Clearing Permit Lynas Find

Supporting Information for Native Vegetation Clearing – Permit Application

LYNAS FIND - EPBC 2023/09471

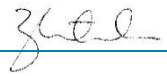
July 2025

Pilgangoora Lithium Tantalum Project

M45/1266 L45/473 L45/484 Shire of East Pilbara

PIL-REF-EN-001

VERSION CONTROL

0	For Issue	Maree Heath	E Almanza		30/7/2025
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Rev	Description	Prepared	Checked	Authorised	Date

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1 PERMIT APPLICATION DETAILS

1.1 BACKGROUND

This application refers to the clearing of native vegetation associated to the Lynas Find project (**the Proposed Action**), which is a controlled action already assessed and approve by the Department of Climate Change, Energy, the Environment and Water (**DCCEEW**) as **EPBC 2023/09471.**

Pilgangoora Operations Pty Ltd (**POPL**), is a 100% owned subsidiary of Pilbara Minerals Limited (**PLS**), that owns and operates the Pilgangoora Lithium-Tantalum Project (**Project**). The Project is located approximately 80 km south-southeast of the town of Port Hedland and 30 km north-east of the Wodgina mine, in the Shire of East Pilbara (Figure 1-1).

The Project is located within Wallareenya Station pastoral lease, an active cattle grazing property, through which unsealed roads provide access from the Great Northern Highway.

Figure 1-1 - Regional location of the Pilgangoora Lithium-Tantalum Project

1.2 PROPOSAL DETAILS AND OWNERSHIP

PLS operates the Project, located approximately 80 km SSE of Port Hedland in the Pilbara region of Western Australia. The Pilgangoora ore bodies form one of the largest hard rock lithium deposits in the world and is considered strategically important within the global lithium supply chain.

The Proposed Action is a proposed open pit mine and waste rock landform (**WRL**) located to the north of the current operations, as well as miscellaneous supporting infrastructure including transport corridors and topsoil stockpiles. Ore removed from the Lynas Find pit will be processed at the current Pilgangoora site.

Implementation of the Proposed Action will require vegetation clearing of the proposed areas, as well as removal of a portion of rocky ridge that represents fauna habitat for the Northern Quoll. The Northern Quoll is listed as Endangered under the Environmental Protection and Biodiversity Conservation Act 1999 (**EPBC Act**), and the Proposed Action was referred by the proponent on the basis of potential impacts resulting from a loss of habitat.

The Proposed Action is located within 2.2 km from the East Turner River - Birthday Gift Roost. In accordance with Batcall (2021) this roost is categorised as a level 2 but was abandoned somewhere between 2018 and

2019. A Conservation Significant Bat Management Plan (**CSBMP**), which includes monitoring of conservation significant bats, has been developed.

The Proposed Action is located within 2.2 km from the East Turner River - Birthday Gift Roost. Although this roost is categorised as a level 1 or 2 roosts, it was found to be abandoned somewhere between 2018 and 2019.

This Native Vegetation Clearing Permit (**NVCP**) (purpose permit) application is being made for clearing to support these activities.

The project is located on Mining Tenure M45/1256.

Ownership details of M45/1256 that underlies the proposed clearing permit area has been extracted from Government of Western Australia DEMIRS Mineral Titles Online and are presented below in **Error! Reference source not found.**.

Figure 1- 2 - Ownership details of mining tenement M45/1256 and leases L45/473 and L45/484

1.3 PROPOSED CLEARING EXTENT

The application area for the purpose permit measures ~230 hectares. Within the application area, up to 87.34 hectares of vegetation is proposed for clearing, consisting of 4.62 hectares of Northern Quoll Critical Habitat, 82.72 hectares of Northern Quoll Supporting Habitat and 5.56 hectares Leaf-nosed Bat Supporting Habitat.

The project was referred to the Department of Climate Change, Energy, the Environment and Water in March 2023 and declared a controlled action under the Environment Biodiversity and Conservation Act 1999, level of assessment - Assessment on Preliminary Documentation (EPBC2023/09471)

The location of the permit application area appears as

Figure 1-3.

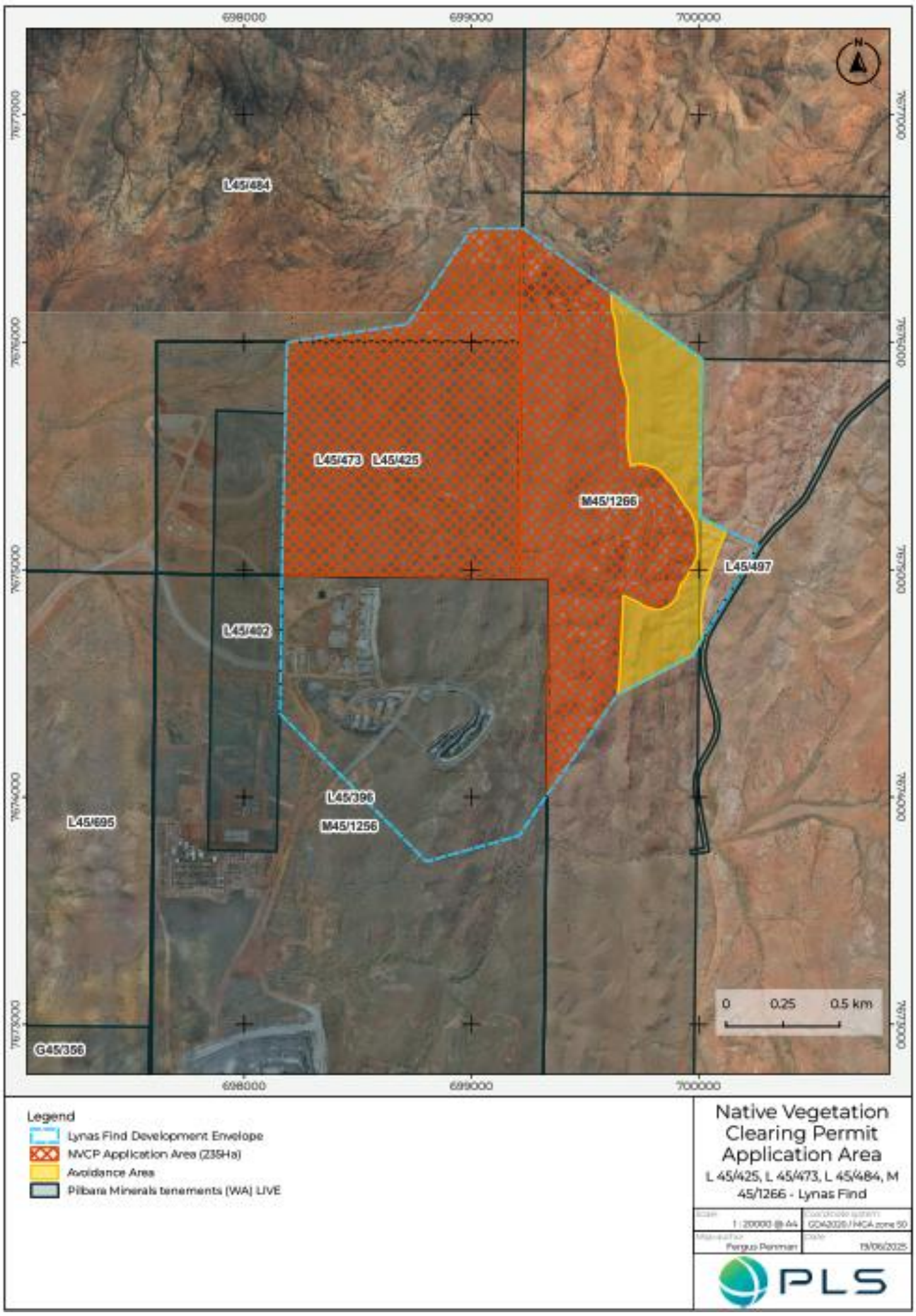

Figure 1-3 - Clearing (Purpose) Permit Application Area

1.4 ALTERNATIVES CONSIDERED/ ACTIONS TO MINIMISE CLEARING AND IMPACTS

1.4.1 ALTERNATIVES

A range of alternative options were investigated to understand the environmental sensitivities of the project application area, whilst supporting mining infrastructure. The alternatives considered are outlined below:

- Investigation of alternative locations for the mine pit
  - The location of the project is based on the mineralisation of ore. This means that the location of the pit is fixed.
  - The location of the WRL was originally planned to be located to the south of the pit to reduce haulage distance from the existing Pilgangoora operations. However, following the outcome of the fauna studies, the WRL was relocated away from Northern Quoll habitat. The new location of the WRL avoids Northern Quoll denning habitat and is not located adjacent to any creeks or waterways. This location was chosen to minimise the environmental impact on the landform.
- Tenement conditions and constraints
  - The tenure was specifically sought to enable the development of a mine pit and waste rock dump.
- The option of not applying for a Native Vegetation Clearing permit
  - It was identified as a risk to business continuity and ability to support operations if a new native vegetation clearing permit was not applied for. As future mining of the project is vital for the future operation of Pilgangoora.

1.4.2 ACTIONS TO MINIMISE CLEARING

A thorough environmental assessment has been completed over the permit application area. The application area has been designed to avoid and minimise areas identified as critical habitat for conservation significant fauna for the northern quoll, and limit impacts on surrounding habitats and vegetation.

Actions to minimise impacts are outlined below.

- Vegetation clearing protocols and the potential impacts of unauthorised clearing are included in the site induction.
- A Land Use Certificate system is in place and requires sign off by the Site Environmental Advisor prior to clearing being undertaken.
- Survey control will be utilised to set out the limits of areas to be cleared using survey pegs and flagging tape.
- All site personnel will be made aware of the vegetation clearing procedure and permitting requirements.
- All topsoil stripped will be retained for use in rehabilitation activities.
- Progressively rehabilitate areas no longer required as soon as practicable.
- Where seed is required, only native plant species of local provenance will be used.
- To assist with ongoing review of the rehabilitation and impact assessment and environmental management at the site, the proponent will submit an annual environmental report to DEMIRS as required by tenement conditions.

2 EXISTING ENVIRONMENT

2.1 REGIONAL SETTINGS

The topography of the general area features a ridgeline to the east of the permit application area, with generally flat land surrounding this topographic feature. The area of the open pit features a crest of approximately 230 m AHD. The crest is associated with a ridgeline running in the north-south direction. Elevation decreases either side of the ridgeline with the WRL occurring on land with a current elevation of approximately 200 m AHD, declining further to the west.

2.2 CLIMATE

The Pilbara has very hot summers, mild winters, and low and variable rainfall. It is classified as hot desert in northern and inland areas and hot grasslands in the north-west. The climate of the Chichester subregion of the Pilbara is described as semi-desert-tropical, receiving 300 millimetres (mm) of rainfall annually (Kendrick and McKenzie, 2001).

The nearest Bureau of Meteorology (BoM) weather station with a long historical record is at Port Hedland Airport (BoM Site Number: 004032), approximately 75 km northeast of the Survey Area. Port Hedland Airport has recorded rainfall from 1942 (80 years), and temperature from 1948 (74 years). The average climate data recorded for the region over these periods is shown in Figure 2 - 1. Monthly mean maximum temperature ranges from 36.8°C in March and December to 27.4°C in July. Monthly mean rainfall ranges from 89.3 mm in February to 0.9 mm in October, with a mean annual rainfall of 318.5 mm (BoM 2023).

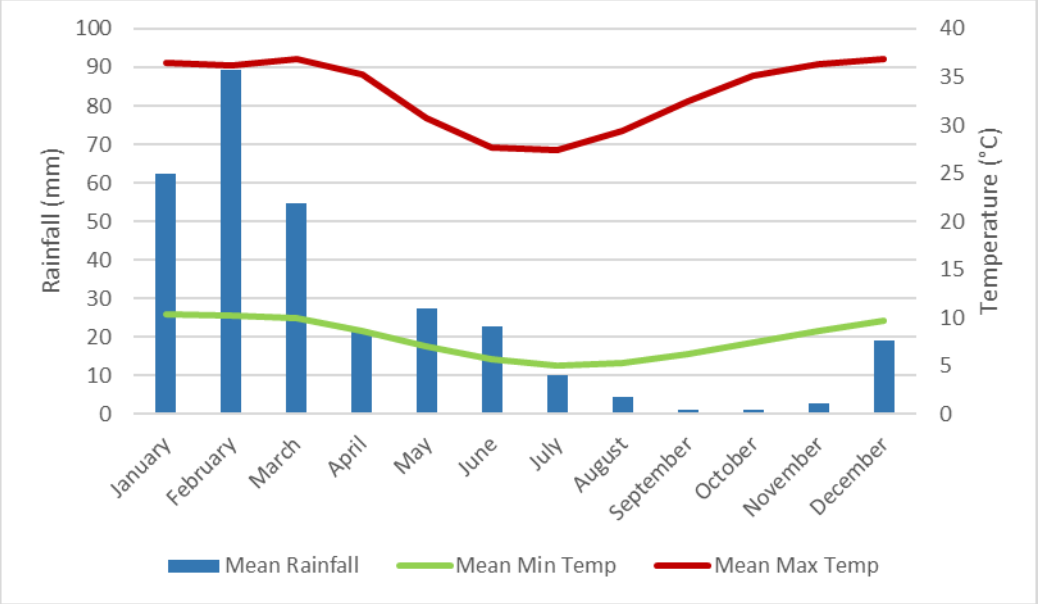

Figure 2 - 1 - Temperature and rainfall averages for Port Hedland Airport weather station (No. 004032) (BOM 2023)

2.3 BIOGEOGRAPHIC REGIONALISATION

The Interim Biogeographic Regionalisation for Australia (IBRA, version 7) classifies the Australian continent into regions (bioregions) of similar geology, landform, vegetation, fauna, and climate characteristics (Thackway and Cresswell 1995). The mapping completed by Beard (1975) provides the basis for the IBRA bioregions. IBRA mapping (Version 7), places the Project within the Pilbara Bioregion.

