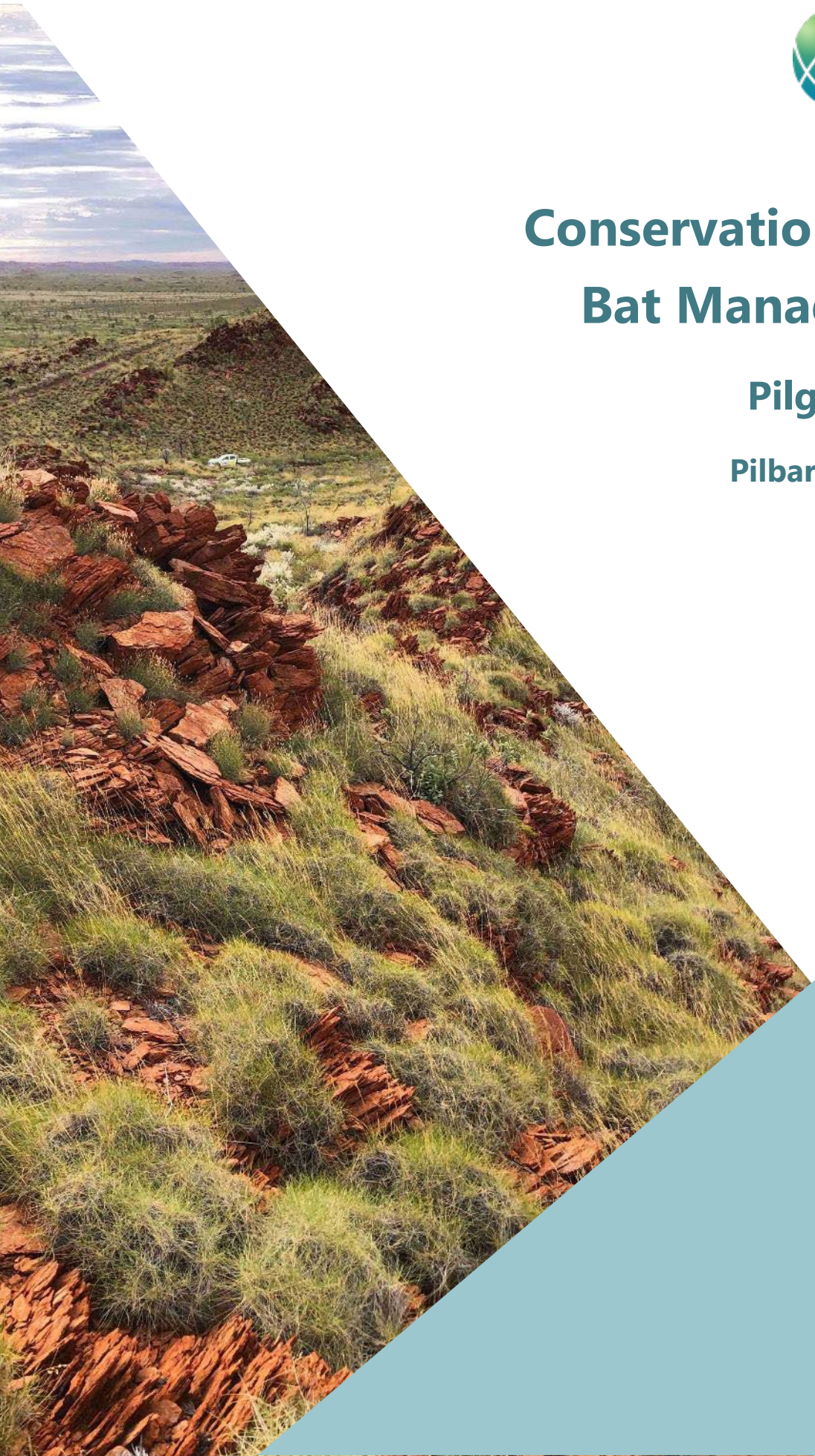

Conservation Significant Bat Management Plan

Pilgangoora Project

Pilbara, Western Australia

Rev. 0

Prepared for
Pilbara Minerals Limited by
Animal Plant Mineral Pty Ltd.

September 2023

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PROJECT TERMS

Abbreviation	Meaning
The Project	Pilgangoora Lithium-Tantalum Project
PLS	Pilbara Minerals Limited

UNITS OF MEASURE

Unit	Measure
km	Kilometre
m	Metre

LIST OF ABBREVIATIONS

Abbreviation	Meaning
APM	Animal Plant Mineral Pty Ltd
BC Act	*Biodiversity Conservation Act 2016*
CS	Conservation Significant
CSBMP	Conservation Significant Bat Management Plan
DBCA	Department of Biological 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
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
MNES	Matters of National Environmental Significance
PLNB	Pilbara Leaf-nosed Bat
PMST	Protected Matters Search Tool
WA	Western Australia

1 INTRODUCTION

1.1 PROJECT AND LOCATION

The Pilgangoora Lithium-Tantalum Project (**the Project**) is owned and operated by Pilbara Operations Pty Ltd, a 100% subsidiary of Pilbara Minerals Limited (**PLS**).

The Project is located approximately 80 kilometres (**km**) south-southeast of the town of Port Hedland and 30 km northeast of the Wodgina Mine, in the north-eastern Pilbara region of Western Australia (**WA**). The site is accessed from Port Hedland via the Pippingarra Road. The location of the Project is shown in Figure 1-1.

The disturbance envelope for the Project is the combined boundary of tenements M45/78, M45/333, M45/511, M45/1256, M45/1266, M45/1275, L45/402, L45/411, L45/413, L45/414, L45/417, L45/421, L45/429, L45/430, L45/449, L45/450, L45/454, L45/473, L45/477, L45/478, L45/479, L45/480, L45/481, L45/482 and L45/528.

The current projected life of mine is approximately 26 years.

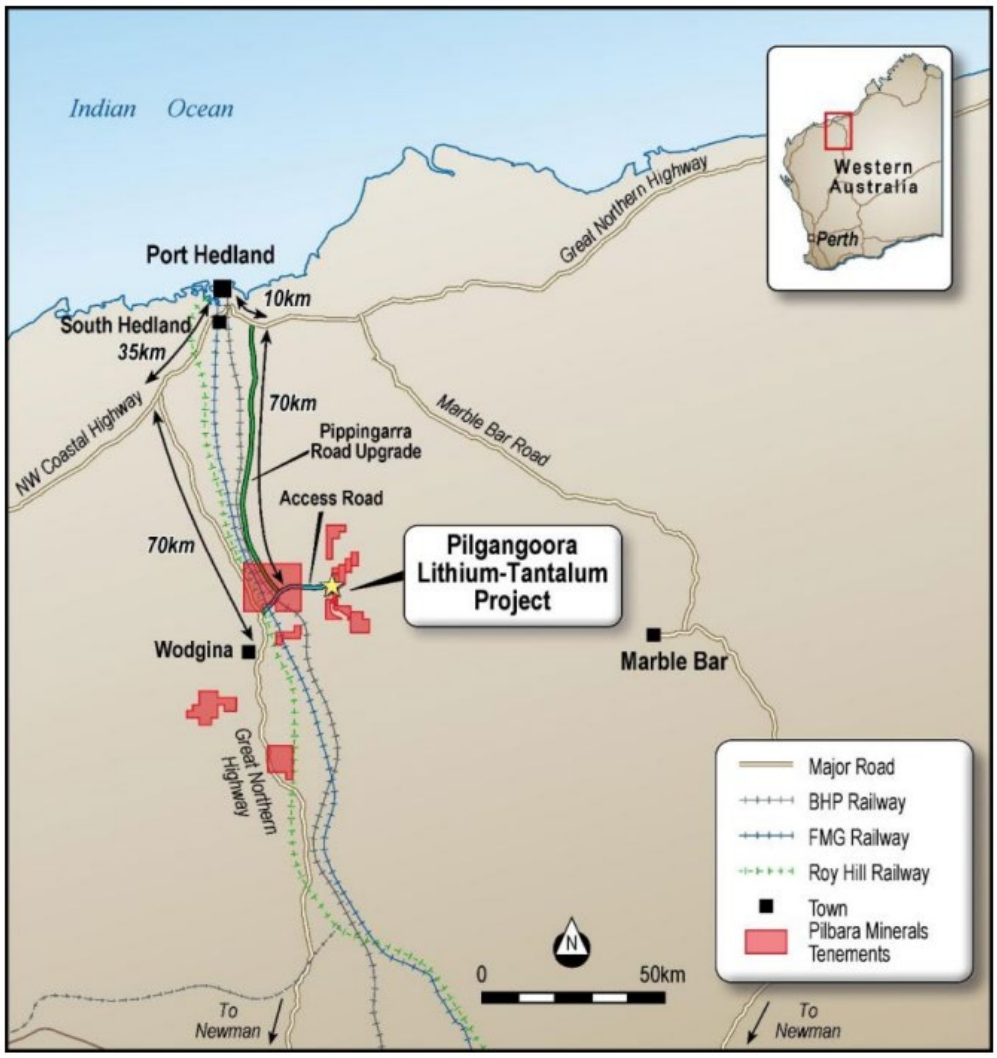


Figure 1-1. Project location

1.2 SCOPE OF WORK

Animal Plant Mineral Pty Ltd (**APM**) was commissioned by PLS to develop a Conservation Significant Bat Management Plan (**CSBMP**) for the Pilgangoora Project. The CSBMP has been developed as an "Operational Management Plan" for an existing and expanding mine site.

