Clearing Permit
Pilgangoora G45/357

Supporting Information for Native Vegetation Clearing (Purpose) Permit Application

27 August 2024

Native Vegetation Clearing Permit Application – Pilgangoora Lithium-Tantalum Project

General Purpose Lease G45/357 - Shire of East Pilbara

VERSION CONTROL

0	Submission to Regulator	TS	EA	IZ	29/08/2024
A	Prepared for Review	TS	MH	EA	26/08/2024
Rev	Description	Prepared	Checked	Authorised	Date

CONTENTS

ACRONYM	MEANING
AHD	Australian Height Datum
AER	Annual Environmental Report
BoM	Bureau of Meteorology
DMIRS	Department of Mines, Industry Regulation and Safety
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESA	Environmentally Sensitive Area
GDE	Groundwater-Dependent Ecosystem
GDV	Groundwater Dependent Vegetation
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
LoM	Life of Mine
m	Metres
mm	Millimetres
Mt	Million tonnes
Mtpa	Million tonnes per annum
PEC	Priority Ecological Community
P	Priority flora
PLS	Pilbara Minerals Ltd
POPL	Pilgangoora Operations Proprietary Limited
PMST	Protected Matters Search Tool
t	Tonnes
TEC	Threatened Ecological Community
TSF	Tailings Storage Facility

1 PERMIT APPLICATION DETAILS

1.1 BACKGROUND

Pilgangoora Operations Pty Ltd (POPL), is a 100% owned subsidiary of Pilbara Minerals Limited (PLS), that owns and operates the Pilgangoora Lithium-Tantalum Project (the 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

POPL proposed to develop mining infrastructure and other activities to support the mining operation situated on general purpose lease G45/357.

The proposed mining activities are under assessment in Mining Proposal Reg ID 126586, submitted in July 2024. Proposed activities include establishment of a waste rock landform, access roads, soil stockpiles and other support infrastructure as required. The infrastructure is to support the development of the South pit at the Project.

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

Ownership details of G45/357 that underlies the proposed clearing permit area has been extracted from Government of Western Australia DEMIRS Mineral Titles Online and is presented below in Figure 1-2.

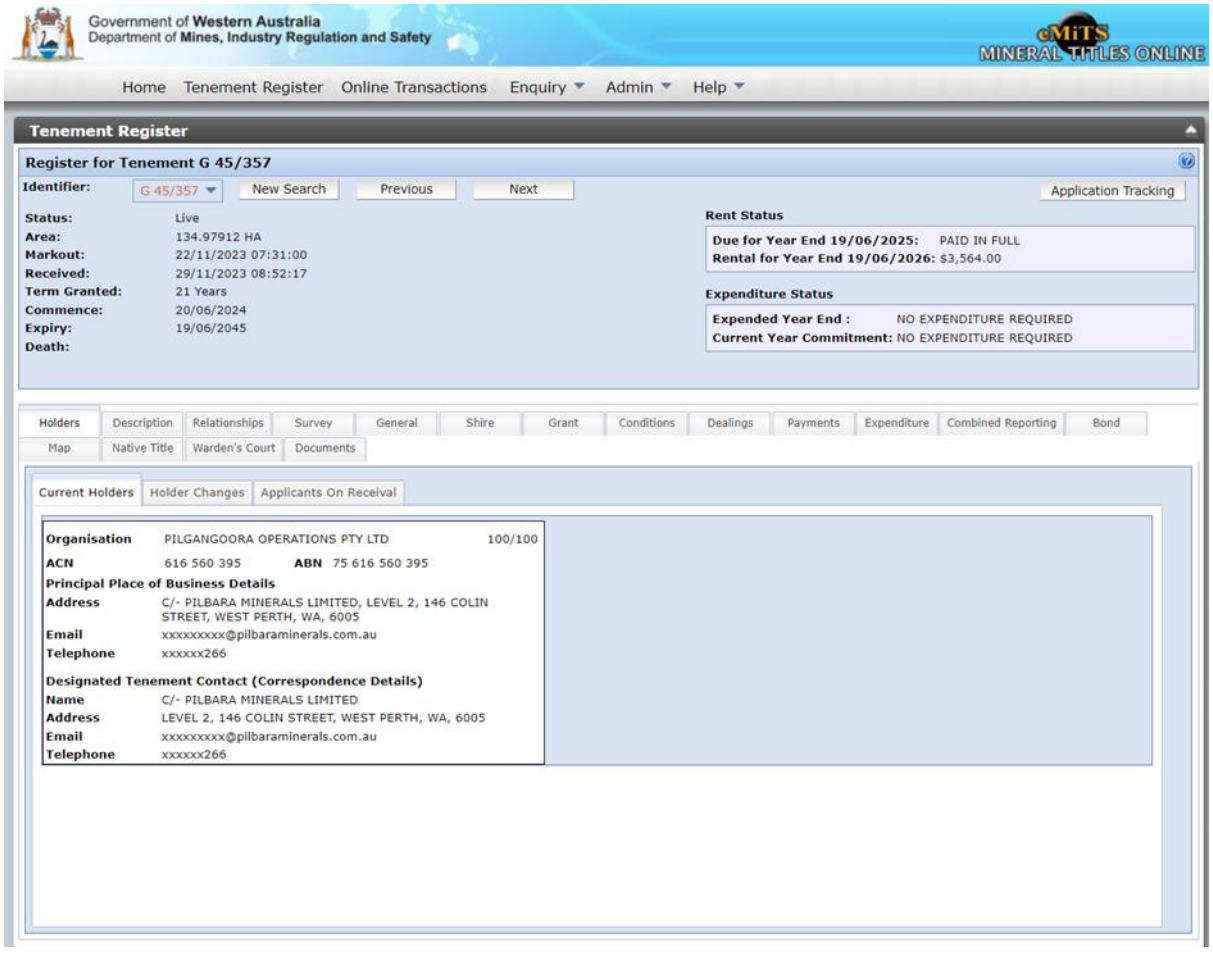

Figure 1-2: Ownership details of general purpose lease G45/357

1.3 PROPOSED CLEARING EXTENT

The application area for the purpose permit measures ~134.97 hectares. Within the application area, up to 134.97 hectares of vegetation is proposed for clearing.

The location of the permit application area appears as Figure 1-3.

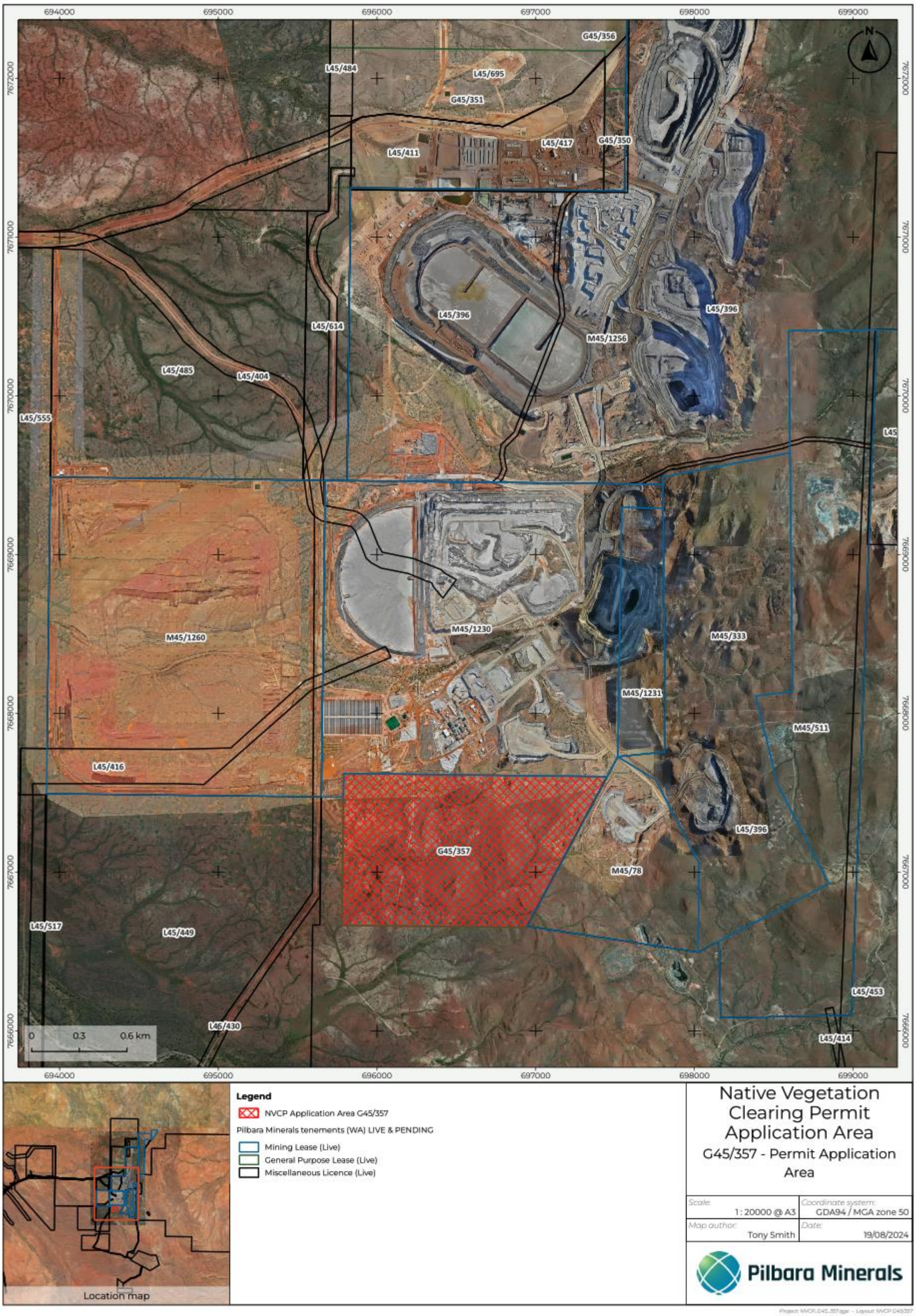

Figure 1-3: Clearing (Purpose) Permit Application Area

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 permit application area, whilst supporting mining infrastructure. The alternatives considered are outlined below:

- Investigation of alternative locations for key mine infrastructure.
    - Multiple options were modelled and assessed for locating waste rock landforms in efficient and effective locations at the Project. The permit application area is one of the most suitable locations modelled for waste rock deposition in relation to the adjacent open cut pit. Other modelled locations were discounted due to greater potential impacts on conservation significant fauna habitat and records than this site.
- Tenement conditions and constraints
    - Purposes of general purpose lease tenure enable deposition of waste rock and establishment of mining support infrastructure. The lease G45/357 was specifically sought (and granted) for these purposes.
- 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. The waste rock landform and supporting infrastructure is vital for the future operation of the Project, as there is not enough capacity in existing approved waste rock landforms to support the volume of waste rock that is scheduled to be deposited.

1.4.2 ACTIONS TO MINIMISE CLEARING

An environmental assessment has been completed over the permit application area via the *Pilgangoora Project Biological Survey* (APM 2023a) (**IBSA-2023-0453**) (also appearing as Appendix 1). The application area has been assessed for impacts to conservation significant fauna habitat and conservation significant flora 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 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 SETTING

The topography of the permit application area is relatively flat on the western half with at approximately 180 metres Australian Height Datum (m AHD). The eastern part of the permit application area contains a number of hills with ground elevations rising to approximately 220 m AHD. The Turner River is approximately 20 km to the west and the hills to the east of the permit application area rise up to 260 m AHD.

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).

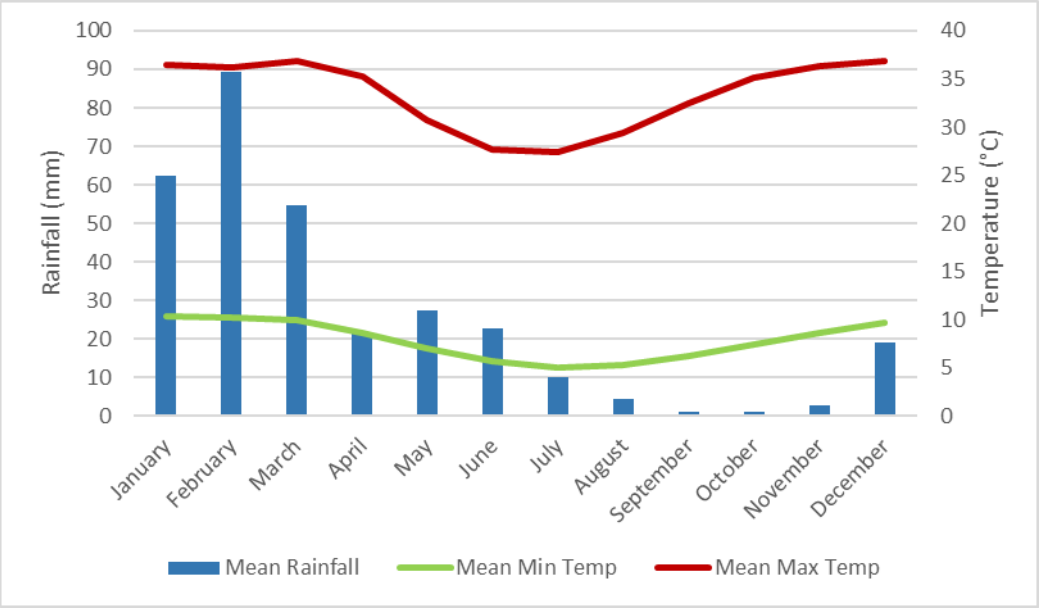

Figure 2-1: Temperature and rainfall averages for Port Hedland Airport weather station (No. 004032) (BOM 2023)

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 permit application area falls within three soil landscape systems:

- Talga land system;
- Satirist land system; and
- Macroy land system.

Description of the land systems are presented in Table 2-1 and illustrated in Figure 2-2.

Table 2-1: Land systems

LAND SYSTEM	GEOLOGY	DESCRIPTION
Talga	Hill and ridge tracts of mafic and ultramafic rock (greenstones), other metamorphics and chert, relief up to 100 metres	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands
Satirist	Quaternary alluvium and colluvium; clay gravel and pebble deposits, minor Lower Proterozoic or Archaean chert, quartzite, shale and agglomerate	Stony plains and low rises supporting hard spinifex grassland and gilgai plains supporting tussock grasslands
Macroy	Level to gently undulating stony and gritty surfaced plains with occasional granite tor field and domes and closely to moderately spaced dendritic tributary drainage floors, relief up to 25 metres	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands

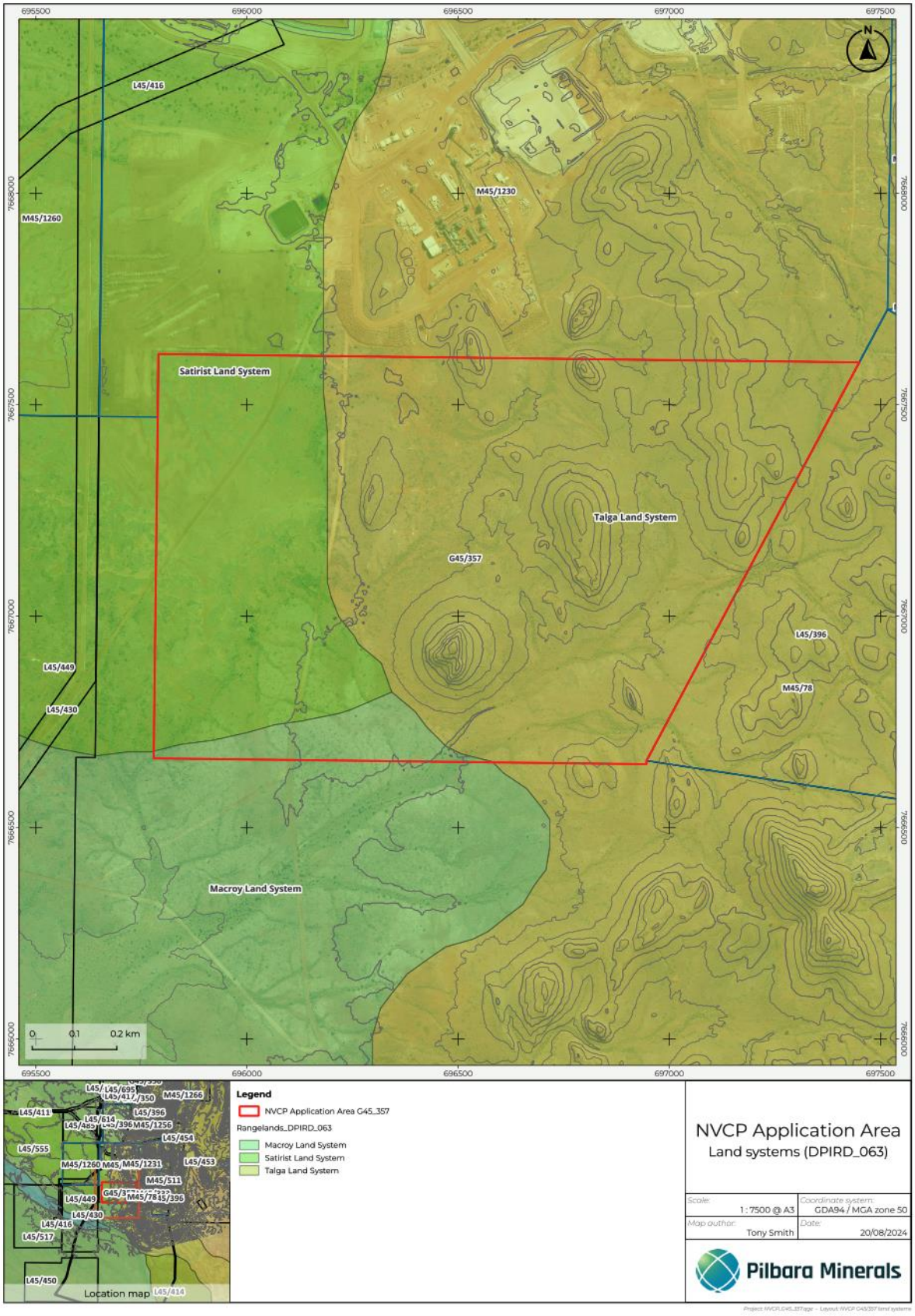

Figure 2-2: Land systems

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 Survey Area is within the Wodgina (2655) map area.

The permit application area contains the following nine geological formations:

- _A2-d-k; Alluvial unit; Partly consolidated alluvial gravel, sand, and silt; local carbonate cement; dissected by present-day drainage.
- A-DA-mats; Dalton Suite; Serpentinite, schistose
- _A-KEe-mbaq; Euro Basalt; Silicified amphibolite and metabasalt.
- _A-KEe-mu; Euro Basalt; Metamorphosed ultramafic rock.
- A-mty-P; Pilbara Craton greenstones; Mylonitized metasandstone
- A-PI-musr; Pilbara Supergroup; Tremolite--chlorite--talc schist.
- _A1f-cb-vb; Alluvial unit; Clay, silt, sand, and basaltic or doleritic gravel on floodplains; gilgai surface in areas of expansive clay; derived from ferromagnesian parent rock; unconsolidated.
- _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.

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

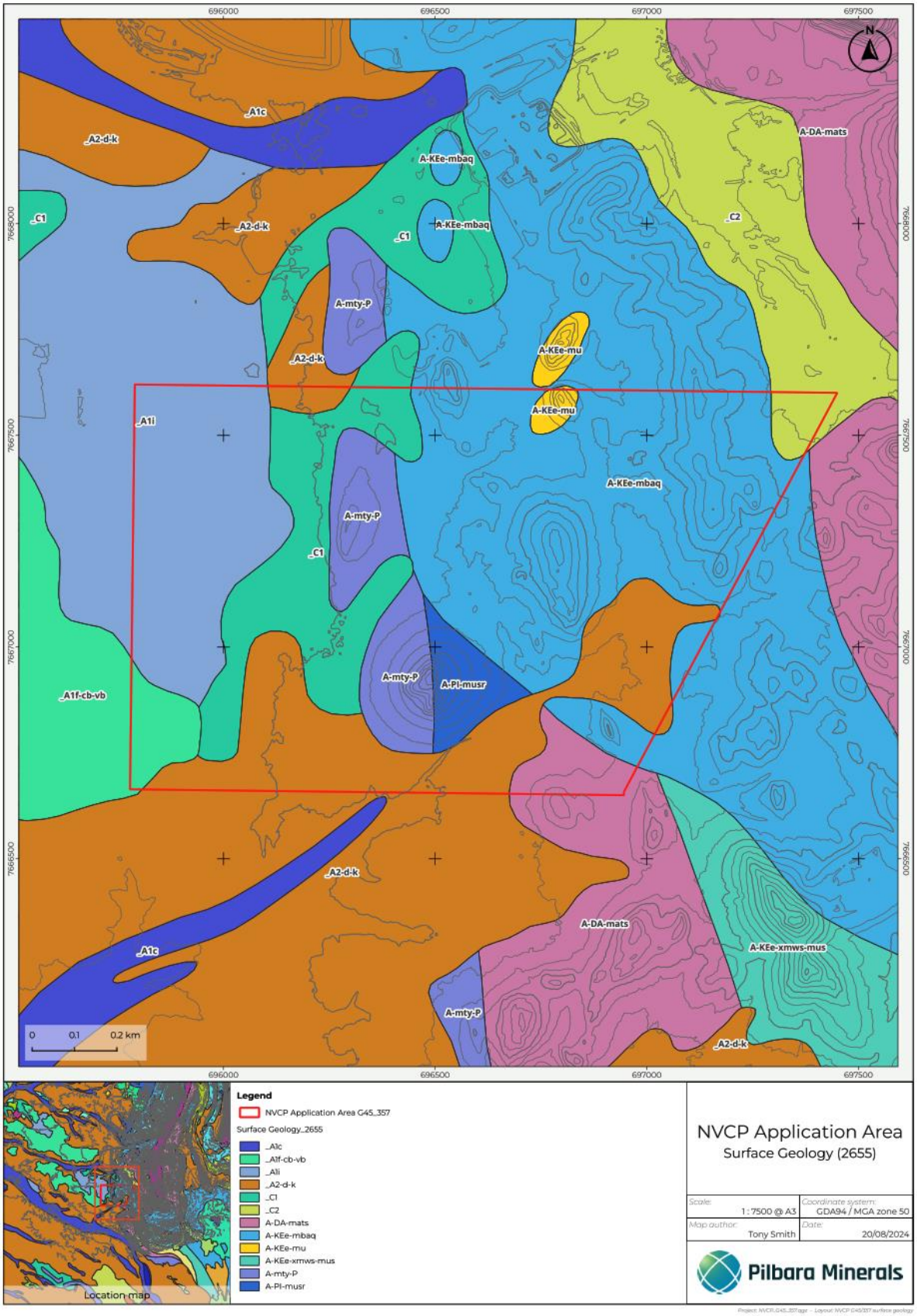

Figure 2-3: Surface geology of the permit application area

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 km^2. 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 because 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.

The permit application area intersects with the Southern Creek and Chinnamon Creek catchments. The Southern Creek catchment is approximately 18.8 km^2 and a Southern Creek tributary traverses the permit application area. The permit application area within Southern Creek catchment equates to approximately 4.8% of the catchment area. Chinnamon Creek catchment is approximately 288 km^2 and the permit application area with it equates to approximately 0.15% of the catchment area. These catchments ultimately report to the Turner River.

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.

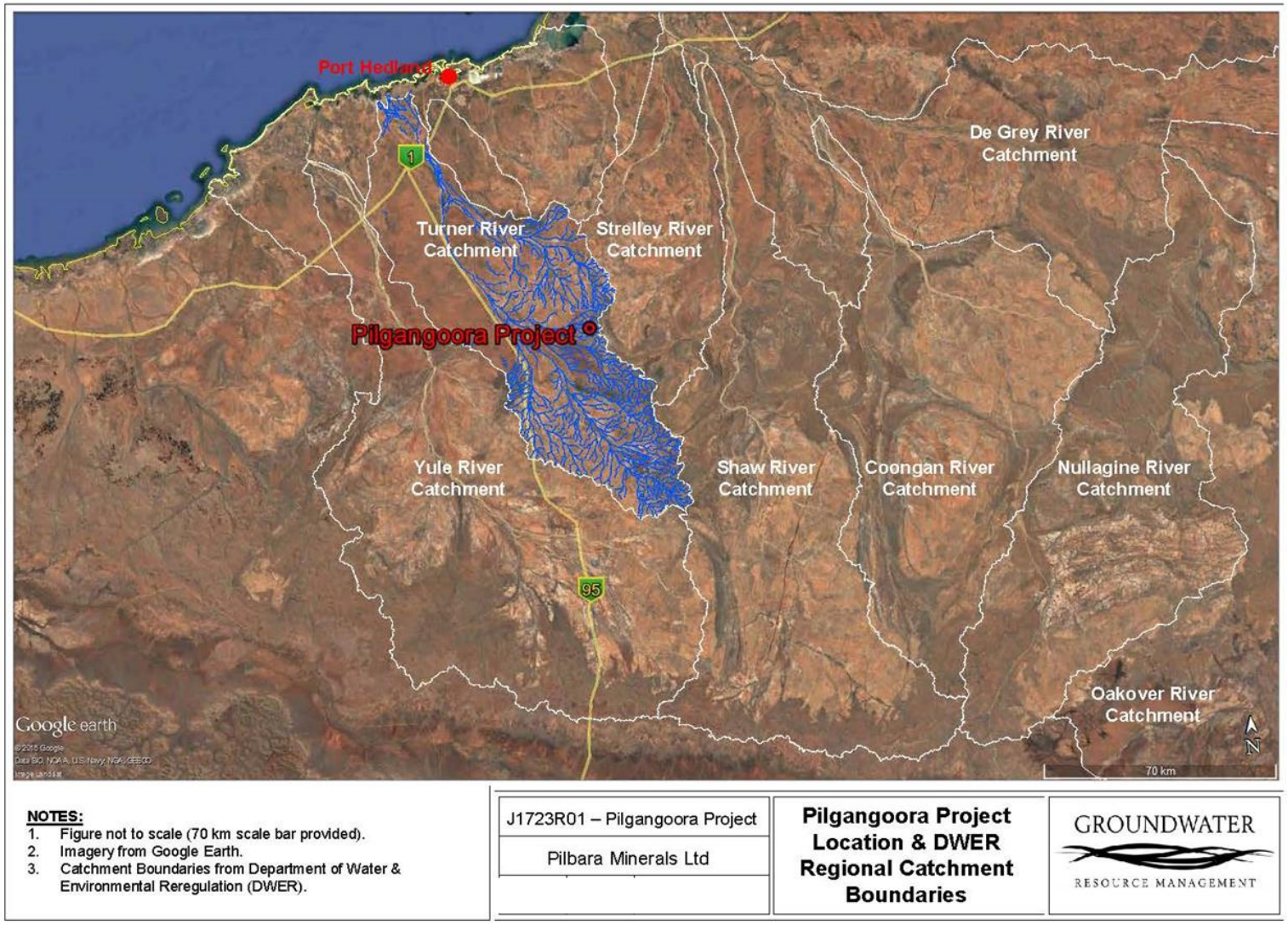

Figure 2-4: Regional surface water catchment

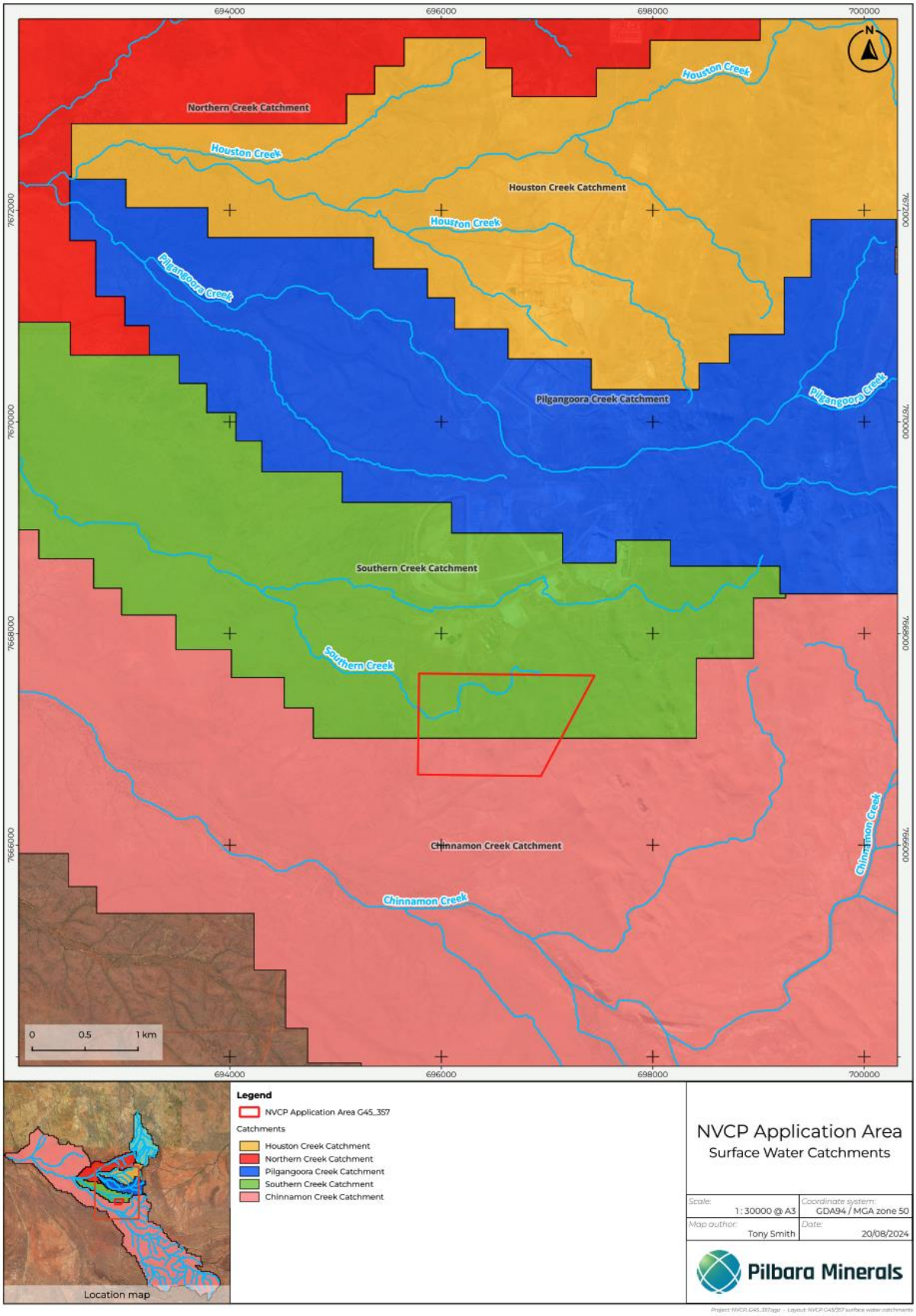

Figure 2-5: Local surface water catchments

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.

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 the ephemeral creeks in the vicinity of the permit application area (Northern Creek, Pilgangoora Creek, Houston Creek, Southern Creek, Chinnamon Creek and tributaries. 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, 2018). In the permit application area there are westerly/south-westerly trending creeklines; these likely feature a greater depth of weathering into the underlying basement, and are anticipated to act as preferential pathways for groundwater flow.

2.8 FLORA AND VEGETATION

A flora, vegetation and fauna survey was completed over the permit application area in 2023 (APM 2023a

4). The survey report is attached as Appendix 1.

2.8.1 FLORA AND VEGETATION DESKTOP REVIEW

No T or P Flora listed under the *BC Act* and/or *EPBC Act* have been previously recorded within the Survey Area.

One T flora species has been recorded within 30 km, *Quoya zonalis* (formerly *Pityrodia* sp. Marble Bar, listed as Endangered under the EPBC Act and BC Act). T and P flora returned from database searches appear in Figure 4-1 of Appendix 1 and a likelihood of occurrence assessment was conducted with results appearing in Table 4-1 of the attached Appendix 1.

There are no TECs listed under the BC Act or EPBC Act known to occur within the Survey Area. One P3 Ecological Community is located approximately 23 km west of the Survey Area; the Gregory Land System.

2.8.2 FLORA

The complete list of plant species recorded within the Survey Area is presented in Appendix F of Appendix 1. The mean species richness was 15 species per quadrat. This is lower than other local surveys including the This is lower than other local surveys including the MMWC Environmental (2016a) Pilgangoora baseline survey which included 49 detailed sites with an average species richness of 25, the Infill Biological Survey (APM 2023b) with 17 detailed sites and an average richness of 32, TSF Option 2 and 5 Survey (APM 2022b) with 19 detailed sites and an average species richness of 23, and the Lynas Find Survey (APM 2022a) with 23 detailed sites and an average species richness of 20. The low species richness is likely a consequence of survey season and seasonal conditions.

A species accumulation curve was performed, returning a modelled Michaelis-Menton species richness of 155, indicating that the floristic survey was approximately 93% complete.

2.8.3 VEGETATION TYPES

Five vegetation types are described for the permit application area, as summarised in Table 2-2 below.

Vegetation types are described below and are compared to those previously recorded for the Pilbara Minerals Pilgangoora Project using structural comparison and common species assemblages. Where communities share a high level of similarity, the vegetation code previously applied has been used here. The cluster analysis grouped the sites occurring in drainage features. They have been described below as separate vegetation types to better reflect the differences in habitat availability and the previously described vegetation types across the Pilgangoora Project.

The DBCA fire history database indicates that the permit application area was burned in 2009-10. On-ground observations supported these remotely recorded fire records. Post fire-regeneration has occurred and time since fire was considered in the assessment of vegetation condition.

Distribution of vegetation types at a scale of 1: 20,000 is shown in Figure 2-6.

Detailed descriptions of vegetation types appear in Section 4.2.2 of Appendix 1.