The Pilbara Bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses.

The Pilbara Bioregion is further subdivided into the Chichester (PIL1), Fortescue (PIL2), Hamersley (PIL3) and Roebourne (PIL4) Sub-regions. The Project lies entirely within the Chichester Sub-region of the Pilbara Bioregion.

The Chichester Sub-region comprises the northern section of the Pilbara Craton and is comprised of undulating Archaean granite and basalt plains and includes significant areas of basaltic ranges. Plains support a shrub steppe characterised by Acacia inaequilatera over Triodia wiseana hummock grasslands, while Eucalyptus leucophloia tree steppes occur on ranges (Kendrick and McKenzie, 2001).

2.4 LAND SYSTEMS

Land Systems of the Pilbara region are described by van Vreeswyk et al. (2004). Mapping of Land Systems is available from Department of Primary Industry and Regional Development (DPIRD, 2019a). The Survey Area falls within two soil landscape system, Macroy and Talga, as listed in 2 and illustrated in Figure 2-2.

Table 2 - Land Systems

LAND SYSTEM	GEOLOGY	DESCRIPTION
Macroy	Level to gently undulating stony and gritty surfaced plains with occasional granite tor fields and domes and closely to moderately spaced dendritic tributary drainage floors, relief up to 25 m	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands
Talga	Hill and ridge tracts of mafic and ultramafic rocks (greenstones), other metamorphics and chert, relief up to 100 m	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands

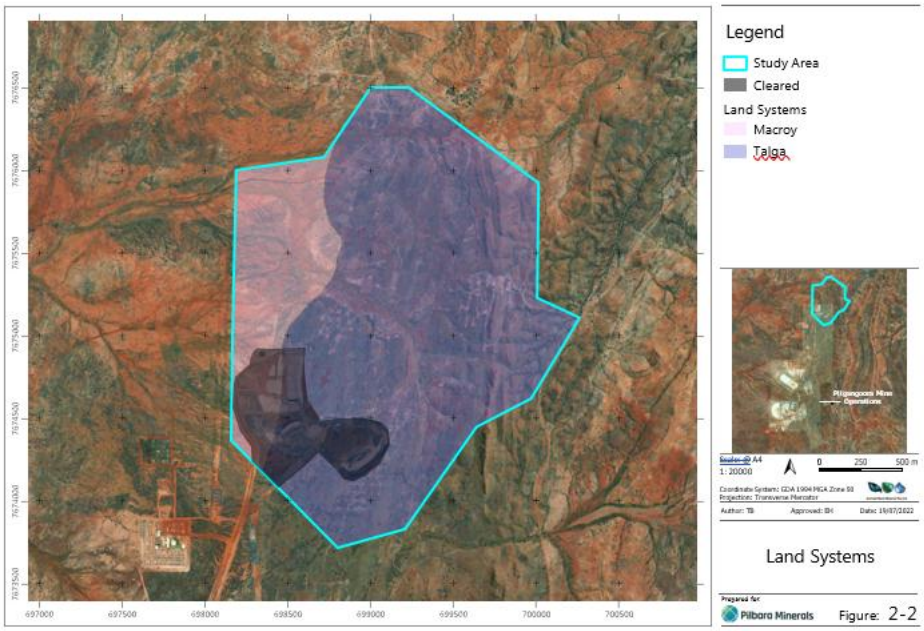

Figure 2-2 - Land System

2.5 GEOLOGY

The Pilbara 2014 Geological Information Series dataset (Geological Survey of Western Australia 2014) features a 1:100 000 scale surface geology compilation. The digital layers are based on published maps from the 1994-2005 Pilbara Craton Mapping Project, carried out by the Geological Survey of Western Australia and Geoscience Australia under the North Pilbara National Geoscience Mapping Accord. The Study Area is within the Wodgina (2655) map area and contains the following 10 geological formations:

- _A1c – Alluvial unit; Sand, silt and gravel in active drainage channels; includes clay, silt and sand in poorly defined drainage courses on floodplains; unconsolidated;
- _A2-d-k - Alluvial unit; Partly consolidated alluvial gravel, sand, and silt; local carbonate cement; dissected by present-day drainage;
- _C1 - Colluvial unit; Colluvial sand, silt and gravel in outwash fans; scree and talus; proximal mass-wasting deposits; unconsolidated;
- _C2 - Colluvial unit; Partly consolidated colluvial sand, silt and gravel in proximal outwash fans; scree and talus; dissected by present-day drainage;

- A-CLmo-jmgm-mwa - Motherin Monzogranite; Interleaved seriate to porphyritic metamonzogranite, hornblende--biotite metagranodiorite, and pegmatite; strongly foliated and banded, locally gneissic; contains greenstone enclaves and pendants;
- A-KEe-mba; Euro Basalt; Amphibolite and metabasalt; includes local metadolerite and metamorphosed komatiitic basalt; locally schistose;
- A-KEe-mbaq; Euro Basalt; Silicified amphibolite and metabasalt;
- A-KEe-mu; Euro Basalt; Metamorphosed ultramafic rock;
- A-KEe-xmws-mus; Euro Basalt; Mafic and ultramafic schists; and
- A-SR-gp – Split Rock Supersuite; Pegmatite.

The geology of the Study Area is shown in Figure 2-3.

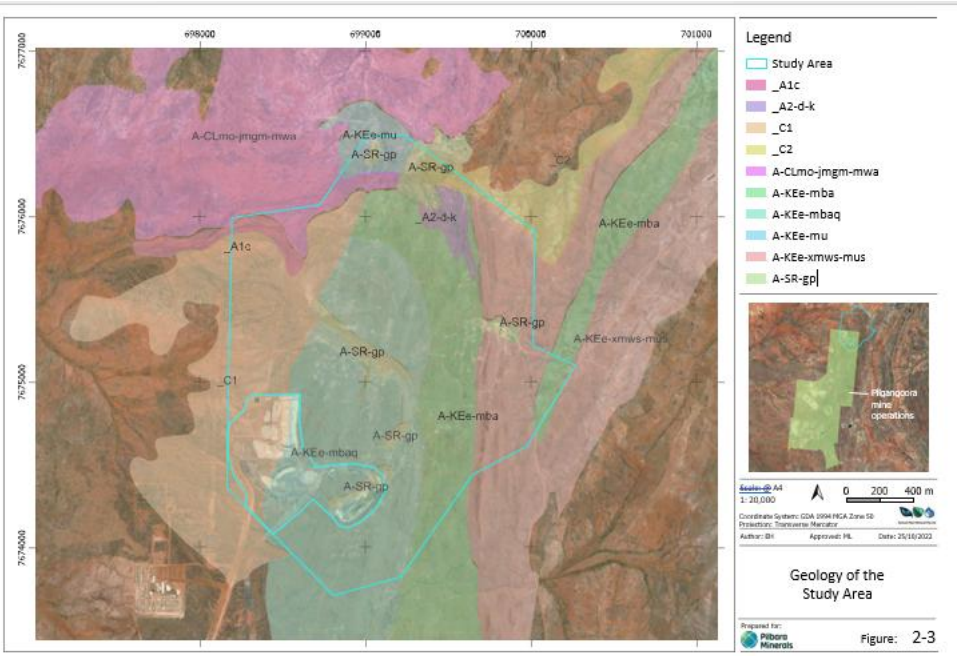

Figure 2-3 - Surface geology of the permit application area

2.6 SURFACE WATER

The permit application area is located entirely within the Turner River catchment to the west of the regional watershed divide with the Strelley River (Figure 2-4).

The Turner River is a regionally significant river system, draining a catchment area of some 4,800 km2. The Turner River catchment forms the eastern-most part of the Department of Water's designated Port Hedland Coast Basin (No. 709).

Northern Creek, Houston Creek, Pilgangoora Creek and Southern Creek drain in a roughly east to west direction across the Project site. All these creeks report to the Chinnamon Creek directly to the south of the permit application area. Confluence of the Chinnamon Creek and Turner River West occurs approximately 12 km downstream of the permit application area. The catchment areas for these creeks are shown on Figure 2-5.

All creeks and drainages in the vicinity of the Project site are typical of watercourses in the Pilbara in that they are ephemeral and highly variable with flows that can increase from zero to hundreds of cubic metres per second in a matter of hours as a result of precipitation from tropical cyclones and low-pressure weather systems. Although none of the on-site creeks are gauged, it is understood that the majority of annual stream flow occurs during January, February and March, after which they usually recede and dry up by June or July.

Where catchments are subject to changes in surface water hydrology associated with construction of infrastructure, these will be assessed under a Rights in Water and Irrigation Act 1914, section 11/17/21A permit to interfere with bed and banks.

