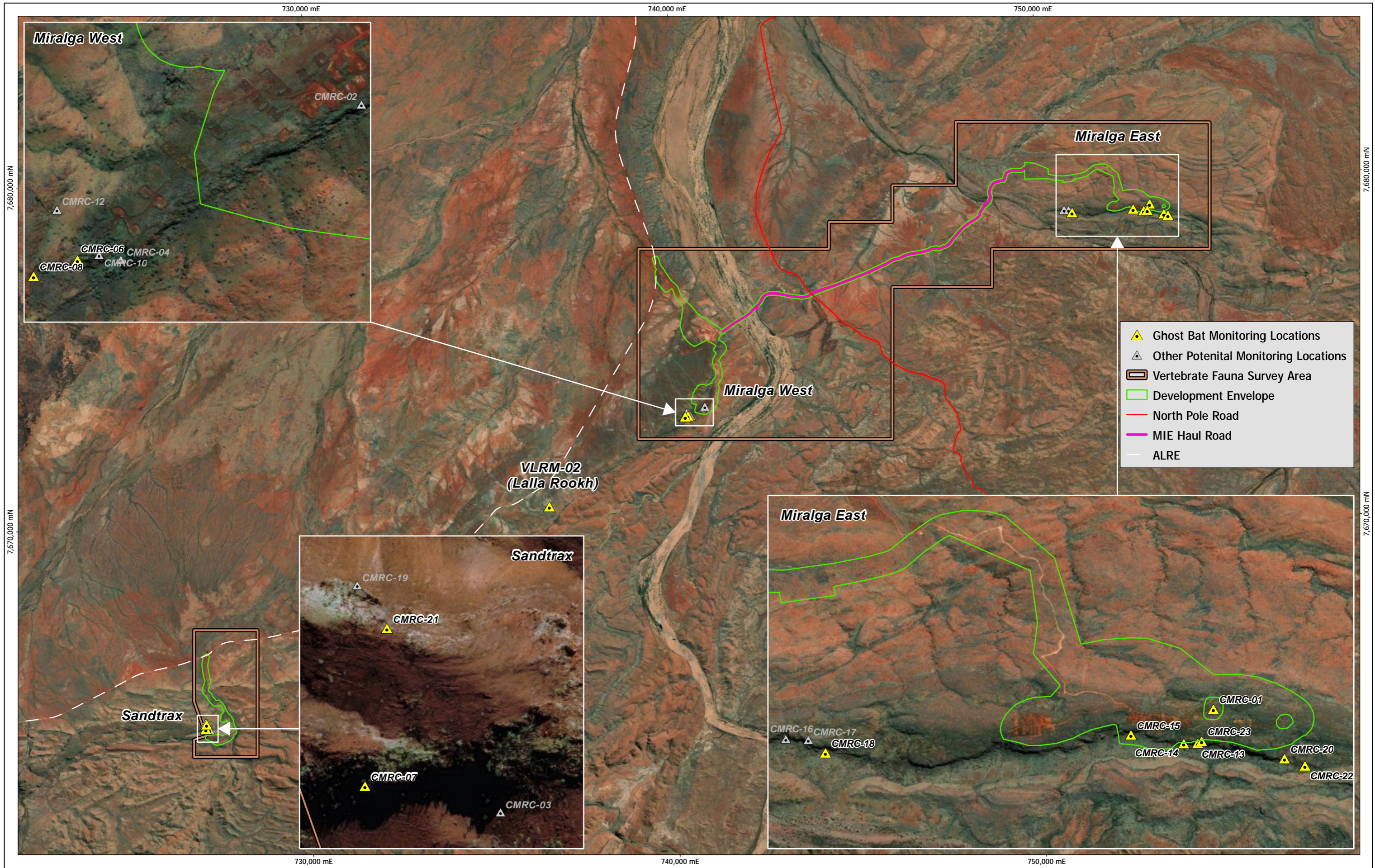
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Table 4: Monitoring Methods Employed at Ghost Bat Monitoring Sites