Table 2-2: Vegetation types

CODE	LANDFORM	VEGETATION DESCRIPTION
7b	Drainage Depression	Low open woodland of *Corymbia hamersleyana* over *Acacia acredenia* and *Acacia adsurgens* and *Indogofera rugosa mid open shrubland and Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* hummock grassland.
9a	Stony plains and rises	Mid isolated shrubs of *Acacia inaequilatera*, *Acacia acradenia* and *Hibiscus sturtii* with *Triodia epactia, Triodia lanigera* and *Triodia wiseana* hummock grassland.
12a	Undulating plains	Isolated low *Corymbia hamersleyana* over *Acacia inaequilatera* and *Grevillea wickhamii* sparse tall shrubland with mid hummock grassland of *Triodia lanigera, Triodia wiseana* and *Triodia epactia.*
15a	Sandy Creek	Low open woodland of *Corymbia hamersleyana* over *Acacia cowleana*, *Acacia adsurgens* and *Indogofera rugosa* mid open shrubland with *Triodia epactia*, *Triodia lanigera* and *Triodia wiseana* hummock grassland.
16a	Claypans	Open herbfield of *Sida fibulifera*, *Eriachne mucronata* and *Neptunia dimorphantha*.
D	-	Disturbed – clear of vegetation

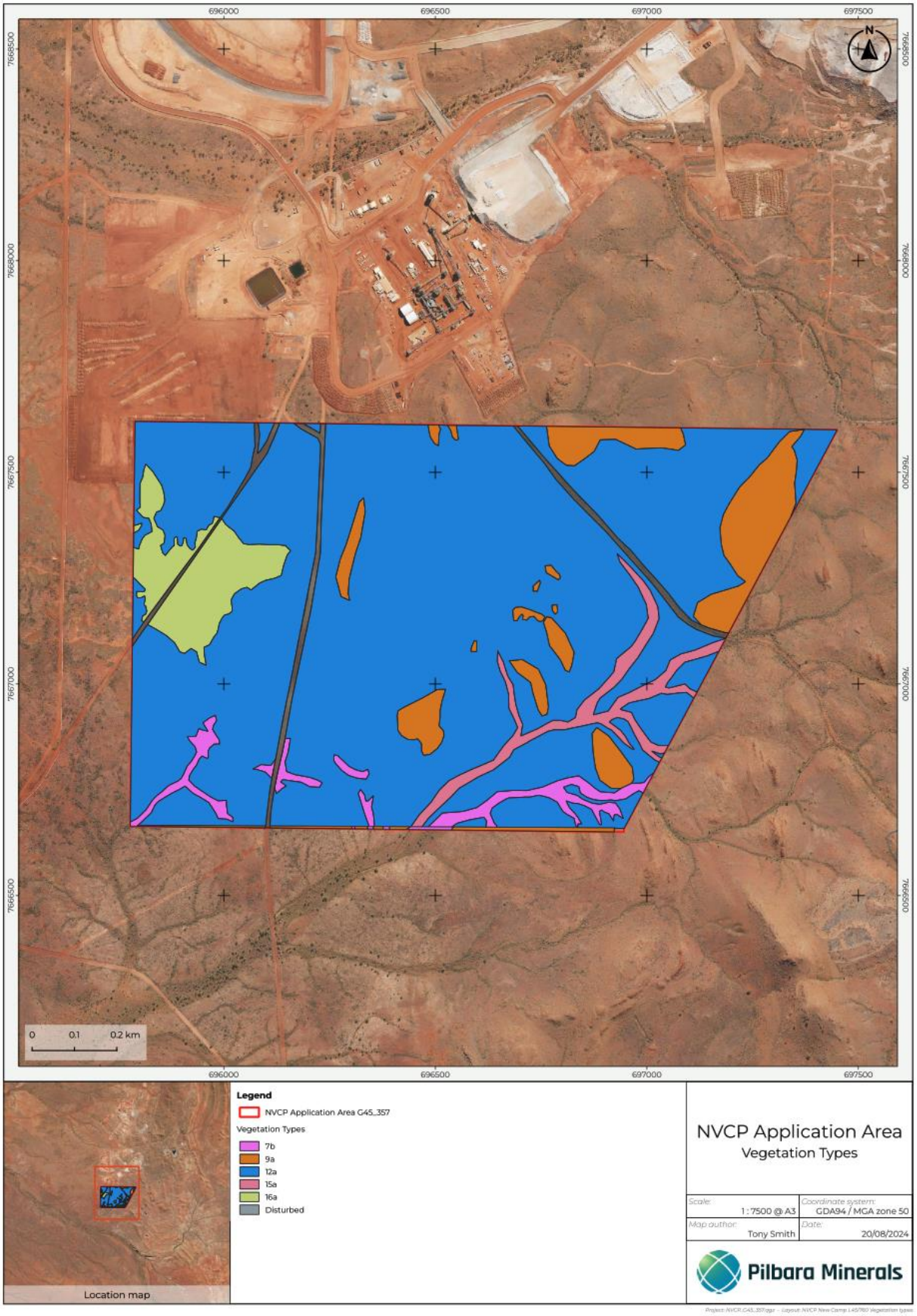

Figure 2-6: Vegetation types

2.8.4 VEGETATION CONDITION

Vegetation condition across the permit application area was within the categories Very Good, Good and Completely Degraded, with most of the Survey Area in Very Good condition (see Appendix 1, Figure 4-4).

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.

Areas receiving a condition rating of Very Good had a low level of grazing activity and occasional tracks may be present.

Areas receiving a condition rating of Good had weeds present, a moderate level of grazing activity and occasional vehicle tracks.

Areas classified as Completely Degraded are cleared of vegetation and maintained in a vegetation free state.

2.8.5 CONSERVATION SIGNIFICANT FLORA

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

One P3 species *Triodia chichesterensis* and has been recorded in the permit application area.

***Triodia chichesterensis* (P3)**

Triodia chichesterensis 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*).

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 permit application area 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.

The species has been previously recorded from studies conducted for the Pilgangoora Project and appears to be locally common on rocky soils with quartzite (APM, 2022a,b, APM, 2023). The species has also been recorded within sand red soils with a substantial coverage of rocks and pebbles including quartzite. Quartzite is common in the area and *T. chichesterensis* is not present in all areas containing quartzite.

Sites N01 (5%) and E01 (1%) abundance cover were recorded in the permit application area. An additional opportunistic collection site found approximately 1000 individuals at that location. All the records would be subject to clearing under the permit.

2.8.6 INTRODUCED FLORA

Two introduced flora species were recorded in the Survey Area and are listed in Table 4 5. No Declared Weeds or WONS were recorded.

Table 2-3: Introduced flora recorded within the permit application 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, to 0.5 m high. Flowers cream to purple from April to May. Grown in brown sands, red loam and pindan soils on sand dunes, plains, rangelands, stony hillsides or floodplains.
Tribulus terrestris	Caltrop	Prostrate annual herb, plants villous, leaflet pairs 4-7;cocci with distinct divergent, median spines 3 -38 mm long. Flowers yellow from January to December. Often grows on sandy soils and in waste places.

The agricultural weeds *Cenchrus ciliaris* and *Cenchrus setiger* were recorded in drainage lines, occurring only occasionally and in generally low abundance. Where found, these weeds were heavily grazed.

The environmental weed *Aerva javanica* was occurring only occasionally and in very low abundance within drainage lines, on stony plains and along disturbed roadsides.

The environmental weed *Tribulus terrestris* was recorded at one site and in very low abundance.

2.9 FAUNA

A fauna, flora and vegetation survey was completed over the permit application area in 2023. The survey report is attached as Appendix 1.

2.9.1 FAUNA DESKTOP REVIEW

The survey included a desktop review. The DBCA database search returned 16 species of significant fauna that have previously been recorded within 30 km of the permit application area. Of these, three were migratory bird species (MI) and one and Other Specifically Protected (OS). Record locations of significant fauna in relation to the survey area are shown in Figure 5-1 of Appendix 1. The database did not contain any records for T fauna within the permit application area.

The PMST returned 13 additional species, five T, six MI and two that are both T and 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 Northern Quoll, Pilbara leaf-nosed Bat, Ghost Bat and Pebble-mound Mouse records.

Database search results of T, P and MI fauna within 30 km of the Survey Area are listed in Table 2-4 with the outcome of the likelihood of occurrence assessment. The complete assessment including the preferred habitat relative to those available in the permit application area and a summary of records in the local area is included in Appendix G of Appendix 1.

Table 2-4: 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.
Calidris acuminata	Sharp-tailed sandpiper	MI	MI	
Calidris ferruginea	Curlew sandpiper	CR	CR, MI	
Calidris melanotos	Pectoral sandpiper	-	MI	
Numenius madagascariensis	Eastern curlew	CR	CR, MI	
Glareola maldivarum	Oriental pranticole	MI	MI	
Hirundo rustica	Barn swallow	MI	MI	
Motacilla cinerea	Grey wagtail	MI	MI	
Motacilla flava	Yellow wagtail	MI	MI	
Apus pacificus	Fork-tailed swift	MI	MI	Possible. Utilises a broad array of habitats.
Charadrius veredus	Oriental plover	MI	MI	Likely. Suitable habitat in the open plains.
Polytelis alexandrae	Princess parrot	-	VU	Unlikely, preferred feeding species are not present in high densities along the major drainage.
Erythrotriorchis radiatus	Red goshawk	VU	VU	Unlikely. Not within the known range of the species distribution.
Falco hypoleucos	Grey falcon	VU	VU	Likely. All areas are suitable for foraging. No suitable nesting habitat.
Falco peregrinus	Peregrine falcon	OS	-	Possible. All areas are suitable for foraging. No suitable nesting habitat.
Pezoporus occidentalis	Night parrot	CR	EN	Possible. No local records. Habitat modelling includes the Survey Area at the extremity of the species potential extent. Foraging resources are limited.
Rostratula australis	Australian painted-snipe	EN	EN	Unlikely. No habitat occurs in the Survey Area. Vegetation too open to provide well vegetated shallows.
Dasycercus blythi	Brush-tailed mulgara	P4	-	Present. Sandy basin habitat is suitable.
Dasyurus hallucatus	Northern quoll	EN	EN	Likely. Dispersal and foraging habitat, denning habitat in the granite overhangs and tree hollows in the creek vegetation.

SPECIES	COMMON NAME	CONSERVATION CODE		ASSESSMENT OF OCCURRENCE
		BC ACT	EPBC ACT	
Lagorchestes conspicillatus leichardti	Spectacled hare-wallaby	P4	-	Likely. Suitable habitat is present in the Spinifex Open Plains habitat.
Macroderma gigas	Ghost bat	VU	VU	Likely. Foraging habitat available. No roosting habitat available.
Macrotis lagotis	Greater bilby	VU	VU	Possible. All habitats are suitable.
Pseudomys chapmani	Western pebble-mound mouse	P4	-	Unlikely. No suitable habitat. Stony rises absent.
Rhinonicteris aurantia	Pilbara leaf-nosed bat	VU	VU	Likely. No roosting habitat available, foraging habitats present.
Smithinopsis longicaudata	Long-tailed dunnart	P4	-	Unlikely. No suitable habitat.
Anilios ganei	Gane's blind snake (Pilbara)	P1	-	Unlikely. No suitable habitat.
Liasis olivaceus subsp. *baronni*	Pilbara olive python	VU	VU	Present. Recorded on camera using a termite mound.
Liopholis kintorei	Great desert skink	VU	VU	Unlikely. No records in the local area. May occur 10 km to the east.

2.9.2 FAUNA HABITATS

The Survey Area is characterised by sandy to stony undulating plains with first and second order ephemeral creeks and shallow drainage basins. Low rocky rises occur in the eastern extents in the north and south. There are higher ranges to the east and water sheds from these into the Survey Area through the minor drainages that continue to the west. The presence of water is ephemeral, and no permanent or semi-permanent water is available. Seasonal inundation is expected to occur within the claypan habitats, with the duration of inundation dependent on the amount of any given rainfall event but is generally expected to be short (days to weeks) due to high evaporation rates. Vegetation is sparse on the rocky rises and plains, and densest in the shallow drainage basins.

The permit application area has a range of fire history from Moderate (2-5 years previously) to Very Old fire age. Burns appear to be low to moderate intensity with larger woody vegetation frequently surviving and good post-fire establishment of ground cover and mid-story shrubs.

Five fauna habitats are described for the permit application area and are summarised in Table 2-5. These are described in detail in Section 5.2.1 of Appendix 1. The distribution of fauna habitats is shown in Figure 2-7.

Table 2-5: Fauna habitats within the permit application area

NAME	AREA (HA)	PROPORTION (%)
Shallow Drainage Basins and Creeks	7.7	5.7
Stony Plains	89.0	65.9
Low Hills	24.8	18.4
Platy Rock Outcrops	10.4	7.7
Rocky Outcrops	0.07	0.05
Disturbed	3	2.25

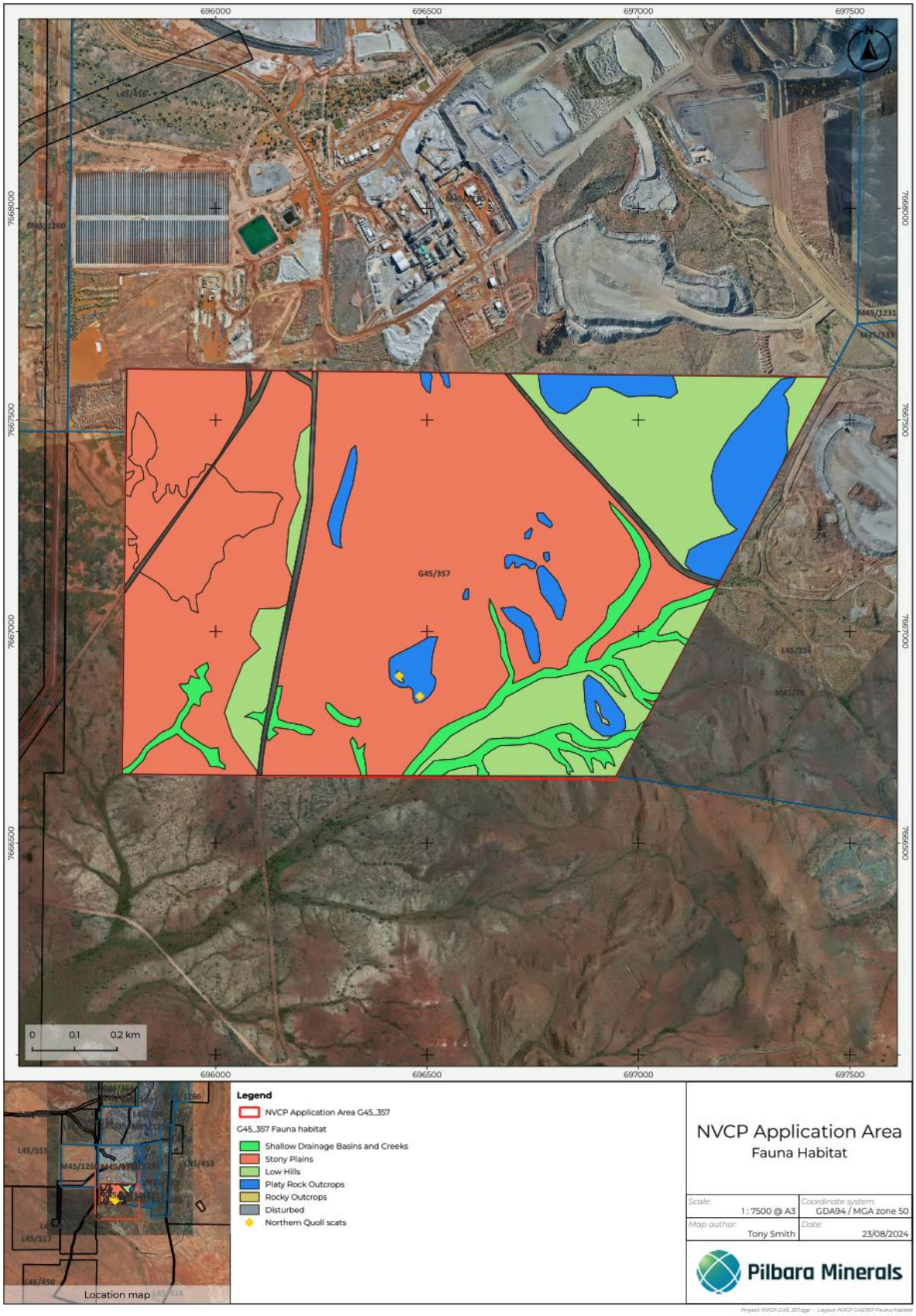

Figure 2-7: Fauna habitats of the permit application area

2.9.3 CONSERVATION SIGNIFICANT FAUNA

Northern Quoll

Northern quoll have been recorded on several occasions within the Pilgangoora Project Area (DBCA Database record, Ecologia Environmental 2018; Terrestrial Ecosystems 2020, APM 2022a, APM 2023b, APM unpublished data). Locally this species seems to be most encountered in the boulder hill tops habitat of the north/south tending ridgeline to the east of the Pilgangoora Project Area. This is the most rugged landform in the local area, at the highest elevation. Boulders on the ridge tops form a mosaic of cracks and crevices large enough to provide denning habitat for the quoll. Habitat critical to the survival of the Northern Quoll and populations important for the long-term survival of the Northern Quoll, as defined in CoA (2016), occur in the boulder hill tops habitats.

Within 30 km of the permit application area, species records predominantly occur within rocky outcrop habitats, but also occur in the Turner River and larger tributaries of the Turner River, 16 km to the west of the permit application area. Quoll have been recorded near to mine infrastructure of the Pilgangoora Project on three occasions.

The occurrence of Northern quoll habitat in the permit application area occurs as isolated outcrops on top of hills surrounded by plain. Evidence of habitat usage within the permit application area was recorded, with scats found in rocky outcrop habitat in the 2023 survey, a short distance (approximately 70 m) from where a scat was recorded earlier in 2023 (APM 2023b). Motion sensor cameras were deployed but failed to capture northern quolls within the permit application area.

All habitats occurring within the permit application 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.

Ghost Bat

No Ghost bats were recorded during the acoustic survey, however acoustic recorders are not suited to Ghost bat detection during foraging as the species seldom uses its echolocation away from caves.

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. APM (2023b) recorded Ghost bat on camera in a location 10 km east northeast of the Survey Area in a Category 4 roost. 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 permit application area may be within range of Category 1, 2 or 3 roosts.

It is likely that the permit application area offers foraging habitat to Ghost Bat across all habitat types.

Pilbara Leaf-Nosed Bat

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 2022). Echolocation based records indicate that it can complete round trips of 50 km or longer in a night under favourable conditions (Bat Call WA 2022).

No call sequences of the Pilbara leaf-nosed Bat were recorded within the permit application 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 permit application area have been categorised using this Priority schedule and are shown in Appendix 1, Figure 5-4 where Historic mine workings are Priority 2, Rocky outcrop habitat is Priority 3, Priority 4 areas include Drainage lines and the remaining habitats are Priority 5.

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

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 and major tributaries. The closest record is 10 km from the permit application area to the west. The permit application 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 red gum trees were present in the Drainage Line fauna habitat within the permit application area and no nests were observed. Larger trees including red gum, become frequent from the confluence of Pilgangoora Creek with Chinnamon Creek, to the west of the permit application area.

Night Parrot

The Survey Area is within the area where Night Parrot is 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 Parrot, 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 some of the plains habitat in the Survey Area may be suitable for the Night Parrot, however there are no patterns of fragmentation and fire records (DBCA 2023b) and field observation show that burning is often landscape scale and at a moderate frequency. There are no samphire or chenopod habitats proximal to the Survey Area, however the drainage depressions may seasonally support a diversity of herbs and other potential forage species. 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 WA (DPAW 2017b) identifies when and where Night parrot surveys may be required. The Survey Area is on the north-western 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 potentially suitable spinifex habitat, passive acoustic survey was conducted in three previous surveys (APM 2022a, APM 2022b and APM 2023b). No Night parrot calls were recorded and foot traverses have not encountered any signs or individuals of Night Parrot.

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.

Greater Bilby

Extant populations of 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). Bilby 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 species is identified by the PMST as known to occur within 30 km of the Survey Area. Database results returned 104 records within a 30 km radius of the Survey Area, the closest being one record to the east of Pilgangoora made in 1979. Recent records (2012-2016; 16 to 25 km west) are from surveys conducted for the rail and road corridors to the west. These records are surrounding the Turner River. The DBCA has a long-term bilby abundance monitoring program at the Turner River (DPAW 2017b).

Suitable habitat in the permit application area includes the Stony Plains and Shallow Drainage Depressions and Creeks habitats. Extensive foot transects were walked across all habitats. No burrows were located. Indeterminate signs were recorded in three closely distributed locations approximately 1.5 km to the west of the permit application area. Diggings/scratchings were recorded that lacked attributes common to digging lizards and other species expected to occur, however they were not beneath a recognised bilby forage species, shallow and not fresh. Footprints that may be attributed to bilby were also found in this location outside the permit application area.

Department of Parks and Wildlife (2017b) provides a protocol for using signs to determine the presence of bilby. Under the protocol, diggings in the open can be used to flag potential bilby activity or potential past presence, but not to verify current presence with certainty. Additional searching was conducted to identify the presence of further signs, but no diggings near shrubs known to host root-dwelling larvae, scats or burrows

were observed. Under the protocol the significance of the observed signs is *Potential bilby activity - Presence not confirmed*.

This species has the potential to occupy the permit application area as bilbies can be relatively transient across their distribution. No burrows were observed suggesting any recent use may be for foraging only and transitory in nature.

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 burrows 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 permit application area with the closest record 6 km to the west/southwest.

Suitable habitat occurs in the Stony Plains habitat in areas where the soils are sandy and suitable for burrowing, 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. No evidence of Mulgara presence was observed. Whilst the habitat is suitable, there is no evidence that Mulgara are currently present in the permit application area.

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, in the surrounding foothills and plains habitats. These records are from the early 1990's.

The species was not recorded within the permit application area, however wallaby scats found in the same habitat types were determined to be likely of belonging to the Spectacled hare-wallaby. The habitats available in the permit application area, particularly in the Shallow Drainage Depressions and Creeks where the scats were recorded, offer a denser cover of vegetation that may be providing sufficient shelter from predation for the species to persist locally.

2.9.4 INTRODUCED FAUNA

The field survey identified the presence of one introduced fauna species, being cattle (*Bos taurus*). As the area is used actively for pastoralism, the presence of cattle is expected.

2.10 ENVIRONMENTALLY SIGNIFICANT AREAS

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 permit application 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 2016). 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 3-1.

Table 3-1: 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 3-2 below.

Table 3-2: 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. Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem	Minor	Likely	Moderate (B2)	• Regular dust suppression of vehicle access roads, hardstands using water carts. • Dust suppression of stockpiles as required. • Clearing of vegetation to be undertaken progressively.	Minor	Possible	Moderate (B3)
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.	Minor	Possible	Moderate (B3)	• Weed hygiene procedure.	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
		Environmental factor: • Biodiversity/Flora/Fauna/Ecosystem				• Machinery and equipment to be cleaned prior to being mobilised to site. • Inspection of machinery on arrival, not permitted to work until appropriately cleaned. • 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 4-1 below addresses the ten clearing principles in relation to the permit application area.

Table 4-1: 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 level of flora diversity in the permit application area is not high, relative to other surveys in the local and regional area. Fauna habitats recorded are like those recorded in the surrounding areas and are not unique to the permit application area. On a regional level, Burbidge et al. (2010) find that habitats that support significantly higher biodiversity for avian fauna in the Pilbara are riverine levees, riverine beds, or clay pans with River Gums and/or paperbark trees. Whilst the survey areas contain drainage lines, the location where the areas of shallow drainage basins and creeks is of lower habitat value than the areas downstream of the confluence of adjacent creeks where the vegetation is larger and contains hollows and is not as well developed as described by Burbidge et al. (2010). On a National and International level there are no Key Biodiversity Areas in the permit application area, with the closest being the Fortescue Marsh, 140 km to the south. 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**
Fauna habitats within the Permit Application Area are typical of the local and regional area and are not unique to the area. The survey areas are typical of the Land Systems within which they occur (Department of Primary Industries and Regional Development, 2019). The Land Systems comprising the permit application area predominately contains the Macroy, Talga and Satirist systems, with the distribution of the Macroy system described as very common. The Northern quoll is known to occur in the local area and critical habitat has previously been identified in the ridgeline to the east of the permit application area. The permit application area contains habitat that is of value to the Northern quoll for foraging and dispersal, evidenced by records of two scats. No camera sitings of Northern quolls were made within the permit application area. The Pilbara leaf-nosed Bat is known to occur in the local area and diurnal roosts occur within the range of the Survey Area. There are no roosts suitable for the Pilbara leaf-nosed Bat in the permit application area. The conservation ranking of foraging habitat in the permit application area is limited to small areas of Priority 3 and Priority 4 foraging habitat with the majority being Priority 5. For the majority of the site, the species may occasionally use the habitats for foraging or in transit to other more productive areas. The Ghost Bat is known to occur in the local area and diurnal roosts are known to occur within range of the permit application area. The permit application area is suitable foraging habitat for the Ghost Bat. The species is likely to occur within the permit application area at some time, for foraging purposes only.	

THE TEN PRINCIPLES OF CLEARING NATIVE VEGETATION	
Clearing is not likely to be at variance with clearing principle (b).	
Principle (c)	**Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.**
No rare (Threatened) flora has been recorded from the permit application area and the vegetation in the assessment area is unlikely to include, or be necessary for the continued existence of rare flora. Vegetation was determined as unsuitable habitat (or suitable land system) for the Endangered *Quoya zonalis* (formerly *Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4)). The permit application area contains three records of Priority (P3) flora *Triodia chichesterensis* totalling ~1000+ individuals. While these are expected to be cleared, they comprise approximately 10% of records within the local (Pilgangoora area. Extensive further populations have been recorded at Wodgina, (approximately 1.9 million individuals). The proposed clearing is not likely to be at variance with clearing principle (c).	
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.**
The vegetation of permit application area is not consistent with the description of any threatened ecological community. The closest Priority Ecological Community to the permit application area is the Gregory Landsystem, over 30 km away. Given the distance from the PEC the clearing will not impact the community. 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.**
Regional Vegetation Associations within the permit application area as described by Beard have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within the permit application area are of 'Least Concern'. 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.**
The permit application area intersects a creek line and drainage depressions. The ephemeral creeks flow periodically during high rainfall events associated with cyclonic events and tropical lows. Being ephemeral creeks, the associated vegetation is adapted to long periods with no stream-flows. The Drainage Depression vegetation type was mapped within the permit application area, - vegetation type 7b. If any activity is expected to cause diversion or pooling of water flows, a permit under the *Rights in Water and Irrigation Act 1917* will be applied for as required. The connectivity of streams within the permit application area will be preserved. 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 TEN PRINCIPLES OF CLEARING NATIVE VEGETATION	
Clearing within the permit application area is for the development of infrastructure supporting a mining operation. The infrastructure will be constructed in accordance with appropriate guidelines and standards to prevent appreciable land degradation. The clearing will be undertaken to minimise potential erosion, sediment movement, dust impacts and water contamination in accordance with management actions outlined in the risk assessment above. Weed impacts will be managed by undertaking the activities outlined in Table 3-2. 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.**
The nearest conservation area to the assessment is the DBCA-managed Mungaroona Range Nature Reserve, which is approximately 80 km south-west of the assessment area. Millstream-Chichester National Park is 120 km west-south-west while Karijini National Park is 140 km south. 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.**
Clearing native vegetation may temporarily cause runoff and sedimentation. However, with appropriate management actions, impacts on hydrology and drainage should be manageable. Any proposed clearing is not likely to intersect groundwater resources of the area as the reported groundwater is >15 metres below ground level. Clearing will be undertaken in accordance with a Land Use Certificate permitting system. Controls outlined in the Land Use Certificate permitting system reduce potential clearing during wet periods or inappropriate conditions that would lead to surface water quality deterioration. Clearing is to be undertaken shortly before commencement of infrastructure construction (< 3 months), limiting the period during which cleared land is subject to erosion that would lead to surface water quality decline. 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 Permit Application Area intersects ephemeral creek lines. The substrate is predominantly sandy, indicating that rainfall is likely to infiltrate and surface flow is likely only during high magnitude (i.e. prolonged) or high intensity rainfall events so potential for causing or exacerbating the incidence or intensity of flooding is minimal. The proposed clearing is not likely to be at variance with clearing principle (j).	

5 REFERENCES

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6 APPENDICES

APPENDIX 1: PILGANGOORA BIOLOGICAL SURVEY (APM 2023)

Pilgangoora Project

Biological Survey

Pilbara, Western Australia

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

October 2023

DOCUMENT REVISION HISTORY AND STATUS

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EXECUTIVE SUMMARY

Animal Plant Mineral Pty Ltd (**APM**) was commissioned by Pilbara Minerals Limited to undertake a Detailed flora and vegetation and Targeted terrestrial vertebrate fauna survey for the Pilgangoora Lithium Project, located 84 kilometres (**km**) south-east of Port Hedland in the Pilbara region of Western Australia (**WA)**. The area under investigation is referred to herein as the **Survey Area**. The Survey Area is 1162 hectares (**ha**).

The field survey was conducted between the 27th of June and the 3rd August 2023. Rainfall in the season preceding the survey was below average. The timing of the flora and vegetation survey was within the recommended Supplementary survey period for the region (EPA 2016). Fauna survey timing was within the range accepted for mammals (EPA 2020). The low rainfall preceding survey was a minor constraint to the completeness of the survey.

Seven vegetation types are described for the Survey Area. No vegetation of conservation significance was recorded, and current extent of regional vegetation units is close to pre-European extent. Vegetation is predominantly in Very Good condition with the main disturbances being low to moderate intensity cattle grazing, vegetation clearing for mining and pastoral activity and a small number of weeds. Completely Degraded areas comprise 34.1 ha or 2.9% of the Survey Area.

No Threatened flora are known to occur in the Survey Area or were recorded during the survey. One Priority (**P**) 3 flora species – *Triodia chichesterensis* was recorded. An additional three P3 species were determined likely to occur based upon the availability of suitable habitat and proximity of local records. One of these is a perennial shrub, identifiable from vegetative parts and would have been detectable at the time of survey. The remaining two are annual species, and seasonal conditions were unsuitable for the presence of these species to be detected.

No Declared weeds or Weeds of National Significance were recorded. Four weeds were recorded - *Cenchrus ciliaris, Cenchrus setiger, Tribulus terrestris* and *Aerva javanica* in small, isolated occurrences of low abundance.

Seven fauna habitats are described for the Survey Area. Stony Plains is the most common habitat present covering 765 ha (65%) of the Survey Area. Shallow Drainage Basins and Creeks followed by Low Hills are also common covering 167 ha (14%) and 145 ha (12%) of the Survey Area respectively. Platy Rock Outcrops, Major Drainage Line, Historic Mine Workings and Rocky Outcrops all contribute less than 4% each with the latter at just 0.06%.

Previous records of Threatened or Priority fauna species in the Survey Area is restricted to a Northern Quoll scat recorded in a Rocky Outcrop area in the south-eastern extent. An additional eight conservation significant fauna are likely to occur based upon local records and the availability of suitable habitat.

Targeted survey for conservation significant fauna identified:

- Denning, foraging and dispersal habitat suitable for the Northern quoll in the Rocky Outcrop areas. Northern quoll presence was confirmed in the north-eastern extent through camera captures, and in the southern extent, where previous evidence was found, in the form of scats. Local populations and habitat of Northern quoll are critical to the survival of the species as defined in CoA (2016) and require a 1 km buffer.

- Call sequences of the Pilbara leaf-nosed Bat. The Pilbara leaf-nosed Bat is known to occur in the local area and diurnal roosts occur within the range of the Survey Area. There are no roosts suitable for the Pilbara leaf-nosed Bat in the Survey Area. The conservation ranking of foraging habitat in the Survey Area is limited to small areas of Priority 2 (Historic Mine Workings) and 3 (Rocky Outcrop) in the north-eastern extent where recorded calls were concentrated, and the remainder being Priority 4 and 5.
- Some signs that cannot be excluded as originating from bilby, however the significance of the observed signs is *Potential bilby activity - Presence not confirmed*. Even if the signs were confirmed to belong to bilby, the occurrence would be transitory and indicates that limited forage was available, and therefore the Study Areas do not present important habitat for this species.
- Two active, four intermediate and two extinct Pebble-mound mouse mounds. The suitability of mound building habitat is confined by the availability of suitable size pebbles, which occur in subsections of the Stony Plains and Low Hills habitats.
- Wallaby scats expected to originate from Spectacled hare-wallaby. Suitable habitat is the Shallow Drainage Basins and Creeks.
- Habitats that would be subject to inundation in the Survey Area are limited to the claypans or gilgai within the Stony Plains habitat. Due to the high evaporation rate and low vegetation cover these are unlikely to retain water for more than a short period and are unlikely to sustain habitat suitable for migratory shorebirds. There are no nationally or internationally significant aggregations of migratory species known to occur within or near the Survey Area.
- Foraging habitat suitable for the Grey falcon and Ghost bat occurs and may be used by local populations, however no evidence of their presence was recorded.