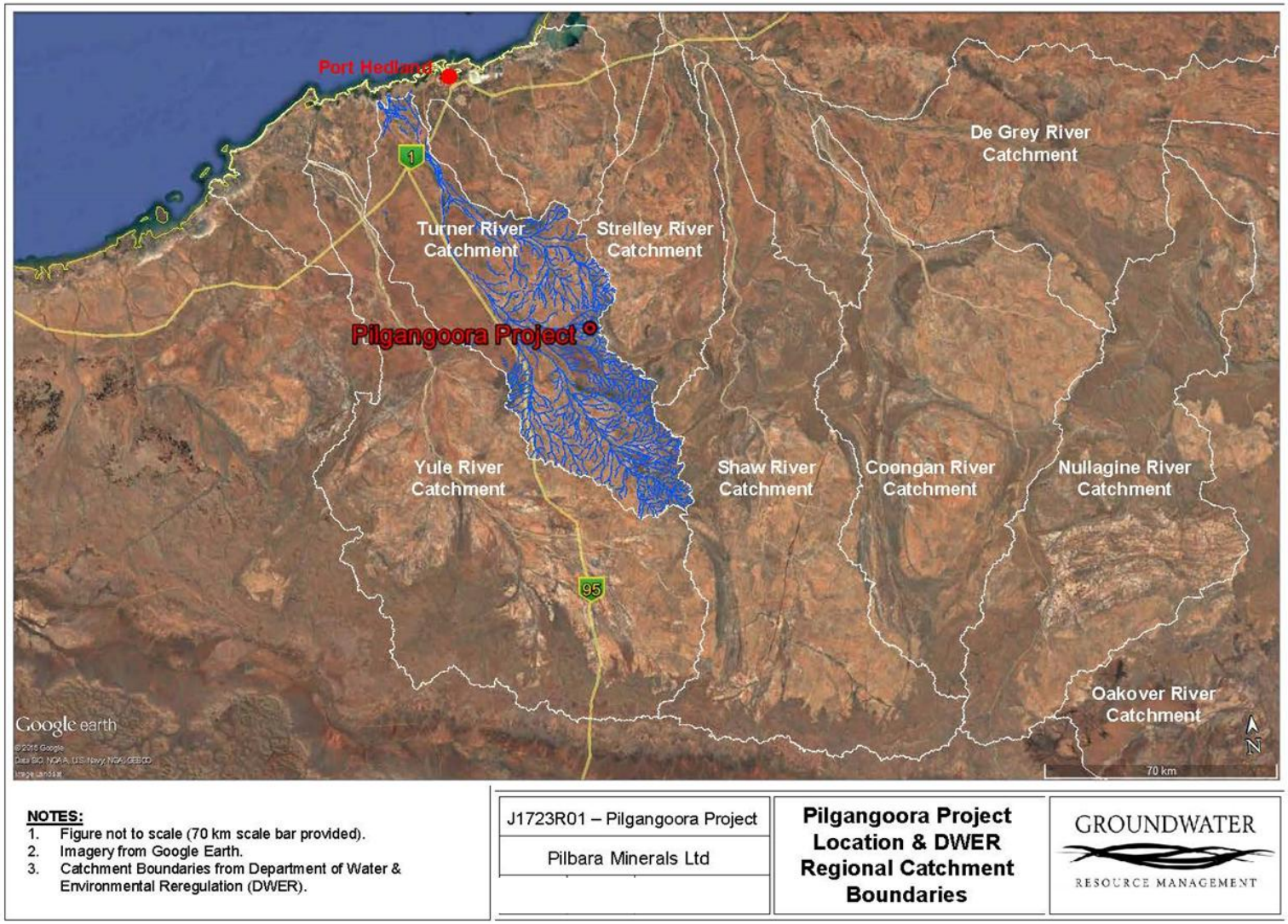

Figure 2-4 - Regional surface water catchment

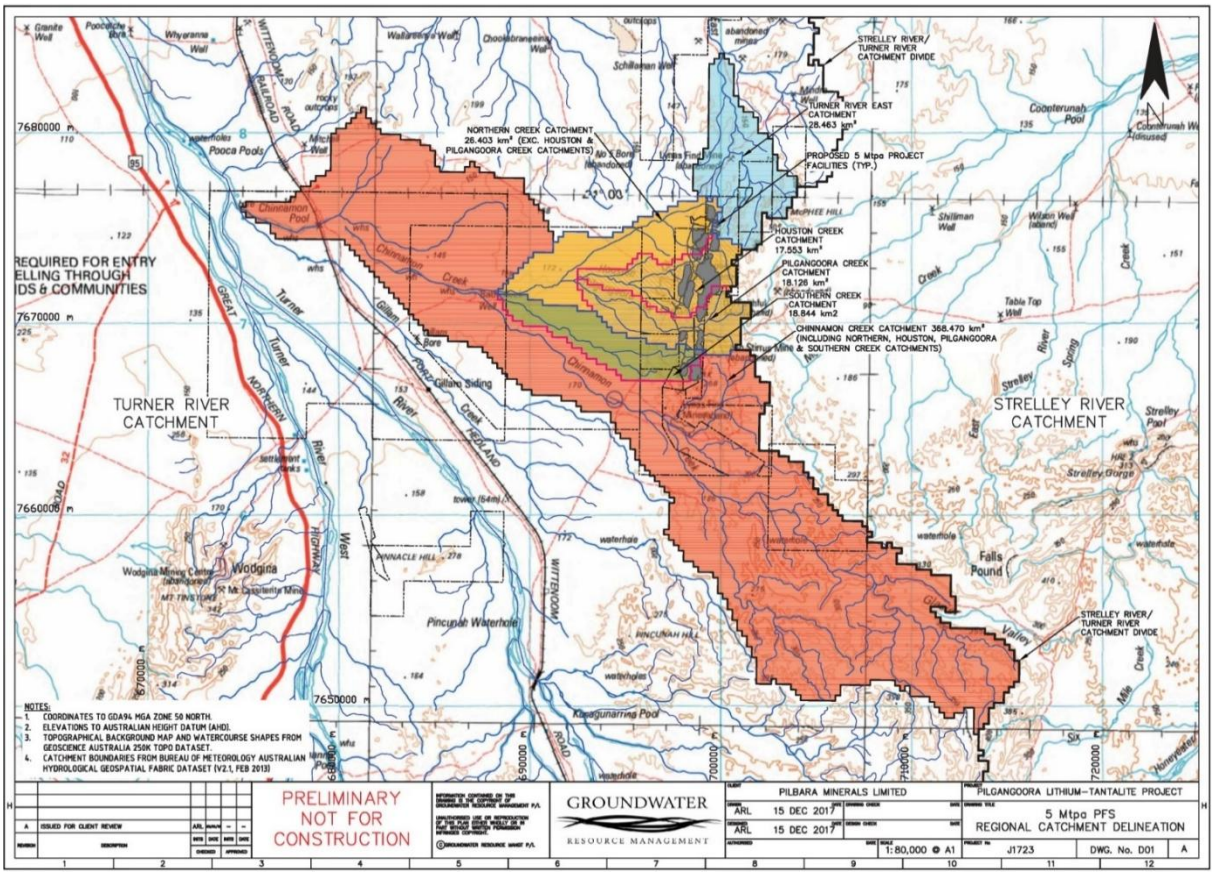

Figure 2-5 - Local surface water catchments

2.7 GROUNDWATER

The Pilgangoora project lies within the East Pilbara Granite Greenstone Terrane. There are no highly productive aquifers in this province although fractured rock aquifers are associated with greenstones and occasional quartz veining.

Data from the broader Pilgangoora project indicates that there is an east to west hydraulic gradient across the site, with a typical depth to groundwater of between 23 mbgl and 53 mbgl.

There have been limited groundwater investigations in the immediate environs of Lynas Find Pit. Several studies have been undertaken of the Pilgangoora Project since 2015, which formed a basis for the Lynas Find groundwater study.

Previous field investigations have found relatively low permeability in bedrock. Regions of higher permeability occur in alluvium and in some fracture zones in the bedrock, which tend to underly some of the alluvial waterways.

Groundwater is recharged by direct rainfall or by stream flow during episodic rainfall events. Recharge is predominantly from surface water runoff and flooding events along the upper reaches of Pilgangoora Creek and Houston Creek (a tributary of Chinnamon Creek). Recharge occurs mainly on or adjacent to the groundwater divide and along drainage lines.

The hydrogeology of the Pilgangoora project area is characterised by an east to west draining system, with the groundwater divide coincident with the catchment divide (GRM, 2022). Throughflow is therefore considered to be limited given the setting of the groundwater catchment.

2.8 FLORA AND VEGETATION

A biological survey was completed over the permit application area in 2022. The survey report is attached as Appendix A.

2.8.1 FLORA AND VEGETATION DESKTOP REVIEW

No T Flora listed under the BC Act or EPBC Act have been previously recorded within the Study Area. Two P Flora species have been previously recorded in the Study Area, *Euphorbia clementii*, and a population of *Euploca mutica* (formerly *Heliotropium muticum*), both of which are listed as P3 in WA.

One T flora species has been recorded within 25 km, *Quoya zonalis* (formerly *Pityrodia* sp. Marble Bar, listed as Endangered under the EPBC Act and T under the BC Act). One P1, ten P3, and one P4 species have records within 30 km of the Study Area.

No additional T species were returned from the PMST or literature review.

There are no TECs listed under the BC Act or EPBC Act known to occur within the Study Area. One Priority 3 Ecological Community is located within 50 km of the Study Area.

2.8.2 FLORA

A total of 113 species of flora were recorded within the Study Area, comprising 110 native species and three introduced species. Five collections could not be identified beyond genus level due to the lack of flowering parts or fruiting bodies, or because they were only found in juvenile form.

The Fabaceae (pea family, 28 native) Poaceae (grass family, 21 native, 2 introduced), Malvaceae (13 native species) and Amaranthaceae (8 native species, one introduced) were the most species-rich families recorded. Twenty-six families were recorded across the Study Area.

The complete list of plant species recorded within the Study Area is presented in Appendix A. The mean species richness was 20 species per quadrat, slightly less than the MMWC Environmental (2016) survey which included 49 detailed sites with an average species richness of 25.

A species accumulation curve was performed with a modelled Chao 2 species richness of 128, indicating that the floristic survey was approximately 83% complete.

The survey recorded 30 species not previously recorded for the Pilgangoora project area (including two Priority (P3) flora). These species are identified in Appendix A and bring the total richness for the Pilgangoora project area to 231 including subspecies, and varieties.

2.8.3 VEGETATION TYPES

Nine vegetation types are described for the Study Area, as summarised in Table 1 and detailed in the subsections below. As the Lynas Find deposit is considered as an extension to the existing Pilbara Minerals Pilgangoora Project, the vegetation coding system previously used at the site has been retained and extended. MMWC Environmental (2016) described vegetation type using the numerals 1 to 6 and the letters a to c to group sites by landform and floristics respectively. Vegetation type 6a reported here is synonymous with vegetation type 6a as reported in MMWC Environmental (2016), with the remaining units labelled from 7 onwards being different from those recorded previously.

Distribution of vegetation types at a scale of 1: 18,000 is shown in Figure 2-6. The dendrogram resulting from the cluster analysis is shown in Appendix A, followed by the site data sheets and photos.

Table 1 - Vegetation Types

CODE	LANDFORM	VEGETATION DISCRIPTION	EXTENT IN STUDY AREA	
			(HA)	%
6a	Gully	Scattered low trees of *Corymbia hamersleyana* over high open shrubland of *Acacia acradenia* and *Grevillea wickhamii* subsp. *hispidula* over scattered shrubs of *Acacia bivenosa* and Cajanus cinereus over open hummock grassland of *Triodia epactia* and *Triodia wiseana* over very open tussock grassland of *Eriachne*	1.26	0.3

CODE	LANDFORM	VEGETATION DISCRIPTION	EXTENT IN STUDY AREA	
			(HA)	%
		mucronata and *Cymbopogon ambiguous*		
7a	Valley Flat	Low *Corymbia hamersleyana* and *Acacia inaequilatera* isolated trees over *Acacia colei*, *Acacia ancistrocarpa*, and *Acacia bivenosa* sparse mid shrubland and *Triodia epactia*, *Triodia angusta* and *Cenchrus setiger mid open hummock grassland.	11.13	2.8
8a	first order creeklines and drainage gullies	Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Grevillea wickhamii,* and *Acacia inaequilatera* open mid shrubland and *Triodia epactia, Triodia wiseana and Triodia chichesterensis* (P3) mid open hummock grassland	3.4	0.9
8b	Creekline	Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Grevillea wickhamii,* and *Acacia inaequilatera* sparse mid shrubland and *Triodia wiseana Triodia angusta* and *Cajanus cinereus* mid open hummock grassland/forbland	2.96	0.8
9a	Stony Plains	Low *Corymbia hamersleyana* isolated trees over *Acacia colei, Acacia ancistrocarpa,* and *Grevillea wickhamii* sparse mid shrubland and *Triodia wiseana Triodia epactia* and *Triodia chichesterensis* (P3) mid hummock grassland	25.79	6.5
9b	Stony Plains	*Acacia ancistrocarpa, Acacia bivenosa* and *Acacia inaequilatera* mid open shrubland and *Triodia wiseana, Alysicarpus muelleri* and *Aristida holathera* mid hummock grassland/forbland/tussock grassland	40.1	10.2
10a	Ridge	Tall, isolated shrubs of *Acacia inaequilatera, Atalaya hemiglauca* and *Acacia colei* over a low sparse shrubland of *Hibiscus sturtii, Acacia acradenia, *Aerva javanica*, and *Triodia wiseana, Triodia brizoides* and *Triodia chichesterensis* (P3) mid open hummock grassland.	10.15	2.6

CODE	LANDFORM	VEGETATION DISCRIPTION	EXTENT IN STUDY AREA	
			(HA)	%
11a	Hill	Tall, isolated shrubs of *Acacia inaequilatera, Acacia colei* and *Acacia acradenia* over *Triodia brizoides, Triodia wiseana,* and *Triodia epactia* mid hummock grassland.	74.78	19
11b	Hill	Low isolated trees of *Corymbia hamersleyana* over tall, isolated shrubs of *Acacia colei, Acacia inaequilatera,* and *Senna glutinosa* subsp. *glutinosa* over *Triodia wiseana, Triodia chichesterensis* (P3), and *Triodia brizoides* mid hummock grassland.	151.24	38.4
D	-	Disturbed areas cleared of vegetation. Including rehabilitated areas where revegetation has not yet re- established.	72.96	18.5

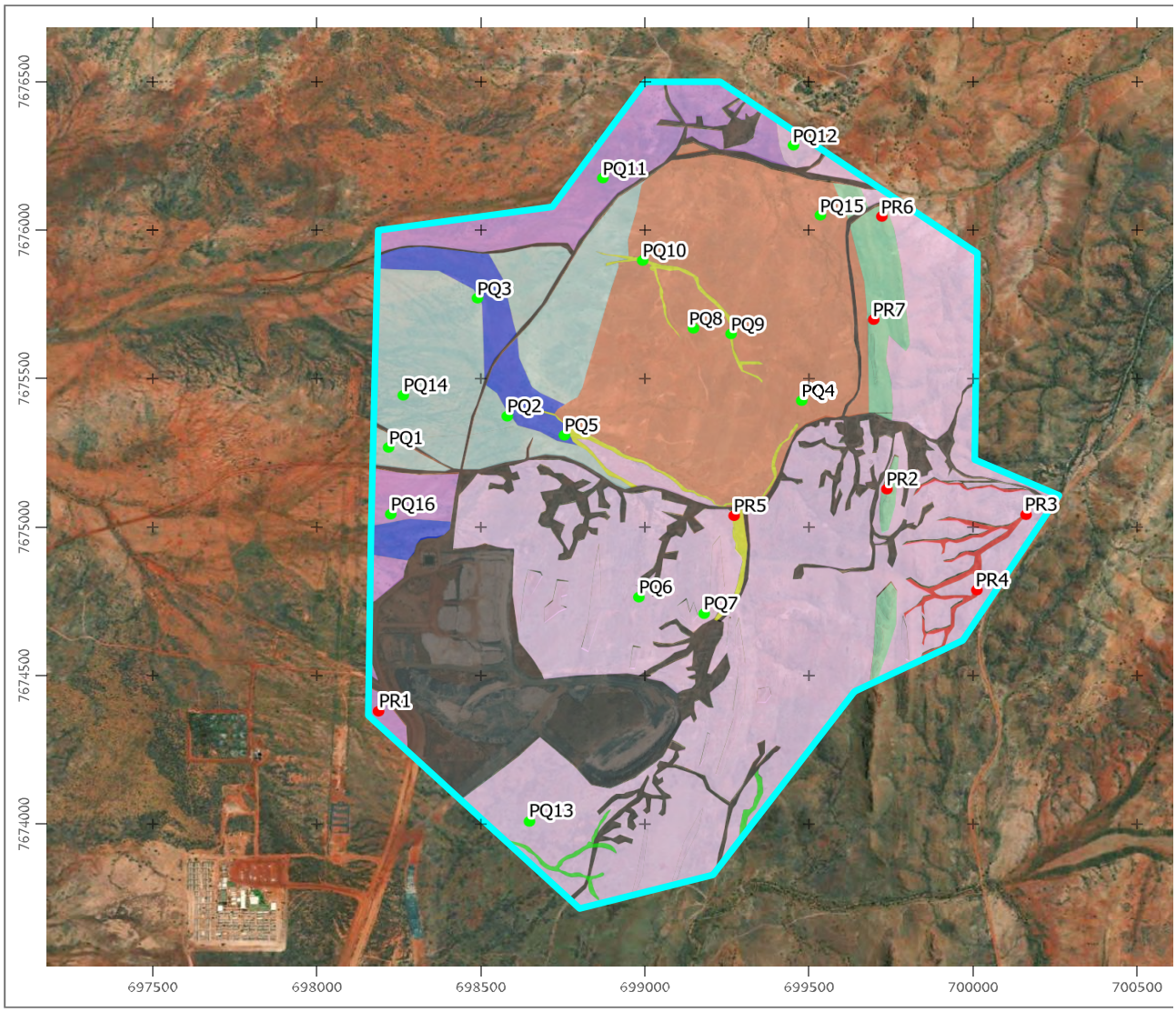

Figure 2-6 - Vegetation types

2.8.4 VEGETATION CONDITION'

Vegetation condition across the Study Area was within the categories Very Good, Good and Completely Degraded, with most of the Study Area in Very Good condition (Table 2). The primary sources of disturbance on site are associated with historical and current mining related disturbances (numerous vehicle tracks, drill pads, active mining area on the eastern boundary). In addition, several weed species occur throughout the site, primarily through the creek lines in the plains area and in the rocky ridge landform. A moderate grazing impact from cattle is present in the plains and a low grazing impact in the hills.

Table 2 - Vegetation condition within the Study Area

VEGETATION CONDITION	AREA (HA)	AREA (%)
Very Good	254.48	64.6
Good	66.75	16.9
Completely Degraded	72.96	18.5

The Study Area has Moderate (burnt 4-8 years previously) to Very Old fire age, with a large portion of the site being burned in 2017/18, and a small portion on the eastern edge being burned in 2013/14 (DBCA 2022).