1.3 OBJECTIVE AND INTENDED OUTCOMES

The Objective of the CSBMP is to avoid direct and indirect impacts to conservation significant (**CS**) bat species including the Threatened-listed Ghost Bat *Macroderma gigas* and Pilbara Leaf-nosed bat (**PLNB**) *Rhinonicteris aurantia* from the Pilgangoora Project where possible. Where not possible to avoid, the objectives are to minimise impacts and implement mitigation strategies which are then to be monitored and measured to gauge their effectiveness. There is currently no roosting habitat for CS bat species within the Pilgangoora area; however, there is foraging habitat.

The intended outcomes of the CSBMP are to:

- Avoid the direct and indirect impacts to CS bat species from the Pilgangoora Project where possible.
- Where not possible to avoid, minimise impacts and implement mitigation strategies. Monitor the effectiveness of mitigation strategies.
- Adopt an adaptive management approach, based on monitoring outcomes, that identifies management responses to be enacted where trigger and threshold values are exceeded.

2 RELEVANT LEGISLATION

Pilbara Minerals Ltd employees and contractors are obliged to comply with all relevant environmental State and Commonwealth legislation. Legislation directly relevant to the management of fauna (including CS bat species) is listed in Table 2-1.

Table 2-1. Legislation

Legislation	Description
Environment Protection and Biodiversity Conservation Act 1999 (**EPBC Act**, Commonwealth)	The Commonwealth EPBC Act is administered by the Department of Climate Change, Energy, the Environment and Water (**DCCEEW**). It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as Matters of National Environmental Significance (**MNES**). If a project has the potential to significantly impact on MNES it is to be referred to the DCCEEW for determination on whether the matter is a 'controlled action' and therefore requiring assessment. Species and communities listed under the EPBC Act are protected and require authorisation by the Minister to take or disturb. The EPBC Act also provides for the development of conservation advice and recovery plans, development of a register of critical habitat, recognition of key threatening processes and the development of threat abatement plans. The PLNB and the Ghost Bat are listed as Threatened species in the category Vulnerable under the EPBC Act. An Action Plan for Australian Bats was completed in 1999 and species profiles were later updated in the 'Action Plan for Australian Mammals 2012' (Woinarski *et al.* 2014). No Recovery Plan is currently in place for the Pilbara Leaf-nosed Bat or the Ghost Bat. Conservation Advice for both species, a Survey Guideline (which pre-dates the listing of the Ghost Bat and is therefore specifically relevant to the Pilbara Leaf-nosed Bat), and EPBA Referral Guidelines are in force under the EPBC Act. The Lynas Find Project, a component of the Pilgangoora Project, has been referred under the EPBC Act (EPBC Number: 2023/09471), and determined to be a Controlled Action on the 23/05/2023.
Biodiversity Conservation Act 2016 (**BC Act**, WA)	The BC Act provides a statutory basis for the listing of Threatened species, specially protected species, extinct species, Threatened Ecological Communities, collapsed ecological communities, critical habitat and key threatening processes in WA. Species and communities listed under the BC Act are protected and require authorisation by the Minister to take or disturb. The PLNB and Ghost Bat are listed as Threatened species in the category of Vulnerable under the BC Act.

3 SPECIES PROFILES

3.1 PILBARA LEAF-NOSED BAT

3.1.1 Roosting Habitat

The PLNB roost during the day in caves and underground mines with stable, warm and humid microclimates; this habitat is critical to the species because of the PLNB's poor ability to maintain its heat and water balance (Churchill *et al.* 1988; Jolly 1988; Churchill 1991; Baudinette *et al.* 2000; Armstrong 2001). There is a possibility that some roosts exist in the deeper spaces amongst granite tor rockpiles in the eastern Pilbara, (Armstrong and Anstee 2000; Armstrong 2001). The PLNB does not roost in overhangs (shallow structures where the rear wall can be observed from the entrance), as these do not support warm, humid microclimates (TSSC 2016). A suggestion that this species becomes 'forest dwelling' in the wet season of the monsoonal northern areas (Churchill 1991, 1995) has not been supported, and is very unlikely in the Pilbara region (Armstrong 2001).

The EPBC Conservation Advice (TSSC 2016) prioritises roosts according to importance to the survival of the species into four categories as outlined in Table 3-2.

Table 3-1: Priorities for conservation of roost sites used by PLNB (TSSC 2016)

Priority	Type	Description
1	Permanent diurnal roost	Occupied year-round and likely the focus for some part of the 9-month breeding cycle; considered as critical habitat that is essential for the daily survival of the PLNB.
2	Non-permanent breeding roost	Evidence of usage during some part of the 9-month breeding cycle (July–March), but not occupied year-round; considered as critical habitat that is essential for both the daily and long-term survival of the PLNB.
3	Transitory diurnal roost	Occupied for part of the year only, outside the breeding season (*i.e.*, April–June), and which could facilitate long distance dispersal in the region; considered as critical habitat that is essential for both the daily and long-term survival of the PLNB.
4	Nocturnal refuge	Occupied or entered at night for resting, feeding or other purposes, with perching not a requirement. Excludes overhangs. Not considered critical habitat but are important for persistence in a local area.

3.1.2 Foraging habitat

The PLNB is an insectivorous species. The type and quality of potential foraging habitat surrounding known or suspected roost sites can be critical to the survival of the PLNB (TSSC 2016). A colony requires access to suitable foraging habitat within its nightly flight range, and larger colonies might require access to a greater proportion of the landscape (TSSC 2016). It has been suggested the PLNB is most encountered within 20 km of its permanent diurnal roosts (Bullen 2013), but in the months where climatic conditions are least challenging for the species (April-May) they have been recorded further afield (Bullen 2021). Echolocation based records indicate that it can complete round trips of 50 km or longer in a night under favourable conditions (Bullen 2021). 'Favourable conditions' are thought to be

a combination of the availability of pools (at least for foraging; it is unknown if they drink), and a greater availability of caves as roosts because their microclimates are influenced by lower rates of evaporation and possibly greater ingress of surface water from rainfall (K.N. Armstrong pers. comm.).

The PLNB has been recorded foraging in a variety of habitats across its range, including open spinifex grasslands, black soil grasslands, open savannah woodland, tall open forest and monsoon rainforest (TSSC 2016; Churchill 2008). In the Pilbara, they are often encountered in large watercourses, around rocky outcrop, gullies, gorges and over pools (TSSC 2016; Armstrong 2001). Given the lack of understanding around which habitats are required to sustain a roosting colony, it is difficult to define critical foraging habitat of the PLNB. However, based on observations of where they are most often encountered at night, and the assumption that the condition of these is important for sustaining a nearby colony, the foraging habitats used by the PLNB are prioritised by EPBC Conservation Advice (TSSC 2016) as outlined in Table 3-3.

Table 3-2: Priorities for conservation of foraging habitat for Pilbara Leaf-nosed Bat (TSSC 2016)

Priority	Type	Description
1	Gorges with pools	Watercourses through upland areas bounded by sheer rock walls for parts of their length, often containing pools that remain for weeks or months, sites of relatively large biomass production, sometimes containing caves.
2	Gullies	Primary drainage with limited riparian development in upland rocky habitats, sometimes containing small pools that may last for weeks, with less biomass production than Priority 1 gorge habitat.
3	Rocky outcrop	Areas of exposed rock at the top of rocky outcrop and mesa hills that contain caves and overhangs, and boulder piles in the granite terrains.
4	Major watercourses	Riparian vegetation on flat land plus the main gravelly or sandy channel of the riverbed, sometimes containing pools that persist for weeks or months, and generally supporting higher productivity of biomass than the surrounding habitats.
5	Open grassland and woodland	Dominated by Triodia, on lowland plains, colluvial slopes and hilltops.

3.1.3 Threatening Processes

Mining-related activities that remove both foraging and critical roost habitat or else introduce a disturbance, such as vegetation clearing, excavation and earthworks, blasting, drilling, rail and haul road vehicle activities (including vehicle strikes) in habitat used by the PLNB are key threatening processes for the species (TSSC 2016). These activities can reduce the size of a particular colony directly through the fatality of individuals (*e.g.* strikes from vehicles, which they are known to be susceptible to, and the destruction of roosts when bats are present within), or indirectly by destroying or degrading the quality of habitat (*e.g.* destroying roosts, creating disturbances to roosting colonies, removing vegetation communities and pools used for foraging, and reducing the availability of insect prey by reducing the production of vegetation biomass) (TSSC 2016).

The main identified threat to the PLNB is the loss of its remaining roost sites. The loss of roost sites through mine collapses and flooding have been implicated in its decline (Duncan *et al.*, 1999; TSSC 2016). Potential threats to this species arise from human visitation to roost sites, and the development of new exploration and mining ventures (TSSC 2016).