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PROJECT TERMS

Abbreviation	Meaning
The Project	Pilgangoora Lithium Project
Survey Area	The 1162 ha area that is the subject of this survey

UNITS OF MEASURE

Unit	Measure
%	Percentage
°C	Degrees Celsius
ha	Hectare
km	Kilometre
m	Metre
mm	Millimetre

LIST OF ABBREVIATIONS

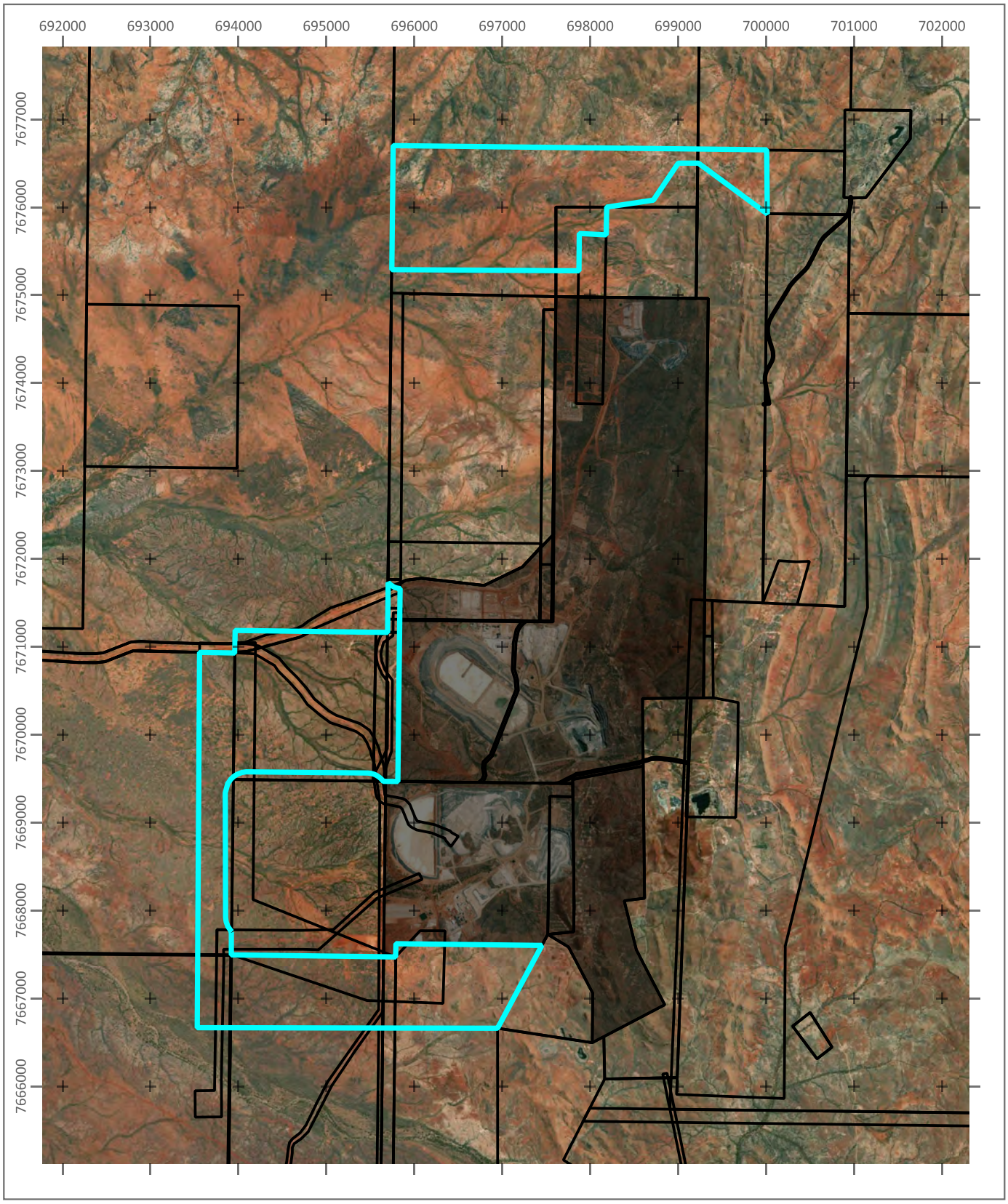
Abbreviation	Meaning
APM	Animal Plant Mineral Pty Ltd
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DBCA	Department of Biological Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEE	Department of Energy and the Environment
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environment Regulation
DPIRD	Department of Primary Industries and Regional Development
EN	Endangered
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Areas
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessment
MI	Migratory
MNES	Matters of National Environmental Significance
OS	Other Specifically Protected
PEC	Priority Ecological Community
P	Priority

Abbreviation	Meaning
PMST	Protected Matters Search Tool
TEC	Threatened Ecological Community
T	Threatened
VU	Vulnerable
WA	Western Australia
WONS	Weeds of National Significance

1 INTRODUCTION

1.1 PROJECT AND LOCATION

Animal Plant Mineral Pty Ltd (**APM**) was commissioned by Pilbara Minerals Limited to undertake a Detailed flora and vegetation and Targeted terrestrial vertebrate fauna survey for the Pilgangoora Lithium Project, located 84 kilometres (**km**) south-east of Port Hedland in the Pilbara region of Western Australia (**WA)**. The area under investigation is referred to herein as the Survey Area. The Survey Area is 1162 ha and the location is shown in Figure 1-1.



Author: TB Approved: EH Date: 25/07/2023

Project Location

Prepared for:

Pilbara Minerals

Figure 1-1

Scale: @ A4
1: 62,500

0 0.5 1 km

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

Animal Plant Mineral Pty Ltd

Legend

- Survey Areas
- Project Tenements
- Pilgangoora Operations

1.2 SCOPE OF WORK

The scope of work includes a Detailed flora and vegetation and Targeted terrestrial vertebrate fauna survey.

Survey data accompanies this report in a format suitable for submission to the Index of Biodiversity Surveys for Assessment (**IBSA**) online portal.

1.2.1 Flora and Vegetation

The flora and vegetation survey was conducted in accordance with the Environmental Protection Authority's (**EPA**) *Technical Guidance - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (2016) at a Detailed level of assessment.

The aims of the desktop study were to:

- Establish vegetation associations previously determined for the site;
- Identify threatened (**T**) and priority (**P**) flora and threatened ecological communities (**TECs**) previously recorded on site;
- Identify weed species previously determined as present on site, in particular any Declared weeds; and
- Identify potentially suitable habitat for conservation significant flora known from the region.

The aims of the field survey were to:

- Describe and map the vegetation types present and provide comparisons to locally described types;
- Identify species present on site, including T and P Flora, and weed species in particular any Declared weeds; and
- Identify conservation significant features of the flora and vegetation.

1.2.2 Terrestrial Fauna

The scope of work was to conduct a basic and targeted terrestrial vertebrate survey in accordance with the EPA's fauna guidelines: *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (2020).

The aims of the desktop study were to:

- Identify T and P Fauna species previously determined as present on-site;
- Identify habitat types previously determined as present on-site regarded as suitable for T and P fauna; and
- Identify introduced species previously determined as present on-site.

The aims of the field survey were to conduct:

- Targeted quoll survey using unbaited camera traps;
- Bat survey using acoustic monitoring devices; and
- Traverses searching for signs of T and P fauna and record habitats suitable for T and P fauna.

2 BACKGROUND AND SUPPORTING INFORMATION

2.1 RELEVANT LEGISLATION AND GUIDANCE

2.1.1 Commonwealth Government EPBC Act

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**) is administered by the Department of Climate Change, Energy, the Environment and Water (**DCCEEW**). It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as Matters of National Environmental Significance (**MNES**).

If a project has the potential to significantly impact on MNES it is to be referred to the DCCEEW for determination on whether the matter is a 'controlled action' and therefore requiring assessment.

The EPBC Act provides for the identification and listing of species under several categories listed in Appendix A. The EPBC Act also provides for the development of conservation advice and recovery plans, development of a register of critical habitat, recognition of key threatening processes and the development of threat abatement plans.

2.1.2 Western Australia BC Act

The *Biodiversity Conservation Act 2016* (**BC Act**) provides a statutory basis for the listing of T species, specially protected species, extinct species, TECs, collapsed ecological communities, critical habitat and key threatening processes in WA. The BC Act provides for the listing of T flora and fauna species and ecological communities under specified conservation categories listed in Appendix A. Species and communities listed under the BC Act are protected and require authorisation by the Minister to take or disturb.

Species may also be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest to science. Species of special conservation interest, migratory species and species subject to international agreements are known as Specially Protected Species in the BC Act.

2.1.3 Western Australia Priority species and communities

Flora and fauna species and communities are listed by the Department of Biodiversity, Conservation and Attractions (**DBCA**) as P when they are considered to have a greater level of significance than other native species and communities. This generally occurs where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to T species and communities categories. Whilst P species and communities are not specifically listed in the BC Act, all flora and fauna are protected in WA following the provisions in Part 10 of the BC Act. This protection applies even when a species is not listed as T or specially protected. The categories covering P species and communities are listed in Appendix A.

2.1.4 BAM Act

Plants may be 'Declared' by the Agriculture Protection Board under the *Biosecurity and Agriculture Management Act 2007* (WA) (**BAM Act**). Declared Plants are gazetted under three categories (C1-C3) which define the action required. Details of the definitions of these categories are provided in Appendix A. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties.

2.1.5 Weeds of National Significance

The DCCEEW, along with the State and Territory governments, has endorsed 32 Weeds of National Significance (**WONS**). Four major criteria were used in determining WONS:

- The invasiveness of a weed species;
- A weed's impact;
- The potential for spread of a weed; and
- Socio-economic and environmental values.

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts (DAWE 2020).

2.1.6 Guidelines

The terrestrial biological assessment was conducted in accordance with the above Commonwealth and State legislation, as well as EPA requirements for environmental surveys as outlined below:

- *Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2020); and
- *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

Relevant species-specific survey and assessment guidelines include:

- *Survey Guidelines for Australia's T Bats* (Department of the Environment Water Heritage and the Art (**DEWHA**) 2010).
- *Survey Guidelines for Australia's T Mammals* (Department of Sustainability Environment Water Population and Communities (**DSEWPAC**) 2011); and

Relevant guidance for the preparation of spatial datasets to accompany this report are:

- Guidelines for biological survey and mapped data (Department of the Environment and Energy (**DEE**) 2018); and
- Instructions for the preparation of data packages for IBSA (EPA 2021).

2.2 LAND USE

The Survey Area lies within the Wallareenya pastoral lease (N050365). The current land use is cattle grazing.

Active mining operations occur within the Pilgangoora Lithium Project, to the east and south of the Survey Area.

2.3 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).

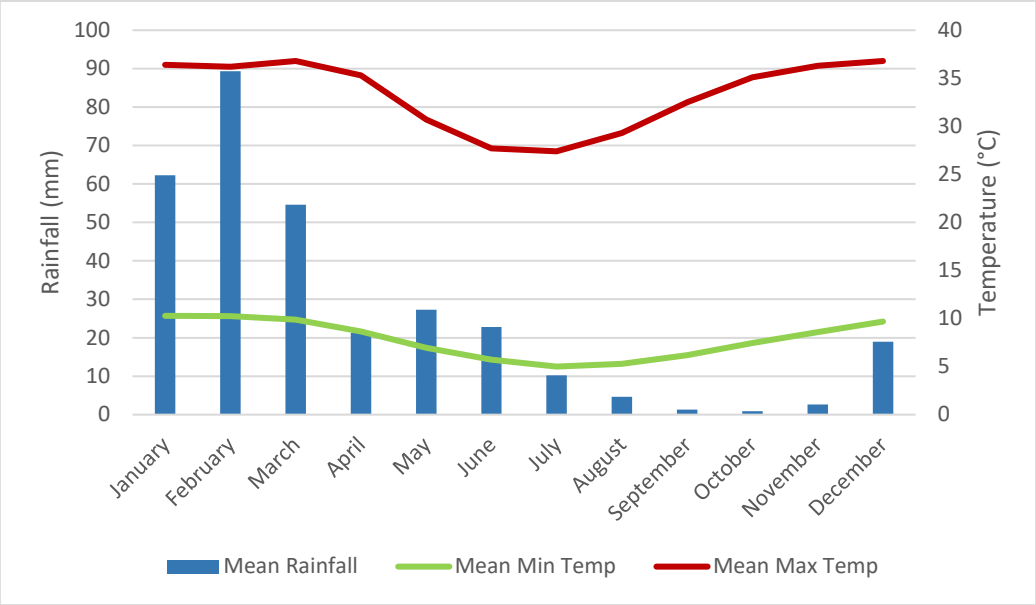


Figure 2-1. Temperature and rainfall averages for Port Hedland Airport weather station (Station No. 004032) (BoM 2023)

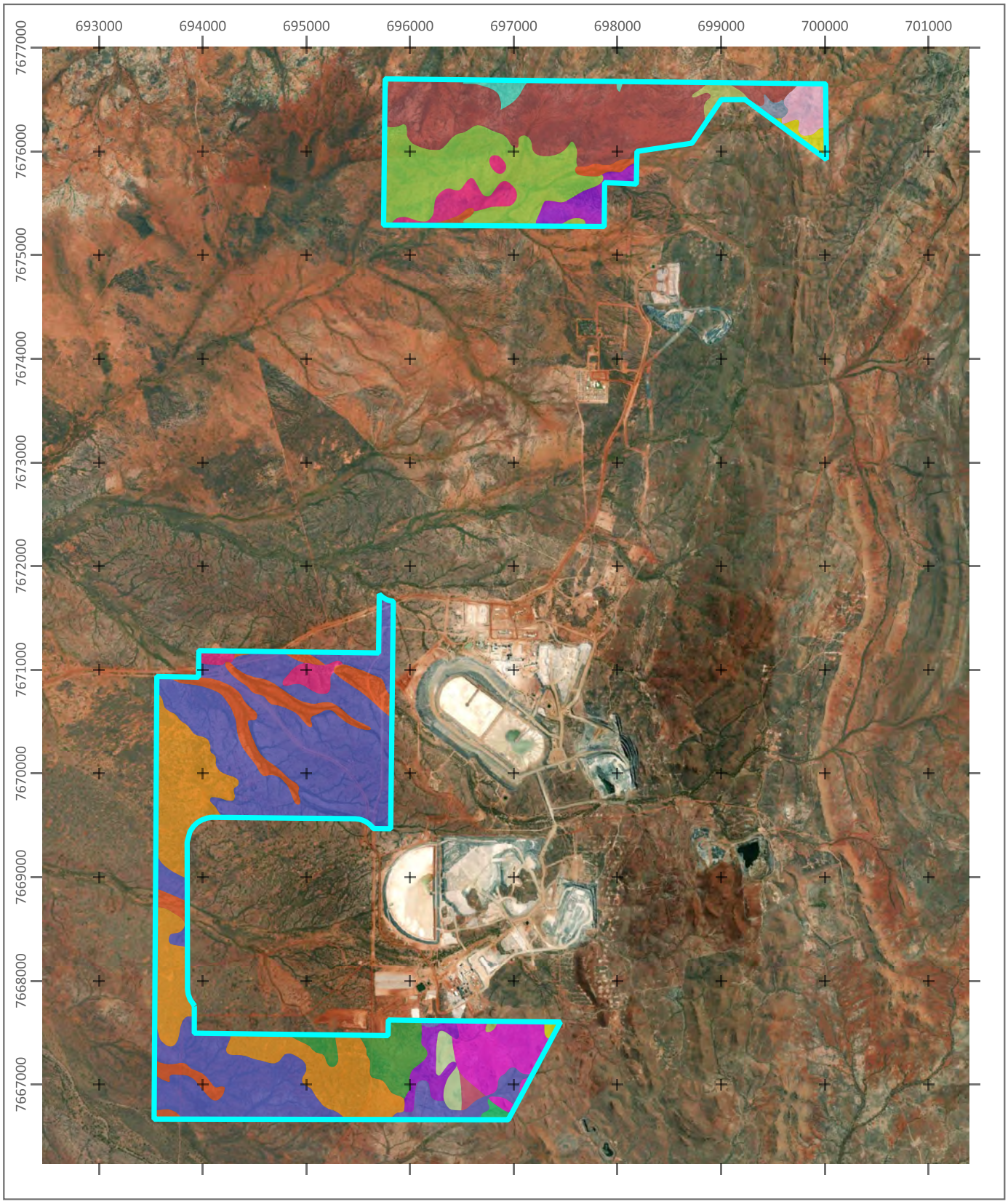
2.4 GEOLOGY

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 Survey Area is within the Wodgina (2655) map area.

The Survey Area contains the following 17 geological formations:

- A-DA-mats; Dalton Suite; Serpentinite, schistose
- A-KEe-mbaq; Euro Basalt; Silicified amphibolite and metabasalt
- A-KEe-mu; Euro Basalt; Metamorphosed ultramafic rock;
- A-CLmo-xmgm-mgg; Motherin Monzogranite; Interleaved metamonzogranite, metagranodiorite, gneiss, and pegmatite; moderately to strongly foliated; intruded by abundant sheets of massive to weakly foliated muscovite-bearing metamonzogranite and pegmatite;
- 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-mty-P; Pilbara Craton greenstones; Mylonitized metasandstone
- A-PI-musr; Pilbara Supergroup; Tremolite--chlorite--talc schist
- A-PI-mats; Pilbara Supergroup; Strongly sheared serpentine schist derived from intrusive ultramafic rocks
- A-Soc-mtqm; Corboy Formation; Muscovite-bearing quartzite; minor pelite
- A-SR-gp; Split Rock Supersuite; Pegmatite
- _A1c; Alluvial unit; Sand, silt, and gravel in active drainage channels; includes clay, silt, and sand in poorly defined drainage courses on floodplains; unconsolidated.
- _A1f-cb-vb; Alluvial unit; Clay, silt, sand, and basaltic or doleritic gravel on floodplains; gilgai surface in areas of expansive clay; derived from ferromagnesian parent rock; unconsolidated
- _A1i; Alluvial unit; Mixed floodplain deposits; sand, silt, and clay adjacent to main drainage channels; numerous small claypans; 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
- _R1-g-pg; Residual or relict unit; Residual quartzofeldspathic sand, with quartz and rock fragments; overlying and derived from mass-wasting of granitic rocks; unconsolidated;

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



Author: TB Approved: EH Date: 25/07/2023

Surface Geology of the Survey Areas

Prepared for:

Pilbara Minerals

Figure 2-2

Scale: @ A4
1: 53,000

0 0.5 1 km

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

Animal Plant Mineral Pty Ltd

Legend

- Survey Areas

Surface Geology

- _A1c
- _A1f-cb-vb
- _A1i
- _A2-d-k
- _C1
- _C2
- _R1-g-pg
- A-CLmo-jmgm-mwa
- A-CLmo-xmgm-mgg
- A-DA-mats
- A-KEe-mbaq
- A-KEe-mu
- A-mty-P
- A-PI-mats
- A-PI-musr
- A-SOc-mtqm
- A-SR-gp

The soils of the Survey Area were mapped by Tille (2006). The Survey Area is situated in the Fortescue Province, in the western edge of the Nullagine Hills Zone, with influences from the Abydos Plains and Hills Zone.

The Nullagine Hills Zone is characterised by:

> "Hills and ranges (with some stony plains) on volcanic and sedimentary rocks of the Pilbara Craton (including the Hamersley Basin). Stony soils with red shallow loams and sands. Spinifex grasslands with kanji and snappy gum. Located in the north-eastern Pilbara around Marble Bar and Nullagine (Tille 2006)."

The Abydos Plains and Hills Zone is characterised by:

> "Stony plains (with some hills) on granitic rocks of the Pilbara Craton (East Pilbara Terrane). Red deep sandy duplexes and red shallow loams with stony soils, red sandy earths and red loamy earths. Spinifex grasslands with kanji (and some tussock grasslands). Located in the northern Pilbara between Yandeyarra Community, Bamboo Springs Station, and Marble Bar (Tille 2006)."

2.5 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.

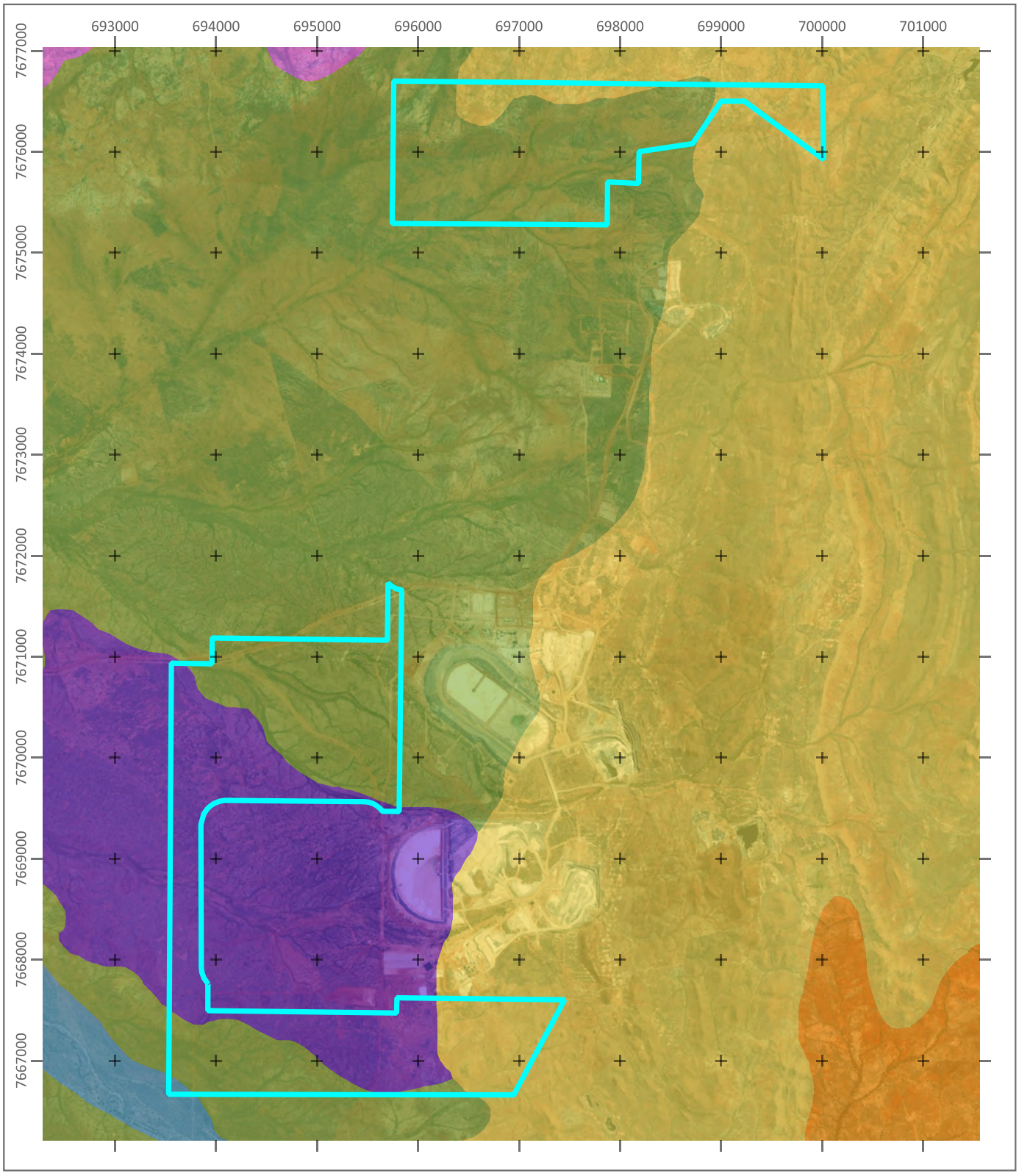
The Chichester Sub-region comprises the northern section of the Pilbara Craton and is comprised of undulating Archaean granite and basalt plains and includes significant areas of basaltic ranges. Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands,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

2.6 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 four soil landscape systems, Macroy, Satirist, River and Talga, as listed in Table 2-1 and illustrated in Figure 2-3.

Table 2-1. 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 metres (**m**)	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands
Satirist	Quaternary alluvium and colluvium; clay, gravel and pebble deposits, minor Lower Proterozoic or Archaean chert, quartzite, shale and agglomerate	Stony plains and low rises supporting hard spinifex grasslands, and gilgai plains supporting tussock grasslands
River	Quaternary alluvium	Active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands 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



Author: TB Approved: EH Date: 25/07/2023

Land Systems

Prepared for:

Pilbara Minerals

Figure 2-3

Scale: @ A4
1: 55,000

0 0.5 1 km

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

Legend

- Survey Areas

Land Systems

- Macroy Land System
- River Land System
- Satirist Land System
- Talga Land System
- Boolaloo Land System
- Rocklea Land System

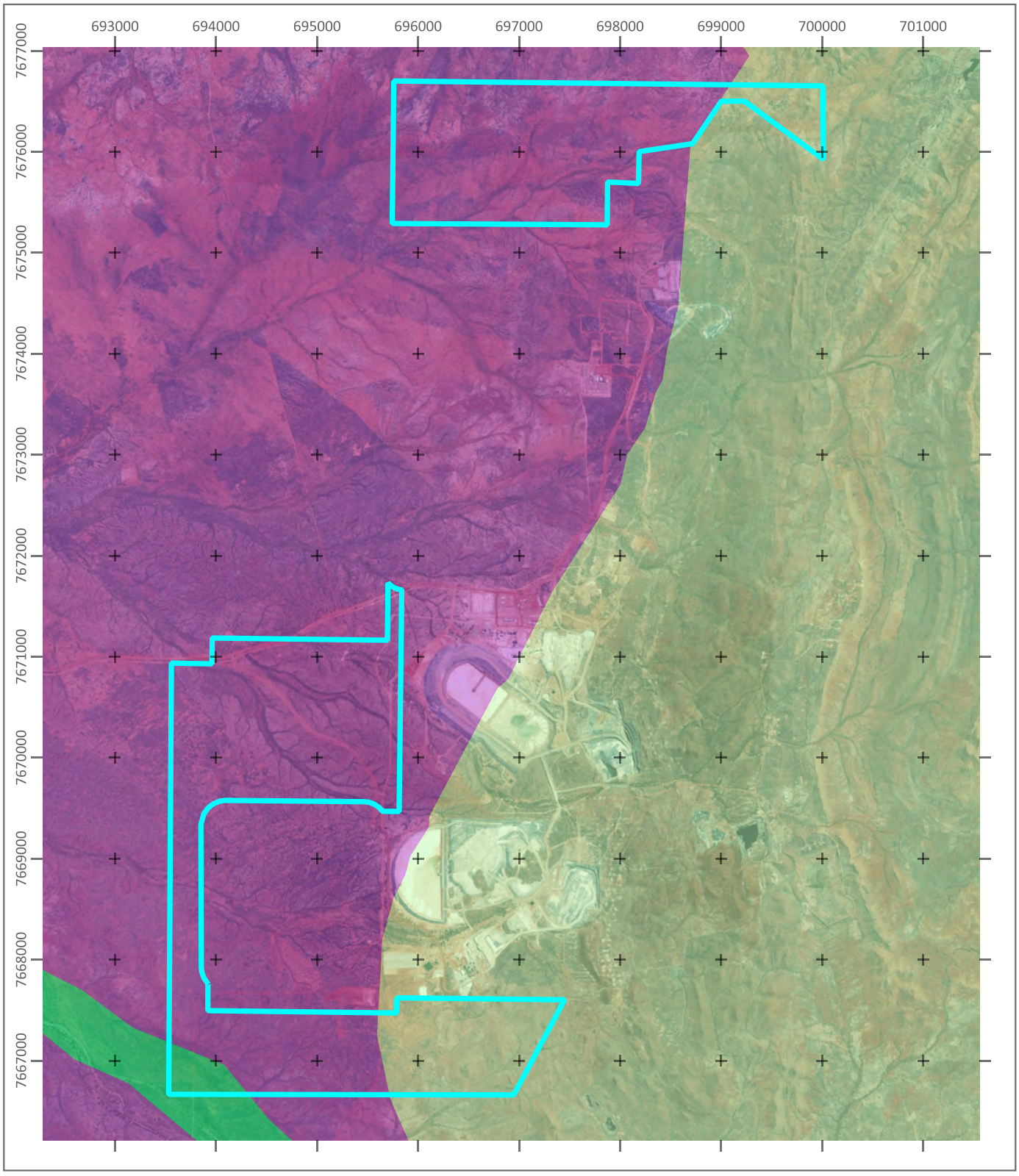
2.7 REGIONAL VEGETATION

The Survey Area is located within the Eremaean Botanical Province and contains three pre-European Beard vegetation association of the Abydos Plain – Chichester System as shown in Figure 2-4 (DPIRD 2019b). The remaining extent of these vegetation associations is outlined in the most recent DBCA Statewide Vegetation Statistics table dated 2018 and summarised in Table 2-2 below.

Vegetation associations within and nearby the Survey Area have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within and nearby the Survey Area are of 'Least Concern'.

Table 2-2 Pre-European Beard Vegetation Associations

Unit	Vegetation Description	Pre-European Extent (ha)	Current Extent (ha)	Pre-European Extent Remaining (%)	Current Extent within DBCA Managed Lands (%)
82	Hummock grassland with scattered bloodwoods and snappy gum *Triodia* spp., *Corymbia dichromophloia, Eucalyptus leucophloia*	2,565,901	2,553,206	99.51	11.57
93	Hummock grassland with scattered shrubs or mallee *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp.	3,044,310	3,040,641	99.88	1.96
619	Riverine; rivergum *E. camaldulensis*	119,374	118,205	99.02	0.2



Author: TB Approved: EH Date: 25/07/2023

Pre-European Beard Vegetation Associations

Prepared for:

Pilbara Minerals

Figure 2-4

Scale: @ A4
1: 55,000

0 0.5 1 km

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

Legend

Survey Areas

Vegetation Association

- 82: Hummock grassland with scattered bloodwoods & snappy gum Triodia spp., Corymbia dichromophloia, Eucalyptus leucophloia
- 93: Hummock grassland with scattered shrubs or mallee Triodia spp. Acacia spp., Grevillea spp. Eucalyptus spp
- 619: Wheatbelt; York gum, salmon gum etc. Eucalyptus loxophleba, E. salmonophloia. Goldfields; gimlet, redwood etc. E. salubris, E. oleosa. Riverine; rivergum E. camaldulensis. Tropical; messmate

2.8 ENVIRONMENTALLY SIGNIFICANT AREAS

2.8.1 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, 80 km to the south-west of the Survey Area.

2.8.2 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 METHODOLOGY

3.1 DESKTOP STUDY

The desktop study provides background information on the known attributes of flora, vegetation, and fauna of the Survey Area, and in the local surrounding area.

3.1.1 Database Searches

A search for EPBC Act MNES was undertaken using the DCCEEW Protected Matters Search Tool (**PMST**). The PMST identifies EPBC listed flora and fauna species and communities based on predicted distributions of the species and/or their habitat, in conjunction with species records. The PMST may predict the occurrence of a species or community in an area where there are no documented records, or documented records are historic. For this search, the Survey Area was imported into the PMST viewer as the feature area and a buffer of 30 km applied. The conservation codes are described in Appendix A. The results of the PMST search are included in Appendix B.

The DBCA maintains databases for records of T and P species and communities. A request was made for a search of DBCA databases for T and P flora and fauna and the presence of TECs or Priority Ecological Communities (**PECs**). Results were obtained in August 2022. A 30 km buffer was applied to the search results from a central coordinate of 696681, 7674607 (GDA 2020, MGA Zone 50).

Flora and Fauna Inventory, including records for Introduced flora and fauna from within 30 km, were obtained from the Dandjoo Biodiversity Data Repository hosted by the DBCA Biodiversity Office (DBCA 2023).

Table 3-1 lists the database searches conducted for the desktop study.

Table 3-1. Database Searches

Attribute	Search Area	Database	Location
Threatened and Priority Ecological Communities	30 km radius	DBCA	Figure 4-2; Section 4.1.1
	30 km radius	PMST	Appendix B
Threatened Flora	30 km radius	DBCA	Figure 4-1; Section 4.1.1
	30 km radius	PMST	Appendix B
Introduced Flora	30 km radius	Dandjoo	Section 4.1.3
Threatened Fauna	30 km radius	DBCA	Figure 5-1; Section 5.1.1
	30 km radius	PMST	Appendix B
Introduced Fauna	30 km radius	Dandjoo	Section 5.1.2

The DBCA fire history database (DBCA 2022) was consulted to identify local fire history.

3.1.2 Literature Review

Flora, vegetation, and terrestrial vertebrate fauna surveys have been conducted in the local area for the Pilgangoora Project. The following local surveys were reviewed, and the results incorporated into the Desktop Study:

- Flora and Fauna Survey Report – Pilgangoora. Prepared on behalf of Altura Mining Limited by Natural Area Consulting, February 2014
- Flora, Vegetation and Fauna Survey Report – Pilgangoora Lithium Project. Prepared on behalf of Altura Mining Limited by Natural Area Consulting, June 2016
- Baseline Vertebrate Fauna Survey, Pilgangoora. Prepared on behalf of Pilbara Minerals Limited by 360 Environmental, May 2016.
- Pilgangoora Project Area – Flora, Vegetation and Fauna Assessment. Prepared on behalf of Pilbara Minerals Limited by MMWC Environmental Pty Ltd, July 2016
- Pilgangoora Access Road Borrow Pits - Flora and Vegetation Assessment. Prepared on behalf of Pilbara Minerals Limited by MMWC Environmental Pty Ltd, July 2016.
- Pityrodia sp. Marble Bar (G. Woodman and D. Coultas GWDC opp 4) Targeted Flora Survey (L45/430 and L45/413). Prepared on behalf of Pilbara Minerals Limited by Ecologia Environmental, 29 June 2017.
- Pilgangoora Lithium Project – M45/1260 Level 1 Fauna and Reconnaissance Flora and Vegetation Assessment. Prepared on behalf of Altura Mining Limited by Ecologia Environmental, 7 July 2018.
- Pilgangoora Project – Stage 2 Expansion Desktop Environmental Assessment. Prepared on behalf of Pilbara Minerals Limited by Ecologia Environmental, 26 October 2018.
- Pilbara Leaf-nosed Bat Survey, Pilgangoora Prepared for Pilbara Minerals Limited by 360 Environmental, November 2015
- Pilbara Leaf-nosed Bat Roost Survey, Pilgangoora Prepared for Pilbara Minerals Limited by 360 Environmental, February 2016
- Northern Quoll Survey on mining tenement M45/1266. Prepared for Pilbara Minerals Limited by Terrestrial Ecosystems, January 2020.
- Lynas Find Biological Survey - Prepared for Pilbara Minerals Limited by APM, October 2022.
- TSF Option 2 and Option 5 Biological Survey - Prepared for Pilbara Minerals Limited by APM, November 2022.
- Northern Quoll Targeted Survey - Prepared for Pilbara Minerals Limited by APM, March 2023.
- E45/2287 Infill Biological Survey - Prepared for Pilbara Minerals Limited by APM, May 2023.
- Targeted Searches for Conservation Significant Bat Roosts - Prepared for Pilbara Minerals Limited by APM, August 2023.

3.1.3 Likelihood of Occurrence

Threatened and Priority flora, fauna and communities returned from the database searches and literature review were assessed for their likelihood of occurrence within the Survey Area using the likelihood of occurrence criteria listed in Table 3-2.

Table 3-2. Likelihood of occurrence criteria

Likelihood of occurrence	Criteria
Recorded	Identified from database records or field survey as occurring within the Survey Area
Likely	Suitable habitat is present in the Survey Area and the species has previously been recorded within 15 km
Possible	Suitable habitat is present within the Survey Area and the species has previously been recorded between 15 – 30 km of the Survey Area
Unlikely	No suitable habitat is present in the Survey Area

3.2 FIELD SURVEY

3.2.1 Survey Personnel and Timing

The terrestrial vertebrate fauna survey was carried out by Dr Mitchell Ladyman. The flora and vegetation field survey was undertaken by Dr Neil Pettit, Dr Eleanor Hoy and Ms Tia Berard.

Acoustic analysis and bat call identification was conducted by Dr Kyle Armstrong and Yuki Konishi at Specialised Zoological, a scientific consultancy business that specialises in bats, bioacoustics, and genetic identification. Dr Armstrong has 20 years' experience in environmental consultancy specialising in bats.

Table 3-3 lists the personnel involved in the field survey.