Area	Monitoring Site	Scat Counts	Ultrasonic Recording	Habitat Assessment	Microclimate Recording	Census
Sandtrax	CMRC-07	Yes	Yes	Yes	Yes	-
	CMRC-21	Yes	Yes	Yes	Yes	-
Lalla Rookh	VLRM-02	- ^a	Yes	Yes	- ^b	Yes
Miralga West	CMRC-06	Yes	Yes	Yes	Yes	-
	CMRC-08	Yes	Yes	Yes	Yes	-
Miralga East (near pits 2 and 3)	CMRC-01	Yes	Yes	Yes	Yes	-
	CMRC-13	Yes	Yes	Yes	Yes ^e	-
	CMRC-14	Yes	Yes	Yes	Yes ^e	-
	CMRC-15	- ^c	Yes ^d	Yes	Yes ^e	-
	CMRC-20	Yes	Yes	Yes	Yes	-
	CMRC-22	Yes	Yes	Yes	Yes	-
Miralga East (west of pits)	CMRC-23	Yes	Yes ^d	Yes	- ^f	-
	CMRC-18	Yes	Yes	Yes	Yes	-

Notes:

- Scat sheets not able to be deployed at VLRM-02 (disused mine shaft), which results in scat counts not being undertaken.
- Microclimate monitoring is not physically possible at VLRM-02 (disused mine shaft).
- Scat sheets not deployed at CMRC-15 as not physically safe to access sheets, which results in scat counts not being undertaken.
- Solar-powered ultrasonic sound recorders are installed at CMRC-15 and CMRC-23 to provide continuous ultrasonic call data.
- Solar-powered temperature and humidity sensors are installed at CMRC-13, CMRC-14, and CMRC-15 to provide continuous microclimate monitoring data.
- Microclimate monitoring is not physically possible at CMRC-23 (physically inaccessible).



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3.1.1 Scat Counts

During the baseline monitoring survey, sheets will be placed over middens or large scat piles within each cave. As Ghost Bats are known to use the same roosting spot within a cave, the sheets aim to collect all scats deposited between monitoring surveys. During each monitoring survey, the number of scats on the sheets within a cave will be counted, and the sheets cleared, or replaced. A representative number of scats should be collected in the event that further analysis is required (e.g. genetic or hormone analysis). The number of scats recorded within a cave can be used to determine a scat deposition rate (the number of scats recorded divided by the number of days since sheets were last cleared) that can be compared between caves and monitoring surveys. At sites where scats degrade quickly (e.g. due to weather or rapid decomposition by invertebrates), scat deposition rates may not be calculable, however the presence of scats can still be used to indicate bat activity. Note scat counts will not be completed at Lalla Rookh due to access restrictions.

3.1.2 Ultrasonic Recordings

Due to the potential for access restrictions within caves (e.g. for heritage or safety reasons) ultrasonic sampling will be completed at each monitoring site to supplement the data obtained from the scat counts. Ultrasonic sampling will be completed at the monitoring sites for a total of seven nights each, to align with state recommendations for vertebrate fauna sampling (EPA, 2016). Attempts will be made to align the sampling nights across all sampling sites. Note, Ghost Bat calls can be difficult to detect due to their seemingly weak calls which can only be detected at close-range (McKenzie & Bullen, 2009), and the fact that the species is somewhat capable of navigating without the need to echolocate (Kulzer et al., 1984). For these reasons, absence of ultrasonic recordings should not be interpreted as complete absence of species at monitoring sites. Where possible, confirmation of species presence through ultrasonic recordings should be used to indicate roosting location, e.g. were calls recorded soon after dusk indicating diurnal roosting at a monitoring cave, or not.