3.1.4 Breeding

Pilbara Leaf-nosed Bat mate during the dry season, with females giving birth to single young usually in wet season months of late-December or January (Woinarski 2014; Bullen 2021). However, breeding has also been reported to occur later in the wet season with non-valent young being observed as present in the roost in early March (Bullen 2021).

3.2 GHOST BAT

3.2.1 Roosting Habitat

Ghost Bats can move amongst several caves seasonally or as dependent on the influence of weather conditions on roost microclimates and foraging opportunities. Thus, they require several cave roosts (Richards *et al.* 2008). They disperse widely when not breeding but may concentrate in relatively few roost sites when breeding. In the Pilbara, except for the large, abandoned mine colonies, Ghost Bats are often present either singly or in small groups (usually less than 15). These have been shown to move periodically, either seasonally or as dependent on prey availability.

Roost sites include caves, rock crevices and disused mine adits (TSSC 2016). In the Hamersley Range in the Pilbara, preferred roosting habitat appears to be caves beneath bluffs of low rounded hills composed of Marra Mamba geology, and larger hills of Brockman Iron Formation; in the eastern Pilbara, caves beneath bluffs composed of Gorge Creek Group geology and granite rockpiles are preferred (TSSC 2016; Armstrong & Anstee 2000). The species' persistence in the arid Pilbara depends on the physiologically benign diurnal roosts found deep underground in humid, temperature-stable caves (Leitner & Nelson 1967; Hall *et al.*, 1997; Armstrong & Anstee 2000; McKenzie & Bullen 2009).

Extensive survey activity in the last decade has led to the proposal of four categories of roosting habitat used by Ghost Bats in the Pilbara region (Cramer *et al* 2022; Bullen 2021) as outlined in Table 3-4.

Table 3-3: Proposed categories of roost sites used by Ghost Bats (Cramer *et al* 2022; Bullen 2021)

Category	Type	Description
1	Permanent diurnal roost	These diurnal roosts are permanently occupied by Ghost Bats, but the number of individuals may vary over time. All permanently occupied roosts are assumed to be breeding or maternity sites and should be considered as critical habitat.
2	Regular diurnal roost	Ghost Bats occupy these sites regularly over long periods, but their presence is not continuous, *i.e.*, most have roosting recorded for >25% of days but they may be abandoned for periods. These sites tend to be deep and have complex internal characteristics. All are assumed to be maternal sites and are therefore critical habitat.
3	Occasional diurnal roost	These sites have internal characteristics that can support roosting, with roosting recorded <25% of days and the site abandoned for long

		periods. These sites are important for the local, long-term persistence of Ghost Bats when located as part of a roosting complex that contains category 1 or 2 sites, and should be considered as critical habitat.
4	Nocturnal feeding roost	Most if not all other overhangs and shelters (*e.g.* adits and culverts) may be used for resting and/or consuming prey during short night-time stays. Scats and/or food scraps are sometimes found. They usually are not structurally suited to maintaining stable temperatures and humidity. These roost sites are not considered critical habitat for Ghost Bats.

3.2.2 Foraging Habitat

Ghost Bats are carnivores, with a broad diet comprising small mammals including other bats, birds, reptiles, frogs and large insects (Toop 1979, Pettigrew *et al*. 1986; Schulz 1986; Boles 1999; Johnston *et al*. 2015; Claramunt *et al*. 2018).

They have a surface foraging strategy with two modes, either perching in vegetation to ambush passing prey (either on the ground or in the air), or gleaning surfaces such as the ground while in flight (Bullen 2021).

Ghost Bats have been recorded foraging in all productive habitats in the Pilbara region, including drainage lines and along riparian corridors, on alluvial plains supporting mulga woodland and tussock grassland, sparse woodland along ridgelines, as well as cave entrances where other bats are hunted (Cramer *et al*. 2022; Bullen 2020).

Bullen (unpublished data, reported in Bullen 2021) suggests that in the Pilbara, Ghost Bats prefer to forage on productive plain areas with thin mature woodland over patchy or clumped tussock or hummock grass (*Triodia* spp.) on sand or stony ground. Isolated trees and trees on the edge of thin thickets on the plains, or trees along the edges of watercourse woodlands, appear to be preferred vantage points. The bats forage at these sites for between 30 and 300 minutes, before moving to a nearby area.

3.2.3 Threatening Processes

Many Pilbara Ghost Bat roosts are vulnerable to iron ore mining and the deterioration and disturbance of old underground gold and copper mines.

Ghost Bats are easily disturbed and may abandon sites where human disturbance occurs (TSSC 2016; Woinarski *et al*. 2014). Minor disturbances by approaching vehicles and people may result in bats moving to alternative roost sites (TSSC 2016).

Vegetation simplification can impact on foraging strategies and productive riparian sites (TSSC 2016). Livestock grazing, fire and weed encroachment can degrade habitat (TSSC 2016; Qld DEHP 2015); some population declines could be attributable to prey lost through habitat modification by fire and livestock (Duncan *et al*., 1999; TSSC 2016).

Fencing, especially fences with barbed wire, can kill substantial numbers of Ghost Bats (Armstrong & Anstee 2000; Woinarski *et al*. 2014; TSSC 2016). A single fence near a colony can effectively remove all

individuals given enough time and has been observed in the Pilbara (Armstrong & Anstee 2000; TSSC 2016).

There is evidence of ghost bats preying upon cane toads in Kakadu National Park; Bats have been found dead with chewed toads in their throats (TSSC 2016). There has been significant reduction in numbers of ghost bats in areas of western Queensland, apparently due to the consumption of cane toads (TSSC 2016).

3.2.4 Breeding

Female bats give birth to single young in late spring (TSSC 2016; Hoyle *et al*. 2001). Juvenile bats commenced flying at seven weeks with all young capable of flight by the end of January. Most breeding sites appear to require multiple entranced caves. Ghost Bats disperse widely when not breeding but concentrate in relatively few roost sites when breeding. Females breed at an age of two to three years (TSSC 2016; Hoyle *et al*. 2001).

4 LOCAL OCCURENCES

The results of baseline surveys and previous conservation significant bat assessments for the Pilgangoora Project, together with current understanding of the species, have informed the management and monitoring approach for this CSBMP.

Surveys that have informed the understanding of presence and distribution of conservation significant bat species across the Pilgangooora Project are listed in Table 4-1.

Table 4-1. Conservation Significant bat surveys

Author (Year)	Survey effort	Summary of findings
360 Environmental (2015)	Targeted Pilbara Leaf-nosed Bat survey. Pilgangoora baseline studies. 12 – 16 October 2015. 24 bat detector units. Habitat mapping.	Analysis by Bat Call WA. PLNB calls recorded at 17 sites. PLNB activity was detected generally along the 13 km of hills containing the Pilgangoora project. Records suggest that the hills and creek lines surrounding the project provide preferred foraging opportunities for the species. Echolocation records indicate that a PLNB roost exists somewhere to the north of the survey area, outside of the Project area.
MWMC Environmental (2016)	Level 1 terrestrial vertebrate fauna survey (Level 2 flora). Pilgangoora baseline studies. 4 – 6 August 2015 One bat detector unit, total 3 nights. Habitat mapping.	Analysis by Bat Call WA. PLNB calls were detected in low numbers at three locations.
360 Environmental (2016)	Pilbara Leaf-nosed bat roost survey. Pilgangoora baseline studies. 18 – 21 January 2016. 15 bat detector units.	Analysis by Bat Call WA. A suspected PLNB maternal roost found 3.5 km north of Pilbara Minerals tenement in an historical underground mine close to the Turner River East branch. An estimate of the number of PLNB at the roost based on ultrasonic calls and video counts ranged between 25 – 50. Maternal roost inferred due to survey timing coinciding with breeding period.
APM (2022a)	Targeted Fauna survey. Lynas Find deposit. 8 – 24 August 2022 Four bat detector units, 51 nights. Habitat mapping. Analysis by Specialised Zoological.	Five call sequences of the PLNB were detected. All call sequences were recorded well after sunset and therefore when the individual was out foraging away from their diurnal roost. Foraging habitat is present but no roosting habitat is present.
APM (2022b)	Fauna Habitat mapping TSF Options 2 and 5. 4 – 21 October 2022 Four bat detector units, 59 nights.	Analysis by Specialised Zoological. No call sequences of CS bat species were detected. Foraging habitat is present, but no roosting habitat is present.
APM (2023a)	Pilgangoora and surrounds. Targeted search. 4 July 2022 - 12 March 2023. Foot traverses, camera traps.	Habitat features assessed using published roost criteria. Cameras returned one capture of a Ghost Bat.
APM (2023b)	Targeted Fauna survey. E45/2287 Infill area. 9 – 30 March 2023. Three bat detector units, 27 nights. Habitat mapping.	Analysis by Specialised Zoological. The detection of a single short echolocation call sequence of PLNB away from areas of suitable roosting habitat is indicative of an individual foraging away from a diurnal roost. Foraging habitat is present, but no roosting habitat is present.
APM (in prep.)	Targeted Fauna survey. NVCP application. July 2023 Bat detector units. Habitat mapping.	Acoustic analysis and bat call identification in preparation. Foraging habitat is present, but no roosting habitat is present.