Table 3-3. Field Survey Personnel

Survey Date	Personnel	Experience	Description
27th – 30th June 2023 14th – 17th July 2023 4th August 2023	Dr Mitchell Ladyman	20+ years	Terrestrial vertebrate fauna survey
14th – 18th July 2023	Dr Neil Pettit Dr Eleanor Hoy Ms Tia Berard	25+ years 15+ years 2 years	Flora and vegetation survey

Autonomous recording devices were installed during the first fauna field survey period, were redeployed during the second survey period and collected in the third survey period.

3.2.2 Survey Conditions

The total summer rainfall prior to survey (1st December 2022 to 28th February 2023) was below average at 97.4 mm compared to 170.6 mm (BoM 2023). The sum of the total rainfall for the period January to July 2023 was 170 mm, which is 61% of the average for the same period (277.6 mm).

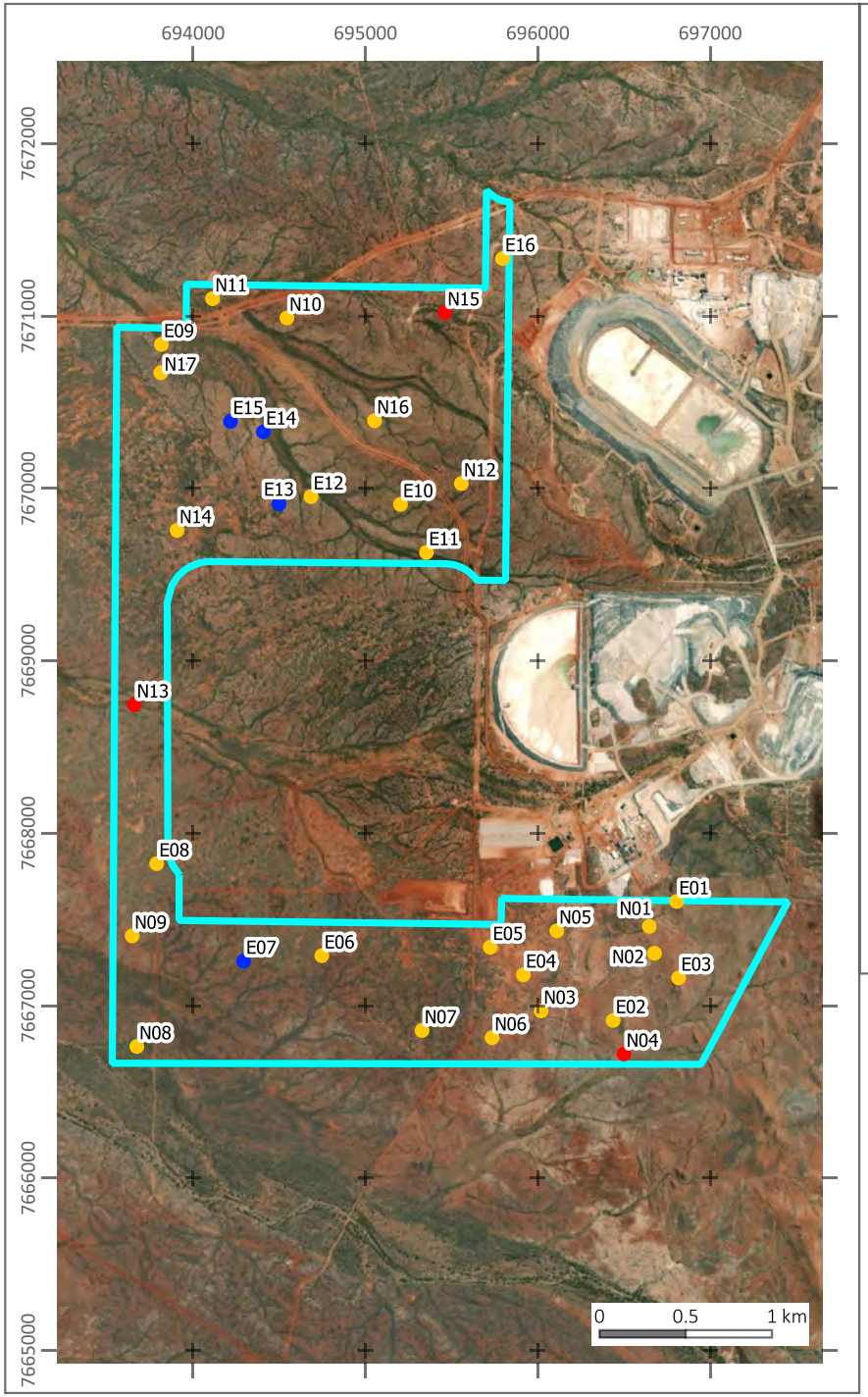
During the survey period, daytime temperatures reached a maximum of between 30.9 and 28.8 °C and a minimum of between 10.5 and 15.3°C overnight, which is typical of the time of year (BoM 2023). No adverse weather conditions occurred that would impact the results of the survey. No rainfall was recorded on the BoM weather station for July and for the duration of the survey.

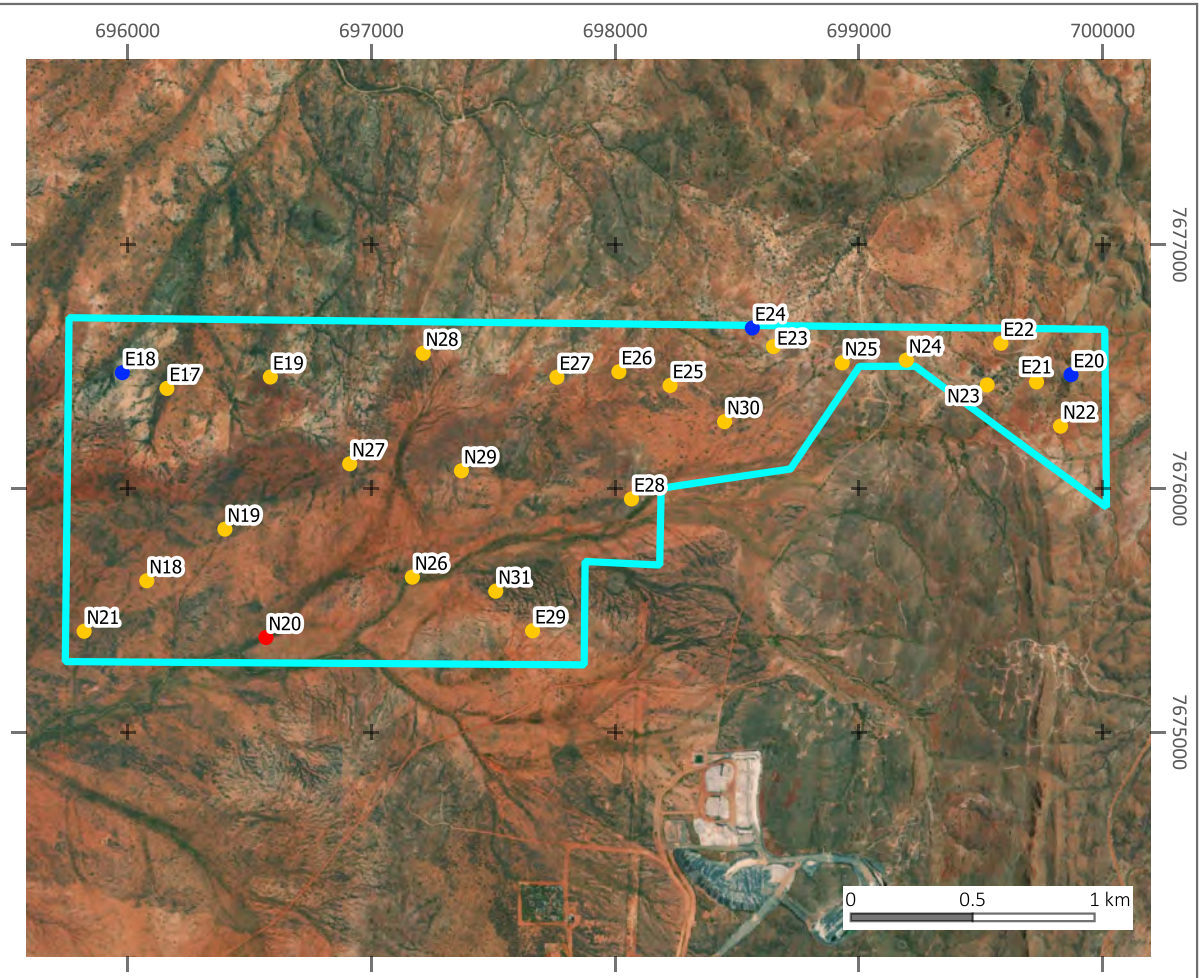
The Survey Area is within the Eremaean botanical province. Recommended timing for flora and vegetation survey is 6-8 weeks post wet season (March – June) for Primary survey, and a Dry season survey (after winter rainfall if available) for Supplementary survey (EPA 2016). The timing of the field survey is within the Supplementary period for the region, being three weeks following a rainfall in mid-June.

Fauna survey timing was within that recommended for mammals (EPA 2020).

3.2.3 Flora and Vegetation

A Detailed survey was conducted for flora and vegetation. Vegetation was sampled using 49 quadrats of 50 x 50 m, four quadrats of 25 x 100 m and six relevés of approximately 50 x 50 m (Figure 3-1). Quadrats are vegetation survey plots which are accurately measured out as 50 x 50 m (or an area equivalent to 2500 m^2) and marked at the north-west corner using a handheld Global Positioning System (**GPS**) unit. Relevés were conducted where vegetation units were present in areas less than 2500 m^2 or in geometries that were not of a regular shape.



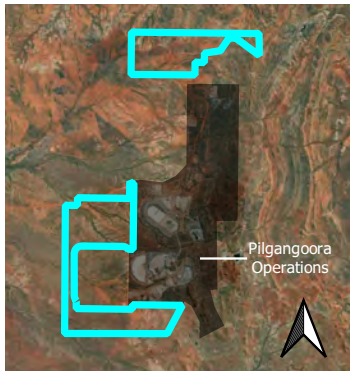


Legend

- Survey Areas

Flora Assessment Sites

- 50 x 50 m Quadrat
- 25 x 100 m Quadrat
- Relevé



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

Author: TB | Approved: EH | Date: 27/07/2023

Flora Survey Sites

Prepared for: Pilbara Minerals

Figure: 3-1

Field data at each survey site was recorded on a pro-forma data sheet and included the parameters listed in Table 3-4. The attributes of Detailed survey sites are provided in Appendix C.

Table 3-4. Parameters recorded at each Detailed site

Variable	Parameters
Collection attributes	Personnel/recorder; date, quadrat dimensions and marking method, site code and georeferenced photographs of the quadrat.
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, litter, rock type and physical attributes.
Location	Coordinates recorded using a hand-held GPS (Garmin) to accuracy approximately ± 5 m.
Vegetation	Dominant growth form, height, cover, and species for the three traditional strata (upper, mid and ground) compatible with NVIS Level V (ESCAVI 2003).
Vegetation condition	Vegetation condition was assessed using the condition rating scale devised by Trudgen (1988).
Disturbance	Level and nature of disturbances (*e.g.* weed presence, fire, and time since last fire, impacts from grazing, vegetation clearing, erosion).
Flora	List of all species within the quadrat including weeds and listing species average height and cover.

A flora inventory was compiled from taxa listed in Detailed survey sites and from opportunistic floristic collections throughout the Survey Area, with at least one collection made for every taxon encountered. Specimens were identified by an experienced botanical taxonomist in the Western Australia Herbarium (**WAH**) using published reference material. The nomenclature applied is consistent with Florabase (WAH 1998-).

The conservation status of all recorded flora was determined from the DBCA Wildlife Conservation Rare Flora Notice 2022, T and P Flora List 6 October 2022, and the EPBC Act List of T Flora (DCCEEW 2023). The Western Australian Organisms List database was consulted to determine if any are BAM Act Declared Plants (DPIRD 2023), and the Weeds of National Significance list to determine any WONS (DAWE 2020).

The vegetation types were described based on their structure and species composition, as defined by quadrat data, and field observations. Vegetation was mapped in the field using handheld GPS units and aerial photographs, then digitised using GIS software. Vegetation is described at the association level (ESCAVI 2003) and referred to as Vegetation Types (EPA 2016).

Vegetation Condition was assigned using the scale developed for the Eremaean and Northern Botanical Provinces adapted from Trudgen (1988) as recommended in EPA (2016). Table 3-5 lists the six potential categories.

Table 3-5. Vegetation Condition Scale

Vegetation Condition	Eremaean and Northern Botanical Provinces adapted from Trudgen (1988)
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; *i.e.* areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs

Data analysis was applied using the method recommended by EPA (2016). A species by site matrix was prepared using the complete suite of species recorded. The Primer 7 (Clarke and Gorley, 2015), software was used to perform floristic composition vegetation classification. Data was transformed to presence/absence and a resemblance matrix was constructed using the Bray Curtis similarity measure. A cluster analysis was performed using group averages. The SIMPROF routine was used to test the hypothesis that the species and/or abundances are different at each group of sites using 999 permutations and a significance level of 5%.

The completeness of the survey was tested using a species accumulation curve and applying the Michaelis-Menton model to estimate the species richness of the Survey Area.

3.2.4 Fauna

Fauna habitat assessments were performed at 18 locations. Descriptive data was recorded including soil type, landform, presence of microhabitats, disturbances and images were recorded. Reference sites were also recorded as mapping notes and site photos, to record the extent/distribution and condition of habitat types. Fauna habitat assessment site photos and reference site photos are included in Appendix D.

Targeted search was conducted for direct observation and signs of conservation significant fauna using traverses on foot, with tracklogs recorded on a handheld GPS. Signs include scats, prints, slough skin, scratchings made during foraging and other diggings, burrows and mounds. Georeferenced photos of signs were taken. Traverses were conducted during daylight hours. Traverses covered a linear distance of 79.4 km and are shown in Figure 3-2.

Motion-triggered and time lapse cameras were deployed throughout the Survey Area between the 27th and 29th of June 2023. These cameras were closed and re-deployed between the 14th and 15th of July 2023 at different locations and were closed on the 3rd of August 2023. Cameras were generally deployed in pairs with one camera set up as motion-triggered capture (3 photos per trigger with a 5-minute reset period) and one set up as a time lapse capture method (1 photo every 5 minutes). Table 3-6 lists the camera locations and confirmed operational days.

Table 3-6. Motion-triggered and time lapse camera setup and duration

Targeted Fauna Habitat	Location (GDA 2020 MGA zone 50)	Camera	Method	Trap nights
Cameras deployed between the 27th June and 15th July 2023				
Shallow Drainage Depression and Creeks	697597, 7675800	C31(1)	Motion Sensor	5
		C21x(1)	Time Lapse	13
Historic Mine Workings	699467, 7676512	C32(1)	Motion Sensor	8
		C20(1)	Time Lapse	17
Shallow Drainage Depression and Creeks	698187, 7676017	C33(1)	Motion Sensor	7
		C9(1)	Time Lapse	16
Rocky Outcrop	699735, 7676675	C34(1)	Motion Sensor	7
		C21(1)	Time Lapse	17
Rocky Outcrop	699658, 7676683	C35(1)	Motion Sensor	6
		C13(1)	Time Lapse	17
Shallow Drainage Depression and Creeks	698401, 7676627	C36(1)	Motion Sensor	4
		C18(1)	Time Lapse	4
Rocky Outcrop	699580, 7676575	C37(1)	Motion Sensor	9
		C7(1)	Time Lapse	17
Major Drainage Line	694153, 7671149	C10(1)	Time Lapse	17
		C6(1)	Motion Sensor	15
Major Drainage Line	695836, 7670653	C16(1)	Motion Sensor	17
		C14(1)	Time Lapse	17
Shallow Drainage Depression and Creeks	698266, 7670653	C30(1)	Motion Sensor	8
		C11(1)	Time Lapse	17

Targeted Fauna Habitat	Location (GDA 2020 MGA zone 50)	Camera	Method	Trap nights
Cameras deployed between the 15th July and 4th August 2023				
Rocky Outcrop	696438, 7666886	C21x(2)	Time Lapse	19
Platy Rock Outcrop	696287, 7667222	C32(2)	Motion Sensor	19
		C21(2)	Time Lapse	19
Stony Plains	694294, 7667312	C33(2)	Motion Sensor	18
Platy Rock Outcrop	696287, 7667222	C34(2)	Motion Sensor	19
		C20(2)	Time Lapse	19
Rocky Outcrop	696923, 7666789	C35(2)	Motion Sensor	20
		C13(2)	Time Lapse	20
Major Drainage Line	695723, 7670951	C36(2)	Time Lapse	17
		C11(2)	Motion Sensor	17
Rocky Outcrop	696904, 7666819	C37(2)	Motion Sensor	20
		C7(2)	Time Lapse	20
Total				**465**

Identifications from camera captures were made as far as necessary to rule out target species, however most fauna captures were determined to species level. Individual captures were counted where a time gap of at least an hour was recorded between captures of the same species unless demarcations were available to definitively identify individuals.

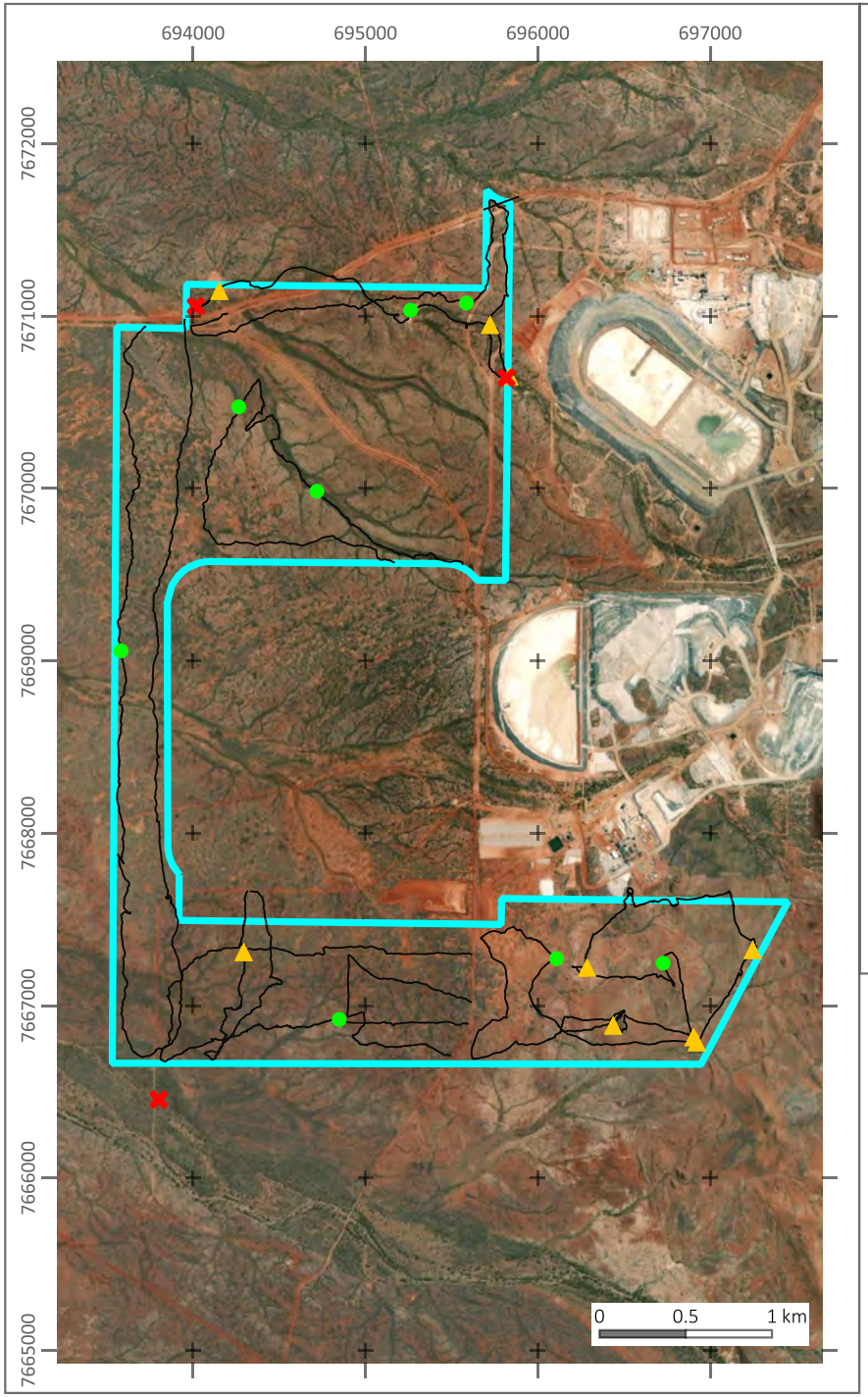
Five Anabat Swift acoustic bat recording devices were deployed between the 14th of July and 2nd of August 2023 for a total of 49 nights. Table 3-7 lists the acoustic bat recording devices deployed, the habitat type targeted, and the number of trap nights.

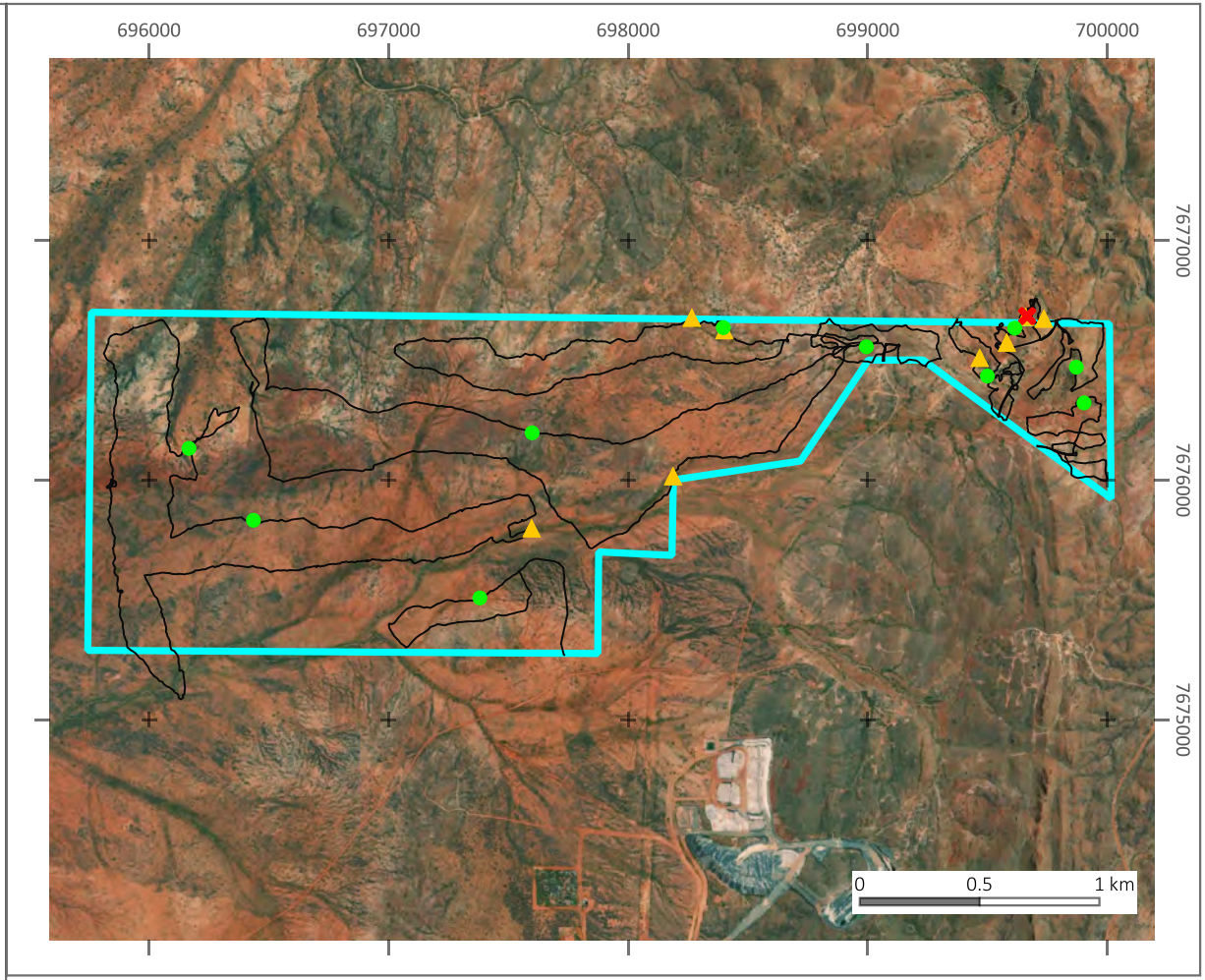
Bat call analysis was performed by Dr Kyle Armstrong of Specialised Zoological. A technical report with specifications on the analysis method is included as Appendix E. The scope of the analysis was limited to the detection of the conservation significant species Ghost bat *Macroderma gigas* and Pilbara leaf-nosed bat *Rhinonicteris aurantia*.

Table 3-7. Acoustic bat recording device location and duration

Habitat	Location (GDA 2020 MGA zone 50)	Acoustic Bat Recorder	Trap nights
Rocky Outcrop	699665, 7676685	AS660654	17
Historic Mine Workings	699456, 7676503	AS60630	7
Major Drainage Line	694016, 7671058	AS45085	3
Major Drainage Line	695818, 7670642	AS642022	17
Shallow Drainage Depressions and Creeks	693801, 7666455	AS450007	5
Total			**49**

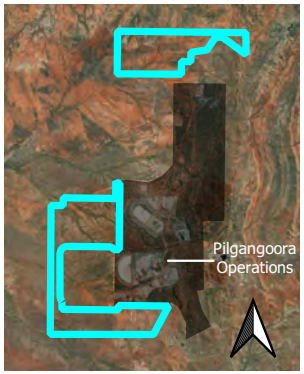
Nomenclature within this report is applied according to the WA Checklist of Terrestrial Vertebrates (Western Australian Museum 2023). Figure 3-2 shows the location of cameras, acoustic recording devices and targeted searches. Detailed fauna habitat assessments were made at the locations where cameras and acoustic recording devices were deployed, and during traverses.





Legend

- Survey Areas
- Acoustic Bat Recorder
- Motion Triggered Camera
- Fauna Habitat Assessment
- Targeted Search Traverses



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

Author: TB Approved: EH Date: 27/07/2023

Fauna Survey Sites

Prepared for:
Pilbara Minerals

Figure: 3-2

3.3 CONSTRAINTS

Several limitations may arise during field survey EPA (2016 and 2020). These potential survey limitations are listed below in Table 3-8 with comments on the constraint to the outcomes of the survey.

Table 3-8. Survey Constraints

Factor	Impact of survey outcomes
Access problems	Not a constraint. All of the Survey Area was accessed.
Experience levels	Not a constraint. The personnel were suitably qualified
Scope: Flora and vegetation	Not a constraint. Survey was carried out at a level of Detailed assessment
Scope: Fauna	Not a constraint. The survey was carried out at a level of Targeted level of assessment, suitable for the size and intensity of the proposed Project and the availability of previous local survey.
Timing, weather, season, cycle	Not a constraint. The Survey Area is within the Eremaean Botanical district. Rainfall in the season prior to survey was lower than average. The Flora and Vegetation survey was conducted in the Supplementary survey period (EPA 2016). No inclement weather occurred during the survey period that would impact the detection of target fauna. Survey timing was within that recommended for mammals. Conditions were unsuitable for reptiles, water birds and amphibians, however the assessment of habitat availability for these groups was possible and target species were predominantly mammals.
Sources of information	Not a constraint. Previous biological reports and database records are available for the locality and region.
Completeness: Flora and vegetation	Minor constraint. Two plant specimens (1.4% of the collection) were not able to be determined to the species level due to lack of fertile material. Modelling indicates the survey captured 93% of the floristic richness present at the time of survey. Due to low rainfall preceding the survey, the presence of annual species was restricted to areas receiving runoff and/or with higher moisture retention.
Completeness: Fauna	Not a constraint. The scope was completed. The survey resulted in no ambiguous identifications of bat calls. Some deployed bat detection devices failed to record correct date and location data and due to continuous recording battery longevity was reduced. The locations and date/time of deployment was recorded using GPS and therefore was known. The acoustic survey totaled 49 nights and confirmed the presence of the Pilbara leaf-nosed bat and therefore the technical issues were not a constraint. Seven photos were unable to be determined to species level but were able to be ruled out as being target species and therefore was not a constraint.

4 FLORA AND VEGETATION RESULTS

4.1 DESKTOP STUDY

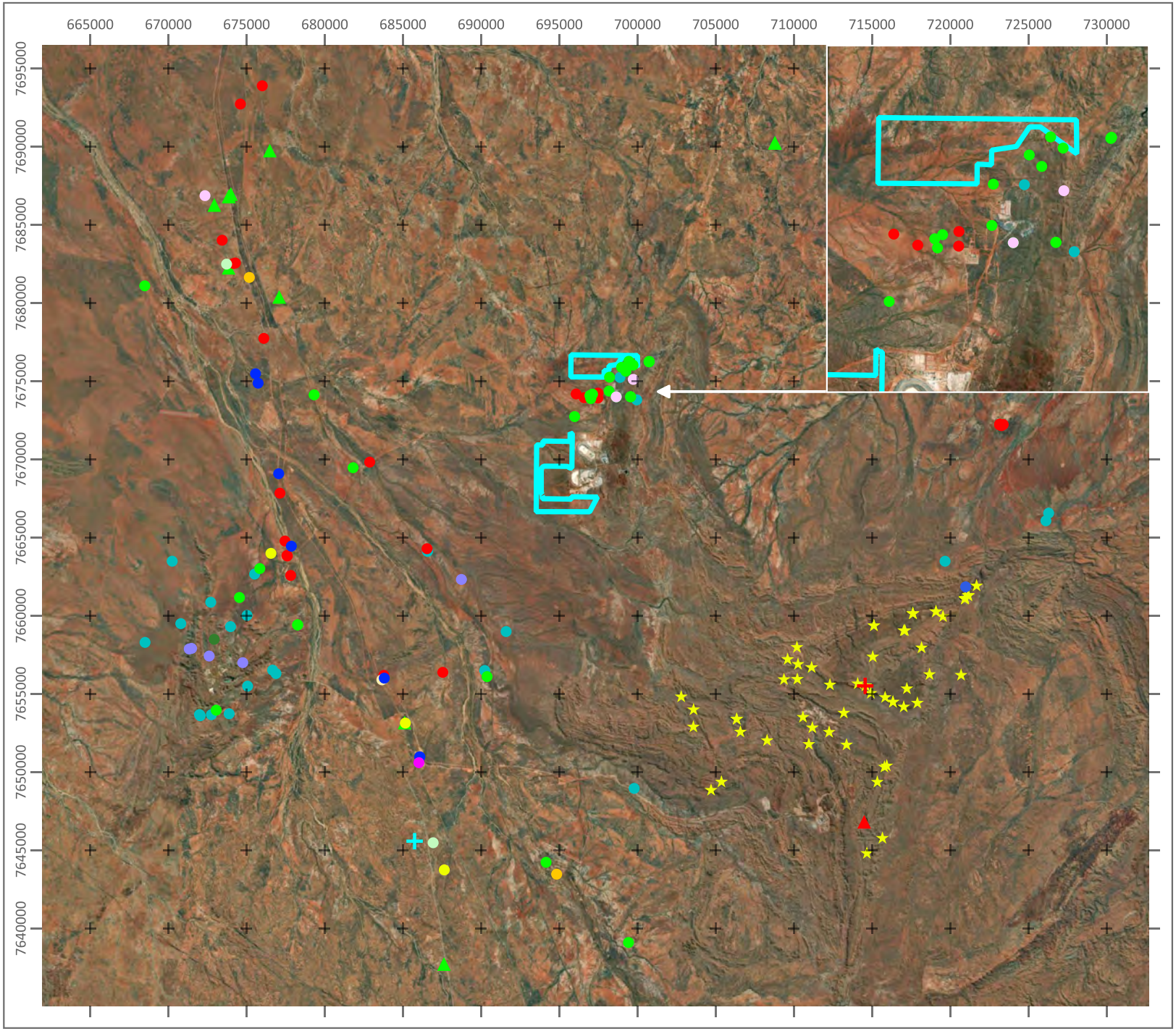
4.1.1 Significant Flora

No T or P Flora listed under the BC Act and/or EPBC Act have been previously recorded within the Survey Area.

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

No additional T or P species were returned from the PMST or literature review, however a local record of *Rothia indica* subsp. *australis* (APM 2022a) increased the likelihood of occurrence from Possible to Likely.

T and P flora returned from the DBCA database with records within 30 km of the Survey Area are shown in Figure 4-1. Records of P flora previously recorded within the Pilgangoora Project are also shown.