The primary sources of disturbance on-site are low to moderate grazing impact from cattle and occasional tracks that support pastoralism activities. Additional tracks are present in support of the nearby mining and exploration activities.

2.8.5 CONSERVATION

No species listed as T under the EPBC Act or BC Act were recorded during the survey. Two P3 species were recorded.

2.8.5.1 TRIODIA CHICHESTERENSIS (P3)

Triodia chichesterensis is described by Anderson et al. (2017). It is characterised by being a short-leaved species, distinguished by the combination of diminutive stature, glabrous leaf sheaths, relatively unbranched inflorescence, often short pedicels, and pubescent lemma midlobe. The short pedicels and pubescent lemma midlobe contrast with the typically longer pedicels and glabrous lemma midlobes of other short-leaved species in the complex (T. nana, T. scintillans, T. vanleeuwenii). It is distinguished from the closely related and often co-occurring *Triodia lanigera* by its shorter and less hairy leaves and less branched inflorescence.

The species has a limited distribution and has been found only in a narrow area in the central Chichester region of the Pilbara of WA. The areas immediately to the west and east of its known distribution are poorly explored, but it is likely to be restricted to an area <100 km beyond current collections, given intensive collecting efforts in the Pilbara (Anderson et al. 2017).

The Lynas Find deposit is in the central part of the range of this species, which is significant from the perspective of determining it from the closely related *Triodia lanigera* (Anderson et al. 2017). Where the two co-occur in the south it can be difficult to determine them based on morphological and distributional parameters. Where the two co-occur in the north, there is a subtle but consistent substrate change that marks the shift in species, with *T. lanigera* occurring on sandier soils and *T. chichesterensis* on rockier soils with quartzite pieces. In the northern species range, it can usually be morphologically distinguished from *T. lanigera* by its shorter and less hairy leaves and less branched inflorescences.

In the Study Area the species was recorded on rocky soils with quartzite. Collection records indicate that florets are observed between February–April and in August. At the time of survey in August, flowering material was available, and the species was able to be determined using the taxonomic key published by Anderson et al. (2017).

Triodia chichesterensis was recorded in four vegetation types - 8a, 9a, 10a and 11b at up to 15% cover, but more commonly at or below 5% cover.

2.8.5.2 ROTHIA INDICA SUBSP. AUSTRALIS (P3)

Rothia indica subsp. *australis* is a prostrate annual herb, to 0.3 m high, densely covered in spreading hairs. Flowering occurs from April to August. It is known from sandy soils in sandhills and sandy flats.

It is known to occur across the northern third of Australia, however records are sparsely distributed. A comparatively large number of records have been made in the Chichester subregion of the Pilbara, likely as a consequence of a large survey effort in the subregion. The Study Area is within the known range of the species, however there are no previous records for the species within the locality.

In the Study Area it was recorded in vegetation types 10a and 11b as scattered and infrequent individuals.

2.8.5.3 EUPLOCA MUTICA (P3)

An additional P1 species was recorded in the local area during the MMWC Environmental (2016) survey but was not recorded in the current survey. At the time of the MMWC Environmental (2016) survey the species was known as *Heliotropium muticum* and was considered to be a Priority 1 species. Taxonomic revision for the species has led to the revision of the name to *Euploca mutica* (Frohlich et al. 2020) and targeted searches resulting in increased known population size has led to a revision of the status to Priority 3.

Euploca mutica is a small, perennial herb/shrub that grows to approximately 0.3 m. In the previous local survey, it was recorded in the sand plain habitat in vegetation association 1a.

Atlas of Living Australia collection records for the species identify that flowering specimens are often collected in August, and that habitat includes sandy or calcareous plains, often on granite geology, with a sandy or loamy surface often with ironstone and quartz. In the Study Area the suitable habitat was assessed as being vegetation type 9a. Targeted searches were conducted throughout vegetation type 9a using traverses at

intervals of approximately 25 m. No Euploca mutica were recorded. As seasonal conditions were suitable and the survey was conducted within the known flowering period, the species absence is determined with a high level of certainty.

2.8.5.4 EUPHORBIA CLEMENTII (P3)

An additional P3 species *Euphorbia clementii* was returned from the database searches as occurring within the Study Area but was not recorded during the survey. *Euphorbia clementii* is an erect herb, growing up to 0.6 m high. It is known from gravelly hillsides and stony grounds. Suitable habitat in the Study Area is the 11a vegetation type.

2.8.6 INTRODUCED FLORA

Three introduced flora species were recorded in the Survey Area and are listed in Table 4. No Declared Weeds or WONS were recorded.

Table 3 - Introduced flora recorded within the Survey Area

SPECIES	COMMON NAME	DESCRIPTION BAM ACT S11 - PERMITTED
Aerva javanica	Kapok	Erect, much-branched perennial herb, 0.4-1.6 m high. Flowers white from January to October. Often found growing on sandy soils and along drainage lines.
Cenchrus ciliaris	Buffel grass	Tufted or sometimes stoloniferous perennial, grass-like or herb. 0.2 - 1.5 m high. Flowers purple from February to October. Grows on white, red, or brown sand, stony red loam, or black cracking clay.
Cenchrus setiger	Birdwood grass	Erect, tussocky, stoloniferous perennial, herb or grass-like. Grows to 0.5 m high. Flowers cream to purple from April to May. Grows on brown sands, red loam, or pindan soils on sand dunes, plains, rangelands, stony hillsides, or floodplains.

The agricultural weeds *Cenchrus ciliaris* and *Cenchrus setiger* were recorded in the plains on the western side of the Study Area where cattle grazing occurs at a high intensity, and tracks are frequent. Where found, these weeds were heavily grazed.

The environmental weed *Aerva javanica* was most common on the high ridge line and infrequent in the rocky hills.

2.9 FAUNA

A fauna, flora and vegetation survey was completed over the permit application area in 2022. The survey report is attached as Appendix A.

2.9.1 FAUNA DESKTOP REVIEW

The DBCA database returned 14 species of significant fauna that have previously been recorded within 30 km of the Study Area. Of these, three are listed as migratory bird species (**MI**) and one as Other Specifically Protected (**OS**). Record locations of T and P fauna in relation the Study Area are shown in Figure 2-7.

One endangered (**EN**), one vulnerable (**VU**) and two P fauna species have previously been recorded within the Study Area.

The PMST returned 12 additional species, six T and six MI. These are species that do not have records within 30 km but where modelling has identified that suitable habitat is known to occur or may occur.

The Literature review returned additional information about the locations and abundance of Pilbara leaf-nosed bat and Northern quoll records.

Database search results of T, P and MI fauna within 30 km of the Study Area are listed in Table 5, with the outcome of the likelihood of occurrence assessment. The complete assessment including the preferred habitat relative to those available in the Study Area and records in the local area is included in Appendix A.

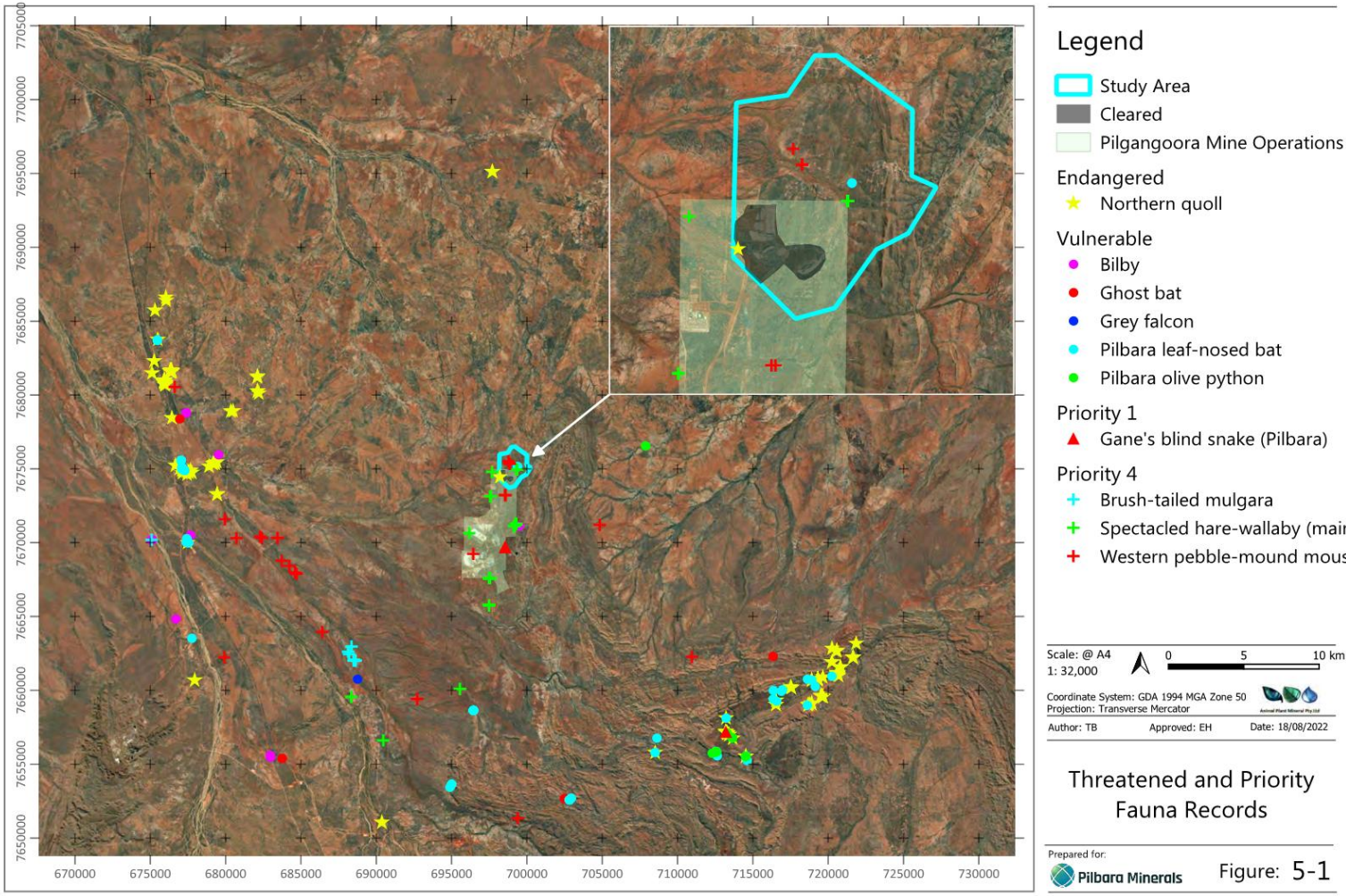

Figure 2-7 Fauna Study Area

Table 4 - Significant fauna database records and likelihood of occurrence

SPECIES	COMMON NAME	CONSERVATION CODE		ASSESSMENT OF OCCURRENCE
		BC Act	EPBC Act	
Actitis hypoleucos	Common sandpiper	MI	MI	Unlikely. No saline or coastal habitats available. Freshwater habitats are likely to be seasonally present in the major drainage line however there are no permanent or semi-permanent pools evident. Substrates are sandy, meaning infiltration is likely to be rapid and surface water very limited. No vegetation known to inhabit seasonally inundated environments was recorded.
Arenaria interpres	Ruddy Turnstone	MI	MI	
Calidris acuminata	Sharp-tailed sandpiper	MI	MI	
Calidris ferruginea	Curlew sandpiper	CR	CR, MI	
Calidris melanotos	Pectoral sandpiper	-	MI	
Calidris ruficollis	Red-necked Stint	MI	MI	
Numenius madagascariensis	Eastern curlew	CR	CR, MI	
Pluvialis fulva	Pacific Golden Plover	MI	MI	
Thalasseus bergii	Crested Tern	MI	MI	
Tringa brevipes	Grey-tailed Tattler	MI, P4	MI	
Tringa glareola	Wood Sandpiper	MI	MI	
Tringa nebularia	Common Greenshank	MI	MI	
Fregata ariel	Lesser Frigatebird	MI	MI	
Apus pacificus	Fork-tailed Swift	MI	MI	Possible. Not habitat dependent.
Charadrius veredus	Oriental Plover	MI	MI	Unlikely. No suitable habitat available for this species.

SPECIES	COMMON NAME	CONSERVATION CODE		ASSESSMENT OF OCCURRENCE
		BC Act	EPBC Act	
Erythrotriorchis radiatus	Red Goshawk	VU	VU	Unlikely. No habitat occurs in the Study Area.
Falco hypoleucos	Grey Falcon	VU	VU	Possible. Suitable foraging habitat in the plains. No nesting habitat is present.
Falco peregrinus	Peregrine Falcon	OS	-	Unlikely. No habitat occurs in the Study Area.
Hirundo rustica	Barn Swallow	MI	MI	Unlikely. No habitat occurs in the Study Area.
Motacilla cinerea	Grey Wagtail	MI	MI	Unlikely. No habitat occurs in the Study Area.
Motacilla flava	Yellow Wagtail	MI	MI	Unlikely. No habitat occurs in the Study Area.
Pandion cristatus	Eastern Osprey	MI	MI	Unlikely. No habitat occurs in the Study Area.
Pezoporus occidentalis	Night Parrot	CR	EN	Possible. Some suitable spinifex, however foraging resources are limited.
Rostratula australis	Australian Painted-Snipe	EN	EN	Unlikely. No habitat occurs in the Study Area.
Dasycercus blythi	Brush-tailed Mulgara	P4	-	Possible. Sandy plains habitat is suitable.
Dasyurus hallucatus	Northern Quoll	EN	EN	Present.
Hipposideros stenotis	Northern Leaf-nosed Bat	P2		Unlikely. Species not known to occur in the Pilbara, generally being confined to more northern areas.
Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby	P4	-	Present. Historic records and suitable habitat across the Study Area.
Leggadina lakedownensis	Lakeland Downs Mouse	P4		Unlikely. No suitable habitat.
Macroderma gigas	Ghost Bat	VU	VU	Possible. Foraging habitat available across the Study Area. No roosting habitat available.