4.1 PILBARA LEAF-NOSED BAT

Locations where PLNB have been detected using acoustic survey are listed in Table 4-2 and the locations shown in Figure 4-1.

Table 4-2. PLNB acoustic survey records

Code	Date range	Location (GDA 2020 Zone 50)		Number of calls
PM02a	12th to 16th October 2015	700936	7660612	5
PM13a	12th to 16th October 2015	696035	7671812	5
PM16a	12th to 16th October 2015	702811	7662378	3
PM18a	12th to 16th October 2015	696150	7665426	1
PM20a	12th to 16th October 2015	698979	7667053	1
PM21a	12th to 16th October 2015	700105	7659956	6
PM23a	12th to 16th October 2015	696932	7669589	9
PM24a	12th to 16th October 2015	696627	7668385	3
PM01a	12th to 16th October 2015	703764	7665772	10
PM11a	12th to 16th October 2015	698150	7670897	19
PM14a	12th to 16th October 2015	701079	7664547	27
PM15a	12th to 16th October 2015	699717	7665413	62
PM17a	12th to 16th October 2015	697907	7662891	18
PM19a	12th to 16th October 2015	696135	7668115	91
PM22a	12th to 16th October 2015	696505	7658657	60
PM08a	12th to 16th October 2015	699206	7669281	3
PM09a	12th to 16th October 2015	701386	7676751	42
PM25	18th to 21st January 2016	701510	7676920	5
PM28	18th to 21st January 2016	701060	7678927	1
PM29	18th to 21st January 2016	700473	7679332	1
PM30	18th to 21st January 2016	700585	7678262	50 to 400 calls per night
PM09	18th to 21st January 2016	701386	7676751	63
AS642029	15/08/2022	700056	7675138	2
AS45007	14/08/2022	699390	7675154	2

AS450085	21/08/2022	698267	7674860	1
AS45007	29/03/2023	697548	7673951	1

Roosts suitable for PLNB are listed in Table 4-3 and the locations are shown in Figure 4-1.

Table 4-3. PLNB roosts

Feature	Roost Type	Location (GDA 2020 Zone 50)	
East Turner River Roost (ETRR)	Maternal Roost (360 Environmental 2016)	700585	7678262
Nickos Gorge Pool Site	Dry Season Roost (360 Environmental 2016)	702833	7652585
Lalla Rookh Mine Shaft	Dry Season Roost (360 Environmental 2016)	736509	7670522
Wodgina mine area	Dry Season Roost (360 Environmental 2016)	672951	7655989
Feature C16iv	Nocturnal refuge (APM 2023a)	696636	7665892
Feature C11iii	Nocturnal refuge (APM 2023a)	697341	7664817
Feature C7iii	Nocturnal refuge (APM 2023a)	697344	7664828
Feature C16iii	Nocturnal refuge (APM 2023a)	697361	7664830
Feature C11i	Nocturnal refuge (APM 2023a)	698072	7669111
Feature C6i	Nocturnal refuge (APM 2023a)	698091	7669145
Feature C12i	Nocturnal refuge (APM 2023a)	698206	7670044
Feature C6	Nocturnal refuge (APM 2023a)	698812	7677289
Feature C11iv	Nocturnal refuge (APM 2023a)	700475	7673293
Feature C5	Nocturnal refuge (APM 2023a)	700657	7676605
Feature C7iv	Potential to be a non-permanent breeding roost, Transitory diurnal roost or Nocturnal refuge (APM 2023a)	699842	7671103
Feature C18iv	Potential to be a Transitory diurnal roost or Nocturnal refuge (APM 2023a)	700459	7673365

Foraging habitat suitable for PLNB is listed in Table 4-4 with the distribution shown in Figure 4-1.

Table 4-4. PLNB Foraging habitat classes

Priority	Type	Area (ha)*
1	Gorges with pools	12
2	Gullies	36
3	Rocky outcrop	18
4	Major watercourses	302
5	Open grassland and woodland	3002
D	Disturbed	1175†

* Areas calculated from baseline vegetation surveys conducted for Pilbara Minerals between 2016 and 2023. Some overlaps occur and areas are approximate only.
† Area obtained from PLS disturbance register, current at February 2023

Habitat features of highest conservation priority for the PLNB near the Pilgangoora project are:

- The maternal roost identified and described by 360 Environmental (2016), named East Turner River Roost. This roost was inferred to be utilised for breeding due to the observation of habitation occurring during the breeding season. The diurnal occupancy was established using acoustic and video recordings of bats entering and exiting the entrance. At the time of survey in 2016 the roost was confirmed to be providing shelter to between 25 and 50 individuals.
- Disused mine pits with permanent surface water. A high concentration of acoustic recordings at pit lakes indicates the constructed features offer high quality foraging habitat.
- Rocky gullies that are Priority 2 for conservation of foraging habitat.

694000 695000 696000 697000 698000 699000 700000

7678000 7677000 7676000 7675000 7674000 7673000 7672000 7671000 7670000 7669000 7668000 7667000 7666000 7665000 7664000

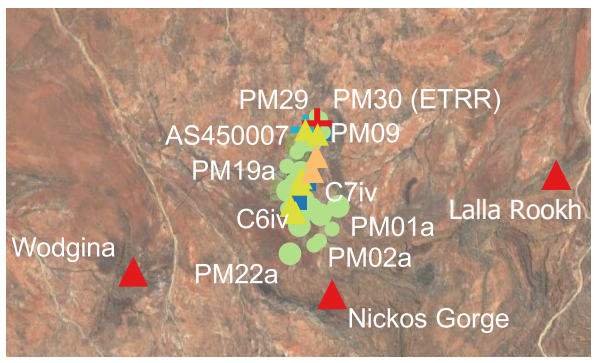
PM30 (ETRR)
C6
C5
AS450007
AS642029
AS450085
C18iv
C11iv
PM13a
C7iv
PM11a
C12i
PM23a
PM08a
C11i
C6i
PM24a
PM19a
PM20a
C6iv
C16iv
PM18a
PM15a
C11iii
C16iii
C7iii

Legend

- Dry Season Roost Confirmed
- Maternal Roost (Priority 1 or 2)
- Potential Diurnal Roost (TBC)
- Nocturnal refuge (Priority 4)
- Acoustic record 10-100 calls
- Acoustic record 1-10 calls

Foraging Habitat

- Gorges with pools (Priority 1)
- Gullies (Priority 2)
- Rocky outcrop (Priortiy 3)
- Major watercourses (Priority 4)
- Open grassland and woodland (Priority 5)
- Disturbed



Local Dry Season Roost Locations

0 20 40 km

Scale: @ A3
1: 40,000

0 500 1,000 m

Coordinate System: GDA 2020 MGA Zone 50
Projection: Transverse Mercator

Animal Plant Mineral Pty Ltd

Author: EH Approved: ML Date: 04/09/2023

Pilbara Leaf-nosed Bat records and habitat

Prepared for:

Pilbara Minerals

Figure 4 - 1

4.2 GHOST BAT

No Ghost Bats have been recorded during acoustic surveys however, acoustic recorders are not suited to Ghost Bat detection during foraging as the species seldom uses echolocation away from caves (Bullen 2021).

A Ghost Bat was captured on camera on the 27 October 2022 at habitat feature C6 (APM 2023a), approximately 2.4 km north of the current active mining operations (Figure 4-2). Habitat feature C6 is an overhang and classified as a Category 4 Roost (APM 2023a).

The Ghost Bat is listed in the PMST as known to occur within the local area and the DBCA database has 103 records for the species within a 100 km radius (Figure 4-2). Ghost bats are known to travel up to 15 km from a roost site for foraging and up to 30 km in one night to alternative roosting sites. Known permanent large roosts in the Pilbara include the Lalla Rookh abandoned mine adit approximately 40 km to the east (Figure 4-2). Ghost Bat have been confirmed to roost at Wodgina and Nickos Gorge on at least one occasion and these are likely to be Category 2 or 3 Roost sites.

The ETRR adit north of the current Pilgangoora operations has been confirmed as a maternal roost for PLNB. At the time of inspection, no Ghost Bat were present within the roost, however the cave is suitable. The PLNB often shares roosts with the Ghost Bat, and some level of mortality of PLNB from predation by Ghost Bats occurs when they are present in the same roost (Churchill 2008). It is possible that ETRR is a Category 2 or 3 Roost for Ghost Bat. Two caves were recorded by APM (2023a) that have the potential to be Category 3 Roosts, however no evidence of Ghost Bat use was recorded at the time of inspection in late 2022/early 2023. Ten Category 4 Roosts were recorded by APM (2023a), these being roosts that may be utilised during foraging activities, but not for diurnal purposes, and are not considered critical habitat.

Ghost Bat foraging habitat has not been prioritised for conservation purposes and all undisturbed habitats within and surrounding the Pilgangoora Project have the potential to offer some value for foraging animals in the locality.