Legend

Survey Areas

Endangered
- Quoya zonalis

Priority 1
- Acacia leeuweniana
- Themeda sp. Panorama (J. Nelson et al. NS 102)

Priority 3
- Eragrostis crateriformis
- Euphorbia clementii
- Euploca mutica
- Gomphrena leptophylla
- Gymnanthera cunninghamii
- Nicotiana umbratica
- Phyllanthus hebecarpus
- Rothia indica subsp. australis
- Stylidium weeliwolli
- Terminalia supranitifolia
- Triodia basitricha
- Triodia chichesterensis
- Vigna triodiophila

Priority 4
- Bulbostylis burbidgeae
- Ptilotus mollis

Scale: @ A4
1: 350,000

0 5 10 km

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

Author: TB Approved: EH Date: 26/07/2023

Threatened and Priority Flora Records

Prepared for:
Pilbara Minerals

Figure: 4-1

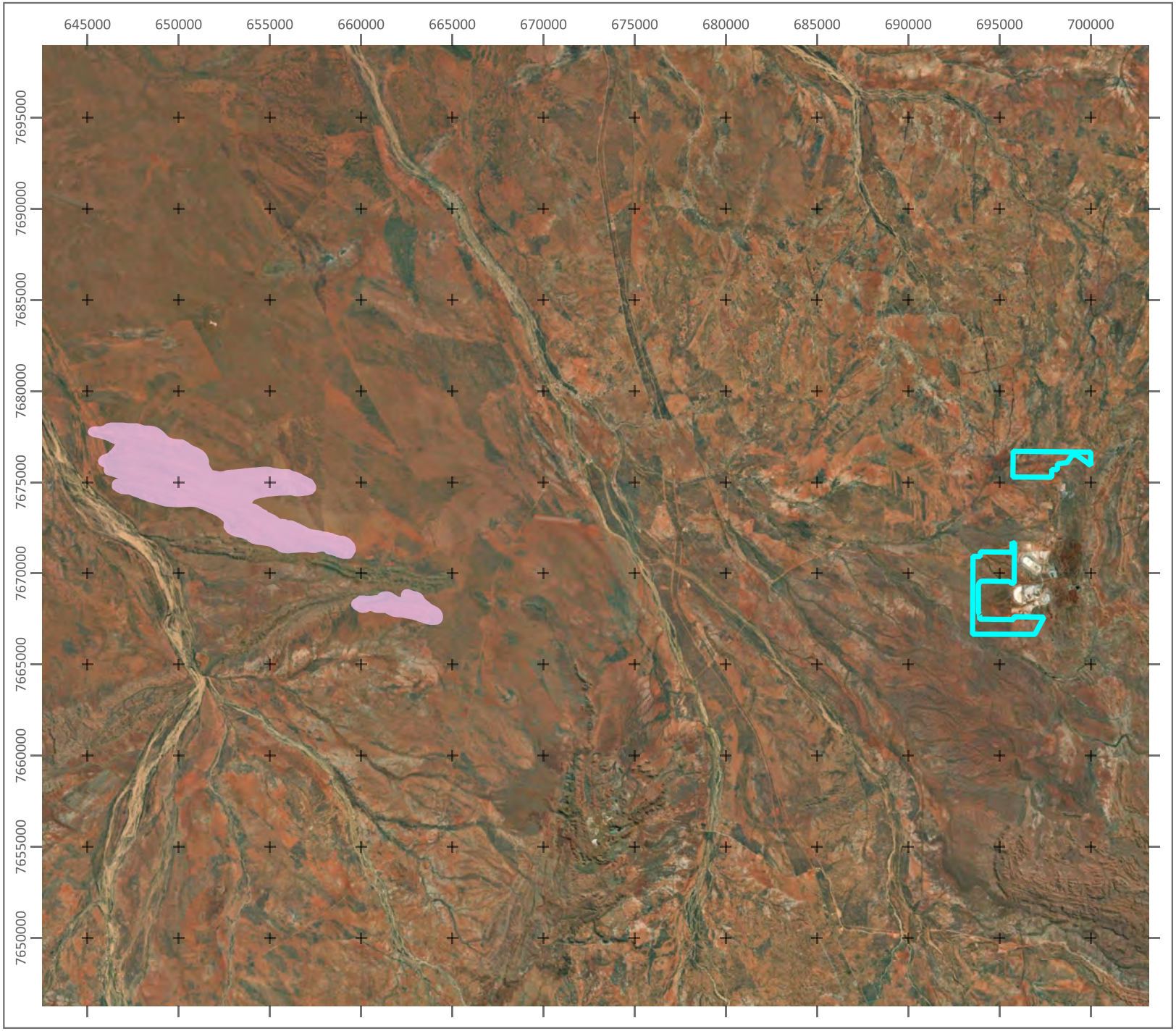
An assessment of the likelihood of occurrence of these 18 species within the Survey Area was performed using the criteria listed in Table 3-2. The results of the assessment are listed in Table 4-1.

Table 4-1. Threatened and Priority Flora Likelihood of Occurrence

Species	Cons. Code BC Act	Cons. Code EPBC Act	Preferred Habitat	Likelihood of Occurrence
Acacia leeuweniana	P1	-	Gritty, skeletal red-grey sandy loam, light orange-brown gravelly sand, granite. In rock fissures in outcrops, among boulders.	Possible. Suitable habitat in granite outcrop areas.
Bulbostylis burbidgeae	P4	-	Granitic soils. Granite outcrops and cliff bases.	Possible. Suitable habitat in granite outcrop areas.
Eragrostis crateriformis	P3	-	Clayey loam or clay. Creek banks, depressions.	Possible. Suitable habitat in the claypans.
Euphorbia clementii	P3	-	Gravelly hillsides, stony grounds.	Likely. Suitable habitat on the stony plains and rises.
Euploca mutica	P3	-	Hummock grassland and sandplains.	Likely. Suitable habitat in sandplains.
Gomphrena leptophylla	P3	-	Open flats, sandy creek beds, edges salt pans and marshes, stony hillsides.	Possible. Suitable habitat in the plains and sandy creek beds.
Goodenia nuda	P4	-	Has been previously found in drainage lines of red-brown loamy sand or sandy loam and in disturbed roadside areas	Possible. Suitable habitat in creeks and roadsides.
Gymnanthera cunninghamii	P3	-	Sandy soils, creeks.	Possible. Suitable habitat in sandy creeks.
Nicotiana umbratica	P3	-	Typically grows in shelter of large boulders on rocky outcrops and in shallow soils	Possible. Suitable habitat in granite outcrop areas.
Phyllanthus hebecarpus	P3	-	Granite boulders/outcropping	Possible. Suitable habitat in granite outcrop areas.
Quoya zonalis	EN	EN	Steep, rocky, sandstone conglomerate and granite slopes in skeletal, brown, sandy loam soils of the Capricorn Land System	Unlikely to occur. No suitable habitat.
Rothia indica subsp. *australis*	P3	-	Sandy soils. Seasonally inundated areas, sandhills and flats.	Likely. Suitable habitat in sandplains.
Stylidium weeliwolli	P3	-	Gritty sand soil, sandy clay. Edge of watercourses.	Possible. Sandy creek edges.
Terminalia supranitifolia	P3	-	Sand. Among basalt rocks.	Unlikely to occur.
Themeda sp. Panorama (J. Nelson *et al.* NS 102)	P1	-	Has been found growing along watercourses and creek lines and on rocky substrate	Possible. Suitable habitat along rivers and creeks and outcrops.
Triodia basitricha	P3	-	Occurs on rocky and gravelly slopes of mountains or low hills.	Unlikely to occur.
Triodia chichesterensis	P3	-	Occurs on sand or loam over rocky or gravelly substrates, often with quartzite.	Present. Suitable habitat includes low rises with rocky soils containing quartzite.
Vigna triodiophila	P3	-	Local record among dolerite boulders on very steep upper slope. Stony red-brown clay loam.	Unlikely to occur.

4.1.2 Significant Vegetation

There are no TECs listed under the BC Act or EPBC Act known to occur within the Survey Area. One P 3 Ecological Community is located approximately 30 km west of the Survey Area; the Gregory Land System (Figure 4-2).



Legend

- Survey Areas
- Gregory Land System
  Priority 3 Ecological Community

Scale: @ A4
1: 300,000

0 5 10 km

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

Author: TB Approved: EH Date: 26/07/2023

Threatened and Priority Ecological Communities

Prepared for:
Pilbara Minerals

Figure: 4-2

4.1.3 Introduced Flora Species

Dandjoo returned two introduced flora species, *Cenchrus ciliaris* and *Flaveria trinervia*, both categorised as S11-Permitted under the BAM Act. Eleven introduced flora species have been recorded locally by previous surveys (MMWC Environmental 2016a; APM 2022a,b), including two Declared pests also listed as WONS.

Table 4-2 lists the introduced flora species recorded within 30 km of the Survey Area.

Table 4-2. Introduced Flora Records within 30 km of the Survey Area

Species	Common Name	BAM Act Listing	WONS
Aerva javanica	Kapok Bush	Permitted – S11	No
Cenchrus ciliaris	Buffel Grass	Permitted – S11	No
Cenchrus setiger	Birdwood Grass	Permitted – S11	No
Chloris barbata	Purpletop Chloris	Permitted – S11	No
Cynodon dactylon	Couch Grass	Permitted – S11	No
Flaveria trinervia	Speedy Weed	Permitted – S11	No
Malvastrum americanum	Spiked malvastrum	Permitted – S11	No
Opuntia stricta	Common Prickly Pear	Declared Pest – S11(2) (C3 Restricted)	Yes
Passiflora foetida var. *hispida*	Stinking Passion Flower	Permitted – S11	No
Tamarix aphylla	Athel Pine	Declared Pest – S22(2) (Exempt)	Yes
Triumfetta pentandra	-	Permitted – S11	No

4.2 FIELD SURVEY

4.2.1 Flora

A total of 143 species of flora were recorded within the Survey Area, comprising 139 native species and four introduced species. Two specimens in the collection (1.4% of the collection) could not be unambiguously identified beyond genus level due to the lack of flowering parts or fruiting bodies.

The *Fabaceae* (pea family, 37 native), *Poaceae* (grass family, 31 native, two introduced), *Malvaceae* (12 native species), and *Amaranthaceae* (seven native species, one introduced) were the most species-rich families recorded. Twenty-eight families represented by 74 genera were recorded across the Survey Area.

The complete list of plant species recorded within the Survey Area is presented in Appendix F. The mean species richness was 15 species per quadrat. This is lower than other local surveys including the MMWC Environmental (2016a) Pilgangoora baseline survey which included 49 detailed sites with an average species richness of 25, the Infill Biological Survey (APM 2023b) with 17 detailed sites and an average

richness of 32, TSF Option 2 and 5 Survey (APM 2022b) with 19 detailed sites and an average species richness of 23, and the Lynas Find Survey (APM 2022a) with 23 detailed sites and an average species richness of 20. The low species richness is likely a consequence of survey season and seasonal conditions.

A species accumulation curve (Appendix F) was performed, returning a modelled Michaelis-Menton species richness of 155, indicating that the floristic survey was approximately 93% complete.

The survey recorded 26 species not previously encountered at the Pilgangoora Project. These species are identified in Appendix F and bring the total richness for the Pilgangoora Project area to 288 including subspecies, and varieties.

Floristic groups identified in the cluster analysis were organised into vegetation types and are discussed in the following section.

The introduced flora species recorded are detailed in Section 4.2.6.

4.2.2 Vegetation Types

Seven vegetation types are described for the Survey Area, as summarised in Table 4-3 and detailed below.

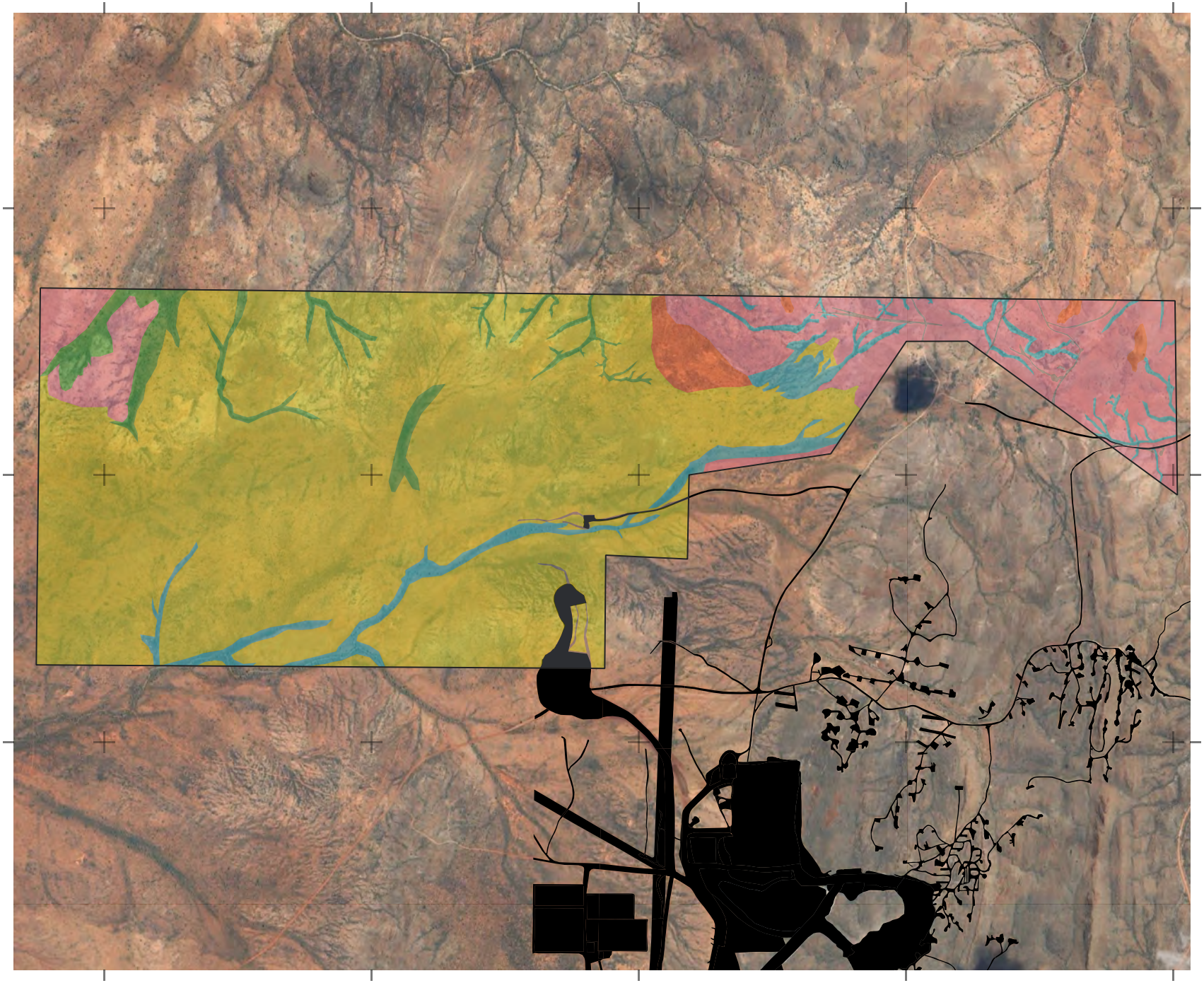
Table 4-3. Vegetation Types

Code	Landform	Vegetation Description	ha	%
12a	Undulating plains	Isolated low *Corymbia hamersleyana* over *Acacia adsurgens, Acacia inaequilatera* and *Grevillea wickhamii* sparse tall shrubland with mid hummock grassland of *Triodia lanigera, Triodia wiseana* and *Triodia epactia.*	824.7	71.0
7b	Drainage depressions	Low open woodland of *Corymbia hamersleyana*; over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland and *Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* hummock grassland.	136.7	11.8
15a	Sandy Creek	Low open woodland of *Corymbia hamersleyana* over *Acacia cowleana, Acacia adsurgens* and *Indigofera rugosa* mid open shrubland with *Triodia epactia, Triodia lanigera* and *Triodia wiseana* hummock grassland.	31.8	2.7
9a	Stony plains and rises	Mid isolated shrubs of *Acacia inaequilatera, Acacia acradenia* and *Hibiscus sturtii* with *Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* hummock grassland.	97.8	8.4
9c	Granite outcrops and rises	Isolated low *Corymbia hamersleyana* over *Acacia adsurgens, Acacia cowleana* and *Acacia maitlandii* mid sparse shrubland with *Triodia lanigera, Triodia wiseana and Triodia epactia* hummock grassland.	9.3	0.8
4b	Major Drainage Line	Low open woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* over *Cajanus cinereus, Acacia cowleana* and *Acacia pyrifolia* mid sparse shrubland with *Triodia epactia, Cenchrus ciliaris* and *Triodia angusta* mid open hummock and tussock grassland.	13.4	1.2
16a	Claypans	Open herbfield of *Sida fibulifera, Eriachne mucronata* and *Neptunia dimorphantha.*	14.1	1.2
D	-	Disturbed – clear of vegetation	34.1	2.9

As the Survey Area is continuous with other surveys conducted for the Pilbara Minerals Pilgangoora Project, the vegetation coding system previously used at the site has been retained and extended. Vegetation communities have been compared to those previously recorded on the site using structural comparison and common species assemblages. Where communities share a high level of similarity, the vegetation code previously applied has been used here and a discussion of similarity presented.

The DBCA fire history database indicates that the western half of the northern Survey Area was burned in 2017/2018, and the eastern half burned in 2013/2014. The south-eastern portion of the southern Survey Area was burned in 2019/2020, and the south-western portion in 2009/2010. On-ground observations supported these remotely recorded fire records. Post fire-regeneration has occurred in all areas and time since fire was considered in the assessment of vegetation condition.

Distribution of vegetation types at a scale of 1: 20,000 is shown in Figure 4-3 a and b. The dendrogram resulting from the cluster analysis is shown in Appendix C, followed by the site data sheets and photos.



Legend

- 7b: Low open woodland of Corymbia hamersleyana over Acacia acradenia open mid shrubland and Triodia wiseana hummock grassland in drainage depressions
- 9a: Mid Acacia inaequilatera isolated shrubs with Triodia wiseana hummock grassland on stony plains and rises
- 9c: Isolated low Corymbia hamersleyana over Acacia adsurgens mid sparse shrubland with Triodia lanigera hummock grassland on granite outcrops and rises
- 12a: Isolated low Corymbia hamersleyana over Acacia adsurgens sparse tall shrubland with mid hummock grassland of Triodia lanigera on undulating plains
- 15a: Low open woodland of Corymbia hamersleyana over Acacia cowleana open mid shrubland with Triodia epactia hummock grassland in sandy creeks
- D: Disturbed
- Pilgangoora Project

Scale: @ A4
1: 20,000

0 200 400 m

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

Author: EH Approved: ML Date: 16/09/2023

Vegetation
Northern Survey Area

Prepared for:
Pilbara Minerals

Figure: 4-3a

693000 694000 695000 696000 697000 698000

7672000 7671000 7670000 7669000 7668000 7667000

Author: EH Approved: ML Date: 17/09/2023

Vegetation
Southern Survey Area

Prepared for:

Pilbara Minerals

Figure: 4-3b

Scale: @ A4
1: 20,000

0 0.5 1 km

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

Animal Plant Mineral Pty Ltd

Legend

- 4b: Low open woodland of Eucalyptus victrix over Cajanus cinereus mid sparse shrubland with Triodia epactia mid open hummock grassland in riverine areas.
- 7b: Low open woodland of Corymbia hamersleyana over Acacia acradenia open mid shrubland and Triodia wiseana hummock grassland in drainage depressions
- 9a: Mid Acacia inaequilatera isolated shrubs with Triodia wiseana hummock grassland on stony plains and rises
- 12a: Isolated low Corymbia hamersleyana over Acacia adsurgens sparse tall shrubland with mid hummock grassland of Triodia lanigera on undulating plains
- 15a: Low open woodland of Corymbia hamersleyana over mid Acacia cowleana open mid shrubland with Triodia epactia hummock grassland in sandy creeks
- 16a: Open herbfield of Sida fibulifera Eriachne mucronata and Neptunia dimorphantha on claypans
- D: Disturbed
- Pilgangoora Project

Landform: **Major Drainage Line** **Vegetation Type: 4b**

Low open woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* over mid *Cajanus cinereus*, *Acacia cowleana,* and *Acacia pyrifolia* sparse shrubland with *Triodia epactia, Cenchrus ciliaris* and *Triodia angusta* mid open hummock and tussock grassland.

Eucalyptus victrix is uncommon in the area with occurrence restricted to these larger drainage channels. Whilst attaining only low heights, some trees attain a diameter at breast height larger than those in the surrounding habitats. Additional shrub species present included *Gossypium robinsonii, Acacia trachycarpa, Crotolaria cunninghamii, Acacia bivenosa, Petalostylis labicheoides, Corchorus incanus, Indigofera monophylla, Hibiscus burtonii, Hibiscus sturtii, Indigofera rugosa* and *Senna glutinosa*.

The groundcover was diverse with a large number of sparsely distributed herbs and annual grasses. Common groundcover species also included *Enneapogon lindleyanus, Themeda triandra, Cymbopogon ambiguus, Eriachne mucronata, Chrysopogon fallax, Euphorbia careyi, Euphorbia mitchelliana, Goodenia microptera, Heteropogon contortus, Rynchosia minima, Scaevola amblyanthera, Sida clementii, Solanum diversiflorum, and Tephrosia rosea.*

This community occurs in the deeper drainage feature with deep incised channels. Soils are loamy to sandy loam, with surface gravel or large rocks present in places. A higher species richness was recorded in this habitat as the soils have a higher moisture retention and the canopy density offers a greater amount of shade than surrounding habitats, allowing annuals to persist in drier conditions.

Plate 4-1. Major Drainage Line 4b

Condition: Impacts from cattle grazing are moderate to severe, the agricultural weed *Cenchrus ciliaris* occurs and occasional tracks are present. The condition of this vegetation is Good to Very Good.

Detailed sites: N11, N15. Total richness: 57 species. Average richness: 39 species.

Introduced/exotic taxa: **Cenchrus ciliaris*.

Conservation significant species: none.

Landform: **Drainage Depressions** **Vegetation Type: 7b**

Low open woodland of *Corymbia hamersleyana* over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* open mid shrubland and *Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* hummock grassland.

The tree layer dominated by *Corymbia hamersleyana* is denser than the surrounding undulating plains and trees occur as low clumps averaging 4 to 5 m tall. *Eucalyptus leucophloia* was also present in a small area in the north of the survey area and was recorded in one quadrat. The shrub layer is also denser than the surrounding undulating plains. Common shrubs also included *Corchorus incanus, Acacia inaequilatera, Acacia bivenosa, Indigofera monophylla* and *Petalostylis labicheoides.*

Common groundcover species also included *Cassytha capillaris, Cajanus cinereus, Senna notabilis, Euphorbia mitchelliana* and *Ptilotus austrolasius.*

This community occurs in the larger drainage depressions between the plains and the creeks. Soils are loamy and or sandy, often with surface gravel present. The distinction between plain, drainage depression and creek is sometimes ambiguous. The depressions are part of the surface drainage network but often lack a defined channel and the sandy soils provide rapid infiltration of surface water, preventing the prolonged availability of surface water and the development of pools. Small areas of drainage depression often occurs within the undulating plains areas in parcels too small to be individually mapped. In general, the difference to Vegetation type 12a is that there is a denser canopy and mid shrub layer and a greater abundance of the soft spinifex *Triodia epactia*.

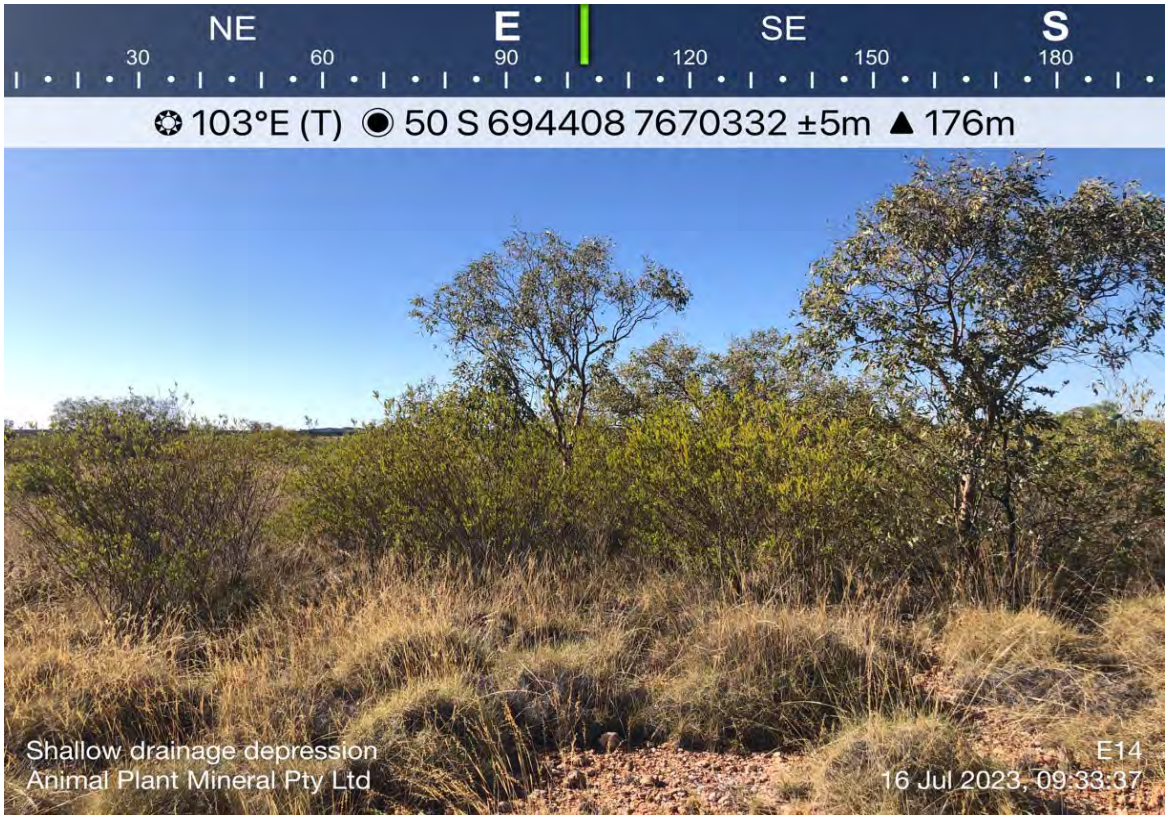


Plate 4-2. Drainage Depression

Condition: Impacts from cattle grazing are moderate, occasional tracks are present and the weeds **Cenchrus ciliaris, *Cenchrus setiger and *Aerva javanica* are present at low density. The condition of this vegetation is Very Good.

Detailed sites: N03, N17, N23, E09, E14, E17, E18, E27.

Total richness: 50 species. Average richness: 17.6 species

Introduced/exotic taxa: The exotic agricultural grasses **Cenchrus ciliaris* and **Cenchrus setiger* and the environmental weed **Aerva javanica* were recorded at two sites in low abundance.

Conservation significant species: *Triodia chichesterensis* (0.1% cover at N017; 5% cover at N23; 10% cover at E18; and 10% cover at E27). Within this vegetation type *Triodia chichesterensis* was found to occur in areas where quartzite was the dominant rock type at the surface.

This vegetation type has not previously been described for the project but is not unique to the area. It occurs commonly within the plains areas where run-on occurs, but generally in patches too small to be sampled or mapped discreetly. The community has been identified separately within the current study as larger areas (*i.e.,* larger than 50 m x 50 m) are present that allows the assemblage to be identified distinctly. The community has been allocated the code 7b as the landform resembles community 7a as described for the Lynas Find deposit (APM 2022a), but with moderate changes in the floristic composition, likely due to the position lower in the landscape.

Landform: Stony plains and rises **Vegetation Type: 9a**

Mid *Acacia inaequilatera, Acacia acradenia* and *Hibiscus sturtii* isolated shrubs with *Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* hummock grassland.

The upper strata is absent in most cases, however *Ficus brachypoda* was present on the upper slopes of the largest outcrop. The shrub layer is very sparse with a combined cover of less than 1%. *Grevillea wickhamii, Petalostylis labicheoides*, *Senna glutinosa, Hakea loreus, Corchorus incanus* and *Grevillea pyramidalis* were present in at least one site.

The groundcover is the predominant layer. Groundcover species also present included *Triodia lanigera, Cassytha capillaris, Tribulus suberosus, Paspalidium clementii, Cymbopogon ambiguus, Euphorbia caryi, Euphorbia tanenensis, Senna notabilis* and *Triumfetta propinqua.*

This community occurs on stony plains and rises leading to the foothills and includes some outcrops of granite. This community was originally mapped for the Lynas Find area (APM, 2022) and was also recorded in the E45/2287 Infill Survey (APM 2023b). A defining characteristic is the dominance of the hummock grass layer, and the presence of *Triodia chichesterensis* in areas where quartzite is common at the surface.

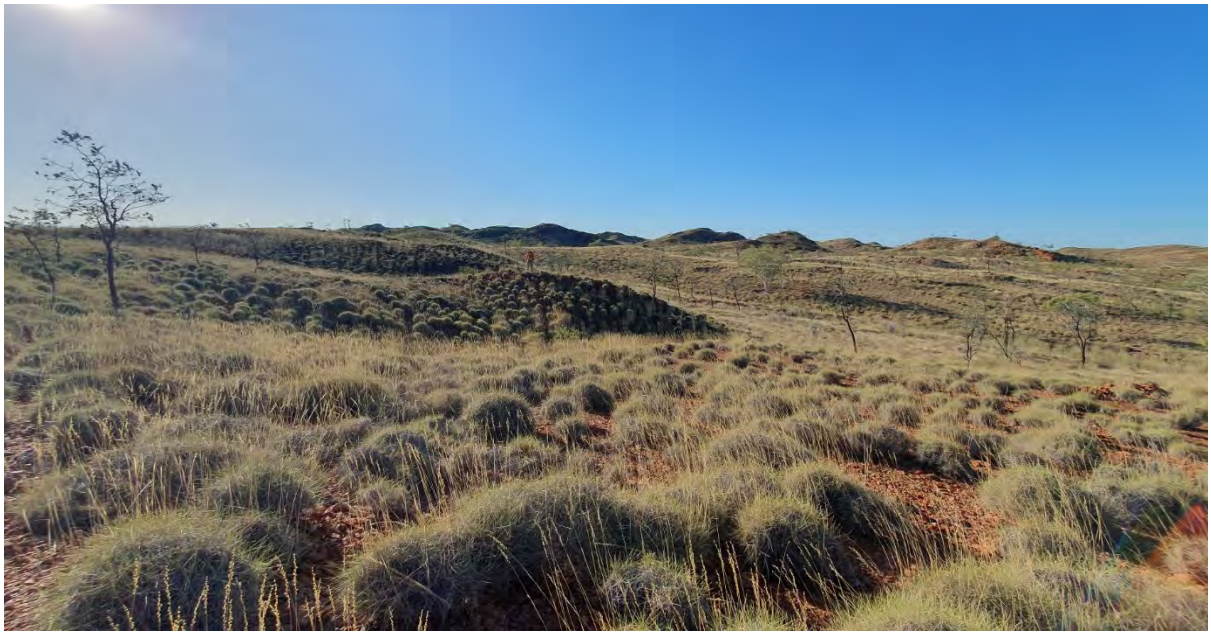


Plate 4-3. Stony plains and rises 9a

Condition: Impacts from cattle grazing are very low, no weeds are present and occasional tracks are present. A light dust is noticeable in areas close to active operations. The condition of this vegetation is Very Good.

Detailed sites: N24, E1, E2, E12, E15, E21 Total richness: 30 species. Average richness: 9.4 species.

Introduced/exotic taxa: none

Conservation significant species: *Triodia chichesterensis* was recorded at 15% cover in quadrat N24 and 1% cover at E01.

Landform: Granite outcrops and rises **Vegetation Type: 9c**

Isolated low *Corymbia hamersleyana* over mid *Acacia adsurgens, Acacia cowleana* and *Acacia maitlandii* sparse shrubland with *Triodia lanigera, Triodia wiseana and Triodia epactia* hummock grassland.

Eucalyptus leucophloia was also present in a small area in the north of the survey area and was recorded in one quadrat within this vegetation type. Common shrubs also included *Indigofera monophylla, Acacia inaequilatera* and *Corchorus incanus. Acacia stellaticpes* and *Acacia spondylophylla* were also present in some sites.

Common groundcover species also included *Eriachne mucronata, Fimbristylis nuda, Goodenia stobbsiana* and *Dicrastylis doranii.*

This community occurs where granite bedrock occurs close to the surface or as outcrops. In some occurrences the granite is visible as flat domes less than 1 m above ground level and up to 20 m in diameter. In other areas the outcropping is as boulders with small cracks and crevices present, and in other areas it is more elevated as low hills or ridges. In outcropping and hill/ridge areas, soil is limited to what is available in cracks, whereas in the dome areas, larger shallow pans of soil may be present. The soil is generally loamy clay or clay loam with gravel.

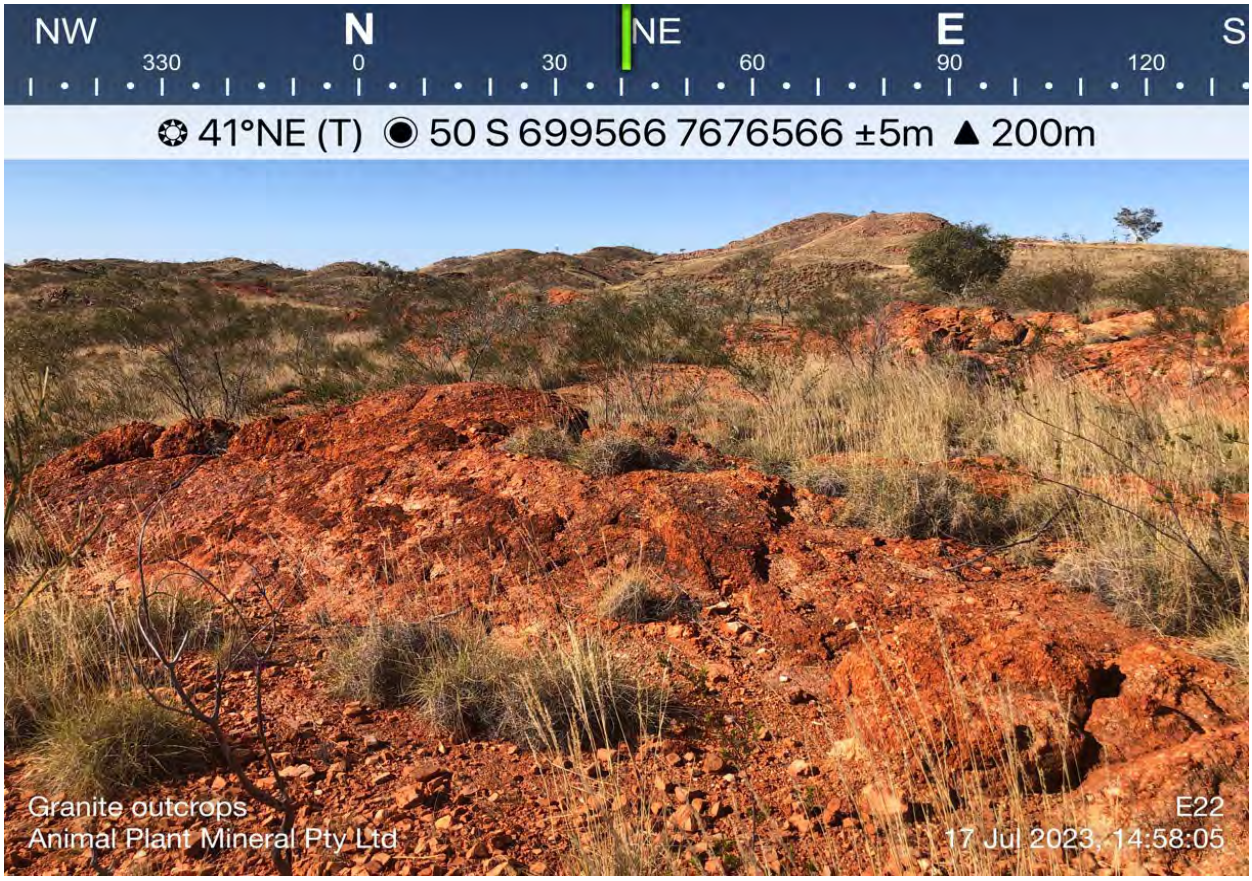


Plate 4-4. Granite bedrock and outcrops

Condition: Impacts from cattle grazing are very low, no weeds are present and occasional tracks are present. The condition of this vegetation is Very Good.