SPECIES	COMMON NAME	CONSERVATION CODE		ASSESSMENT OF OCCURRENCE
		BC Act	EPBC Act	
Macrotis lagotis	Greater Bilby	VU	VU	Possible. Suitable habitat includes the plains and low hills habitats.
Pseudomys chapmani	Western Pebble-mound Mouse	P4	-	Present. Mounds located in the low rolling hills.
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	VU	VU	Present. No roosting habitat available. Foraging habitat of low quality.
Sminthopsis longicaudata	Long-tailed Dunnart	P4		Possible. Suitable habitat in the low hills, boulder rock outcrops and platy rock outcrops.
Anilios ganei	Gane's Blind Snake (Pilbara)	P1		Unlikely. Suitable habitat unlikely to be present as drainage lines small and highly ephemeral. Very few termite mounds present for foraging resource.
Ctenotus nigrilineatus	Pin-striped Finesnout Ctenotus	P1		Possible. Suitable habitat occurs in the low hills and outcrops.
Liasis olivaceus subsp. baronni	Pilbara Olive Python	VU	VU	Unlikely. There are no gorges or significant water filled gullies in the Study Area.
Liopholis kintorei	Great Desert Skink		VU	Unlikely. Suitable habitat may occur 15 km to the southeast.

2.9.2 FAUNA HABITAT

The Study Area is characterised by rocky hills throughout the eastern half and into stony plains in the western half.

Drainage lines originate in the rocky eastern half and flow west towards the sandplains where formed channels cease and wash out areas are present and water moves as sheetflow. East of the high ground, small rocky first order streams join and flow to the northeast.

Six fauna habitats are described for the Study Area and are summarised in Table 5 below. The distribution of fauna habitats is shown in Figure 2-8. Photos of the habitat assessment locations are shown in Appendix A.

These are described in detail in Appendix A. The distribution of fauna habitats is shown in 2-8.

Table 5 - Fauna habitats within the Survey Area

NAME	AREA (HA)	PROPORTION
Boulder Rock Outcrops	17.21	4.4
Platy Rock Outcrops	5.44	1.4
Low Hills	214.43	54.3
Sandy Plains	11.13	2.8
Stony Gullies	7.61	1.9
Stony Plains	65.89	16.7
Disturbed	72.96	18.5

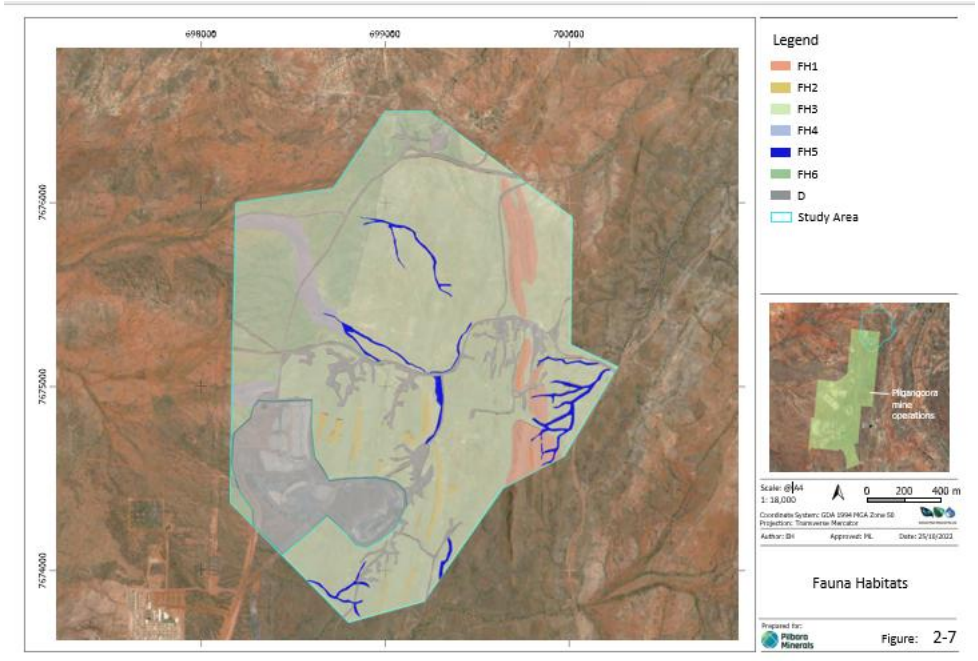

Figure 2-8 - Fauna habitats of the Survey Area

2.9.3 CONSERVATION SIGNIFICANT FAUNA

2.9.3.1 NORTHERN QUOLL

In the Pilbara region, the species tends to prefer the Rocklea, Macroy and Robe land systems (Biota Environmental Services 2008). These land systems are comprised of basalt hills, mesas (and buttes of limonites), high and low plateaux, lower slopes, occasional tor fields and stony plains supporting either hard or soft spinifex grasslands (van Vreeswyk et al. 2004).

The Northern quoll has also been recorded in other land systems which are comprised of sandstone and dolomite hills and ridges, shrublands, sandy plains, clay plans and tussock grasslands and coastal fringes including dunes, islands and beaches (Biota Environmental Services 2008).

This species has been located on several occasions within the Lynas Find Study Area and south into the Pilgangoora project area (DBCA Database record, Ecologia Environmental 2018; Terrestrial Ecosystems 2020). Locally this species seems to be most encountered in the boulder hill tops (FH1) of the north/south tending ridgeline running along the eastern half of the Study Area. This is the most rugged landform in the Study Area, at the highest elevations. Boulders on the ridge tops form a mosaic of cracks and crevices large enough to provide denning habitat for the quoll. Two camera records and three quoll scats were recorded in this area in the present study. Ecologia Environmental (2018) recorded 5 scats and Terrestrial Ecosystems (2020) made captures on 12 cameras within this habitat type.

The lithology of the other lower hills and breakaways in the remainder of the Study Area differs significantly. These schists are more plate like and provide no denning opportunity. Trees within the Study Area were generally small and did not provide hollows for denning opportunities. No quoll scats were recorded in gullies.

Foraging or dispersal habitat is recognised to be any land comprising predominantly native vegetation in the immediate area (i.e. within 1 km) of shelter habitat, quoll records or land comprising predominately native vegetation that is connected to shelter habitat within the range of the species (CoA 2016).

Habitat critical to the survival of the Northern quoll and populations important for the long-term survival of the Northern quoll are defined in CoA (2016). The Northern quoll within FH1 are a population important for the long-term survival of the Northern quoll as it is a population occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water.

Habitat critical to the survival of the Northern quoll is present in the Study Area and includes:

- habitat FH1;
- areas of native vegetation within 1 km of FH1; and
- dispersal and foraging habitat associated with or connecting the population within FH1 to other nearby populations or foraging habitats.

The FH1 habitat is contained within the A-KEe-xmws-mus; Euro Basalt; Mafic and ultramafic schists geological unit (Geological Survey of Western Australia 2014). Examination of aerial imagery in conjunction with the geological units indicates that the best local denning and foraging habitats would be within this unit, based upon the expectation of denning suitable outcrops occurring within the same geological formation.

Within the Study Area, creek lines are small, fast flowing and have only sporadic small trees of *Corymbia hamersleyana*. These provide little to no denning and foraging opportunities as no standing or fallen hollow logs are available and very sparse litter is present. No quoll records or signs were recorded in the creeks. Whilst in other environs creek lines would be a dispersal and foraging habitat for northern quoll, in the Study Area this habitat type does not appear to be frequented by the species.

All habitats occurring within the Study Area may be utilised by the species, at some time, to forage and or during dispersal activities; however, their significance to the species will vary depending on resource availability and connectivity. An opportunistic sighting of northern quoll was made in 2018 within the Study Area near to the entrance of the active mining area, demonstrating the species moves reasonable distances from the core shelter habitat, including into disturbed areas. Open surface water – a turkey's nest constructed for the mining operations - is currently present near to the location of sighting. It is not known whether the surface water was present at the time of the quoll sighting but if so, the open water may attract the quoll searching for food and water.

Foraging habitat within the Study Area is likely to vary depending on resource availability, which may be seasonally dependant.

Figure 2-9 shows the location of Northern quoll records, F1 habitat, areas within 1km of the FH1 habitat and the A-KEe-xmws-mus geological unit.

Three quoll scats were recorded during the traverses, within 30 to 113 m south of camera MSC01 (the southern of the two camera records). Quoll scat locations are (GDA 1994, MGA Zone 50):

- 699741, 7675127;
- 699703, 7675048; and
- 699719, 7675052.

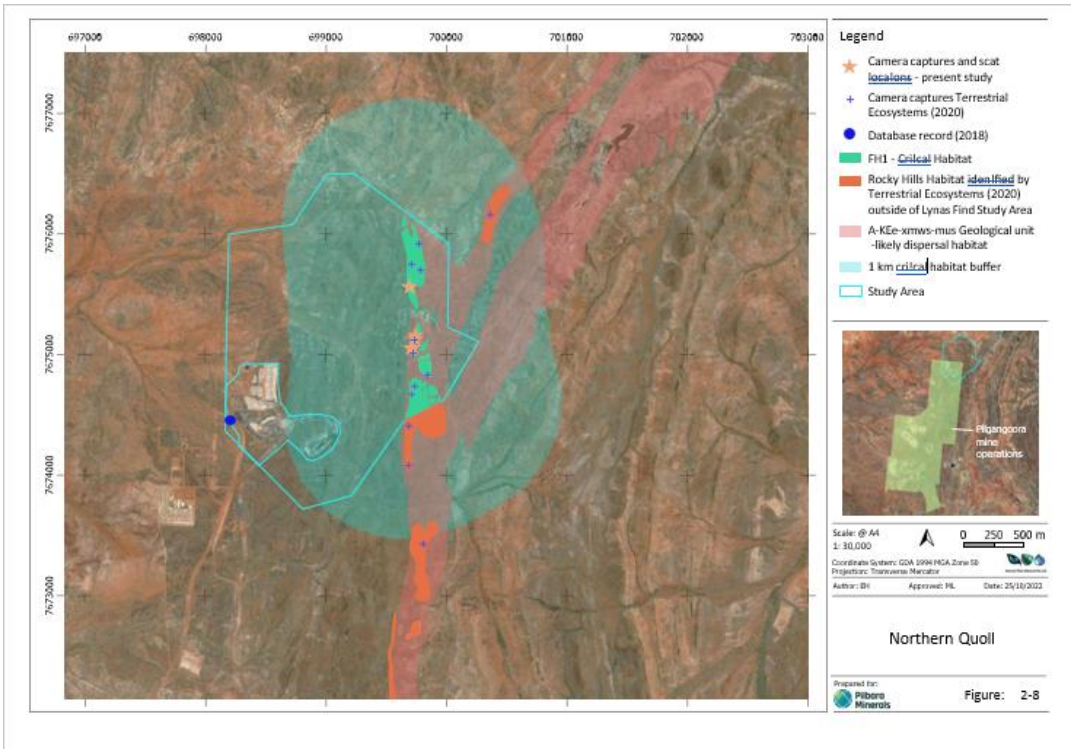

Figure 2-9 - Northern quoll records

Figure 2-10 - Northern quoll captured on MSC01

Figure 2-11 - Northern quoll captured by MSC09 (tail only)

2.9.3.2 GHOST BAT

A recent review of Ghost bat (Bat Call WA 2021a) updates the knowledge base on ecology, threats, and survey requirements for the species.

Ghost bats move between a number of caves seasonally or as dictated by weather conditions and/or foraging opportunities, so they require a range of cave sites (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 dictated by prey availability. Their vagrant foraging strategy relates to patchy, locally unreliable rainfall events (and prey biomass) across much of its foraging habitat in the Pilbara and elsewhere in other semi-arid parts of its broader Australian range. Hence the relatively small groups that must move from roost to roost to access their ephemeral patchy food resource.

Extensive survey activity in the last decade has led to the proposal of 4 categories of roosting habitat used by Ghost bats in the Pilbara region (Bullen 2021):

- Category 1 maternity/diurnal roost sites with permanent Ghost bat occupancy;

- Category 2 maternity/diurnal roost caves with regular occupancy;
- Category 3 diurnal roost caves with occasional occupancy; and
- Category 4 nocturnal roost caves with opportunistic usage.

Within the Study Area there are no Category 1, 2 or 3 sites/caves available to this species. The largest crevices/fissures located within the Study Area would not provide the required temperature and humidity regulation or any security from predators, such as cats. At best, the FH1 habitat may provide Category 4 nocturnal roost caves with opportunistic usage.

Numerous observations suggest that most shallow caves, shelters and deep overhangs in the Pilbara are used in at least an opportunistic manner by itinerant Ghost bats. This may be anything from a single foraging visit to a longer visit, with a resting period or possibly a feeding session. Evidence of such visits is the widespread presence of small numbers of scats and/or food scraps found, or occasional echolocation calls recorded during surveys. These visits may or may not be repeated, depending on whether the bat is passing through a district or is a more permanent resident nearby. These are not considered critical habitat.

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 (Bullen unpublished data). In the Study Area there are scattered *Corymbia hamersleyana* trees available for perching.

No Ghost bats were recorded during the acoustic survey. Visual inspection of the FH1 habitat was made and no scats or food scraps were recorded.

The Ghost bat is listed in the PMST as known to occur within the local area and the DBCA database has records for the species within a 30 km radius. 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, indicating the Study Area may be within range of Category 1, 2 or 3 habitat.

It is possible that the Study Area offers foraging habitat to Ghost bat across all habitats and Category 4 nocturnal roosts in habitat FH1.