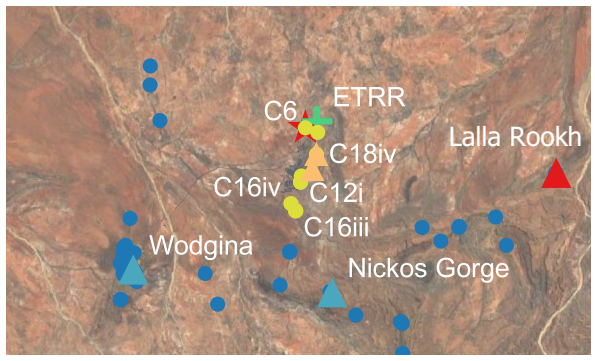
694000 695000 696000 697000 698000 699000 700000

7678000 7677000 7676000 7675000 7674000 7673000 7672000 7671000 7670000 7669000 7668000 7667000 7666000 7665000 7664000

ETRR
C6
C5
C18iv
C11iv
C7iv
C12i
C11i
C6i
C16iv
C11iii
C16iii
C7iii

Legend

- Ghost Bat camera capture
- Category 1 Roost
- Category 2 or 3 Roost
- Potential Category 2 or 3 Roost
- Potential Category 3 Roost
- Category 4 Roost
- DBCA Database Records
- Pilgangoora Project disturbance_footprint_feb_2023



Local Dry Season Roost Locations

0 20 40 km

Scale: @ A3
1: 40,000

0 500 1,000 m

Coordinate System: GDA 2020 MGA Zone 50
Projection: Transverse Mercator

Animal Plant Mineral Pty Ltd

Author: EH Approved: ML Date: 04/09/2023

Ghost Bat records and habitat

Prepared for:

Pilbara Minerals

Figure 4 - 2

5 ENVIRONMENTAL IMPACTS AND MANAGEMENT

A risk assessment has been undertaken to identify all potential impacts of the Pilgangoora Project on the local conservation significant bat population (Table 5-4). This has involved the identification of activities that can result in impacts to the CS bats, implementing controls to reduce the risk, and monitoring the effectiveness of controls.

The risk assessment has identified the potential and realised risks to the CS bats abundance health and habitat and from these, an inherent risk (before the implementation of controls) and residual risk (after implementation of controls) have been determined. Management measures have been proposed to reduce the risk to a level based on 'As Low As Reasonably Possible' principles.

The risk matrix ranking is provided in Table 5-1, whilst the categories used to determine the likelihood and consequence are provided in Table 5-2 and Table 5-3.

Table 5-1: Risk Matrix Rating

		Consequences				
		Insignificant	Minor	Moderate	Major	Severe
Likelihood	Rare	Low	Low	Low	Moderate	Moderate
	Unlikely	Low	Low	Moderate	Moderate	High
	Possible	Low	Moderate	Moderate	High	High
	Likely	Moderate	Moderate	High	Extreme	Extreme
	Almost Certain	Moderate	High	High	Extreme	Extreme

Table 5-2: Risk Matrix Likelihood

Likelihood	Frequency	Description
Almost Certain	Twice or more per year	Event will occur during the Project or period under review
		High number of known incidents
Likely	Once per year	Event likely to occur during the Project or period under review.
		Regular incidents known.
Possible	Once in 5 years	Event may occur in some instances during the Project or period under review.
		Occasional incidents known.
Unlikely	Once in 10 years	Event is not likely to occur during the Project or period under review.
		Some occurrences known
Rare	Once in 20+ years	Event will occur in exceptional circumstances during the Project or period under review.
		Very few or no known occurrences

Table 5-3: Risk Matrix Consequence

Consequence ranking	Definition
Insignificant	Alteration or disturbance to an isolated area with no effect on CS bat habitat or ecosystem. No loss of CS bat individuals.
Minor	Alteration or disturbance to <10% of CS bat habitat or ecosystem resulting in impact recovery within 2 years. Loss of CS bat individuals.
Moderate	Alteration or disturbance to 10-40 % of a habitat or ecosystem resulting in a recoverable impact within 2-5 years. Decrease of up to 50% CS bat species level of activity and presence within Pilgangoora local area.
Major	Alteration or disturbance to 40- 70 % of a habitat or ecosystem resulting in a recoverable impact within 5-15 years. Decrease of up to 80% CS bat species level of activity and presence within Pilgangoora local area.
Severe	Alteration or disturbance to >70 % of a habitat or ecosystem resulting in a recoverable impact within >15 years. Decrease of up to >80% CS bat species level of activity and presence within Pilgangoora local area.

Table 5-4: Risk Assessment

Risk Pathway	Description of Impact (Unwanted Event) and relevant information	Likelihood	Consequence	Risk	Controls / Treatment	Likelihood	Consequence	Risk
Vegetation clearing and land disturbance of foraging and dispersal habitat	Decrease in CS bat species level of activity and presence due to reduced food resources – foraging habitat within Project area is of low to moderate value for foraging for CS Bat species.	Possible	Moderate	Moderate	Disturbance to native vegetation will be minimise where practicable A Native Vegetation Clearing Permit (NVCP) will be obtained from DMIRS prior to clearing (if required) Staged clearing An internal LUC will be obtained prior to ground disturbance No unauthorised off-track driving to occur Conduct progressive rehabilitation using local provenance seed to minimise the time between disturbance and rehabilitation	Unlikely	Moderate	Moderate
Vegetation clearing and land disturbance Vehicle movements Human and mine site activities	Introduction or spread of weed species resulting in: • an increase of the susceptibility of vegetation to fire and an increase in the intensity of fire. • degradation of CS bat foraging habitat.	Possible	Moderate	Moderate	Firebreaks will surround all project infrastructure Roads and haul roads will act as fire breaks No unauthorised vehicle or human access to exclusion areas or off main mine access roads All vehicles will be clean or vegetation or soil material prior to mobilisation to site Existing weed species and infestations within operational mining areas will be managed Wash down bays will be installed for vehicles required to go off main mine roads (*e.g.* for environmental monitoring, exploration *etc.*) Monitoring of introduced flora will be conducted annually	Unlikely	Moderate	Moderate
Vehicle movement and human activities increasing the risk of fire ignition	Ignition of fires resulting in habitat loss and CS bat individual deaths Reduction of population size	Possible	Moderate	Moderate	Fire breaks of 5 m will surround project infrastructure Inductions will include fire safety and awareness, including not stopping hot vehicles over dry grass Roads and haul roads will act as fire breaks Fire fighting equipment (*e.g.* extinguishers, fire blankets) will be located across site in fire risk areas including workshops, hydrocarbon and chemical storage areas, offices, camp site, mobile and fixed plant areas *etc.* All light vehicles will be fitted with firefighting equipment Fire suppression equipment will be made available for all hot works Hot work permits must be obtained prior to conducting work Specific personnel will be trained in the use of fire extinguishing equipment and fire prevention measures in work areas An emergency response team will be available to respond to fire where it is safe to do so	Unlikely	Moderate	Moderate
Domestic waste, mine site water sources and human activities attracting feral fauna.	Degradation of foraging habitat. Decrease in CS bat species level of activity and presence due to increased predation or competition for resources, disease transmission, poisoning from ingestion of cane toads.	Possible	Minor	Moderate	Inductions and training will address feeding of native fauna Reporting of bat sightings by mine site personnel Rubbish bins with lids located around site Educational fauna signage in crib rooms and high traffic areas Lined dams fenced with fauna egress points	Unlikely	Minor	Low
Mine site noise	Reduction of habitat utilisation and corresponding reduction of CS bat species level of activity and presence.	Unlikely	Moderate	Moderate	All plant and equipment designs will meet occupational noise standards	Rare	Moderate	Low

Risk Pathway	Description of Impact (Unwanted Event) and relevant information	Likelihood	Consequence	Risk	Controls / Treatment	Likelihood	Consequence	Risk
Generation of dust from mine activities	Habitat degradation resulting in reduced use of foraging habitat, as measured by CS bat species level of activity and presence.	Possible	Minor	Moderate	Use of water carts along roads and cleared areas to minimise dust generation Staged clearing Use of engineering controls to minimise dust Use of sprinklers and deluge sprays where required Vehicle speeds restricted on cleared tracks to minimise the generation of dust	Unlikely	Minor	Low
Insufficient recording and reporting leading to lack of data on CS bats	Impacts to CS bat species going unnoticed Reduction in CS bat species level of activity and presence in the Pilgangoora area	Unlikely	Moderate	Moderate	Monitoring to identify presence of CS bat species	Rare	Moderate	Low
Vehicle movement and collision with CS bats	Mortality to individuals through road kills	Possible	Moderate	Moderate	Vehicle speed will be restricted to 60 km/hr Records of vehicle incidents involving fauna will be recorded	Unlikely	Moderate	Moderate
Barbed wire fences and collisions by CS bats	Mortality to individuals through collision with barbed wire fencing	Possible	Moderate	Moderate	Minimise use of barbed wire fencing, where practicable. Investigate potential for different fencing designs to minimise risks to CS bats. Liaise with pastoralist regarding alternatives, where required.	Rare	Insignificant	Low

6 MANAGEMENT APPROACH

Management provisions to avoid, minimise and mitigate risks are outlined in Table 6-1. Management provisions are applied in a hierarchical order:

1. Avoid impacts – preserve populations and habitat to avoid further loss.

2. Mitigate impacts – prevent habitat degradation and retain habitat function.

3. Monitor effectiveness of mitigation – ensure mitigation is effective and feeds back into an adaptive management plan.

Table 6-1: CS Management Plan provisions

Factor	Terrestrial Fauna		
Objective	Avoid the direct and indirect impacts to CS bat species from the Pilgangoora Project where possible Where not possible to avoid, minimise impacts and implement mitigation strategies. Monitor the effectiveness of mitigation strategies		
Key environmental values	CS bat species and their habitat (foraging)		
Key impacts	Loss of CS bat species habitat and/or injury to or loss of individual bats		
Key risks	Destruction of foraging habitat Direct and indirect impacts to foraging habitat		
Management targets	Management actions	Monitoring	Reporting
Minimise impacts of mine activities on CS bat habitat	Disturbance to native vegetation will be minimised. A Native Vegetation Clearing Permit from Regulators will be obtained prior to clearing. An internal Land Use Certificate will be obtained prior to ground disturbance. No unauthorised off-track driving to occur. Demarcation of approved clearing areas. Conduct progressive rehabilitation where possible, using local provenance seed.	Inspections following clearing and ground disturbance. Annual audits / inspections to check habitat areas and disturbance areas.	Regulator reporting as required by approvals. Reporting under Ground Disturbance Permit system for completion of clearing. Internal reporting of incidents. Reporting of any incidents to appropriate Regulator as required.
Minimise impacts of mine activities on CS bat foraging habitat from weeds.	No unauthorised vehicle or human access to exclusion areas or off main mine access roads. All vehicles will be clean of vegetation or soil material prior to mobilisation to site. Existing weed species and infestations within operational mining areas will be managed. Wash down bays will be installed for vehicles required to go off main mine roads (*e.g.*, for environmental monitoring, exploration *etc.*). Monitoring of introduced flora will be conducted annually.	Site weed inspections to check for new infestations. Annual weed assessments and mapping.	Regulator reporting as required by approvals. Records kept of all infestations and weed species. Records kept of weed management and techniques used.

Management targets	Management actions	Monitoring	Reporting
Minimise impacts of mine activities on CS bat foraging habitat and CS bat species level of activity and presence from human-induced fire.	Fire breaks of 5 m will surround project infrastructure. Inductions will include fire safety and awareness, including not stopping hot vehicles over dry grass. Roads and haul roads will act as fire breaks. Firefighting equipment (*e.g.* extinguishers, fire blankets) will be located across site in fire risk areas including workshops, hydrocarbon and chemical storage areas, offices, camp site, mobile and fixed plant areas *etc.* All light vehicles will be fitted with firefighting equipment. Fire suppression equipment will be made available for all hot works. Hot work permits must be obtained prior to conducting work. Specific personnel will be trained in the use of fire extinguishing equipment and fire prevention measures in work areas. An emergency response team will be available to respond to fire where it is safe to do so.	Regular audits of all high-risk areas, vehicles *etc.* to check for firefighting equipment. Regular inspections of fire breaks. Audits of hot works to ensure appropriate controls are being implemented to prevent fire ignition.	Regulator reporting as required by approvals. Reporting of incidents.
Minimise impacts of mine activities on CS bat species level of activity and presence from vehicle collision.	Vehicle speed restrictions of 60 km/hr will apply. Roadkill will be moved off road to discourage scavenging and further strikes. Records of vehicle incidents involving fauna will be recorded.	Monitoring of vehicle speeds.	Records kept of incidents. Regulator reporting as required by approvals or legislation.
Minimise impacts of mine activities on CS bat habitat and CS bat species level of activity and presence from noise and dust.	All plant and equipment design will meet occupational noise standards. Dust generation from project activities will be minimised by engineering controls and use of dust suppression measures, such as water trucks, sprinklers, and deluge sprays. Vehicle speeds will be restricted on cleared tracks to minimise the generation of dust.	Noise monitoring. Dust monitoring.	Records kept of incidents. Regulator reporting as required by approvals or legislation.

7 MONITORING PROGRAM

7.1 ENVIRONMENTAL OBJECTIVE

A monitoring program for CS bat species will be conducted to investigate their long-term presence in the Project area.

The program's Environmental Objective is to ensure the continued use of habitats by CS bat species within the Pilgangoora Project area.

The Key Questions to be addressed for each CS bat species are:

1. Is there a detectable significant decrease in the use of the Project area by the PLNB during the life of the Project?
2. Does the Ghost Bat continue to use the project area during the life of the Project?

Baseline surveys established where CS bat species are most likely to be observed, the habitats available in the Project area and their relative level of use. This information has informed the design of this monitoring program.

When interpreting the measured outcomes from this monitoring program and how they address the stated Environmental Objective and Key Questions, it is important to make these interpretations given relevant considerations of context, and to be clear about the meaning of certain words—so that a common understanding of whether the outcomes address the questions directly, and whether interpretations are reasonable.

Relevant considerations of context include:

1. Despite extensive search effort, baseline field surveys (APM 2022, 2023) have determined that diurnal roost sites of the PLNB, of any category as defined by the TSSC (2016), are not present within the Pilgangoora Project area, with confirmed and potential diurnal roost sites at least 1.5 km from current operations.

2. There are several confirmed diurnal roost sites in the wider area that are within the project areas of other resources companies (especially in hilly areas to the east), and any effects from either natural or anthropogenic factors that affect colony sizes at those roosts might have a measurable effect on the presence and activity of CS bat species that use the Pilgangoora Project area for foraging.

3. The number of acoustic-based detections recorded during baseline surveys (APM 2022, 2023) was relatively small (total 6 echolocation sequences from 4 recording sites across a total of 137 recording nights between August 2022 and March 2023). Likewise, a single detection by camera trap of a Ghost Bat at Cave C6 (adjacent to the Project area) was made during this same survey period. The implication is that the sensitivity of measures of activity and presence will be relatively low because the variation due to the chance of detection might mask any pattern that derives from mining-related activity in the Pilgangoora Project area.

Definitions of words and terms in the Key Questions and Performance Indicator (Table 7-1) are:

level of activity: the monitoring program will not make any estimate of the abundance of CS bat species, but it can use the number of echolocation calls (see *measures of bat presence*) as an index or measure of use of available habitats by foraging PLNB; and likewise, the number of nights of detection of the Ghost Bat at Cave C6.

measures of bat presence: for the PLNB, measured by the number of discrete echolocation sequences, number of recognised pulses, or number of sound files of a standardised duration that contain at least one echolocation pulse of the target species, whichever is chosen; and number of nights of detection of the Ghost Bat at Cave C6 from video and acoustic detectors, and using acoustic lures.

significant decrease (change): a decrease in measures of bat presence that meet the criterion described for the 'trigger' (see section *7.5.1 Performance Indicator*) but bearing in mind that this level of change might not be directly comparable with patterns in areas where greater numbers of bats are present.

use: in this Project area, the PLNB is present because it forages in the available habitats; and the Ghost Bat is present because it can visit (though not necessarily roost during the day) in Cave C6 during the night.

7.2 MONITORING PROGRAM DESIGN

The following publications and guidelines have been applied to the monitoring program:

- A review of PLNB ecology, threats and survey requirements, Prepared for the Department of Agriculture, Water and Environment (Bullen 2021)
- Survey guidelines for Australia's threatened bats, EPBC Survey Guideline (DEWHA, 2010); and
- Conservation Advice *Rhinonicteris aurantia* (Pilbara Form) Pilbara Leaf-nosed Bat. Threatened Species Scientific Committee (TSSC 2016).

7.3 SITE SELECTION

Monitoring sites are fixed locations that are to remain accessible throughout the life of the monitoring program. Indicative monitoring sites have been located that meet the following criteria:

- Are within existing Pilbara Minerals tenements;
- are accessible by vehicle;
- are within CS bat foraging habitat;
- are outside of areas where development is expected to occur; and
- are sites considered most likely to have visitation by the CS bat species.

No points of congregation (such as a diurnal roost or nocturnal refuge cave) have been located within the Project area during past surveys; therefore, permanent monitoring sites will be established in open habitats where bats forage, but also where they are most likely to be encountered if they are present in the Project area. The best positions for monitoring sites will be near pools or watercourses (such as McPhee Pit and Iron Stirrup) where the likelihood of encountering the species will be greatest. Indicative sites have been suggested in this management plan, which will then be subject to further initial assessment before arriving at a set of standardised sampling sites.

Figure 7-1 shows the habitats considered most likely to encounter CS bat species, within which these indicative sites will be located.

7.4 SURVEY METHODOLOGY

Monitoring will include a combination of three non-invasive methods to detect presence and levels of activity. Acoustic-based monitoring of the calls of the PLNB with bat detectors and the presence of Ghost Bats at Cave C6 can be conducted continuously on every night of the year using devices that are supported by sufficient power and solar recharge, and adequate flash memory card space. The presence of the Ghost Bat can be further investigated with an approach that relies on an acoustic lure (with a range of c. 100 m) twice yearly during visits to download the long-term monitoring equipment, and at periods of minimum (August – October) and maximum (January – March) rainfall (anytime with the stated ranges (BoM, 2023).