Detailed sites: E20, E22, E24, E25

Total richness: 30 species. Average richness: 11.6 species.

Introduced/exotic taxa: none

Conservation significant species: none

This vegetation type was closely aligned with 12a in the cluster analysis (Appendix C), but with a measurable change in the shrub composition and the minor presence of sedges and annual grasses likely due to the higher clay content of the soil. The assemblage has not previously been recorded and is assigned the code 9c.

Landform: Undulating plains **Vegetation Type: 12a**

Isolated low *Corymbia hamersleyana* over *Acacia adsurgens, Acacia inaequilatera* and *Grevillea wickhamii* sparse tall shrubland with mid hummock grassland of *Triodia lanigera, Triodia wiseana* and *Triodia epactia.*

The tree layer is commonly sparse and often absent over large areas and is limited to low individual trees between 3 and 5 m tall. *Eucalyptus leucophloia* was also present in a small area in the north of the survey area and was recorded in one quadrat of this vegetation type. Other common shrub species included *Acacia cowleana, Acacia stellaticeps, Indigofera monophylla, Indigofera rugosa and Corchorus incanus.*

Groundcover was diverse. This is because of the broad distribution of the vegetation type resulting in a large area sampled and a high quadrat allocation, and also due to the microhabitats present within the vegetation unit that ranges from stonier microhabitats on higher elevations to clay rich habitats on lower elevation. Common species also included *Triodia angusta, Ptilotus austrolasius, Bonamia erecta, Goodenia stobbsiana, Ptilotus calostachyus, Cassytha capillaris* and *Bonamia pilbarensis.*

This community is the most commonly occurring vegetation type in the Survey Area and occurs on loamy sand soils of undulating plains, most often with small pebbles and stones at the surface. It has a broad distribution from some of the low hills into the lower plains and includes some of the smaller creeks where distinct riparian vegetation has not developed. The *Acacia* dominated mid story occurs in higher density in areas where run-on occurs. Shallow drainage depressions have been mapped and described as a separate community where the extent is of sufficient scale, but denser groves of shrubs often occur in this community at a scale too fine for individual mapping.

Mudflats have also been described as a separate community where the extent is sufficient, however in some areas the mudflats occur at a scale too fine for mapping separately. Quadrats N14 and E8 represent such areas and in the cluster analysis are identified as a discreet group as they are an intermediary between undulating plains and mudflat vegetation. The quadrats and area they represent have been included in the vegetation type 12a for consistency with the adjoining TSF 2 and 5 Survey Area (APM 2022b).

In areas of slightly higher elevation where this vegetation type occurs, the shrub layer is dominated by tall shrubs, however overall, the shrub layer is sparse at under 10% cover. The ground layer is dominated by the hard spinifex species *Triodia lanigera* and *Triodia wiseana* with the soft spinifex *Triodia epactia* sometimes occurring in locations that have higher soil water content.

Plate 4-5. Typical site for community 12a Undulating Plains

Condition: Impacts from cattle grazing are moderate, occasional tracks are present and some dust is evident in places close to the existing operations. One weed species was recorded. The condition of this vegetation is Very Good.

Detailed sites: N01, N02, N04, N05, N06, N07, N09, N10, N12, N14, N16, N18, N19, N21, N22, N27, N28, N29, N30, N31, E03, E06, E07, E08, E10, E11, E16, E19, E21, E23, E26, E28, E29.

Total richness: 70 species. Average richness: 12.7 species.

Introduced/exotic taxa: The exotic agricultural grass **Cenchrus ciliaris* was recorded at one site in low abundance.

Conservation significant species: *Triodia chichesterensis* (5% cover at N01, 10% cover at N12, 35% cover at E23). Within this vegetation type *Triodia chichesterensis* was found to occur in areas where quartzite was the dominant rock type at the surface.

This vegetation type is synonymous to Vegetation type 12a described for the TSF Survey Area to the south (APM 2022b), and the E45 2287 Infill Survey (APM 2023b), with very minor changes in the abundances of the common *Triodia* and *Acacia* species present.

Landform: Sandy Creek **Vegetation Type: 15a**

Low open woodland of *Corymbia hamersleyana* over *Acacia cowleana, Acacia adsurgens* and *Indigofera rugosa* mid open shrubland with *Triodia epactia, Triodia lanigera* and *Triodia wiseana* hummock grassland.

Santalum lanceolatum was also present in the overstory of one quadrat within this vegetation type. Common shrubs also included *Acacia colei*, *Acacia inaequilatera, Corchorus incanus, Indigofera monophylla* and *Hibiscus sturtii.*

Common groundcover species also included *Bonamia erecta, Sporobolus australasicus, Chrysopogon fallax* and *Themeda triandra.*

This community occurs in and around the sandy bottomed creeks. Soils are red in colour and composed of sandy loam to loamy sand, with a small amount of surface gravel present. Riparian banks are often present with alluvial loamy soils. Creeks are all ephemeral with no permanent or semi-permanent pools present. This vegetation type is similar to Vegetation type 7b, but with a greater abundance of the soft spinifex *Triodia epactia* and annual grasses, the channel is defined, and the denser shrub layer is lacking. This vegetation type has previously been described and mapped in the E45/2287 Infill Survey Area (APM 2023b).

Plate 4-6. Sandy Creek 15a

Condition: Impacts from cattle grazing are moderate, the agricultural weed **Cenchrus ciliaris* is present in low abundance and occasional tracks are present. The condition of this vegetation is Very Good.

Detailed sites: N08, N13, N20, N25, N26 Total richness: 56 species. Average richness: 27.5 species.

Introduced/exotic taxa: **Cenchrus ciliaris* was recorded at N8 at 0.5% cover and at N13 at 0.1% cover.

Conservation significant species: none

Landform: Claypans **Vegetation Type: 16a**

Open herbfield of *Sida fibulifera, Eriachne mucronata* and *Neptunia dimorphantha.*

The upper and midstory are absent in this community, with a low groundcover the dominant strata. Additional groundcover species present included *Eragrostis xerophila, Solanum diversiflorum, Sporobolus caroli, Portulaca oleraceae, Cynodon convergens, Ileilema* sp., *Rynchosia minima* and *Senna notabilis.*

This community occurs where calcrete occurs close to the surface in minor depressions and a clay soil has deposited to a shallow depth. The soil depth is insufficient to support shrub and tree development and a herb and annual grass layer predominates.

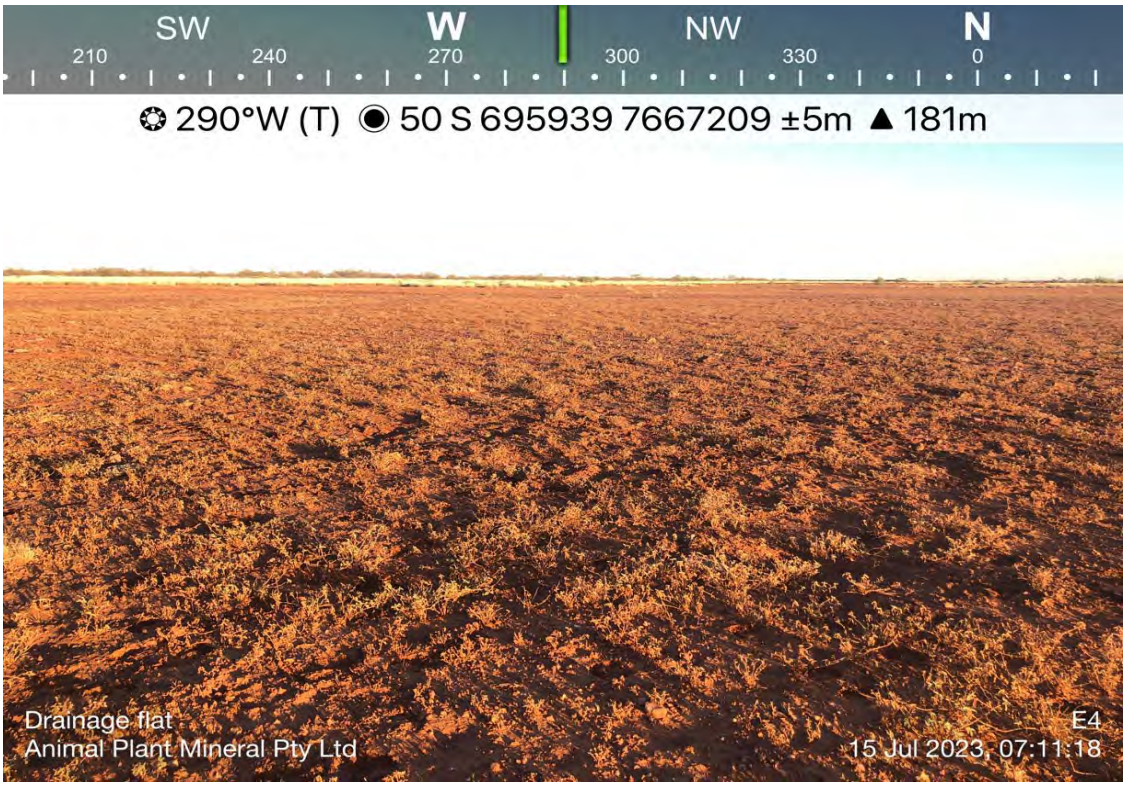


Plate 4-7. Claypan 16a

Condition: Impacts from cattle grazing are moderate to high, no weeds are present and occasional tracks are present. The condition of this vegetation is Good.

Detailed sites: E04, E05, E13.

Total richness: 13 species. Average richness: 7 species.

Introduced/exotic taxa: none

Conservation significant species: none

This vegetation type also occurs in smaller patches within the 12a community. As the community is dominated by herbaceous and annual taxa it is expected that the diversity of species would be higher following seasonal rainfall.

4.2.3 Vegetation Condition

Vegetation condition across the Survey Area was within the categories Very Good, Good and Completely Degraded, with most of the Survey Area in Very Good condition (Table 4-4; Figure 4-4).

Table 4-4. Vegetation condition within the Survey Area

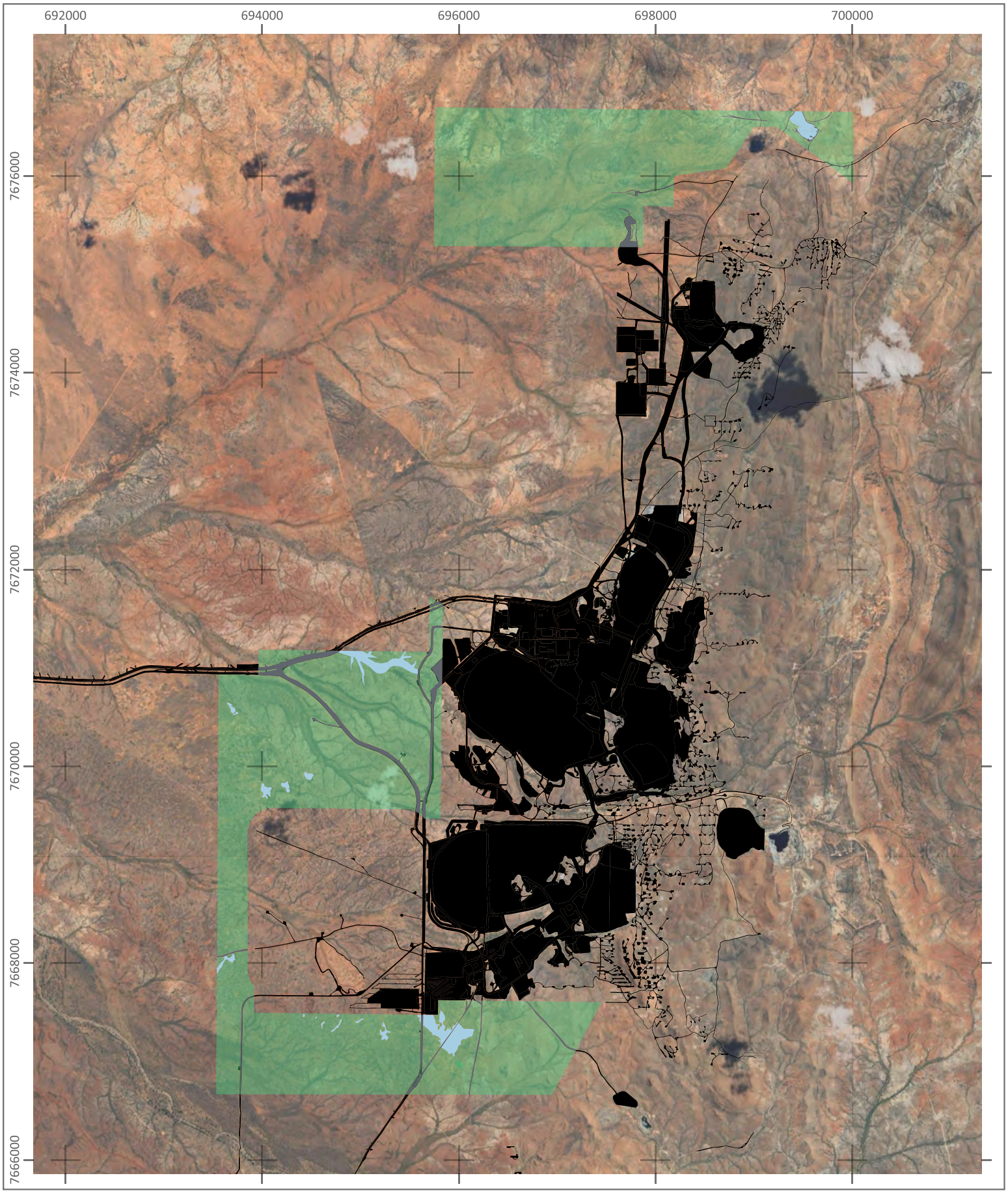
Vegetation Condition	Area (ha)	Area (%)
Very Good	1101.62	94.80
Good	26.27	2.26
Completely Degraded	34.10	2.93

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 activity. Near to some areas of active operations, a fine layer of dust was present.

Areas receiving a condition rating of Very Good had a low level of grazing activity and occasional tracks may be present.

Areas receiving a condition rating of Good had weeds present and/or a moderate level of grazing activity and occasional vehicle tracks.

Areas classified as Completely Degraded are cleared of vegetation and maintained in a vegetation free state.



Author: EH Approved: ML Date: 18/09/2023

Vegetation Condition

Prepared for:

Pilbara Minerals

Figure: 4-4

Scale: @ A4
1: 50,000

0 1 2 km

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

Animal Plant Mineral Pty Ltd

Legend

- Very Good
- Good
- Completely Degraded
- Pilgangoora Project

4.2.4 Significant Flora

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

One P3 species *Triodia chichesterensis,* was recorded during the survey.

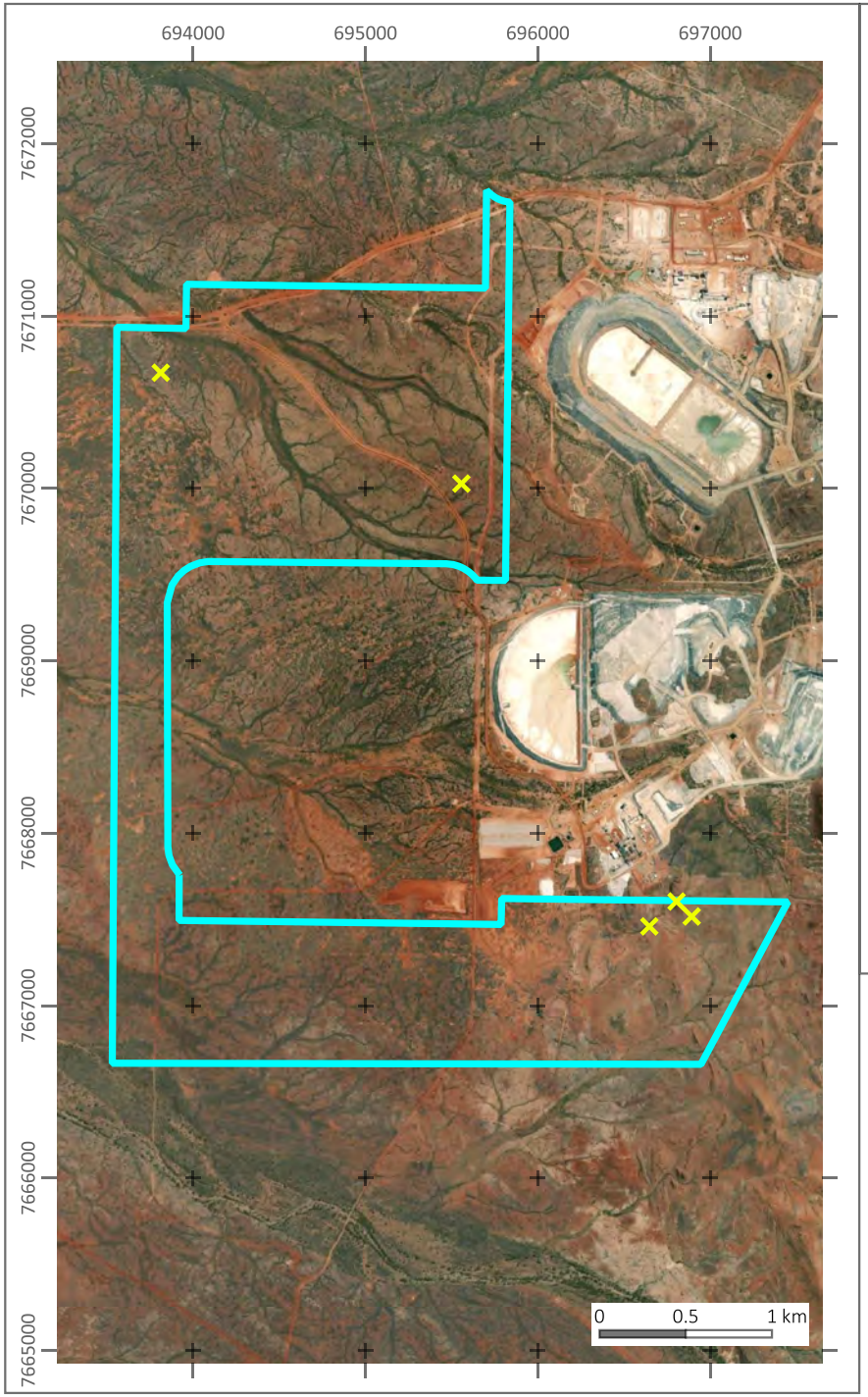
Triodia chichesterensis is described by Anderson *et al*. (2017). It is characterised by being a short-leaved species, distinguished by the combination of diminutive stature, glabrous leaf sheaths, relatively unbranched inflorescence, often short pedicels, and pubescent lemma midlobe. The short pedicels 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*).

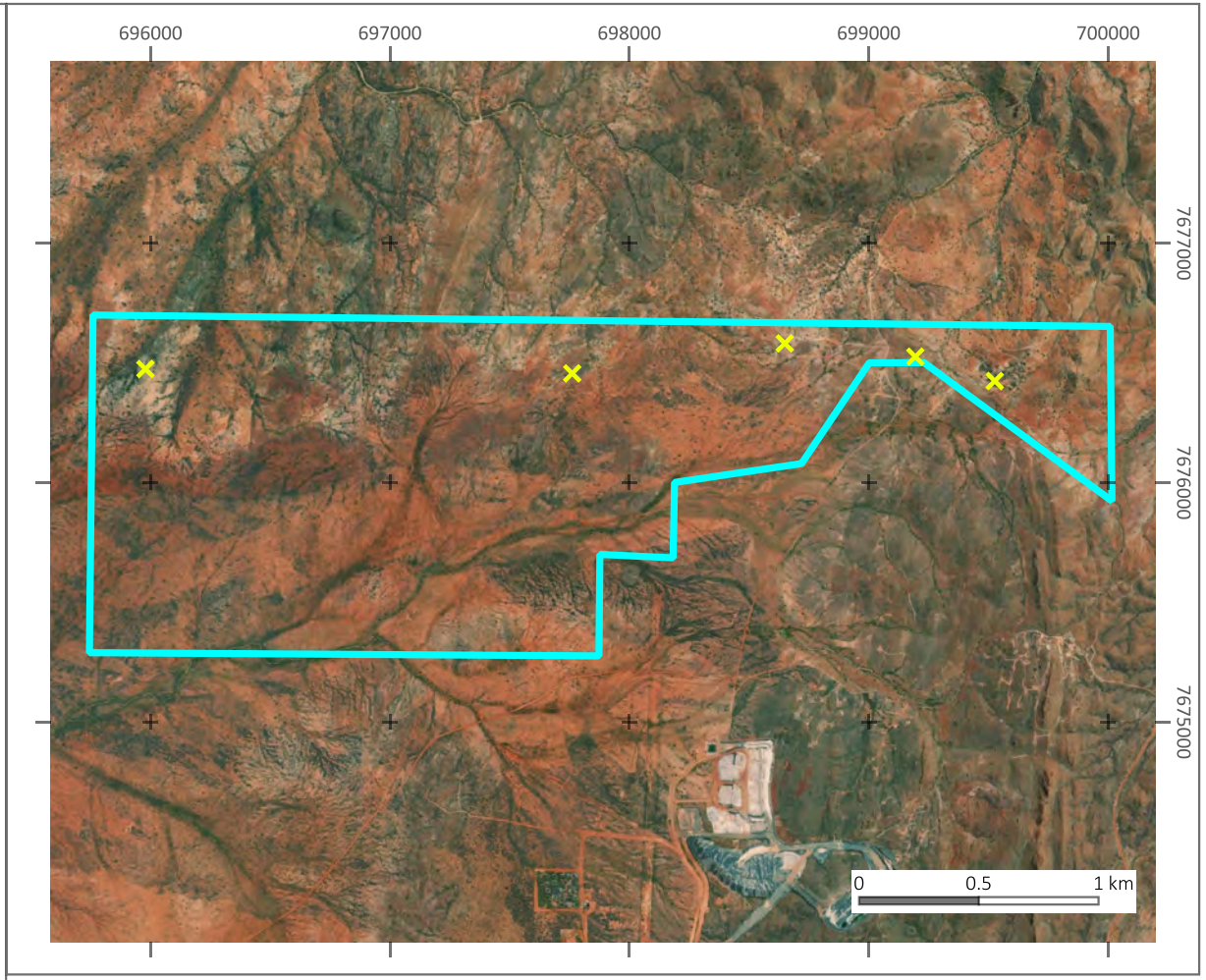
The species has a limited distribution and has been found only in a narrow area in the central Chichester region of the Pilbara of WA. The areas immediately to the west and east of its known distribution are poorly explored, but it is likely to be restricted to an area <100 km beyond current collections,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

The Survey Area 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.

The species has been previously found within the Project on rocky soils with quartzite (APM, 2022a,b, APM, 2023). Within the Survey Area, the species was also recorded within sandy red soils with a substantial coverage of rocks and pebbles including quartzite. Quartzite is common in the area and *T. chichesterensis* is not present in all areas containing quartzite.

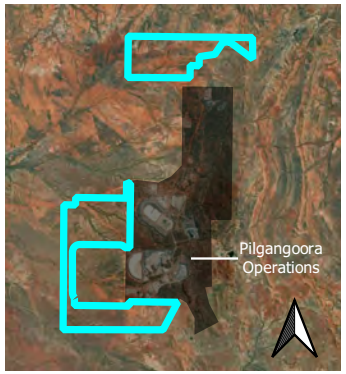
Collection records indicate that florets are observed between February and April and in August. At the time of the survey in July, no flowering material was available, and the species was determined using the vegetative characteristics only. Observations of the species made within the Survey Area are presented in Figure 4-5.





Legend

- Survey Areas
- Triodia chichesterensis



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

Author: TB Approved: EH Date: 30/08/2023

Priority Flora Records

Prepared for:
Pilbara Minerals

Figure: 4-5

4.2.5 Significant Vegetation

No vegetation types occurring within the Survey Area are analogous to any known TEC's or PEC's.

One species associated with Groundwater Dependent Ecosystems was recorded. *Eucalyptus victrix* was recorded in vegetation type 4b in the Major Drainage Line. Individuals were relatively old with a large diameter at breast height compared to other trees in the surrounding habitats. *Eucalyptus victrix* is regarded as being a facultative phreatophyte that most likely draws most of its water requirement from the unsaturated zone but can use groundwater opportunistically as required (Pfautsch *et al.* 2014).

4.2.6 Introduced Flora

Four introduced flora species were recorded in the Survey Area and are listed in Table 4-5. No Declared Weeds or WONS were recorded.

Table 4-5. 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, to 0.5 m high. Flowers cream to purple from April to May. Grown in brown sands, red loam and pindan soils on sand dunes, plains, rangelands, stony hillsides or floodplains.
Tribulus terrestris	Caltrop	Prostrate annual, herb, plants villous; leaflet pairs 4 - 7; cocci with distinct divergent, median spines 3 - 8 mm long. Flowers yellow from January to December. Often grows on sandy soils and in waste places.

The agricultural weeds *Cenchrus ciliaris* and *Cenchrus setiger* was recorded in drainage lines, occurring only occasionally and in generally low abundance. Where found, these weeds were grazed.

The environmental weed *Aerva javanica* was occurring only occasionally and in very low abundance within drainage lines, on stony plains and along disturbed roadsides.

The environmental weed *Tribulus terrestris* was recorded at one site and in very low abundance.

5 TERRESTRIAL VERTEBRATE FAUNA RESULTS

5.1 DESKTOP STUDY

5.1.1 Significant Fauna

The DBCA database returned 16 species of significant fauna that have previously been recorded within 30 km of the Survey Area. Of these, three are listed as migratory bird species (**MI**) and one as Other Specifically Protected (**OS**). Record locations of significant fauna in relation to the Survey Area are shown in Figure 5-1. The database does not contain any records for T fauna within the Survey Area.

The PMST returned 13 additional species, five T, six MI and two that are both T and 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.

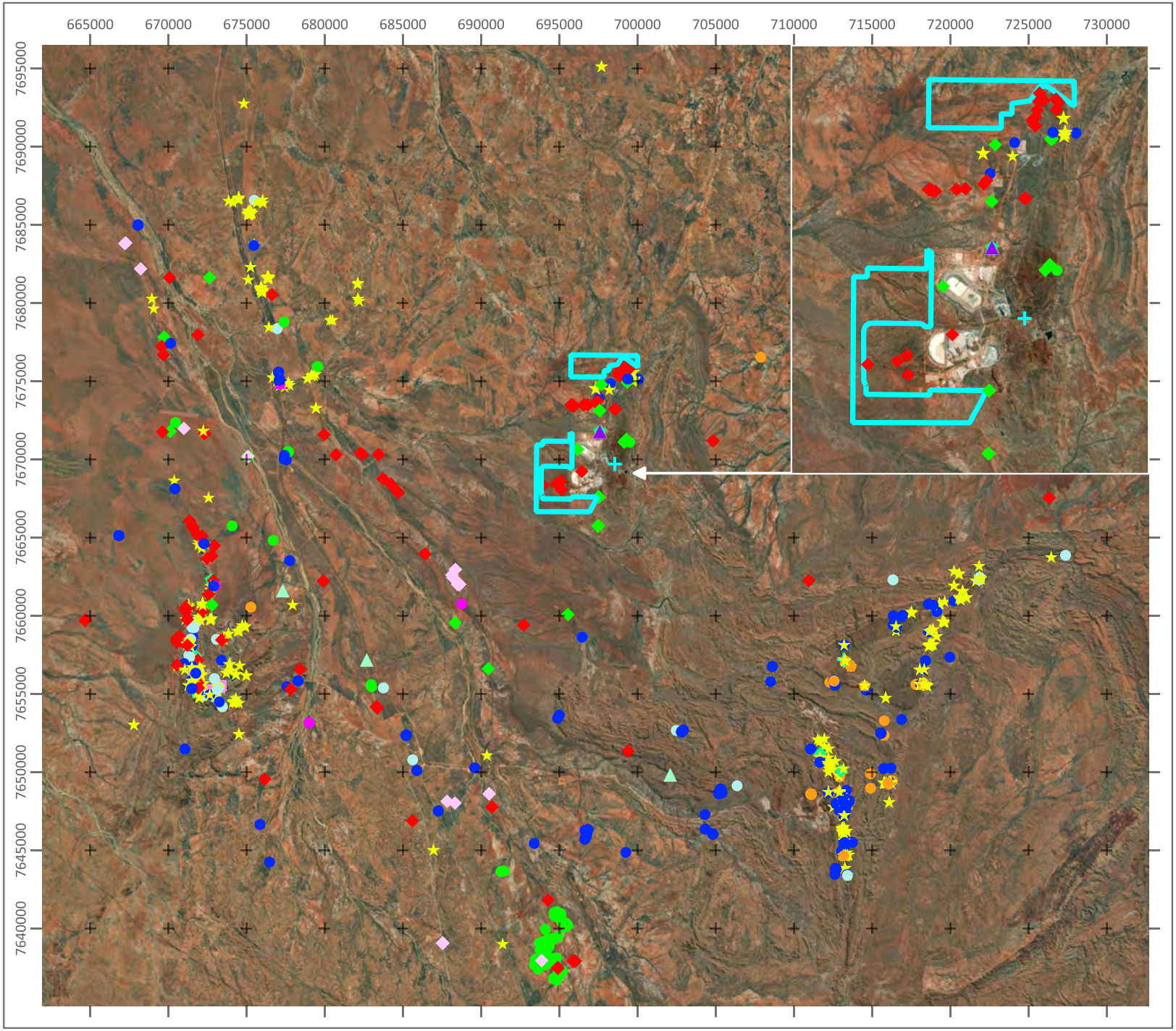
The literature review returned additional information about the locations and abundance of Northern quoll, Pilbara leaf-nosed bat, Ghost bat and Pebble mound-mouse records, including a scat for the T fauna Northern quoll, previously recorded within the Survey Area (APM 2023a).

Database search results of T, P and MI fauna within 30 km of the Survey Area are listed in Table 5-1, with the outcome of the likelihood of occurrence assessment. The complete assessment including the preferred habitat relative to those available in the Survey Area and a summary of records in the local area is included in Appendix G.

5.1.2 Introduced Fauna

Dandjoo database records did not return any introduced fauna. A search of the superseded NatureMap database in September 2022 for a nearby area returned records for eight introduced fauna as listed below:

- Camel (*Camelus dromedarius*);
- Cat (*Felis cattus*);
- Cattle (*Bos taurus*);
- Dog (*Canis lupus*);
- Donkey (*Equus asinus*)
- Fox (*Vulpes vulpes*)
- Horse (*Equus caballus*); and
- House mouse (*Mus musculus*).



Legend

- Survey Areas

Endangered
- Northern Quoll

Vulnerable
- Bilby
- Ghost Bat
- Grey Falcon
- Pilbara Leaf-nosed Bat
- Pilbara Olive Python

Priority 1
- Gane's Blind Snake (Pilbara)

Priority 2
- Northern Leaf-nosed Bat

Priority 4
- Brush-tailed Mulgara
- Long-tailed Dunnart
- Spectacled Hare-Wallaby (mainland)
- Western Pebble-mound Mouse

Migratory
- Common Sandpiper
- Fork-tailed Swift
- Oriental Plover

Other Specially Protected
- Peregrine Falcon

Scale: @ A4
1: 350,000

0 5 10 km

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

Author: TB Approved: EH Date: 26/07/2023

Threatened and Priority Fauna Records

Prepared for:
Pilbara Minerals

Figure: 5-1

Table 5-1. 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 claypans (gilgai) within the Stony Plains however the high evaporation rate means these habitats are unlikely to persist more than a few weeks at most. The major drainage line with granite bedrock has the potential for ephemeral pools however there are no permanent or semi-permanent pools evident.
Calidris acuminata	Sharp-tailed sandpiper	MI	MI	
Calidris ferruginea	Curlew sandpiper	CR	CR, MI	
Calidris melanotos	Pectoral sandpiper	-	MI	
Numenius madagascariensis	Eastern curlew	CR	CR, MI	
Glareola maldivarum	Oriental pranticole	MI	MI	
Hirundo rustica	Barn swallow	MI	MI	
Motacilla cinerea	Grey wagtail	MI	MI	
Motacilla flava	Yellow wagtail	MI	MI	
Apus pacificus	Fork-tailed swift	MI	MI	Possible. Utilises a broad array of habitats.
Charadrius veredus	Oriental plover	MI	MI	Likely. Suitable habitat in the open plains.
Polytelis alexandrae	Princess parrot	-	VU	Unlikely, preferred feeding species are not present in high densities along the major drainage.
Erythrotriorchis radiatus	Red goshawk	VU	VU	Unlikely. Not within the known range of the species distribution.
Falco hypoleucos	Grey falcon	VU	VU	Likely. All areas are suitable for foraging. No suitable nesting habitat.
Falco peregrinus	Peregrine falcon	OS	-	Likely. All areas are suitable for foraging. No suitable nesting habitat.

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
Pezoporus occidentalis	Night parrot	CR	EN	Possible. No local records. Habitat modelling includes the Survey Area at the extremity of the species potential extent. Foraging resources are limited.
Rostratula australis	Australian painted-snipe	EN	EN	Unlikely. No habitat occurs in the Survey Area. Vegetation too open to provide well vegetated shallows.
Dasycercus blythi	Brush-tailed mulgara	P4	-	Likely. Sandy plains habitat is suitable.
Dasyurus hallucatus	Northern quoll	EN	EN	Present. Suitable foraging habitat in the creeks but of low quality. Limited suitable denning and foraging habitat available in the Rocky Outcrops.
Lagorchestes conspicillatus leichardti	Spectacled hare-wallaby	P4	-	Present. Historic records nearby and suitable habitat is present in the Shallow Drainage Basins and Creeks habitat.
Macroderma gigas	Ghost bat	VU	VU	Likely. Foraging habitat available. No roosting habitat available.
Macrotis lagotis	Greater bilby	VU	VU	Possible. All habitats are suitable.
Pseudomys chapmani	Western pebble-mound mouse	P4	-	Present. Mounds located in the plains where suitable pebbles occur.
Rhinonicteris aurantia	Pilbara leaf-nosed bat	VU	VU	Present. No roosting habitat available, foraging habitats present.
Sminthopsis longicaudata	Long-tailed dunnart	P4	-	Unlikely. No suitable habitat.
Anilios ganei	Gane's blind snake (Pilbara)	P1	-	Unlikely. No suitable habitat.
Liasis olivaceus subsp. *baronni*	Pilbara olive python	VU	VU	Unlikely. No suitable habitat.
Liopholis kintorei	Great desert skink	VU	VU	Unlikely. No records in the local area. May occur 10 km to the east.