3.1.3 Microclimate Recording

Microclimate (i.e. temperature and relative humidity) will be recorded continuously at cave CMRC-15 (as required by EPBC 2019/8601) and at other Ghost Bat roosts as desired. A microclimate logging device will be installed at each monitoring site at a position within the roosting chamber, preferably on the cave wall and not at ground level. Microclimate data will be recorded at six-hourly intervals to provide four readings per day. Baseline monitoring should cover a continuous period of at least 12 months so as to be as representative as possible of natural conditions across all seasons. When comparing operational and post-mining microclimate with baseline microclimate, a number of factors may be relevant in the interpretation of results, including:

- The representativeness of the baseline dataset.
- Prevailing weather/climate during the relevant period.
- Microclimate data available from any other comparable caves.
- Nearby project activities and their potential effects on the microclimate of the cave.
- Whether the cave is or has recently been artificially closed to bats.
- Ghost Bat presence and activity, particularly if the species is recorded occupying caves with microclimate outside the ranges referenced in the Conservation Advice (TSSC, 2016).

3.1.4 Censuses

A census should be completed at Lalla Rookh each monitoring survey. This method is the most accurate method to indicate the likely colony size inhabiting the structure. Censuses can be



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completed by field personnel manually counting bats as they leave the roosting structure soon after dusk and/or via infrared lit video camera. Results from the census will be used to indicate regional population fluctuations and to help explain results in lieu of presence and activity changes at other monitoring sites.

3.1.5 Habitat Assessments

Formal cave and habitat assessments will be conducted at each monitoring site to characterise the quality and complexity of habitat provided for the Ghost Bat. The monitoring sites will be revisited during subsequent surveys and assessed for disturbance and condition (e.g. fire, cracking, rock falls and/or dust accumulation).

Assessments will be undertaken at each monitoring site each survey to document changes at and surrounding the monitoring site, which may explain changes to Ghost Bat presence and activity. The location of the assessment (including photo points) will be established and permanently marked during the baseline monitoring survey. This location will be revisited each monitoring survey thereafter to allow comparisons to be made over time. Each assessment will record the characteristics set out below.

At the entrance of each monitoring site (i.e. the entrance to a cave):

- Entrance photographs (taken from two established photo monitoring points).
- Evidence of structural damage, if any, with reference to the following questions:
 - Are there any new open or intersecting joints or fractures along the roof, wall or bedding planes of the cave?
 - Are there any loose rocks or signs of fresh rock fall within the cave? If yes, make notes about the amount of dust, debris and/or fallen rocks, including an estimation of the size of the largest rock.
- Presence of water.
- Presence of Ghost Bat, including number of individuals and/or secondary evidence such as scats, evidence of foraging, etc.

In the landscape surrounding each monitoring site:

- Condition of vegetation.
- Presence of water.
- Presence of any artificial light sources or other disturbances.

3.2 Blast Monitoring

Blast monitoring was recommended by Blast It Global (2020) to measure vibration received at Ghost Bat caves and validate predicted vibration. Key monitoring elements are shown in Table 5.

Due to the difficulties of access to cave sites situated on the lower regions of the escarpment, Blast It Global (2020) recommended that representative monitoring locations be installed on top of the escarpment. A permanent blast vibration monitoring block will be located as close to the lateral extents of CMRC-13, CMRC-14, CMRC-15 and CMRC-23 as possible (ideally within 10 m) and positioned between the cave and the proposed blasting locations. A surveyor must use the surveyed location of the cave void to determine the closest blast monitoring location to the cave in the event that the cave entrance is not an appropriate location for the monitoring block.

The desktop blast modelling and predictions will require calibration for actual on-site conditions. This will be achieved by the blasting engineer comparing the results of initial blasts with the predictions of



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the model. The various inputs to the model will then be adjusted based on monitoring results, so that the model more closely replicates the recorded results. Adjustments are applied iteratively with successive blasts. The calibrated site-specific version of the model is also known as the 'site law' or 'site prediction equations'. A reasonable degree of confidence in the site law is achieved when the blasting engineer is satisfied that the model is reliably predicting (and not underestimating) the blast vibrations as measured.