7.4.1 Pilbara Leaf-nosed Bat

Given the relatively low encounter rate of this species in the Project area to date, it is recommended that sampling be extended to include all nights of the year. This need not increase the effort for field investigators because sampling hardware can be deployed to record data unattended over the long term. (*e.g.*, with the Titley Scientific Anabat Swift that has a quality microphone, geolocated recordings, capacity for two 1 TB sounds, and capability to run from an external battery). Bat detectors will be installed at sites with a solar panel to recharge an external battery and 2 TB of on-board memory. The memory cards can be changed out for analysis of accumulated recordings two or three times per year during visits for other components of the monitoring program by either consultants or PLS environmental staff.

Bat detectors will be deployed to quantify the level of CS bat activity at five indicative sites. These will be located within the habitats identified in Figure 7-1. The PLNB is most often encountered at caves and overhangs (some being either diurnal roost sites or nocturnal refuges) or otherwise around rocky outcrop at the top of mesa hills, in watercourses and gullies within gorges, and around pools. The highest priority for the establishment of standardised sampling sites will be at Cave C6 that is known to be used by the Ghost Bat and might also be visited by the PLNB, and sites where open water (pools) is available for long periods or permanently.

Standardised recordings settings on the bat detectors will include a sampling rate of 320 kHz (sufficient for the PLNB while minimising flash memory requirements), making nightly recordings between sunset and sunrise, a triggered start to recordings using factory default settings, and a recording duration of two seconds as standard.

Bat echolocation calls recorded by the units will be analysed by an experienced analyst using a standardised system that has been applied in numerous other Pilbara studies and presented as daily summaries of activity (measured by the number of discrete sequences, number of recognised pulses, or number of sound files of a standardised duration that contain at least one echolocation pulse of the target species, whichever is chosen).

7.4.2 Ghost Bats

The presence/absence of Ghost Bats will be monitored with three methods:

1. With a camera trap set to take periodic still images at Cave C6 on every night throughout the year;
2. By analysing bat detector recordings made on a long-term deployment at Cave C6;
3. With an acoustic lure set-up on biannual surveys.

During baseline surveys, an individual Ghost Bat was photographed by a camera trap on one night in October 2022. A similar approach using a camera trap (*e.g.*, a quality Reconyx model) will be taken, with the camera set to take a still image in black and white with an infrared flash (to reduce the likelihood of disturbance) every 30 minutes. The camera trap will have sufficient power and flash memory to last for four to six months and will be downloaded and checked during visits for other components of the monitoring program by either consultants or environmental staff of the proponent.

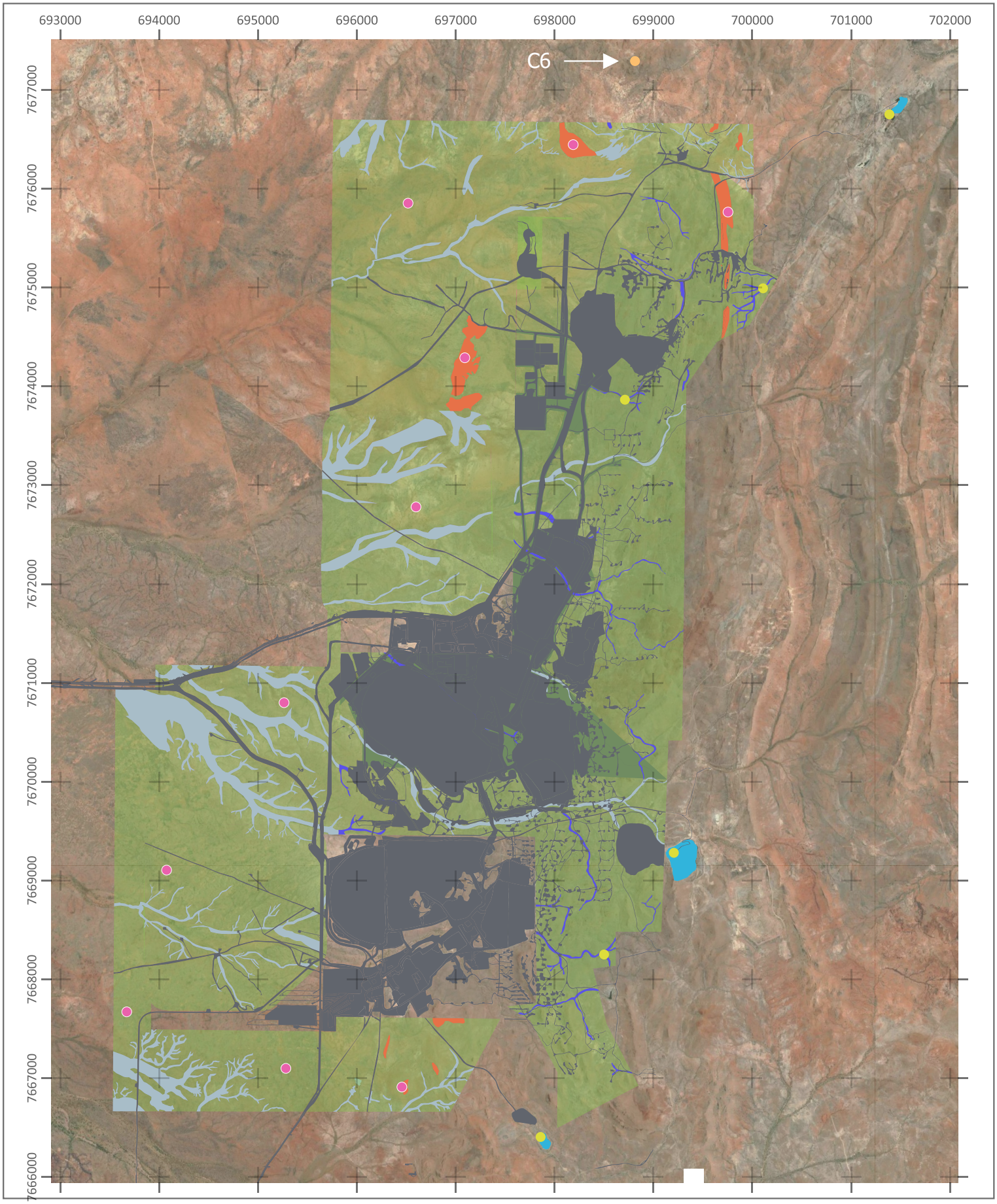
The most reliable way of detecting the Ghost Bat with bat detectors is to place the equipment with the microphone facing into a potential cave roosting site. The echolocation calls of this species are of low amplitude, and therefore most detectable when a Ghost Bat flies close to the bat detector as it exits the underground structure. One of the PLNB monitoring sites will be established at Cave C6. The recordings from this bat detector will also be analysed for echolocation and social calls of the Ghost Bat. Outputs will be presence/absence per night, and time of first and last detection relative to sunset and sunrise.

Ghost Bats can be detected while they are foraging in open habitats away from roosts and rocky areas using an acoustic lure (Hanrahan *et al.* 2023 in press)—a combination of infrared video-capable camera traps (must be able to record video snippets continuously and automatically), an infrared spotlight and portable speakers to broadcast Ghost Bat social calls. The speaker is set on a dropper c. 1 m above the ground, and the camera trap and infrared spotlight face the speaker from c. 10 m away. A bat detector can also be placed next to the speaker to record any echolocation calls from visiting Ghost Bats (social calls will not be distinguishable) or other species of bat, especially the PLNB (this species will also approach lures broadcasting Ghost Bat social calls; K.N. Armstrong pers. comm.). Continuous video recordings are made for at least three hours from sunset. Ghost Bats can be identified with high reliability when they approach the speaker, primarily by the eyeshine from their large eyes, but also morphological characteristics such as their overall size, large ears and lack of tail.

Acoustic lures will be deployed at 10 sites across the Project area over a period of several days during the two site visits (January – March; August – October) where the bat detectors are checked and have data retrieved. Figure 7-1 shows the habitats within which monitoring cameras for Ghost Bats will be placed. Acoustic lures will be spread evenly throughout the Project area and across a variety of habitats during a survey, with a distance of at least 2 km between lure positions on any given night to reduce the chance that the same individual bat visits several in close proximity.

The analysis of the many gigabytes of infrared video recording is automated (removing frames with no moving objects above a certain size), and video snippets of visitations will be validated manually by an experienced analyst.

Photo monitoring points will also be established at potential perching sites (*e.g.*, Fig trees or crevices).



Author: EH Approved: ML Date: 04/09/2023

Indicative Monitoring Locations

Prepared for:

Pilbara Minerals

7-1

Scale: @ A4
1: 50,000

0 1 2 km

Coordinate System: GDA 2020 MGA Zone 52
Projection: Transverse Mercator

Animal Plant Mineral Pty Ltd

Legend

Indicative Monitoring Locations

- Ghost Bat
- PLNB
- PLNB/Ghost Bat
- disturbance_footprint_feb_2023

Habitat Types

- Permanent pools (Pit Lakes)
- Gullies
- Rocky outcrop
- Major watercourses
- Open grassland and woodland

7.5 DATA ANALYSIS

Data analysis encompasses processing steps to recognise either calls or images of the target species; and then a summarisation of the outcomes. As described above, the analysis of ultrasonic data and infrared video is possible using semi-automated but standardised processes that minimise the amount of manual validation required. Data summarisation will report the number of detections per night of sampling from acoustic recordings for the PLNB; and the number of nights where the Ghost Bat was detected using three methods of detection (images, video, acoustic recordings).