5.2 FIELD SURVEY

5.2.1 Fauna Habitats

The Survey Area is characterised by sandy to stony undulating plains with first and second order ephemeral creeks and shallow drainage basins. Low rocky rises occur in the eastern extents in the north and south. There are higher ranges to the east and water sheds from these into the Survey Area through the minor drainages that continue to the west. The presence of water is ephemeral, and no permanent or semi-permanent water is available. Seasonal inundation is expected to occur within the claypan habitats, with the duration of inundation dependent on the amount of any given rainfall event, but is generally expected to be short (days to weeks) due to high evaporation rates. Vegetation is sparse on the rocky rises and plains, and densest in the shallow drainage basins.

The Survey Area has Moderate (burnt 2-5 years previously) to Very Old fire age. Recent fires recorded on the DBCA (2022) database indicate approximately 66 ha burned in 2019, 237 ha burned in 2017, five ha burnt in 2015, 58 ha burned in 2014, 17 ha burnt in 2012 and 88 ha burnt in 2009, totalling 39.5% of the Survey Area being burned in the past 25 years. Burns appear to be low to moderate intensity with larger woody vegetation frequently surviving and good post-fire establishment of ground cover and mid story shrubs.

Seven fauna habitats are described for the Survey Area and are summarised in Table 5-2 and described in detail below, including comparisons to previously described Fauna Habitats at the Pilgangoora Project.

Table 5-2. Fauna Habitats within the Survey Area

Name	Area (ha)	Proportion (%)
Stony Plains	765.45	65.41
Shallow Drainage basins and creeks	167.41	14.31
Low Hills	144.81	12.38
Platy Rock Outcrops	39.91	3.41
Major Drainage Line	13.50	1.15
Historic Mine Workings	4.32	0.37
Rocky Outcrop	0.86	0.06
Disturbed	34.10	2.91

The distribution of fauna habitats is shown in Figure 5-2. Photos of the habitat assessment locations are shown in Appendix D.

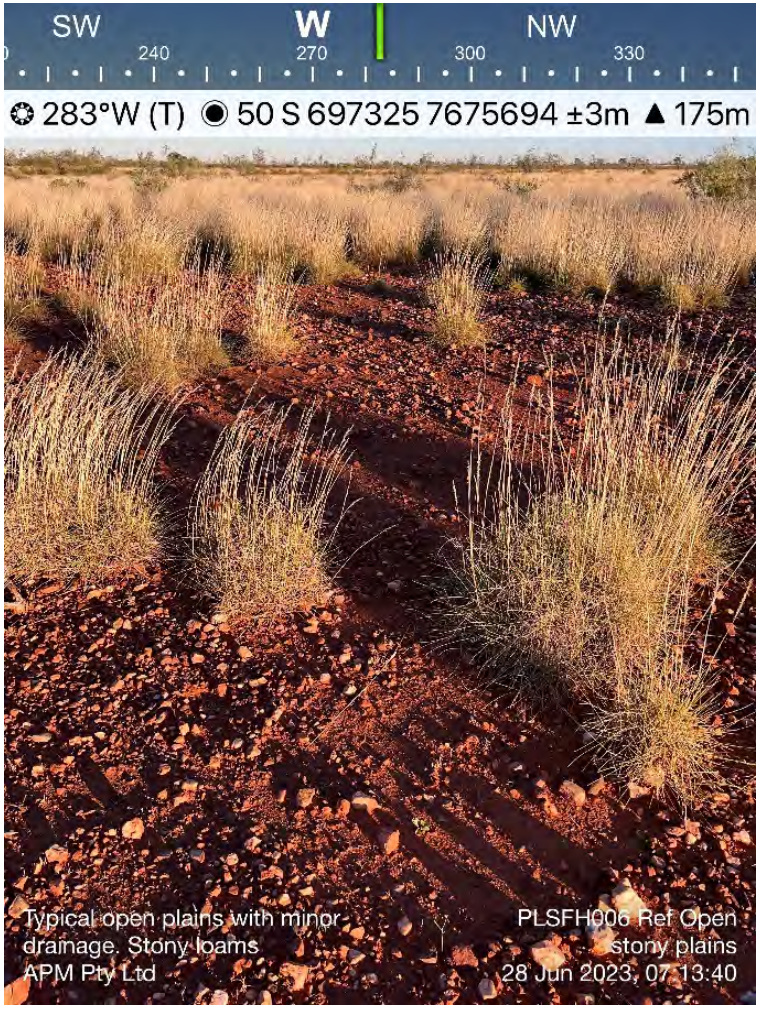
Stony plains

Survey Sites:
C33(2)
FH006
FH006b
FH007
FH009
FH010
FH10a
FH012
FH012b
FH014

This habitat type is characterised by its red sandy loam soils with variable surface rock/pebble cover, but generally stones are present. The Stony Plains habitat is typical of those described by van Vreeswyk *et al.* (2004) where it is interspersed with granite domes in the extent of the Macroy Land System and interspersed with gilgai in the extent of the Satirist Land System.

The sandy substrate is suitable for burrowing species, a sparse Eucalypt overstory is present, offering perching opportunities but with limited hollow development, sparse termite mounds are present. Granite domes have some exfoliating rock but microhabitats are limited to narrow and shallow cracks. Higher clay content soils in the gilgai may offer cracked clay in the dry season and shallow inundation following rain.

Vegetation consists of isolated low *Corymbia hamersleyana* over mid to tall *Acacia adsurgens, Acacia inaequilatera* and *Grevillea wickhamii* sparse tall shrubland with mid hummock grassland of *Triodia lanigera, Triodia wiseana* and *Triodia epactia.*



Shallow Drainage basins and creeks

Survey Sites:
C9/C33(1)
C11/C30(1)
C18/C36(1)
C21x/C31(1)
AS450007
FH008
FH015

Minor sandy bottomed ephemeral first and second order creeks, and shallow drainage depressions. The densest vegetation of the Survey Area occurs in this habitat type, with thick Acacia shrubs found in the drainage depressions, and on the edges of defined creek banks.

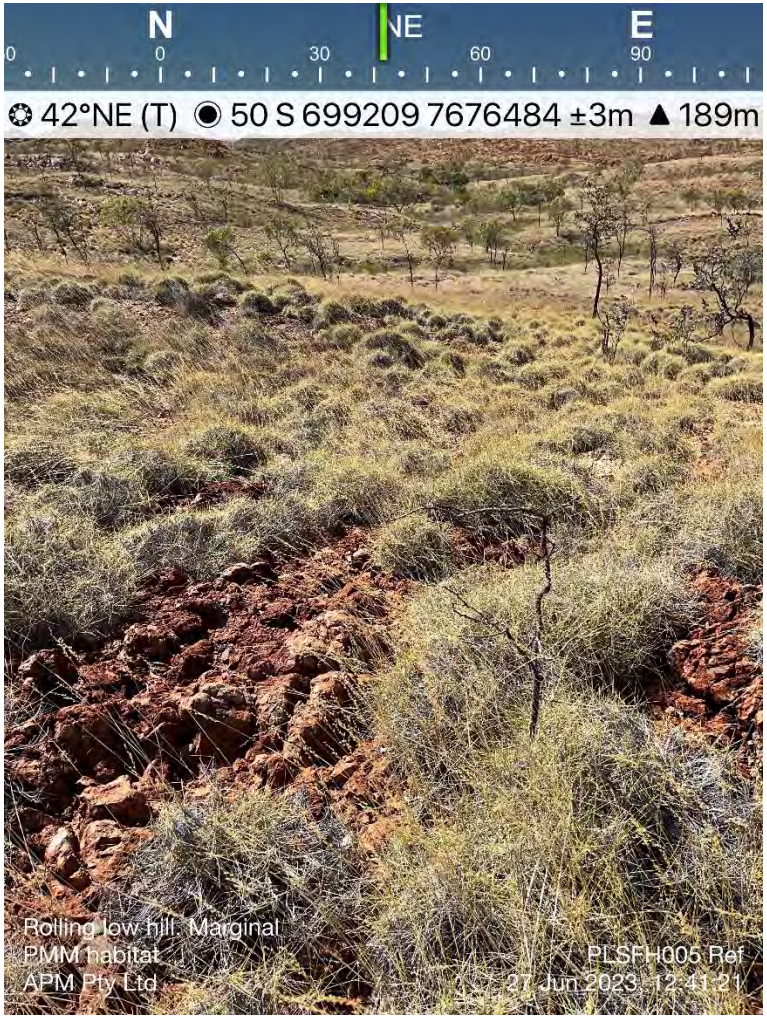
The sandy substrate indicates that water pooling is unlikely to occur, and no evidence of water pooling was observed.

Sand in the stream beds is suitable for burrowing species. Stands of trees occur but generally of insufficient size to have hollows and no fallen hollow branches were observed. Small amounts of litter were present. The dense vegetation provides cover for species sensitive to predation. This habitat may act as a wildlife corridor for birds, bats, mammals, and reptiles.

Cattle impacts were moderate. The weedy and fire prone introduced fodder grass genus *Cenchrus* is present in low frequency and density. Fires are of moderate frequency and low to moderate intensity.

The vegetation consists of low open woodland of *Corymbia hamersleyana*; over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland and *Triodia wiseana, Triodia epactia* and *Triodia lanigera* hummock grassland.

This habitat type is synonymous with habitat FH2 described and mapped for the TSF Survey (APM 2022b) and Infill Survey (APM 2023b).

Low hills Survey Sites: FH004 FH005	Gently undulating stony surfaces of quartzite, laterite or granite on shallow red sandy loam soils. This habitat is suitable for small species that construct shelters from small stones, however in most areas stones are too large for species such as Pebble mound mouse. This habitat type contains limited microhabitats providing limited vegetation with sparse midstory, very few, generally small trees lacking hollows, unsuitable substrate for burrowing, few to no logs and limited leaf litter. This habitat lacks structure and microhabitats and provides limited value to fauna. The vegetation consists of mid isolated shrubs of *Acacia inaequilatera, Acacia acradenia* and *Hibiscus sturtii* with *Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* hummock grassland. This habitat is the same as the FH3 Habitat described for Lynas Find (APM 2022a).	

Platy Rock Outcrops

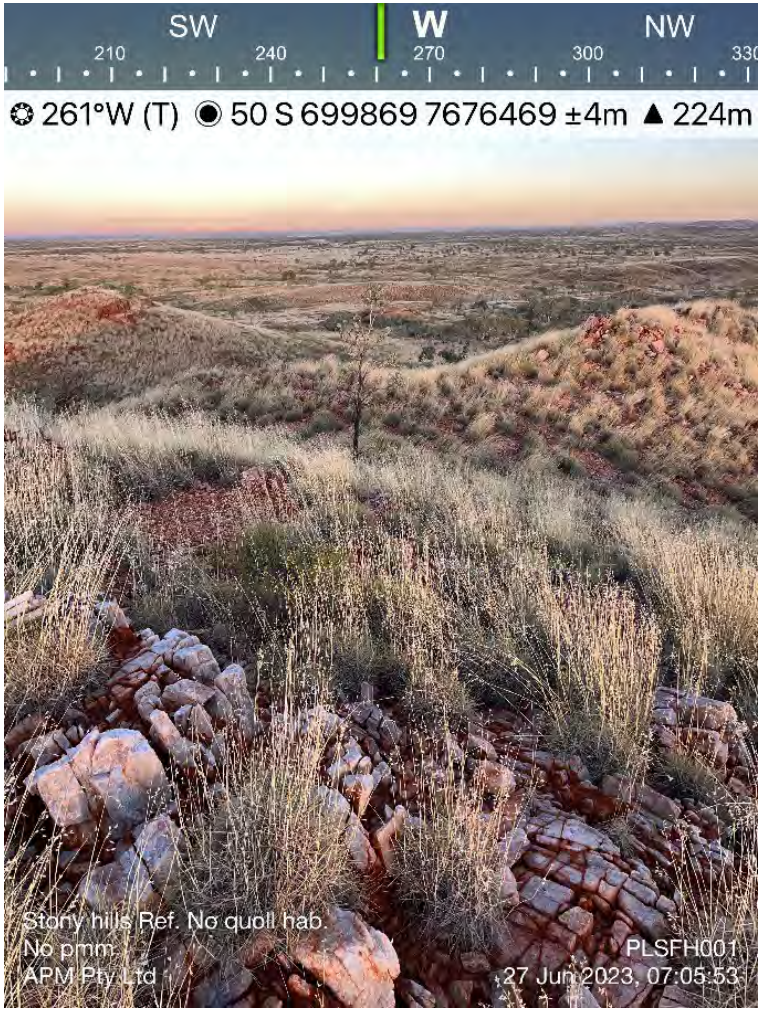
Survey Sites:
C21/32 (2)
C34(2)
FH001
FH013

Rocky outcrops and ridges composed of platy, sharp, red granite or schist or blocky quartzite with >75% rock cover. Weathered bedrock provides cracks and crevices as important shelter sites for small ground dwelling reptiles and small mammals. Soils are hard and unsuitable for burrowing species due to the surface rock cover.

Crevices are restricted to shallow and narrow cracks in rocks, unsuitable for conservation significant species.

The vegetation consists of Mid isolated shrubs of *Acacia inaequilatera, Acacia acradenia* and *Hibiscus sturtii* with *Triodia wiseana, Triodia epactia* and *Triodia chichesterensis* hummock grassland.

This habitat is the same as 'Platy Rock Outcrops' of the Lynas Find Survey Area.



Major Drainage Line

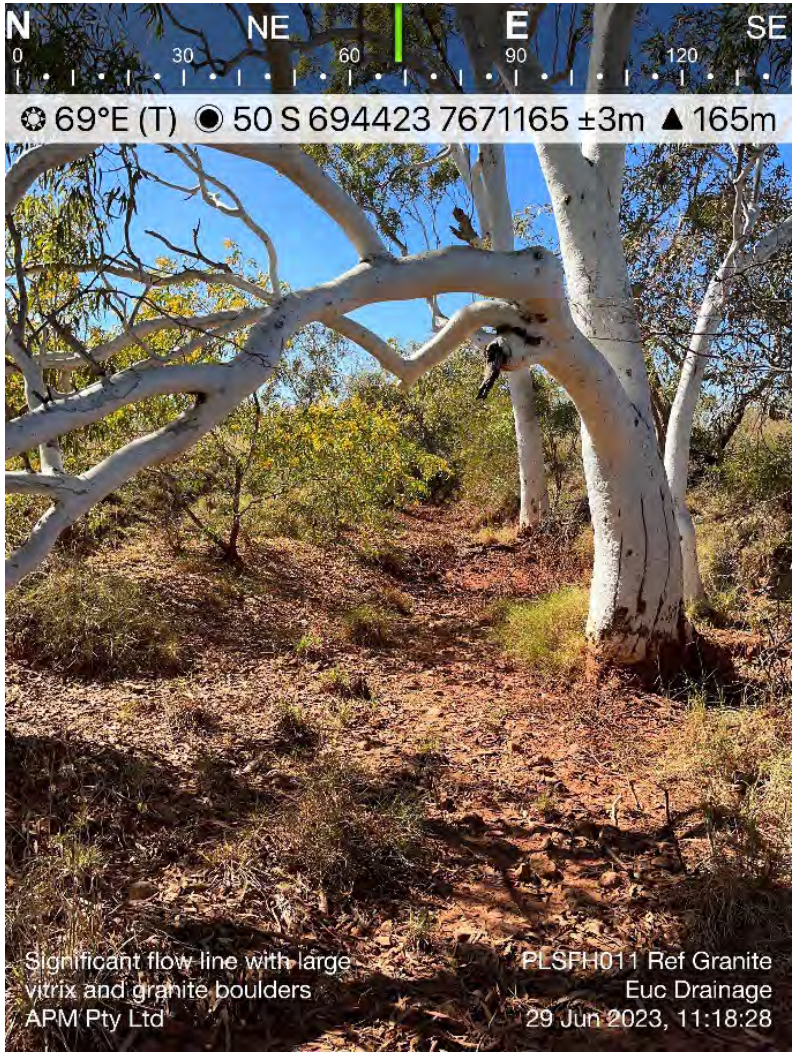
Survey Sites:
C14/16(1)
C11/36(2)
C6/10(1)
AS642022
AS45085
FH011

Major sandy bottomed ephemeral drainage line, with exposed granite and large trees.

In areas where granite bedrock is exposed there is opportunity for ephemeral pools. Large trees are present in places that support many upright very large hollows and some hollow logs large enough for quoll. Fallen hollow timbers and crevices in granite provide opportunity for sheltering fauna. Dense tall vegetation provides shading and litter accumulation. Rainbow Bee Eater which was observed to have nests where incised steep clay edges were present. Sand in the stream beds is suitable for burrowing species.

Cattle impacts were moderate. The weedy and fire prone introduced fodder grass genus *Cenchrus* is present in low frequency and density. Fires are of moderate frequency and low to moderate intensity.

The vegetation consists of low open woodland of *Corymbia hamersleyana*, over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland and *Triodia wiseana, Triodia epactia* and *Triodia lanigera* hummock grassland.



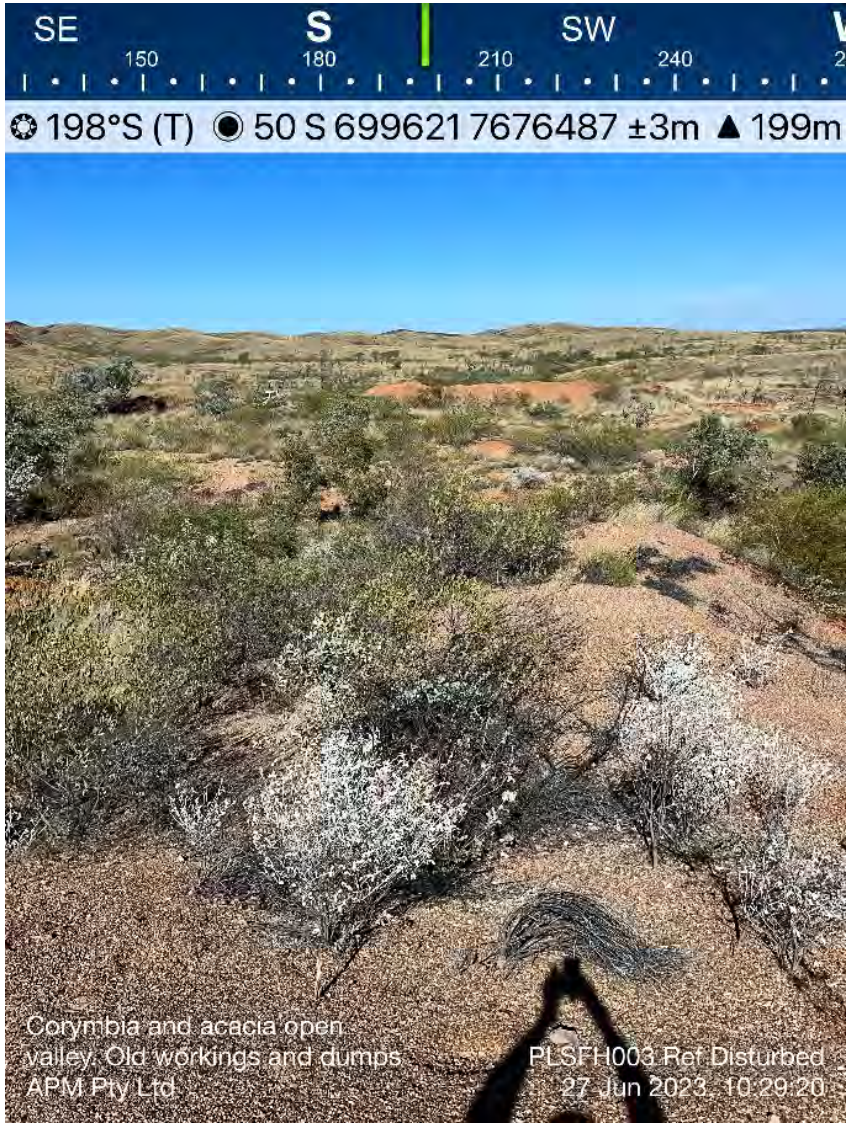
Historic Mine workings

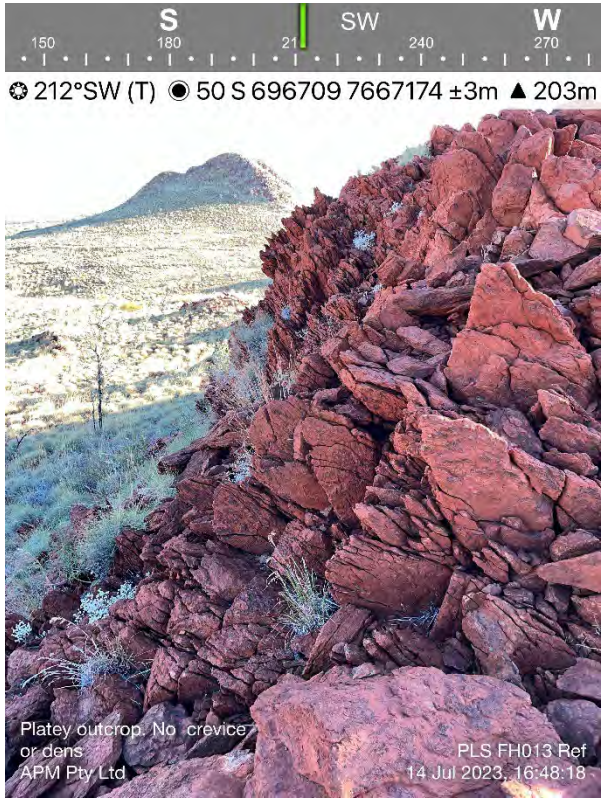
Survey Sites:
C20/32(1)
AS660630
FH003

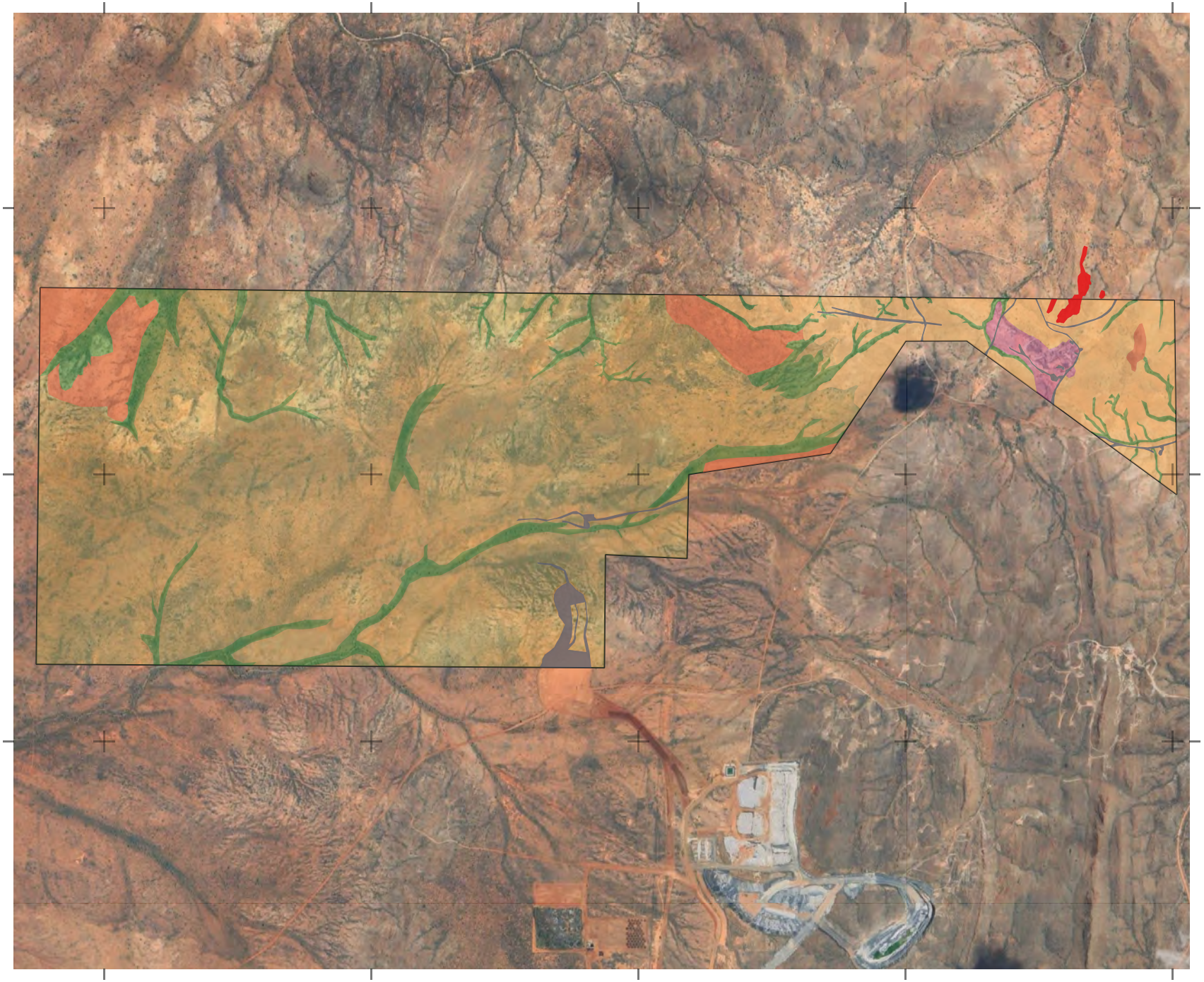
Appears to be old screening site. Many piles of gravel. Deep soil profile in some gullies (deposition). Drainage line dammed at 3 points. Entire closed valley disturbed by dams.

The gravel piles and areas of deposition provide soft substrate for burrowing animals and the presence of open surface water provides semi-permanent pools. The open vegetation and semi-permanent water are likely to provide suitable foraging habitat for Pilbara leaf-nosed bat.

Vegetation consists of *Eucalyptus leucophloia* and *Corymbia hamersleyana* low open woodland; *Acacia inaequlatera, Acacia acradenia* and *Corchorus incanus* sparse mid shrubland over *Triodia epactia, Triodia chichesterensis* and *Triodia brizoides* mid hummock grassland.



Rocky Outcrop Survey Sites: C13/35(1) C21/34(1) C7/37(1) C21x(2) C13/35(2) C7/37(2) AS660654 FH013 FH002	Rocky outcrops composed of angular, red granite boulders, occurring on hill tops or in steeply incised drainage lines. Small crevices and overhangs present, which may provide important shelter sites for small and large reptiles such as goannas and snakes, and mammals such as the Northern quoll. No large caves are present that would be sufficient for the Pilbara leaf-nosed bat or Ghost bat roosting. Soils are shallow and occur in small pockets between rocks and are unsuitable for burrowing species. One hill supports a patch of *Ficus* (a known preferred food of the Northern quoll). This fauna habitat is synonymous with the FH1 fauna habitat reported in (APM 2022a) and Infill Survey (2023) and the Rocky Hill habitat reported in 360 Environmental (2016). The occurrences in the northern extent of the Survey Area are continuous with previously mapped similar habitat at Lynas Find. In the southern extent of the Survey Area, occurrences are small, isolated outcrops, fragmented from the adjoining ranges by plains areas, but does contain the stand of Ficus.	
D Disturbed Extent in Survey: 10.76 ha (3.2%)	Completely Degraded – cleared land.	



Legend

- Stony Plains
- Shallow drainage basins and creeks
- Low Hills
- Major Drainage Line
- Platy Rock Outcrop
- Historic Mine Workings
- Rocky Outcrop
- Disturbed

Scale: @ A4
1: 20,000

0 200 400 m

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

Author: EH Approved: ML Date: 28/10/2023

Fauna Habitats
Northern Survey Area

Prepared for:
Pilbara Minerals

Figure: 5-2a

693000 694000 695000 696000 697000 698000

7672000 7671000 7670000 7669000 7668000 7667000

Author: EH Approved: ML Date: 28/09/2023

Fauna Habitats
Southern Survey Area

Prepared for:

Pilbara Minerals

Figure: 5-2b

Scale: @ A4
1: 20,000

0 0.5 1 km

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

Animal Plant Mineral Pty Ltd

Legend

- Stony Plains
- Shallow drainage basins and creeks
- Low Hills
- Major Drainage Line
- Platy Rock Outcrop
- Historic Mine Workings
- Rocky Outcrop
- Disturbed

5.2.2 Acoustic bat recorders

The recording dataset comprised a total of 49 recording nights from five bat detector units.

Acoustic processing of the bat detector recordings was conducted separately for each of Ghost bat and Pilbara leaf-nosed bat using methods optimised for the detection of their unique echolocation call types.

No calls of the Ghost bat were observed in the recordings. Call sequences of the target species Pilbara leaf-nosed bat were detected and are listed in Table 5-3.

Table 5-3. Call sequences of the Pilbara leaf-nosed bat

Serial	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time of Detection	Time since
450085	14/7/2023	2	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	First: 22:59:42 Last: 0:27:25	Sunset: 5H 19M 57S Dawn: 6H 15M 0S
450085	15/7/2023	2	15/07/2023 17:40	15/07/2023 18:03	16/07/2023 6:18	16/07/2023 6:42	First: 22:57:54 Last: 1:43:31	Sunset: 5H 17M 46S Dawn: 4H 58M 44S
660630	17/7/2023	2	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	First: 22:34:08 Last: 1:14:19	Sunset: 4H 53M 15S Dawn: 5H 27M 32S
660654	14/07/2023	4	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	First: 21:08:43 Last: 23:28:39	Sunset: 3H 28M 58S Dawn: 7H 13M 46S
660654	16/07/2023	1	16/07/2023 17:40	16/07/2023 18:04	17/07/2023 6:18	17/07/2023 6:42	First 22:22:32 Last: 22:22:32	Sunset: 4H 42M 2S Dawn: 8H 19M 32S
660654	17/07/2023	1	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	First: 21:23:34 Last: 21:23:34	Sunset: 3H 42M 41S Dawn: 9H 18M 17S
660654	18/07/2023	3	18/07/2023 17:41	18/07/2023 18:05	19/07/2023 6:17	19/07/2023 6:41	First: 21:31:09 Last 23:09:21	Sunset: 3H 49M 53S Dawn: 7H 32M 17S
660654	22/07/2023	3	22/07/2023 17:42	22/07/2023 18:06	23/07/2023 6:16	23/07/2023 6:40	First 4:39:16 Last: 4:40:50	Sunset: 10H56M26S Dawn: 1H 59M 43S
660654	24/07/2023	1	24/07/2023 17:43	24/07/2023 18:07	25/07/2023 6:16	25/07/2023 6:39	First: 23:08:36 Last: 23:08:36	Sunset: 5H 24M 59S Dawn: 7H 31M 19S
660654	25/07/2023	1	25/07/2023 17:44	25/07/2023 18:07	26/07/2023 6:16	26/07/2023 6:39	First: 23:28:16 Last: 23:28:16	Sunset: 5H 44M 16S Dawn: 7H 11M 18S
660654	28/07/2023	1	28/07/2023 17:45	28/07/2023 18:08	29/07/2023 6:15	29/07/2023 6:38	First: 21:51:48 Last: 21:51:48	Sunset: 4H 6M 38S Dawn 8H 46M 37S

Table 5-3 shows the detection of echolocation call sequences was well after sunset and well before sunrise. No roosting habitat was recorded during the survey and therefore the activity is most likely to indicate individuals out foraging away from a diurnal roost.

The data is discussed further in Section 5.2.6

5.2.3 Motion triggered and time lapse cameras

Targeted fauna captured on camera are listed in Table 5-4. Northern quoll were captured on camera on six occasions across four cameras. The locations and habitats of the captures are discussed in Section 5.2.5.1.

Table 5-4. Targeted fauna camera captures

Camera	Species	Date	Time
MSC007(1)	Northern Quoll	09-Jul-23	0:27
MSC021(1)	Northern Quoll	09-Jul-23	2:07
MSC034(1)	Northern Quoll	28-Jun-23	3:00
MSC034(1)	Northern Quoll	28-Jun-23	5:12
MSC035(1)	Northern Quoll	28-Jun-23	1:39
MSC035(1)	Northern Quoll	28-Jun-23	5:02

Non-target captures returned a diversity of species, including introduced fauna. Table 5-5 lists the non-target records from cameras.

Table 5-5. Non-target captures from motion triggered and time lapse cameras

Common name	Species	# captures
Australian Owlet-nightjar	*Aegotheles cristatus*	2
Common Bronzewing	*Phaps chalcoptera*	1
Common Rock Rat	*Zyzomys argurus*	62
Cow	*Bos taurus*	6
Diamond Dove	*Geopelia cuneata*	1
Echidna	*Tachyglossus aculeatus acanthion*	1
Euro	*Macropus robustus*	3
Gecko	*Gehyra* sp.	26
Honey eater	-	1
Kaluta	*Dasykaluta rosamondae*	1
Little Button Quail	*Turnix velox*	2
Magpie Lark	*Grallina cyanoleuca*	4
Mulga Snake	*Pseudechis australis*	1
Painted finch	*Emblema pictum*	5
Peaceful Dove	*Geopelia striata placida*	5
Perentie	*Varanus giganteus*	8
Pilbara grasswren	*Amytornis whitei whitei*	2
Sandy inland Mouse	*Pseudomys hermannsbergensis*	2
Skink	*Morethia ruficauda exquisita*	2
Spinifex Pigeon	*Geophaps plumifera*	2
Spotted Nightjar	*Eurostopodus argus*	4
Western Crow	*Corvus orru cecilae*	5
Western Ringtail Dragon	*Ctenophorus caudicinctus*	1
Willie wagtail	*Rhipidura leucophrys leucophrys*	10
Woolley's Pseudantechinus	*Pseudantechinus woolleyae*	1
Yellow-throated Minor	*Manorina flavigula*	2

Identifications were only made as far as necessary to rule out target species. Five captures of birds, one of a suspected Dasyurid or rodent and one of an indeterminate skink were of poor image quality and were unable to be identified.

Six captures were of cattle, which is expected as the land is within a station and pastoralism is the active land use within all surveyed areas.