2.9.3.3 PILBARA LEAF NOSED BAT

A recent review of Pilbara leaf-nosed Bat (Bat Call WA 2022b) updates the knowledge base on ecology, threats, and survey requirements for the species. It is generally encountered in rocky areas that provide opportunity for roosting, in particular the ironstone Hamersley Range, the ridgelines granite boulder piles and disused mines of the eastern Pilbara, and along medium and major drainage lines that radiate away from rocky uplands.

Pilbara leaf-nosed Bat roost during the day beyond the twilight zone in caves and underground mines with stable, warm and humid microclimates because of its poor ability to maintain its heat and water balance (Churchill et al. 1988; Jolly 1988; Churchill 1991; Baudinette et al. 2000; Armstrong 2001). The Pilbara leaf-nosed Bat 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) has not been supported and is very unlikely in the Pilbara region (Armstrong 2001).

Roosts have been categorised according to importance to the survival of the species into four categories (TSSC 2016):

- Category 1 - Permanent diurnal maternity roosts where seasonal presence of young is proven.
- Category 2 - Permanent diurnal roosts where presence of young is unproven;
- Category 3 - Semi-permanent diurnal roosts; and
- Category 4 - Nocturnal refuge.

The Pilbara leaf-nosed Bat was recorded locally during Targeted survey for individuals and roosts for the Pilgangoora Project (360 Environmental 2015, 2016). A Category 1 or 2 roost was located, and high-quality foraging habitat was identified at a major water body in an abandoned open cut pit. The roost site and confirmed foraging habitat are 13 km northeast of the Survey Area. An estimate of the number of Pilbara leaf-

nosed bat at the roost based on ultrasonic calls and video counts ranged between 25-50. There are additional known permanent diurnal category 1 or 2 Pilbara leaf-nosed bat roosts within 40 km of the Survey Area (Bat Call WA 2022b), and Category 4 Roosts have been recorded to the east of the Pilgangoora Project (APM 2023c). The Survey Area does not contain any Category 1, 2, 3 or 4 roosts.

Generally, the Pilbara leaf-nosed Bat 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 (Bat Call WA 2022b). Echolocation based records indicate that it can complete round trips of 50 km or longer in a night under favourable conditions (Bat Call WA 2022b).

No call sequences of the Pilbara leaf-nosed Bat were recorded within the Survey Area.

Foraging habitats used by the Pilbara leaf-nosed Bat are prioritised by EPBC Conservation Advice (TSSC 2016) as:

- Priority 1 - Gorges with pools;
- Priority 2 – Gullies;
- Priority 3 – Rocky Outcrop;
- Priority 4 – Major Watercourses; and
- Priority 5 – Open Grassland and Woodland.

Habitats in the Survey Area have been categorised using this Priority schedule and are shown in Appendix A where Priority 4 areas include the Drainage Lines and the remaining habitats are Priority 5.

Whilst the Pilbara Leaf-nosed Bat is known to occur in the local area, the Survey Area does not present habitat that is of high priority for conservation of the species.

2.9.3.4 GREY FALCON

The Grey falcon occurs in most of the drier parts of Australia (Schoenjahn 2018). Its distribution is centred on inland drainage systems where there is an average annual rainfall of less than 500 mm. Its main habitat is timbered lowland plains, particularly Acacia shrublands that are crossed by tree-lined watercourses. It generally occurs at low densities across inland Australia (BirdLife International 2019).

The Grey falcon hunts far out into tussock grassland and open woodland. It nests in old nests made by other birds, usually nests in the tallest trees along watercourses, particularly river red gum (TSSC 2020). Prey species include doves, pigeons, small parrots and cockatoos, and finches, but a variety of other bird prey species has been recorded, as well as mammals and lizards (TSSC 2020).

Local records are centred on the Turner River. At its closest point, the Turner River is 23 km from the Study Area. The plains habitat in the Study Area is suitable foraging habitat for this species, and within range of the population likely to be nesting in the Turner River riparian zone. No nesting habitat is present in the Study Area.

2.9.3.5 THE NIGHT PARROT

The Study Area is within the area where Night parrot are modelled as may occur. Very limited information is available on the Night parrot, however some information on habitat characteristics where the species has persisted is available.

DBCA (2017) summarises habitat characteristics. Night parrot roosting and nesting sites are in clumps of dense vegetation, primarily old and large spinifex (Triodia) clumps, but sometimes other vegetation types. Often the vegetation in these habitats will be naturally fragmented and therefore well protected from fire. Little is known about foraging sites, but favoured sites are likely to vary across the range of the species. In Queensland, Night parrots have been shown to feed in areas rich in herbs including forbs, grasses and grass-like plants, and it is likely that such areas may also be important in WA. Triodia is likely also to provide a good food resource for Night parrots, in times of mass flowering and seeding, but they also rely heavily on a range of other food species. Sclerolaena has been shown to be a source of food and moisture.

The species and growth pattern of the spinifex in the FH6 habitat in the Study Area may be suitable for the Night parrot. There are no samphire or chenopod habitats proximal to the Study Area, therefore foraging habitats are limited locally, however Night parrots have been known to fly up to 40 km or more in a night during foraging expeditions, so foraging habitat is not necessarily within or adjacent to roosting areas.

An interim guideline for preliminary surveys of Night parrot in Western Australia (DPAW 2017) identifies when and where Night parrot surveys may be required. The Study Area is on the northwestern edge of the area classed as a high priority for survey. Due to the inclusion of the site in the high priority survey area and the presence of suitable spinifex habitat passive acoustic survey was conducted at locations where the best spinifex habitat was found. Four devices were deployed for a total of 16 trap nights. No Night parrot calls were recorded.

Foot traverses through the plains habitat where the largest and oldest hummock grasses occur did not encounter any signs of individuals of Night parrot.

No Night parrot calls were recorded in the 56 hours of assessed recordings.

While the habitat is potentially suitable, there are no historic records of Night parrot in the area and very few records of extant individuals. While it remains possible that the species could colonise in the future there is no evidence that they are currently present.

2.9.3.6 GREATER BILBY

Extant populations of the bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils (typically sandy for burrow excavation). It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas (Southgate 1990). Laterite and rock feature substrates are an important part of Greater bilby habitat, which support shrub species such as Acacia, and Spinifex hummocks which are quite uniform and discrete, providing runways between hummocks, enabling easier movement and foraging (Southgate et al. 2007).

The Study Area is within the area where the species is listed in the PMST as known to occur. Database results returned 334 records within a 50 km radius of the Study Area, the closest being one record to the east of Pilgangoora made in 1979. The high number of records are due to monitoring (transect) surveys in association with the construction of rail corridors that pass the Study Area to the west.

Suitable habitat occurs in the Study Area across the sandy plains, stony plains and low hills habitats (FH3, FH4 and FH6). Extensive foot transects were walked across these habitats at 10-20 m intervals. No burrows were located, and no tracks or other traces were recorded. It is unlikely the species is currently present.

This species has the potential to occupy the Study Area in the future as bilbies can be relatively transient across their distribution. However, no historical burrows were observed suggesting they have not occupied the area in recent times.

2.9.3.7 WESTERN PEBBLE MOUND MOUSE

The Western pebble-mound mouse is endemic to the Pilbara where it is found on stony hillsides with hummock grassland (Menkhorst and Knight, 2010). This species builds pebble mounds from small stones, which typically cover areas from 0.5-9.0 m2. The mounds are characteristic of the species. Pebble mounds are restricted to areas with suitable class stones and are usually found on gentle slopes and spurs that are often vegetated by hard spinifex (Ford and Johnson 2007; Van Dyck and Strahan 2008). Active mounds are characterised by the conical shape of the mound with clear, distinct entrance holes (Anstee 1996). Mounds are often sited close to narrow ribbons of Acacia dominated scrub that grow along incised drainage lines (Van Dyck and Strahan 2008).

Targeted searches were performed using foot transects in suitable habitat. Eleven active and inactive mounds were recorded. The status of mounds was assessed according to the method published in Anstee (1996). The Anstee (1996) index is most accurate at predicting the status of mounds with very high (classed as active) or very low (classed as inactive) scores. Mounds with intermediate activity could be either active or inactive, depending on whether they are in the process of being activated or degrading following abandonment. Mound locations and status are listed in Table 7.

Table 6 - Western Pebble-mound Mouse mound status and location

STATUS	LOCATION
Active	699553, 7676033
Active	699477, 7676125

STATUS	LOCATION
Active	699489, 7675818
Active	698929, 7675803
Intermediate	699126, 7676089
Intermediate	698970, 7676056
Intermediate	698995, 7676300
Intermediate	698874, 7675599
Inactive	699073, 7676012
Inactive	699424, 7676228
Inactive	699359, 7676249

2.9.3.8 BRUSH-TAILED MULGARA

Brush-tailed mulgara is widespread but patchily distributed in sandy regions of arid central Australia and WA. It inhabits hummock grass plains, sand ridges, and mulga shrubland on loamy soils (Menkhorst and Knight, 2010). It uses the open space between vegetation, a microhabitat that is known to support important prey species and may forage in termite mounds (Molyneux et al. 2018).

The Brush-tailed mulgara constructs burrow or utilises those of other species. Burrows may provide access to prey items, protection from predators and have thermoregulation benefits (Molyneux et al. 2018).

Local records are to the west of the Study Area with the closest records 15 km to the southwest. Records originate from biological surveys assessing the impact of rail lines servicing the Pilbara region.

Suitable habitat in the Study Area includes Sandy Plain and some areas of Stony Plain, however the preferred sand dune habitat is not present.

Targeted searches were conducted in suitable habitat for signs (tracks and burrow entrances) of the Mulgara, but none were detected. Based on somewhat limited habitat, the Mulgara is considered as Possibly occurring in the Study Area.

2.9.3.9 SPECTACLED HARE-WALLABY (MAINLAND)

The Spectacled hare-wallaby inhabits tropical tussock or hummock grassland with mid-dense or sparse tree and shrub cover (Menkhorst and Knight, 2010). In the Pilbara this species has declined drastically, possibly due to fox predation and because frequent burning of spinifex grassland has prevented the development of the large hummocks required for shelter (Van Dyck and Strahan 2008).

There are many local records, including within the FH3 habitat of the Study Area and in the surrounding plains habitats to the west. These records are from the early 1990's.

No signs or records of spectacled hare-wallaby were made in the Study Area, despite targeted searches for individuals or signs (e.g. scats), motion triggered camera deployment and spotlighting. The species was not recorded during the detailed and reconnaissance fauna surveys for the Pilgangoora Project. The absence of the species is likely a consequence of the broader regional decline.

The presence of suitable habitat and the historic records indicate it is possible for the species to occur. Whilst it has been recorded in the FH3 habitat historically, the largest hummock grasses presenting the highest quality habitat for the species, is currently found in the Sandy Plains (FH4) habitat.

2.9.3.10 LONG-TAILED DUNNART

The Long-tailed dunnart is a specialist rock dwelling species (Freeland et al. 1988). It prefers exposed rock and stony soils with hummock grasses and shrubs, on flat-topped hills, lateritic plateaus, sandstone ranges and breakaways. All sites it is known to frequent are within rugged rocky landscapes that support a low open woodland or shrubland of Acacias (especially Mulga) with an understorey of spinifex hummocks and (occasionally) also perennial grasses and cassias.

Local records occur at two sites approximately 25 km south east and south west of the Study Area. The FH1 habitat is suitable for the Long-tailed dunnart and the species possibly occurs.

2.9.3.11 PIN-STRIPED FINESNOUT CTENOTUS

The Pin-striped finesnout ctenotus has been found on spinifex plains on granitic soils near watercourses (Wilson and Swan 2013). Record locations are near to granite outcrops in the hilly interior of the Pilbara. Very little information is available for the species. It is possible that the FH1 and FH5 habitats are suitable for the species. Local records are remote and are in association with a larger watercourse than are present in the Study Area. It is possible that the species occurs within the Study Area.

2.10 INTRODUCED FAUNA

2.10.1 CONSERVATION ESTATE

The Western Australian Conservation Estate includes land and waters vested in the Conservation and Parks Commission under the Conservation and Land Management Act 1984. The Conservation Estate is managed by the Parks and Wildlife Service of DBCA to protect WA's biodiversity, and includes National Parks, Nature Reserves, Conservation Reserves, and other areas managed primarily for biodiversity conservation (DEE 2016).

A search of the Collaborative Australian Protected Area Database returned no conservation estates located within 50 km of the Survey Area. The nearest gazetted terrestrial conservation estate is Mungaroona Range, 60-80 km to the south-west of the Survey Area.

2.10.2 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally Sensitive Areas (**ESA**) are areas that are defined by the Department of Water and Environment Regulation (**DWER**) (2019) as:

- A declared World Heritage property as defined in s.13 of the EPBC Act;
- An area that is included on the Register of the National Estate, because of its natural heritage value under the Australian Heritage Council Act 2003;
- A defined wetland and the area within 50 m of the wetland;
- The area covered by vegetation within 50 m of T flora, to the extent to which the vegetation is continuous with the vegetation in which the T flora is located;
- The area covered by a TEC;
- A Bush Forever site;
- Areas covered by the Gnangara Mound Crown Land Policy and Western Swamp Tortoise Policy;
- Areas covered by lakes, wetlands, and fringing vegetation of the Swan Coastal Plain Lakes Policy, including Southwest Agricultural Zone Wetlands Policy and Swan and Canning Rivers Policy; and
- Protected wetlands as defined in the Environmental Protection (Southwest Agricultural Zone Wetlands) Policy 1998.

Environmentally Sensitive Areas can be viewed on the DWER clearing permit system map viewer. There are no ESAs within the Survey Area.

The Australian Wetlands Database includes nationally significant wetlands (as listed in the directory of important wetlands), wetlands listed under the Ramsar convention, wetlands that are representative, rare or unique, or wetlands that are considered of international importance (DEE 2019). The nearest wetlands listed in the Directory of Important Wetlands within 150 km of the Survey Area are the Leslie (Port Hedland) Saltfields System, 80 km to the north, the De Grey River System, 85 km to the north-east, and the Fortescue Marshes, 130 km to the south-west.