Personnel using and installing blast monitoring equipment, and the blast designers and shotfirers in charge, will be supervised by the Superintendent of Mine Planning & Engineering who will hold a Bachelor of Mine Engineering (or equivalent) and have practical experience in blasting to ensure sufficient competency to undertake the requirements of this specific blasting scenario. All blasting practices should adhere to documented procedures and design standards to achieve above average confinement of the explosives' charge.

Table 5: Blast Monitoring

Monitoring	Location	Method	Timing
Vibration monitoring	Caves CMRC-13, CMRC-14, CMRC-15 and CMRC-23	Vibration monitor installed in (or close to) the nearest cave to the blast location. Permanent monitoring blocks (a fixture installed in the ground to which a vibration monitor can be affixed, allowing the monitor to be moved between several sites) may be used.	During each blast occurring within 400 m of CMRC-13, CMRC-14, CMRC-15, and/or CMRC-23.
Cave inspection	Caves CMRC-13, CMRC-14, CMRC-15 and CMRC-23	Inspection of cave to assess whether any damage has been sustained in the cave and, if so, an estimate of the extent of the damage using the evidence of structural damage criteria in Section 3.1.5. The preferred inspection method is visual and in-person, e.g. by entering the cave. However, it is recognised that access may not always be possible, e.g. for safety reasons, or to comply with the Ghost Bat cave entry guidelines set out in Appendix C of the SSMP.	<p>During operations, each cave to be inspected:</p> <ul style="list-style-type: none"> • Once before the first blast within 400 m. • After each top bench blast within 400 m. • After any blast where vibration at the cave exceeds the 85 mm/s trigger criterion in the SSMP. • At least every month starting from the month of the first blast within 400 m. <p>During operations, each cave to be laser scanned annually.</p>



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4 Reporting

A standalone report at the conclusion of each monitoring period will be prepared documenting the occurrence of Ghost Bat at monitoring sites within the Project area. This report will include the following sections: methods, results, discussion and recommendations. This report will be appended to Atlas's external reports as detailed in the SSMP.

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Appendix C. Cave Disturbance Guidelines

A conservative protocol is recommended to protect the reproducing females and their young during the most important part of their reproductive cycle. This covers the periods when:

- Gravid females are subject to premature birth due to either capture and handling or repeated flushing the bats from their diurnal roost caves.
- Females carrying newborns are subject to dropping them due to capture or disturbance.
- Non-volant young in nurseries are subject to abandonment due to repeated disturbance of the mothers.
- Newly volant young during the early adolescent period are subject to premature abandonment due to repeated disturbance of the mothers and/or young.

For Ghost Bat category 1, category 2, and category 3 roost caves that are part of an important cave grouping, it is recommended that restrictions tighter than Western Australian government fauna licencing limitations be applied:

1. Surveys with higher disturbance to Ghost Bats (i.e. when Ghost Bats are captured, or are present and are disturbed) should be limited to once per cave during August, September, and January.
2. Multiple lower disturbance survey entries per cave are allowed in August, September, and January. The surveys should be done by one ecologist working quietly to minimise stressing the bats present and hopefully not flushing them. If a Ghost Bat(s) is disturbed and flushed, the caves and their entrance areas should be vacated to allow the bat(s) to return and settle. Restrictions per item 1 above then apply (i.e. no re-entry for the remainder of the month).
3. No cave entries should be carried out in October, November and December inclusive. Any damage assessments required during blasting operations in this time period should be carried out from the cave entrance.
4. Survey entries in accordance with Western Australian government fauna licencing limitations should be allowed outside these periods.



Appendix D. Additional Reference Material



- Production Bores
- Turkey's Nest (TN) Proposed
- Turkey's Nest (TN) Existing
- Marble Bar Road
- North Pole Road
- MIE Haul Road
- - - ALRE
- Development Envelope



File Name: GIS_3428.aprx
 Date: 27/10/2022
 Drawn: Sam.Nikora
 Doc No:

Projection: GDA 1994 MGA Zone 50
 0 2 4 8
 kilometres
 Scale 1:200,000 Page size: A3



Turkey's Nests

Figure No:
 Appendix D