7.5.1 Performance Indicators

The Performance Indicator approach and hierarchy has been developed in accordance with guidelines by the EPA. Data collected from baseline surveys (APM 2022, 2023) and the first two years of monitoring will provide the foundation for assessment against the Performance Indicator (Table 7-1). The annual monitoring program will rely on the Performance Indicator to help establish whether there is a significant detectable change in the use of the Pilgangoora Project area by the CS bat species. The meaning of certain words and terms has been clarified in section *7.1 Environmental Objective*.

Table 7-1: Performance Indicator

Outcome	Performance Indicator	Timeframe
No detectable significant change to the level of activity or presence of CS bats in the greater Pilgangoora area.	Measures of bat presence are equivalent to the established baseline	Annual

Trigger and threshold levels will be used to determine if the management approach has been successful in minimising impacts (whether identified or not) from the project on CS bat species. Should the Performance Indicator be exceeded, then contingency responses outlined in Section 11 will be implemented.

Two levels of the Performance Indicator have been developed: 1. Trigger level; and 2. Threshold level. The trigger level helps to forewarn of the approach of the threshold level, and therefore 'trigger' the response of actions to prevent the threshold level from being reached. Exceeding the threshold level represents an unacceptable impact that requires substantive review of the CSBMP and associated procedures/management plans. Trigger and threshold levels for the Performance Indicator are listed in Table 7-2.

Table 7-2. Trigger and Threshold Levels

Outcome	Trigger	Threshold
No detectable significant change to the level of activity or presence of CS bats in the greater Pilgangoora area	Measures of bat presence and activity are significantly lower than the established baseline for two years, and the change is not attributable to climatic conditions, fire ignited from natural sources, or disturbance to diurnal roosts outside the Pilgangoora Project area that are within the influence of other mining projects.	Measures of bat presence and activity are significantly lower than the established baseline for three years.

7.5.2 Environmental and Project Management Attributes

CS bat populations may fluctuate naturally according to resource availability, therefore environmental attributes will be assessed in conjunction with CS bat monitoring results. Environmental attributes that are to be recorded from the Project to provide contextual value for interpretation of CS bat species levels of activity and presence include:

- Rainfall (preceding months to years to allow for lag in population response) – recorded at an on-site weather station; and
- Fire history (years since last fire) – recorded through the PRO-WHS-INC – Incident Management Procedure and supported by DBCA Fire History spatial layer DBCA_060.

Management actions have been designed to avoid, minimise, mitigate or manage impacts to CS bat species and their habitat. It is necessary to monitor the implementation of these actions to ensure they are effective. Project Management attributes that are to be recorded from the Project to provide contextual value for interpretation of trapping program data include:

- Roadkill records - recorded through the PIL01-PRO-0000-G-007 Fauna Management Procedure and the PRO-WHS-INC – Incident Management Procedure;
- Feral animal numbers – recorded through the PIL01-PRO-0000-G-007 Fauna Management Procedure;
- Vegetation/habitat clearing – recorded through the PIL01-PRO-0000-G-008 Ground Disturbance Permit Procedure, PRO-ENV-LAN Land Management Procedure, Land Use Certificate procedure;
- Dust levels; and
- Noise and Vibration levels.

8 CONTINGENCY ACTIONS

The Environmental Objective for the CS Bat species and the monitoring program are outlined in Section 7.1, with management targets outlined in Table 6-1. Where monitoring indicates that these objectives and targets are not being met, the actions listed in Table 8-1 will be taken. The Performance Indicator process is presented in Table 8-1.

Table 8-1: Contingency Actions

Outcome	Trigger level exceedance actions	Threshold level exceedance actions
A significant change to the level of activity or presence of CS bats in the greater Pilgangoora area is concluded	Audit CSBMP and associated procedure/management plan management actions and address any departure from conformity.	Deploy additional (at least 2x) recorders / camera traps Consult with DCCEEW and DBCA. Review the CSBMP and associated procedure/management plans

9 REPORTING

An annual report will be compiled that details the site visits, data analysis, results, match against the Performance indicator, and whether any trigger or threshold was exceeded.

After each site visit to check and download data from devices making continuous recording, and deploy the acoustic lure assessments, a short memo will be compiled to document the continued collection of data, and any issues arising.

10 ROLES AND RESPONSIBILITIES

Accountability for fulfilling the requirements of this Plan is dependent on the stage of project development (construction, operations, decommissioning).

During construction activities, the Project Manager (Construction) will be accountable for ensuring the requirements of the Plan are met, irrespective of whether construction activities are undertaken by an external service provider or internal personnel.

During operational, decommissioning and closure stages, the Registered Mine Manager is accountable for ensuring the requirements of the Plan are met.

Responsibility for specific tasks may be delegated to the Site Environment Manager or other personnel. Where responsibilities are delegated, this must be clearly recorded and communicated.

Specific tasks that are likely to be delegated are listed in Table 10-1.

Table 10-1. Roles and responsibilities

Role	Responsibilities
Construction Manager Registered Mine Manager	• Ensure overall implementation and compliance with the CS Bat Management Plan. • Communicate with the Contractor/Work Supervisor and Site Environment Manager delegated tasks of the CS Bat Management Plan. • Record delegated duties.
Contractor/Site Manager/Work Supervisor	• Ensure compliance with the CS Bat Management Plan. • Provide information for LUC applications regarding disturbance activities including start date, duration, location, description of all activities and total area of disturbance. • Provide proposed disturbance area location maps and coordinates for LUC applications. • Ensure an LUC is in place prior to conducting clearing and ground disturbance. • Implement requirements in the approved LUC. • Ensure disturbance areas do not exceed LUC boundaries. • Communicate CS Bat management requirements to applicable work crews.
Site Environment Manager	• Review borrow pit LUC applications and ensure appropriate controls are included to meet environmental requirements and approvals conditions. • Ensure disturbance activities are approved by the appropriate Regulator *e.g.* Environmental Protection Authority (EPA), Department of Climate Change, Energy, the Environment and Water (DCCEEW), Department of Water and Environmental Regulation (DWER), Department of Mines, Industry Regulation and Safety (DMIRS). • Conduct or coordinate field validation of survey and pegging of disturbance areas. • Inspect proposed disturbance area prior to clearing for significant environmental values or weed infestations. • Conduct regular inspection of work activities to ensure disturbance areas are within LUC boundaries and appropriate controls are in place.

	• Communicate and promote awareness of CS bat management with the Construction Manager, Contractor/Works Supervisor and applicable work crews. • Ensure Contractor/Operator and work crews have undertaken applicable environmental training and inductions. • Ensure CS Bats and CS bat habitat monitoring is scheduled and undertaken annually. • Ensure personnel undertaking annual monitoring have the requisite permits and animal ethics approval.
Tenure/GIS provider	• Review LUC applications for disturbance to ensure proposed excavations are within approved project boundaries • Communicate with the PLS Environmental Advisor and the Contractor/Works Supervisor to facilitate the CS Bat Management Plan • Regularly update the Ground Disturbance Register tracking total disturbance in accordance with project approvals requirements. • Ensure CS bat habitat is uploaded into GIS systems.

11 ASSOCIATED MANAGEMENT PLANS

Management of impacts to CS bat species involves management of impacts across a range of mine activities. The following PLS management plans and documents are relevant to managing impacts to CS bats:

- PIL01-PRO-0000-G-007 Fauna Management Procedure;
- PIL01-PRO-0000-G-008 Ground Disturbance Permit Procedure;
- PRO-ENV-LAN Land Management Procedure;
- PRO-WHS-INC – Incident Management Procedure;
- PIL01-PRO-0000-G-009 Spill response Procedure;
- PIL01-PRO-0000-G-010 Weed Management Procedure;
- PIL01-PRO-0000-G-011 Topsoil Management Procedure;
- PIL01-PRO-0000-G-012 Waste Management Procedure;
- Land Use Certificate Process; and
- Mine Closure Plan.

12 TRAINING AND AWARENESS

Minimising impacts to CS bat species across site will involve implementing training and education for mine site personnel and raising awareness of CS bat species and managing impacts. The following training and awareness programs will be implemented:

- Site inductions will include a fauna component, with a focus on conservation significant fauna, including CS bat species;
- Site inductions will include components on how mine site personnel can minimise impacts on fauna;
- Toolbox meetings will be utilised to undertake education and refreshers regarding fauna management and CS bat species; and
- Educational posters will be placed around crib rooms and high traffic areas to help identify conservation significant fauna. Posters will include information on how to report sightings.

13 ADAPTIVE MANAGEMENT AND REVIEW

PLS will implement an adaptive management approach for the CSBMP. The Plan will be reviewed in the following circumstances:

- Every four years; or
- In response to additional data that indicates risks have changed; or
- If ongoing monitoring indicates that thresholds have been breached and objectives are not able to be met.

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