3 ENVIRONMENTAL RISK MANAGEMENT

3.1 IDENTIFYING ENVIRONMENTAL THREATS

Threats related to clearing of native vegetation at the Pilgangoora Project are summarised in Table 8.

Table 7 - Threats from clearing native vegetation

ENVIRONMENTAL THREAT	POTENTIAL RISK
Clearing of native vegetation	Clearing beyond approved boundaries and/or exceeding approved disturbance areas.
Dust	Impacts to native flora caused by dust emanating from the site.
Impacts to surface water flows	Clearing of vegetation leading to changes to runoff or mobilisation of sediment resulting in adverse impacts to natural surface water flows, potentially impacting creek lines and downstream riparian vegetation.
Native fauna and habitat	Clearing of vegetation and activity associated with the project has potential to directly (vehicle strikes, habitat removal) and indirectly impact native fauna (changes to foraging or dispersion dynamics).
Introduced flora	Weeds competing with native species and impacting the success of rehabilitation.

3.2 RISK ASSESSMENT

An Environmental Risk Assessment was undertaken for the threats identified above using the criteria adopted from the DEMIRS Statutory Guidelines for Mining Proposals (2020) – see Table 9 below.

Table 8 - Clearing risk assessment

ENVIRONMENTAL THREAT	CAUSE	POTENTIAL IMPACT	BEFORE MANAGEMENT			MANAGEMENT PRACTICES TO BE IMPLEMENTED	AFTER MANAGEMENT		
			Consequence	Likelihood	Inherent Risk		Consequence	Likelihood	Residual risk
Clearing of vegetation	Clearing works undertaken for project development	Clearing of vegetation in unapproved areas and/or outside the tenement boundary. Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Possible	Moderate (B3)	Survey undertaken prior to clearing. Induction training highlights the procedure for clearing and the consequences of unauthorised clearing. Land Use Certificate permitting system and procedure is in place. Survey control of areas to be cleared. Post clearing checks to ensure clearing has been undertaken in accordance with approval.	Moderate	Unlikely	Moderate (C4)
		Clearing of vegetation resulting in loss of conservation significant species or habitat. Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Likely	High(C2)	Survey undertaken prior to clearing. Induction training highlights the procedure for clearing and the consequences of unauthorised clearing. Land Use Certificate permitting system and procedure is in place. Survey control of areas to be cleared. Understand and record Priority Flora locations. Maintain GIS records and record impacts to Priority Flora if they are subject to clearing.	Moderate	Possible	Moderate (B3)
Dust	Vehicle and machinery movement	Dust resulting from movement of vehicles and operation of machinery settles on adjacent vegetation and causes plant death. Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem	Minor	Likely	Moderate (B2)	Regular dust suppression of vehicle access roads, hardstand areas using water carts. Stripping and movement of topsoil not to be undertaken in windy conditions where practical.	Minor	Unlikely	Low (B4)
	Wind	Dust generated by wind blowing across cleared areas and stockpiles settles on adjacent vegetation and causes plant death.	Minor	Likely	Moderate (B2)	Regular dust suppression of vehicle access roads, hardstands using water carts. Dust suppression of stockpiles as required.	Minor	Possible	Moderate (B3)

ENVIRONMENTAL THREAT	CAUSE	POTENTIAL IMPACT	BEFORE MANAGEMENT			MANAGEMENT PRACTICES TO BE IMPLEMENTED	AFTER MANAGEMENT		
			Consequence	Likelihood	Inherent Risk		Consequence	Likelihood	Residual risk
		Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem				Clearing of vegetation to be undertaken progressively.			
Surface water flows	Interruption of natural surface water flows	Surface water flows are captured or redirected away from the natural drainage channels resulting in impact to riparian vegetation. Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem Water resources	Major	Possible	High (D3)	Surface water flows to be redirected away from operational areas in an effort to minimise disruption of surface flow. Surface Water Management Plan to implemented.	Major	Unlikely	Moderate (D4)
	Uncontrolled surface water movement	Surface water flows carry sediment into surrounding vegetation causing vegetation death. Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem Water resources	Moderate	Likely	High (C2)	Drainage and containment structures to direct flows to sediment traps for removal of sediment before discharge to the environment.	Moderate	Unlikely	Moderate (C4)
Native fauna and habitat	Clearing of Vegetation	Clearing results in loss of conservation-significant fauna or suitable habitat Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Possible	Moderate (C3)	Survey undertaken prior to clearing. Clearing managed with the Land Use Certificate process.	Moderate	Unlikely	Moderate (C4)
	Interaction with fauna	Interaction with native fauna causes detriment to significant species. Environmental factor: Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Possible	Moderate (C3)	Induction and site rules relating to avoiding interaction with fauna. Appropriate management of waste. Speed limits imposed on Project roads. Management of site landfill in accordance with DWER licence conditions.	Moderate	Unlikely	Moderate (C4)
Introduced flora	New weed species introduced to site	Machinery and equipment brought to site carrying seeds of weed species not currently found in the project area. Environmental factor: Biodiversity/Flora/Fauna/Ecosystem	Minor	Possible	Moderate (B3)	Weed hygiene procedure. Machinery and equipment to be cleaned prior to being mobilised to site. Inspection of machinery on arrival, not permitted to work until appropriately cleaned.	Minor	Unlikely	Low (B4)

ENVIRONMENTAL THREAT	CAUSE	POTENTIAL IMPACT	BEFORE MANAGEMENT			MANAGEMENT PRACTICES TO BE IMPLEMENTED	AFTER MANAGEMENT		
			Consequence	Likelihood	Inherent Risk		Consequence	Likelihood	Residual risk
						Weed surveys to be undertaken.			

4 ADDRESSING THE TEN CLEARING PRINCIPLES

Under section 51-O of the EP Act, the CEO must have regard to the clearing principles, outlined in Schedule 5 of the EP Act, when deciding to grant, or refuse, a permit. Table 11 below addresses the ten clearing principles in relation to the permit application area.

Table 9 - Addressing the Ten Clearing Principles

THE TEN PRINCIPLES OF CLEARING NATIVE VEGETATION	
Principle (a)	**Native vegetation should not be cleared if it comprises a high level of biological diversity**
The vegetation condition across 64.6% of the Project Area was within the Very Good category, 16.9% good and 18.5% completely degraded from historical and current mining related disturbances, weed species and moderate grazing impact from cattle. No vegetation types occurring within the Project Area are analogous to any known TEC's or PEC's. No species known to be associated with groundwater dependent ecosystems were recorded in the Project Area. The flora and vegetation of the Project Area is generally typical of the Pilbara, and of the adjacent lands surrounding the Project Area. **Thereby the proposed clearing is unlikely to have a significant impact on biological diversity and it is unlikely to be considered to be at variance with clearing principle (a).**	
Principle (b)	**Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia**
A maximum of 87.1 ha of vegetation will be disturbed as a result of Proposed Action implementation. Of this 87.1 ha, up to 4.62 ha is considered to be high quality denning habitat for Northern Quolls. The remaining vegetation consists of good condition vegetation, that is well represented in the surrounding areas. Additionally, 5.56 ha of habitat with a moderate habitat value to the PLNB will be impacted. The Project will impact a maximum of 4.62 ha of this critical denning habitat, corresponding to 25% of the 19.83 ha of rocky hills habitat surveyed within the project area. An avoidance area has been implemented to ensure the remaining 75% of the denning habitat within the project area is protected. A further 82.58 ha of potential foraging habitat will also be cleared for the project. Management of north quoll populations will be through the implementation of the Northern Quoll Management Plan (NQMP). The avoidance area located to the east of the proposed pit will act as a habitat corridor for Northern Quoll individuals, reducing the likelihood of fragmentation of populations. Although the denning habitat that runs north to south will be interrupted by the construction of the pit, dispersal of individuals between remaining denning habitat will still be possible through the proposed avoidance area. The distance between remaining sections of denning habitat is under 1 km, which is well within the limits of Northern Quoll dispersal. No roosting sites will be impacted, and only a relatively small area of foraging habitat will be impacted. Mitigation strategies also involve management of invasive species that may pose a threat to the PLNB, and ongoing monitoring within the area will increase data availability on the species. The only other conservation significant species confirmed as present within the area was the Pebble- mound mouse, classified as Priority 4 under the BC Act. Habitat types FH3 and FH6 are identified as common	

THE TEN PRINCIPLES OF CLEARING NATIVE VEGETATION

throughout the DE. The Pebble mound mouse habitat types throughout the DE include 59.97 ha of habitat type FH3 and 15.13 ha of FH6 and is representative of widespread habitat within the Pilbara region.

Likely to be at variance, however the impacts to fauna listed under the EPBC Act are regulated through EPBC Approval EPBC2023/09471

Principle (c)	**Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.**

The Biological survey completed (APM, 2022) found Two Priority 3 species: *Triodia chichesterensis* was frequently recorded and no count of individuals was made, due to the high frequency and abundance of the species presence. *Rothia indica subsp. australis* was recorded in two locations as one individual at each location. As the species is small and the Study Area containing these vegetation types comparatively large, it is likely there are other individuals within the area.

Where possible, impacts to this species will be minimised, however it is likely that the proposed footprint will result in the loss of at least one *Rothia indica subsp. australis* and several individuals of *Triodia chichesterensis.*

Potentially at variance with this principle.

Principle (d)	**Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of a threatened ecological community.**

There are no TECs listed under the BC Act or EPBC Act known to occur within the Project Area. One Priority 3 Ecological Community is located within 50 km of the Project Area: the Gregory Land System.

Therefore, the clearing is not likely to be at variance with clearing principle (d).

Principle (e)	**Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.**

Two IBRA pre-European vegetation units were identified in the Project Area (APM, 2022a). Both vegetation units 82 and 93, have a conservation significance rating of least concern and both have above 99% of their pre-European extent remaining.

The proposed clearing is not likely to be at variance with clearing principle (e).

Principle (f)	**Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.**

No wetlands are within 25km of the Project area and no surface water impacts are expected due to the location of the Lynas Find pit being at the top of regional catchments (Pentium Water, 2022).

APM (2022a) reported the nearest wetlands listed in the Directory of Important Wetlands within 150 km of the Project Area are the Leslie (Port Hedland) Saltfields System, 80 km to the north, the De Grey River System, 85 km to the north-east, and the Fortescue Marshes, 130 km to the south-west.

THE TEN PRINCIPLES OF CLEARING NATIVE VEGETATION

Proposed clearing within the clearing envelope is not likely to be at variance with clearing principle (f)

Principle (g)	**Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.**

The Project area soils have been assessed as non-sodic meaning the soils are not dispersive and have a low risk of erosion is used for landform rehabilitation (MWM, 2023). The cation exchange capacity ranges from low to moderate, which suggests the soils are suitable for supporting plant life. Due to these soil properties the clearing of native vegetation will not result in further land degradation of the surrounding areas.

The proposed clearing is not likely to be at variance with clearing principle (g).

Principle (h)	**Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.**

APM (2022a) used the Collaborative Australian Protected Area Database (CAPAD), to determine no conservation estates were located within 50 km of the Project Area and the nearest gazetted terrestrial conservation estate is Mungaroona Range, 85 km south-west of the Project Area.

The proposed clearing is not likely to be at variance with clearing principle (h).

Principle (i)	**Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.**

Pentium Water (2023) identified Impacts to surface water quality is unlikely due to the location of the project being at the top of the regional catchment. Pit and WRL bunding will we sufficient in managing run- off hence no impacts to surface water quality is likely to occur as a result of the project.

Groundwater drawdown is likely to also be limited to areas in close proximity to the pit, hence there are no nearby groundwater dependent ecosystems or groundwater users that may be detrimentally impacted by dewatering at Lynas Find.

The proposed clearing is not likely to be at variance with clearing principle (i).

Principle (j)	**Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.**

The hydrological investigation (Pentium Water, 2023) noted that the proposed pit is at the top of regional catchment boundaries and there will be no natural flow into or around the pit, meaning the pits will only be influenced by direct rainfall. Similarly, the waste rock landform is also near the top of the catchment boundary with minimal upstream flows affecting it. The study recommended bunding of the landform to prevent loss of sediment to local creek systems. PLS will adopt this measure.

The proposed clearing is not likely to be at variance with clearing principle (j).

5 REFERENCES

360 Environmental (2015) Pilbara Leaf-nosed Bat Survey, Pilgangoora Prepared for Pilbara Minerals November 2015

360 Environmental (2016a) Baseline Vertebrate Fauna Survey, Pilgangoora. Prepared on behalf of Pilbara Minerals Limited. Publication date: May 2016.

360 Environmental (2016b) Pilbara Leaf-nosed Bat Roost Survey, Pilgangoora Prepared for Pilbara Minerals February 2016

Anderson B, Thiele K and Barrett M (2017) A revision of the Triodia basedowii species complex and close relatives (Poaceae: Chloridoideae). Australian Systematic Botany 30, 197-229

APM (2022a) Lynas Find Biological Survey - Prepared for Pilbara Minerals Limited by APM, October 2022

APM (2022b) TSF Option 2 and Option 5 Biological Survey - Prepared for Pilbara Minerals Limited by APM, November 2022

APM (2023a) Pilgangoora Project – Targeted Searches for Northern quoll. Memo report prepared for Pilbara Minerals Pilgangoora Project March 2023.

APM (2023b) E45/2287 Infill Biological Survey, Pilgangoora Project, WA. Technical Report prepared for Pilbara Minerals Limited May 2023.

APM (2023c) Pilgangoora Project – Targeted Searches for Conservation Significant Bat Roosts. Memo report prepared for Pilbara Minerals Pilgangoora Project August 2023.

APM (2023d) Pilgangoora Project Biological Survey- Prepared for Pilbara Minerals Limited Pilgangoora Project, October 2023.

Armstrong K (2001) The roost habitat and distribution of the orange leaf-nosed bat, Rhinonicteris aurantius, in the Pilbara region of Western Australia. Wildlife Research. 28:95–104.

Armstrong K and Anstee S (2000) The ghost bat in the Pilbara: 100 years on. Australian Mammalogy. 22:93–101.

ALA (2023) Atlas of Living Australia. Online database. Accessed December 2023.

Bat Call WA (2021a) A review of ghost bat ecology, threats and survey requirements, report prepared for the Department of Agriculture, Water and the Environment, Canberra. CC BY-NC-ND 4.0.

Bat Call WA (2022b) A review of Pilbara leaf-nosed bat ecology, threats and survey requirements, report prepared for the Department of Agriculture, Water and the Environment, Canberra, November.

Baudinette R, Churchill S, Christian K, Nelson J and Hudson P (2000) Energy, water balance and the roost microenvironment in three Australian cave-dwelling bats (Microchiroptera). Journal of Comparative Physiology. B 170:439–446.

Beard J (1975) Vegetation Survey of WA, 1:1,000,000 series, Pilbara Sheet and Explanatory Notes. University of Western Australia Press.

BirdLife International (2019) Species factsheet: Falco hypoleucos. Accessed July 2022 http://www.birdlife.org

BirdLife International (2022) Species factsheet: Erythrotriorchis radiatus. Downloaded from http://www.birdlife.org on 01/11/2022.

Bullen R (2013) Pilbara leaf-nosed bat, Rhinonicteris aurantia: Summary of current data on distribution, energetics and threats. Presentation made to Western Australian Department of Environment and Conservation workshop on Pilbara leaf-nosed bats, 25 June 2013

Bullen R (2021) Ghost bats in the Pilbara, Macroderma gigas: Summary of current data on distribution, energetics and threats. Presentation made to Curtin University workshop, 2 March 2021.

Bureau of Meteorology (2023) Climate Data Online. Available online: http://www.bom.gov.au/climate/data/

Churchill S (1991) Distribution, abundance and roost selection of the Orange Horseshoe-bat, Rhinonycteris aurantius, a tropical cave dweller. Wildlife Research. 18:343–353.

Churchill S, Helman P and Hall L (1988) Distribution, populations and status of the Orange Horseshoe Bat, Rhinonicteris aurantius (Chiroptera: Hipposideridae). Australian Mammalogy. 11(1):27–33.

Clarke K and Gorley R (2015) PRIMER v7: User Manual/Tutorial. PRIMER-EPlymouth.

Commonwealth of Australia (COA) (2016) EPBC Act referral guideline for the endangered northern quoll, Commonwealth of Australia 2016.

Cramer VA, Armstrong KN, Bullen RD, Cross SL, Gibson L, Hanrahan N, Knuckey CG, Ottewell K, Reiffer S, Ruykys L and Shaw RE (2022) Research priorities for the ghost bat (Macroderma gigas) in the Pilbara region of Western Australia. Australian Mammalogy. https://doi.org/10.1071/AM21042

Department of Agriculture, Water and the Environment (DAWE) (2020) National Established Weed Priorities – Towards A National Framework – Final Draft. Prepared by Wild Matters Pty. Ltd. for the Department of Agriculture, Water and the Environment July 2020.

Department of Biodiversity, Conservation and Attractions (DBCA) (2017) Night parrot. Published: 26 May 2017. Available at https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/night-parrot

Department of Biodiversity, Conservation and Attractions (DBCA) (2023a) Dandjoo search accessed on the 14/03/2023. Available at https://dandjoo.bio.wa.gov.au/

Department of Biodiversity, Conservation and Attractions (DBCA) (2023b) DBCA Fire History (DBCA-060). Fire Management Services Branch. Last updated 01/07/2023. Available at https://catalogue.data.wa.gov.au/dataset/dbca-fire-history

Department of Biodiversity, Conservation and Attractions (DBCA) (2023c) List of threatened and priority flora. https://www.dbca.wa.gov.au/wildlife-and-ecosystems/plants/list-threatened-and-priority-flora. Accessed 12/01/2024.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023) Approved lists under the EPBC Act. Available at: https://www.dcceew.gov.au/environment/epbc/what-is-protected/approved-lists#species

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

Department of Parks and Wildlife (DPAW) (2017a) The conservation and management of the bilby (Macrotis lagotis) in the Pilbara: Progress Report 2017, Department of Parks and Wildlife, Perth.

Department of Parks and Wildlife (DPAW) (2017b) Interim guideline for preliminary surveys of night parrot (Pezoporus occidentalis) in Western Australia. Version 1 May 2017.

Department of Primary Industries and Regional Development (DPIRD) (2019a) Soil Landscape Mapping – Best Available DPIRD-027. Version 05.01. Data last updated 02-08-2019.

Department of Primary Industries and Regional Development (DPIRD) (2019b) Pre-European Vegetation (DPIRD-006). Available from Natural Resource Information (WA) (agric.wa.gov.au). Accessed 2 August 2021.

Department of Primary Industries and Regional Development (DPIRD) (2023) Western Australian Organism List (WAOL). Available at: https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol Accessed 15/09/2023.

Department of Primary Industries and Regional Development (DPIRD) (2023) Hard spinifex plain pastures in the Pilbara, Western Australia. Page last updated: Friday, 14 April 2023. Available at: https://www.agric.wa.gov.au/rangelands/hard-spinifex-plain-pastures-pilbara-western-australia

Department of Sustainability Environment Water Population and Communities (DSEWPAC) (2011a) Survey Guidelines for Australia's Threatened Mammals, Australian Government. Retrieved from https://www.awe.gov.au/environment/epbc/publications/survey-guidelines-australias-threatened-mammals

Department of the Environment (2015) Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats. In effect under the EPBC Act from 23-Jul-2015.

Department of the Environment and Energy (DEE) (2016) Collaborative Australian Protected Areas Database -Terrestrial CAPAD 2016. Australian Government

Department of the Environment and Energy (DEE) (2018) Guidelines for biological survey and mapped data, Australian Government. Retrieved from https://www.awe.gov.au/environment/environmental-information-data/information-policy/guidelines-for-biological-survey-mapped-data

Department of Water and Environmental Regulation (DWER) (2019) Clearing Regulations - Environmentally Sensitive Areas. Government of Western Australia.

Ecologia Environmental (2018a) Pilgangoora Lithium Project – M45/1260 Level 1 Fauna and Reconnaissance Flora and Vegetation Assessment. Prepared on behalf of Altura Mining Limited. Publication date: 7 July 2018.

Ecologia Environmental (2018b) Pilgangoora Project – Stage 2 Expansion Desktop Environmental Assessment. Prepared on behalf of Pilbara Minerals Limited. Publication date: 26 October 2018.

Ecoscape (2020) Pippingarra and Wodgina Roads: Flora and Fauna Survey – Prepared for Iron Bridge Operations Pty Ltd 10/08/2020.

Ellis RJ and Johnstone RE (2016) Liasis olivaceus barroni (Pilbara olive Python) diet. Herpetol. Rev. 47, 685.

Ellis, RJ (2013) Liasis olivaceus barroni (Pilbara olive python) diet. Herpetol. Rev. 44, 693.

Environmental Protection Authority (EPA) (2016) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment. Available online: https://www.epa.wa.gov.au/policies-guidance/technical-guidance-flora-and-vegetation-surveys-environmental-impact-assessment

Environmental Protection Authority (EPA) (2020) Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment. Available online: https://www.epa.wa.gov.au/policies-guidance/technical-guidance-terrestrial-vertebrate-fauna-surveys-environmental-impact

Environmental Protection Authority (EPA) (2021) Instructions for the preparation of data packages for the Index of Biodiversity Surveys for Assessments (IBSA). 15 November 2021.

Executive Steering Committee for Australian Vegetation Information (ESCAVI) (2003) Australian Vegetation Attribute Manual National Vegetation Information System, Version 6.0 Department of the Environment and Heritage.

Frohlich MW, Thulin M and Chase MW (2020) Ninety-three new combinations in Euploca for species of Heliotropium section Orthostachys (Boraginaceae sensu APG). Phytotaxa 434 (1): 013–021.

Geological Survey of Western Australia (2014) 1:100 000 Geological Map – WODGINA (2655), second edition. Perth: Author.

Hill B and Ward S (2010) National Recovery Plan for the Northern Quoll Dasyurus hallucatus. Department of Natural Resources, Environment, The Arts and Sport, Darwin

Jolly S (1988) Five colonies of the Orange Horseshoe Bat, Rhinonycteris aurantius (Chiroptera: Hipposideridae), in the Northern Territory. Australian Wildlife Research. 15:41–49.

Kendrick P and McKenzie N (2001) Pilbara 1: PIL1 Chichester Supregion. Available online: https://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/pilbara01_p547-558.pdf

Menkhorst P and Knight F (2010) A Field Guide to the Mammals of Australia. 3rd ed. CSIRO Publishing, Sydney

MMWC Environmental Pty Ltd (2016a) Pilgangoora Project Area – Flora, Vegetation and Fauna Assessment. Prepared on behalf of Pilbara Minerals Limited. Publication date: July 2016

MMWC Environmental Pty Ltd (2016b) Pilgangoora Access Road Borrow Pits - Flora and Vegetation Assessment. Prepared on behalf of Pilbara Minerals Limited. Publication date: July 2016.

Molyneux J, Pavey C, James A, Carthew S (2018) Habitat use by the brush-tailed mulgara (Dasycercus blythi). Australian Journal of Zoology 65(5) 335-345.

Natural Area Consulting (2014) Flora and Fauna Survey Report – Pilgangoora. Prepared on behalf of Altura Mining Limited, February 2014.

Natural Area Consulting Flora (2016) Vegetation and Fauna Survey Report – Pilgangoora Lithium Project. Prepared on behalf of Altura Mining Limited, June 2016.

Outback Ecology (2009) Wodgina DSO Project Flora and Vegetation Assessment. Unpublished report prepared for Atlas Iron Limited.

Pearson DJ (1993) Distribution, status and conservation of pythons in Western Australia In: Lunney, D and Ayers, D (Eds) Herpetology in Australia: a Diverse Discipline, pp. 383-395, Royal Zoological Society of NSW, Sydney.

Pearson DJ (2006) Giant Pythons of the Pilbara. Landscope 19: 32-39.

Pfautsch S, Dodson W, Madden S and Adams MA (2014) Assessing the impact of large-scale water table modifications on riparian trees: a case study from Australia. Ecohydrology, 8(4):642-51.

Richards G, Hand S, Armstrong K and Hall L (2008) Ghost bat Macroderma gigas. In The Mammals of Australia. Third Edition. (Eds S. Van Dyck and R. Strahan), pp. 449-450. Reed New Holland, Chatswood.

Schoenjahn J (2018) Adaptations of the rare endemic grey falcon Falco hypoleucos that enable its permanent residence in the arid zone of Australia. PhD Thesis. University of Queensland

Southgate R (1990) Habitats and diet of the Greater Bilby Macrotis lagotis Reid (Marsupialia: Permelidae) (pp.293-302). In 'Bandicoots and bilbies'. (Surrey Beaty and Sons: Sydney.)

Southgate R, Paltridge R, Masters P and Carthew S (2007) Bilby distribution and fire: a test of alternative models of habitat suitability in the Tanami Desert, Australia. Ecography 30, 759–776.

Specialised Zoological (2022) Acoustic analysis and bat call identification from Lynas Find, Western Australia. Unpublished report by Specialised Zoological for Animal Plant Mineral Pty Ltd, 23 November 2022, project reference SZ637.

Specialised Zoological (2024). Acoustic analysis and bat call identification from Pilgangoora, Western Australia: October 2023. Unpublished report by Specialised Zoological for Animal Plant Mineral Pty Ltd, 8 January 2024, project reference SZ690

Swan M (2007) Keeping and Breeding Australian Pythons, Mike Swan Herp Books, Lilydale.

Terrestrial Ecosystems (2020) Northern Quoll survey on mining tenement M45/1266. Memo prepared for Pilbara Minerals, January 2020.

Thackway R and Cresswell I (1995) An Interim Biogeographic Regionalisation for Australia. Available online: https://www.environment.gov.au/system/files/resources/4263c26f-f2a7-4a07-9a29-b1a81ac85acc/files/ibra-framework-setting-priorities-nrs-cooperative-program.pdf

Threatened Species Scientific Committee (TSSC) (2008) Approved Conservation Advice for Liasis olivaceus barroni (Olive Python - Pilbara subspecies). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66699-conservation-advice.pdf. In effect under the EPBC Act from 03-Jul-2008.

Threatened Species Scientific Committee (TSSC) (2016) Conservation Advice: Rhinonicteris aurantia (Pilbara form), Pilbara Leaf-nosed Bat., Canberra, Australian Capital Territory

Threatened Species Scientific Committee (TSSC) (2020) Conservation Advice Falco hypoleucos grey falcon. Approved from 09/07/2020.

Tille P (2006) Soil-Landscape Zones of Western Australia's Rangelands and Interior. (Resource Management Technical Report 313). Western Australia: Department of Agriculture and Food.

Trudgen M (1988) A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.

van Dyck S and Strahan R (editors) (2008) The Mammals of Australia. 3rd ed. Reed New Holland, Sydney.

van Vreeswyk A, Payne A, Leighton K and Hennig P (2004) An inventory and condition survey of the Pilbara region, Western Australia. Available online: https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1006&context=tech_bull

Western Australian Herbarium (1998-) Florabase. Descriptions by the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions. Text used with permission (https://florabase.dpaw.wa.gov.au/help/copyright). Accessed on 17 May 2023

Western Australian Museum (2023) Checklist of the Terrestrial Vertebrate Fauna of Western Australia. Available at https://museum.wa.gov.au/research/departments/terrestrial-zoology/checklist-terrestrial-vertebrate-fauna-western-australia May 2023.

Wilson S and Swan G (2013) A Complete Guide to Reptiles of Australia. New Holland Publishers, Sydney.

APPENDIX A – LYNAS FIND PROJECT – BIOLOGICAL SURVEY (APM 2022)