5.2.4 Traverses

During traverses, the following fauna signs were identified:

- One Northern quoll scat;
- Three closely located diggings and scats that cannot be excluded as bilby in origin;
- Eight Western pebble-mouse mounds (including two extinct mounds);
- One Wallaby scat pile in the shallow drainage line habitat that cannot be excluded as Spectacled hare-wallaby in origin; and
- Four Rainbow bee-eaters (*Merops ornatus*) and five Rainbow bee-eater nests.

Notes were taken on habitat quality, disturbances, and the availability/unavailability of habitat micro-niches.

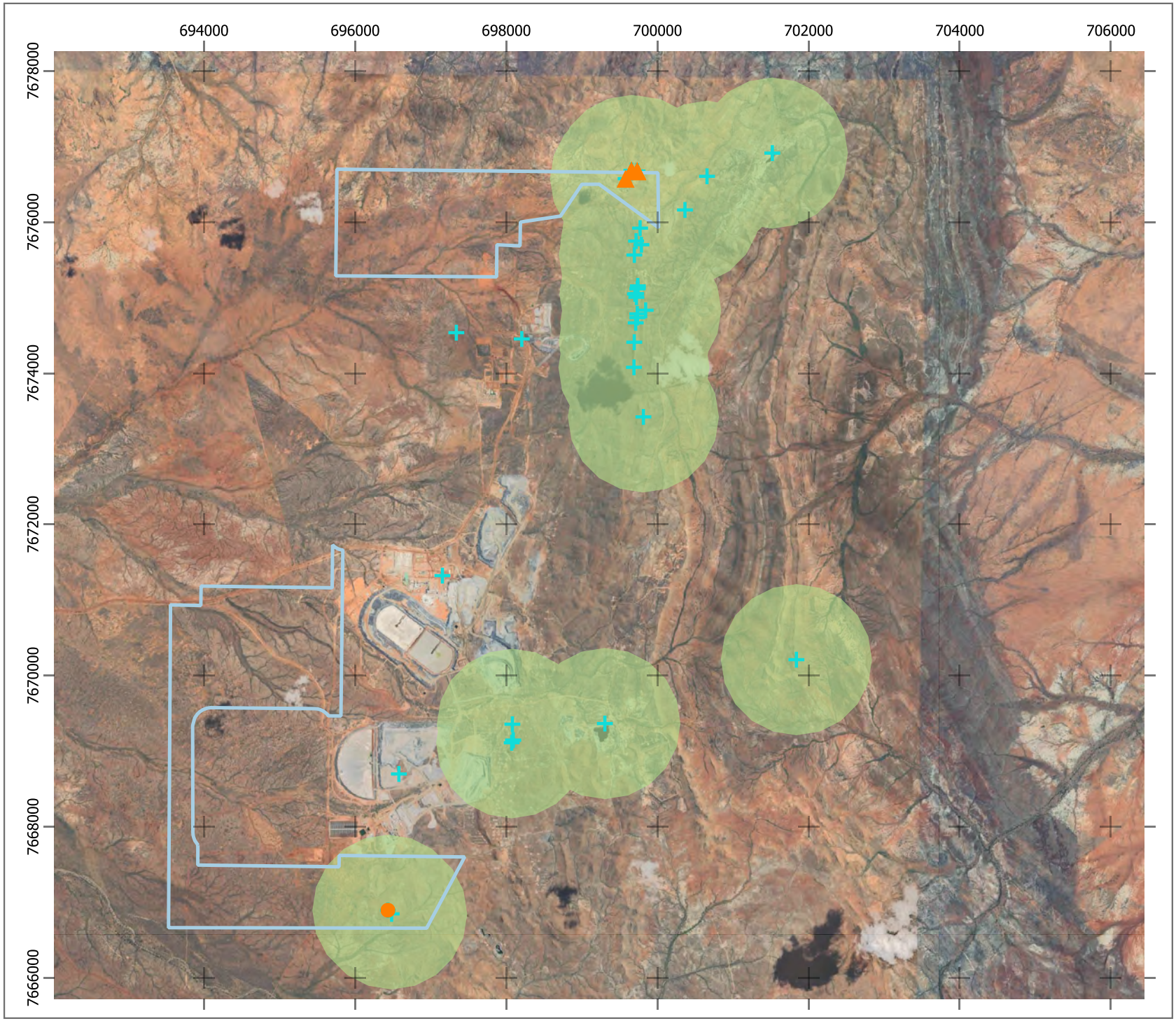
Signs of conservation significant fauna are discussed further in Section 5.2.5 below.

5.2.5 Conservation Significant Fauna

5.2.5.1 Northern Quoll

Northern quoll has been recorded on several occasions within the Pilgangoora Project Area (DBCA Database record, Ecologia Environmental 2018; Terrestrial Ecosystems 2020, APM 2022a, APM 2023b, APM unpublished data [Figure 5-3]). Locally this species seems to be most encountered in the boulder hill tops habitat of the north/south tending ridgeline running along the eastern half of the Pilgangoora Project Area. This is the most rugged landform in the local area, at the highest elevation. Boulders on the ridge tops form a mosaic of cracks and crevices large enough to provide denning habitat for the quoll. In some locations the habitat is able to support fig trees – a favoured food of Northern quoll.

Within 30 km of the Survey Area, species records predominantly occur within rocky outcrop habitats, but also occur in the Turner River and larger tributaries of the Turner River, 16 km to the west of the Survey Area. Quoll have been recorded near to mine infrastructure of the Pilgangoora Project on three occasions.



Legend

- NVCP Survey Area
- NVCP Area Northern Quoll Records
  - Camera
  - Scat
  - Previous Northern Quoll Records
- 1 km buffer Northern Quoll critical habitat

Scale: @ A4
1: 70,000

0 1 2 km

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

Author: EH Approved: ML Date: 29/10/2023

Northern Quoll

Prepared for:
Pilbara Minerals

Figure: 5-3

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) and are present in the Pilgangoora Project Area. Habitat critical to the survival of the Northern quoll previously recorded at the Pilgangoora Project Area includes:

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

Evidence of habitat usage within the Survey Area includes six camera captures across four camera locations and one scat collection. The camera captures were all in Rocky Outcrop habitat in the north-eastern extent, with a high level of connectivity to previously recorded Northern quoll habitat and records. The scat was recorded in the south-eastern extent, also in Rocky Outcrop habitat, near to where a scat has previously been recorded (APM 2023a), but where deployed cameras did not capture individuals. The occurrence of Northern quoll habitat in the south-eastern extent occurs as isolated outcrops on top of hills surrounded by plain, and a stand of fig trees is present.

No quoll records or signs were recorded in major or minor drainage lines, despite the presence of large hollow bearing trees and boulders in the Major Drainage Line habitat. Whilst in other environs creek lines would be a dispersal and foraging habitat for Northern quoll, in the Survey Area this habitat type does not appear to be frequented by the species. It is unknown whether the population inhabiting the rocky hills to the east are connected with the Turner River population, but it would be expected that connectivity between the two populations would occur via the creeks and channels which provide greater cover and forage potential over the 16 km separation. However, there is currently no evidence of such usage and extensive survey effort across the Pilgangoora area has not recorded any quoll usage of drainage features.

All habitats occurring within the Survey 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. At the time of survey there is little evidence of consistent use of the Survey Area by Northern quoll outside of the Rocky Outcrop habitat, however as the populations are critical to the survival of the Northern quoll, the area within 1 km of these habitats are also considered critical (Figure 5-3).

5.2.5.2 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 four categories of roosting habitat used by Ghost bats in the Pilbara (Cramer *et al* 2022; Bullen 2021a):

- Category 1 permanent diurnal roost;
- Category 2 regular diurnal roost;
- Category 3 occasional diurnal roost; and
- Category 4 nocturnal feeding roosts.

Within the Survey Area there are no Category 1, 2, 3 or 4 roosts available to this species.

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, reported in Bullen 2021). In the Survey Area there are scattered to clumped trees available for perching in all habitat types.

No Ghost bats were recorded during the acoustic survey, however acoustic recorders are not suited to Ghost bat detection during foraging as the species seldom uses its echolocation away from caves.

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. APM (2023b) recorded Ghost bat on camera in a location 600 m north of the northern Survey Area in a Category 4 roost. 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 Survey Area may be within range of Category 1, 2 or 3 roosts.

It is likely that the Survey Area offers foraging habitat to Ghost bat across all habitat types.

5.2.5.3 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, 1995) 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 1.5 km from the Survey Area to the north and east respectively and are shown in Figure 5-4. 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).

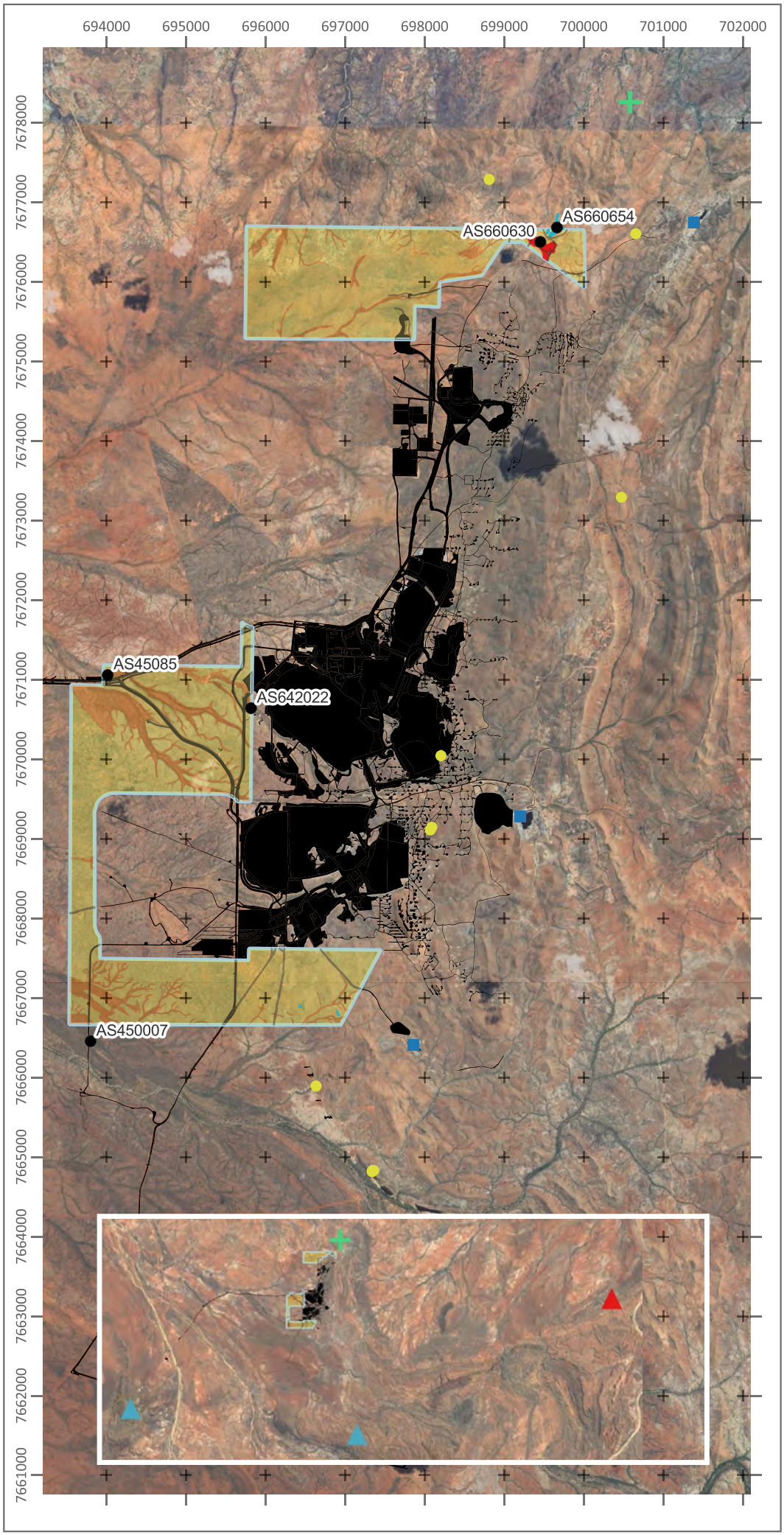
Twenty-one call sequences of the Pilbara leaf-nosed bat were recorded within the Survey Area at three locations, where two were reasonably close together. The call sequences were all between 9 pm and 4:40 am. The detection of echolocation call sequences well after sunset and well before sunrise, and away from areas of rocky outcrop containing deep caves, is indicative of individuals of this species out foraging away from a diurnal roost.

Foraging habitats used by the PLNB 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
- Priority 5 – Open Grassland and Woodland.

Habitats in the Study Areas have been categorised using this Priority schedule and are shown in Figure 5-4 where the Historic Mine Workings are Priority 2, Rocky Outcrop habitat is considered Priority 3, Priority 4 areas include the Major Drainage Line and Shallow Drainage Basins and Creeks and the remaining habitats are Priority 5.

The call sequences were recorded in Rocky Outcrop habitat (15 passes), Major Drainage Line (4 passes) and Historic Mine Workings (2 passes).



Legend

- Confirmed Category 1 Roost
- Confirmed Category 1 or 2 Roost
- Confirmed Category 2 or 3 Roost
- Category 4 Roost
- Previously recorded Priority 1 Foraging Habitat

Foraging Habitat categories within the Survey Area

- Priority 2
- Priority 3
- Priority 4
- Priority 5

- Acoustic bat recorder

Scale: @ A4
1: 70,000

0 500 1,000 m

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

Author: EH Approved: ML Date: 29/09/2023

Pilbara leaf-nosed bat

Prepared for:

Pilbara Minerals

5.2.5.4 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 and major tributaries. The closest record is 10 km from the Survey Area to the southeast. The Survey Area is suitable foraging habitat for this species, and within range of the population likely to be nesting in the Turner River riparian zone. Some large trees were present in the Major Drainage Line fauna habitat but no nests were observed.

5.2.5.5 Night Parrot

The Survey Area is within the area where Night parrot is 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 parrot, 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 some of the plains habitat in the Survey Area may be suitable for the Night parrot, however there are no patterns of fragmentation and fire records (DBCA 2022) and field observation show that burning is often landscape scale and at a moderate frequency. There are no samphire or chenopod habitats proximal to the Survey Area, however the drainage depressions may seasonally support a diversity of herbs and other potential forage species. 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 WA (DPAW 2017b) identifies when and where Night parrot surveys may be required. The Survey Area is on the north-western 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 potentially suitable spinifex habitat, passive acoustic survey was conducted in three previous surveys (APM 2022a, APM 2022b and APM 2023b). No Night parrot calls were recorded and foot traverses have not encountered any signs or individuals of Night parrot.

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.

5.2.5.6 Greater Bilby

Extant populations of 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). Bilby 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 species is identified by the PMST as known to occur within 30 km of the Survey Area. Database results returned 104 records within a 30 km radius of the Survey Area, the closest being one record to the east of Pilgangoora made in 1979. Recent records (2012-2016; 16 to 25 km west) are from surveys conducted for the rail and road corridors to the west. These records are surrounding the Turner River. The DBCA has a long-term bilby abundance monitoring program at the Turner River (DPAW 2017a).

Suitable habitat in the Survey Area includes the Stony Plains and Shallow Drainage Depressions and Creeks habitats. Extensive foot transects were walked across all habitats. No burrows were located. Indeterminate signs were recorded in three closely distributed locations. Diggings/scratchings were recorded as shown in Plate 5-1. The diggings/scratchings lacked attributes common to digging lizards and other species expected to occur, however they were not beneath a recognised bilby forage species, shallow and not fresh. Plate 5-2 shows footprints that may be attributed to bilby.

Plate 5-1. Diggings that may be bilby in origin

Plate 5-2. Footprints that may be bilby in origin

Department of Parks and Wildlife (2017a) provides a protocol for using signs to determine the presence of bilby. Under the protocol, diggings in the open can be used to flag potential bilby activity or potential past presence, but not to verify current presence with certainty. Additional searching was conducted to identify the presence of further signs, but no diggings near shrubs known to host root-dwelling larvae, scats or burrows were observed. Under the protocol the significance of the observed signs is *Potential bilby activity - Presence not confirmed*.

This species has the potential to occupy the Survey Area as bilbies can be relatively transient across their distribution. No burrows were observed suggesting any recent use may be for foraging only and transitory in nature.

5.2.5.7 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 m^2. 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 (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. Eight 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 5-6, an example of an active mound is shown in Plate 5-3.

Table 5-6. Western Pebble-mound mouse mound status and location

Status	Location (GDA 2020; MGA zone 50)
Active	695841, 7676603
	695812, 7671480
Intermediate	699951, 7676327
	697187, 7676582
	696721, 7676031
	695078, 7666773
Inactive	694979, 7666774
	695015, 7666772

Suitable habitat occurs in the Stony Plains and Low Hills habitats where suitable size pebbles are available.

Plate 5-3. An active Western pebble-mound mouse mound

5.2.5.8 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 burrows 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 Survey Area with the closest record 6 km to the southwest. Records originate from biological surveys assessing the impact of rail lines servicing the Pilbara region.

Suitable habitat occurs in the Stony Plains habitat in areas where the soils are sandy and suitable for burrowing, 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. No evidence of Mulgara presence was observed. Whilst the habitat is suitable, there is no evidence that Mulgara are currently present in the Survey Area.

5.2.5.9 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, in the surrounding foothills and plains habitats. These records are from the early 1990's.

Scats recorded during targeted searches may be attributable to Spectacled hare-wallaby (Plate 5-4).

The species was not recorded during the detailed and reconnaissance fauna surveys for the Pilgangoora Project (See Section 3.1.2), with the absence of the species attributed to the broader regional decline. Scats were recorded at two sites during the TSF Infill Survey which were determined to be likely of belonging to the Spectacled hare-wallaby. The habitats available in the Survey Area, particularly in the Shallow Drainage Depressions and Creeks where the scats were recorded, offer a denser cover of vegetation that may be providing sufficient shelter from predation for the species to persist locally.

It is not possible from the available evidence to comprehensively determine the presence of Spectacled hare-wallaby in the Survey Area. Rothschild rock wallaby (*Petrogale rothschildi*) has been recorded at the project and is of similar size to the Spectacled hare-wallaby, however the species is known to stay close to suitable shelter habitat (DPAW 2013) that is not present in or near the Survey Area where the scats were recorded.

Plate 5-4. Wallaby scats

5.2.5.10 Rainbow Bee-eater

In WA the Rainbow bee-eater is considered to be a Migratory bird protected under an international agreement. As such it is listed as Specially Protected under the *Wildlife Conservation Act 1950* and listed under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice. The listing applies to birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), relating to the protection of migratory birds.

The Rainbow bee-eater was removed from the list of Migratory species under the EPBC Act on the 9th June 2016. The species remains on the Marine listing and is subject to 254 of the EPBC Act, which makes it an offence to kill or injure Marine listed species when occurring in or on a Commonwealth area. The Survey Area is not in or on a Commonwealth area.

The species remains listed as IA on the Western Australian Fauna Checklist, however it does not appear to have any special protection outside of Commonwealth areas.

At the Survey Area, four Rainbow bee-eater individuals were observed and five nest locations were recorded. Locations are listed in Table 5-7.

Table 5-7. Locations of Rainbow bee-eater observations

Status	Location (GDA 2020; MGA zone 50)	
Individuals	694528	7671258
	695106	7671029
	695390	7671066
	695410	7671052
Nests	694492	7671219
	695036	7671097
	695100	7671046
	695219	7670961
	695728	7670883

5.2.6 Introduced Fauna

The field survey identified the presence of one introduced fauna species, being cattle (*Bos taurus*). As the area is actively used for pastoralism, the presence of cattle is expected.

6 CONCLUSIONS

6.1 FLORA

The flora and vegetation survey recorded a total of 143 taxa within the Survey Area which is comparable to the number of taxa recorded in other previous local surveys: 120 taxa (67 genera from 28 families) recorded by APM (2022b) for TSF Options 2 and 5, 118 taxa (67 genera and 25 families) recorded by APM (2023b) for the TSF Infill Survey, 116 taxa (63 genera from 26 families) recorded by APM (2022a) at the Lynas Find Deposit; 195 taxa (101 genera and 39 families) recorded by MMWC Environmental (2016a) at the Pilgangoora Project, and 122 taxa (67 genera and 38 families) recorded by Outback Ecology (2009) at Wodgina.

The flora and vegetation of the Survey Area is generally typical of the Pilbara, and of the adjacent lands surrounding the Survey Area.

6.2 FLORA OF CONSERVATION SIGNIFICANCE

No T flora was recorded in the Survey Area. One P3 species was recorded.

Triodia chichesterensis was recorded within a variety of vegetation types. It co-occurs with the closely related *Triodia lanigera* and, as is common in the northern part of the species range, the distribution of the two species is generally substrate based with *T. chichesterensis* restricted to areas where quartzite is commonly found at the surface. Quartzite is common in the local area and not all areas containing quartzite host *T. chichesterensis.*

An additional three species were determined likely to occur based upon the availability of suitable habitat. One of these, *Euploca mutica* (P3) is a perennial species, identifiable from vegetative parts and would have been detectable at the time of survey. Two species (*Euphorbia clementii* [P3] and *Rothia indica* subsp. *australis* [P3]) are annual species. Seasonal conditions were unsuitable for the presence of these species to be detected.

6.3 INTRODUCED FLORA

No weeds Declared under the BAM Act or classed as WoNS were recorded in the Survey Area. Four weeds were recorded, two species of agricultural grass *Cenchrus ciliaris* and *Cenchrus setiger* and the environmental weeds *Aerva javania* (Kapok) and *Tribulus terrestris* (Caltrop). Occurrence was infrequent and where present, they occurred in low numbers.

Declared weeds known to occur in the region are perennial species able to be identified from vegetative parts. The absence of Declared weeds within the Survey Area is reported with a high level of confidence.

6.4 VEGETATION OF CONSERVATION SIGNIFICANCE

There are no recognised TECs or PECs located within or adjacent to the Survey Area.

None of the vegetation types described for the Survey Area are analogous to any known TECs or PECs. The nearest record of a TEC or PEC to the Survey Area is the Gregory Land System (P3 PEC), approximately 50 km away.

The Chichester Subregion includes seven Ecosystems at Risk which are subject to a range of threatening processes (Kendrick and McKenzie 2001). None of these ecosystems are relevant to the Survey Area.

One species associated with Groundwater Dependent Ecosystems was recorded. *Eucalyptus victrix* was recorded in vegetation type 4b in the Major Drainage Line. Individuals were relatively old with a large diameter at breast height compared to other trees in the surrounding habitats. *Eucalyptus victrix* is regarded as being a facultative phreatophyte that most likely draws the majority of its water requirement from the unsaturated zone but can use groundwater opportunistically as required (Pfautsch *et al.* 2014).

Regional Vegetation Associations within and nearby the Survey Area as described by Beard have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within the Survey Area are of 'Least Concern'.

6.5 FAUNA OF CONSERVATION SIGNIFICANCE

The Northern quoll is known to occur in the local area and critical habitat has previously been identified in the ridgeline to the east of the Survey Area. The Survey Area contains habitat that is of value to the Northern quoll for denning, foraging and dispersal. This habitat is described and mapped as the Rocky Outcrop habitat. The Rocky Outcrop habitat and the area within 1 km is habitat critical to the survival of the Northern quoll (CoA 2016).

The Pilbara leaf-nosed bat is known to occur in the local area and diurnal roosts occur within the range of the Survey Area. There are no roosts suitable for the Pilbara leaf-nosed bat in the Survey Area. The conservation ranking of foraging habitat in the Survey Area is limited to small areas of Priority 2 and 3 foraging habitat with the majority being Priority 4 and 5. For the majority of the site, the species may occasionally use the habitats for foraging or in transit to other more productive areas. One location recorded a higher number of calls than other locations. This is a rocky outcrop habitat in the north-eastern extent of the Survey Area, nearest to the known Category 1/2 roost less than 2 km to the north. Individuals may be visiting this Priority 3 foraging habitat, or it may be in the flight path of individuals travelling to other higher quality foraging habitats, or both. Records ranged from one to four passes per night, with calls logged on eight out of 17 active recording nights. Other local high quality foraging habitats have been found to record 40 or more call sequences over a period of three nights (360 Environmental 2016b).

The Greater bilby is known to occur in the region, however there are no locally confirmed modern records. Some signs were observed that cannot be excluded as originating from bilby, however the significance of the observed signs is *Potential bilby activity - Presence not confirmed*. Even if the signs were confirmed to belong to bilby, the occurrence would be transitory and indicates that limited forage was available, and therefore the Study Areas do not present important habitat for this species.

The Ghost bat is known to occur in the local area and diurnal roosts are known to occur within range of the Survey Area. The Survey Area is suitable foraging habitat for the Ghost bat. The Ghost bat was not recorded during the acoustic survey, however, the method has limitation with detection of the species. The species is likely to occur within the Survey Area at some time, for foraging purposes only.

The Grey falcon is known to occur in the local area and the Survey Area is within foraging range of the species. Grey falcon nesting in the Turner River area are likely to visit the Survey Area at some times for the purpose of foraging only.

The survey recorded two active, four intermediate and two extinct Pebble-mound mouse mounds. The Pebble mound mouse is known to occur in the area and its presence within the Survey Area is confirmed. The suitability of mound building habitat is confined by the availability of suitable size pebbles, which occur on the Stony Plains and Low Hills habitats.

The Spectacled hare-wallaby has not previously been confirmed to occur on site in modern times but was historically extant in the area. Scats have been collected on two occasions that are considered likely to be from this species. The most suitable habitat for the species is the Shallow Drainage Basins and Creeks habitat that contains dense vegetation that can provide suitable cover to evade introduced predators.

Habitats that would be subject to inundation in the Survey Area are limited to the claypans or gilgai within the Stony Plains habitat. Due to the high evaporation rate and low vegetation cover these are unlikely to retain water for more than a short period and are unlikely to sustain habitat suitable for migratory shorebirds. There are no nationally or internationally significant aggregations of migratory species known to occur within or near the Survey Area.

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APPENDICES

APPENDIX A: CONSERVATION AND DECLARED CATEGORIES

Conservation categories for threatened species and communities protected under Federal legislation are defined under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Environment Protection and Biodiversity Conservation Regulations 2000* are listed in Tables A.1. and A.2.

Table A.1: Categories and definitions for threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

Conservation Category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (V)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: i) the taxa is a species of fish; ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; and iv) Cessation of the management plan would adversely affect the conservation status of the taxa. Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.

Table A.2: Definitions for Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999*.

Conservation Category	Definition
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

For Section 182 of the EPBC Act and 179 of the EPBC Act Threatened Ecological Communities and Native species are in the Critically Endangered, Endangered or Vulnerable category if they meet any of the criteria for the category mentioned in Table A.3:

Table A.3: Criteria for listing Threatened Species and Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Regulations 2000*

Threatened Species				
Item	**Criterion**	**Category**		
		Critically Endangered	**Endangered**	**Vulnerable**
1	It has undergone, is suspected to have undergone, or is likely to undergo in the immediate future:	A very severe reduction in numbers	A severe reduction in numbers	A substantial reduction in numbers
2	Its geographic distribution is precarious for the survival of the species and is:	Very restricted	Restricted	limited
3	The estimated total number of mature individuals is: And: (a) Evidence suggests that the number will continue to decline at: or (b) The number is likely to continue to decline and its geographic distribution is:	Very low A very high rate Precarious for its survival	Low A high rate Precarious for its survival	limited A substantial rate Precarious for its survival
4	The estimated total number of mature individuals is:	Extremely low	Very low	low
5	The probability of its extinction in the wild is at least:	50% in the immediate future	20% in the near future	10% in the medium term future
Threatened Ecological Communities				
Item	**Criterion**	**Category**		
		Critically Endangered	**Endangered**	**Vulnerable**
1	Its decline in geographic distribution is:	Very severe	Severe	substantial
2	Its geographic distribution is: And the nature of its distribution makes it likely that the action of a threating process could cause it to be lost in:	Very restricted The immediate future	restricted The near future	limited The medium term future
3	For a population of a native species that is likely to play a major role in the community, there is a: To the extent that restoration of the community is not likely to be possible in:	Very severe decline The immediate future	Severe decline The near future	Substantial decline The medium term future
4	The reduction in its integrity across most of its geographic distribution is: As indicated by degradation of the community or its habitat, or disruption of important community processes, that is:	Very severe Very severe	severe severe	substantial substantial
5	The rate of continuing detrimental change is: As indicated by	Very severe	severe	substantial

	(a) A rate of continuing decline in its geographic distribution, or a population of a native species that is believed to play a major role in the community, that is: or	Very severe	severe	serious
	(b) Intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:	Very severe	severe	serious
6	A quantitative analysis shows that its probability of extinction, or extreme degradation over all its geographic distribution, is:	At least 50% in the immediate future	At least 20% in the near future	At least 10% in the medium term future

In Western Australia, the *Biodiversity Conservation Act 2016* (BC Act) provides for the statutory listing of Threatened Ecological Communities, under the categories listed in Table A.4.

Table A.4: Definitions and criteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities. Department of Environment and Conservation (2013).

PD : Presumed Totally Destroyed
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or** B) All occurrences recorded within the last 50 years have since been destroyed.
CR : Critically Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
En : Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii) modification throughout its range is continuing such that in the short term future (within approximately

20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.
B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);
ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;
iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

VU : Vulnerable

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):
A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

In Western Australia, possible Threatened Ecological Communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (Table A.4).

Table A.5: Definitions and criteria for Priority Ecological Communities Department of Environment and Conservation (2013).

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

In Western Australia, the Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Categories of Threatened, Extinct and Specially Protected fauna and flora are listed in Table A.6.

The definition of flora includes algae, fungi and lichens. The definition of Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Table A.6: Conservation codes for Western Australian flora and fauna under the *Biodiversity Conservation Act 2016* (DBCA 2019).

Code	Conservation Category	Definition
Threatened species		
Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.		
CR	**Critically Endangered**	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered**	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora
VU	**Vulnerable**	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct species		
Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.		

EX	**Extinct**	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	**Extinct in the Wild**	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species		
Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.		
MI	**Migratory Species**	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (conservation dependent fauna)**	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
OS	**Other Specially protected species**	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Table A.7: Priority species under Western Australian *Biodiversity Conservation Act 2016*.

P1: Priority One – Poorly known taxa
Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2: Priority Two – Poorly known taxa
Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3: Priority Three – Poorly known taxa
Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
((a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

The management of introduced species in Western Australia is regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). The BAM Act seeks to establish a biosecurity regulatory scheme to prevent serious animal and plant pests from entering the State and becoming established, and to minimise the spread and impact of any that are already present within the State.

The list of declared pests is provided under the BAM Act. Declared animal and plant pests fall into three categories as Gazetted under the *Biosecurity and Agriculture Management Regulations 2013*. These categories are outlined in Table A.7.

Table A.8: Declared pests control categories as gazetted under the *Biosecurity and Agriculture Management Regulations 2013.*

Category	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

References

Department of Biodiversity Conservation and Attractions (2019) Conservation Codes for Western Australian Flora and Fauna. Last updated 3 January 2019. Accessed 25/04/20. https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation%20code%20definitions.pdf

Department of Environment and Conservation (2013). Definitions, categories and criteria for threatened and priority ecological communities. Accessed 25/04/20 https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf

APPENDIX B: PMST SEARCH RESULTS

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 25-Aug-2023

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	14
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	23
Key Ecological Features (Marine):	None
Biologically Important Areas:	1
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.		
Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
MAMMAL		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis		
Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
PLANT		
Quoya zonalis listed as Pityrodia sp. Marble Bar (G.Woodman & D.Coultas GWDC Opp 4)		
Pilbara Foxglove [91588]	Endangered (listed as Pityrodia sp. Marble Bar)	Species or species habitat known to occur within area
REPTILE		
Liasis olivaceus barroni		
Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Liopholis kintorei		
Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat likely to occur within area
Migratory Wetlands Species		

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat likely to occur within area overfly marine area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area

Extra Information

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Lynas Find Project	2023/09471		Assessment
Controlled action			
Abydos Direct Shipping Ore (DSO) Project, Stage 2	2013/6985	Controlled Action	Post-Approval
Abydos Direct Shipping Ore Project	2012/6345	Controlled Action	Post-Approval
Additional Rail Infrastructure between Herb Elliott Port Facility and Cloudbreak Mine Site	2010/5513	Controlled Action	Post-Approval
Development of the Wodgina Direct Shipping Ore Project, Stage 2	2011/5975	Controlled Action	Post-Approval
Miralga Creek Project, Pilbara region, WA	2019/8601	Controlled Action	Post-Approval
North Star Hematite Project	2012/6530	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
North Star Magnetite Project	2012/6689	Controlled Action	Post-Approval
Panoram Copper-Zinc mine	2007/3310	Controlled Action	Completed
Roy Hill to Port Hedland Rail Line and Associated Infrastructure	2010/5424	Controlled Action	Post-Approval
Wodgina Direct Shipping Ore Project	2009/5167	Controlled Action	Post-Approval
Not controlled action			
Development of iron ore resources in eastern Pilbara region, including port at P	2004/1562	Not Controlled Action	Completed
Expansion of the Talison Minerals Storage Facility, Wodgina Mine	2008/4675	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Pilbara Bulk Ore Transport System Project, WA	2016/7637	Not Controlled Action	Completed
Pilbara Transmission Project, Pilbara, WA	2018/8349	Not Controlled Action	Completed
Rail and Port Facilities	2001/474	Not Controlled Action	Completed
Sulphur Springs Copper-Zinc Mining Project, Pilbara Region, WA	2013/6899	Not Controlled Action	Completed
Wodgina Lithium Mine Expansion, Pilbara, NT	2018/8194	Not Controlled Action	Completed
Not controlled action (particular manner)			
Additional Rail Infrastructure	2012/6314	Not Controlled Action (Particular Manner)	Post-Approval
Atlas Boodarie Link Project, WA	2012/6506	Not Controlled Action (Particular Manner)	Post-Approval
Mine the Hercules Deposit under the Wodgina Direct Shipping Ore Project Stage 3	2013/6789	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
Mine the Hercules Deposit under the Wodgina Direct Shipping Ore Project ??? Stage 3	2013/6777	Referral Decision	Completed

Biologically Important Areas

Scientific Name	Behaviour	Presence
Seabirds		
Ardenna pacifica		
Wedge-tailed Shearwater [84292]	Breeding	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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APPENDIX C: DETAILED FLORA AND VEGETATION SURVEY SITES

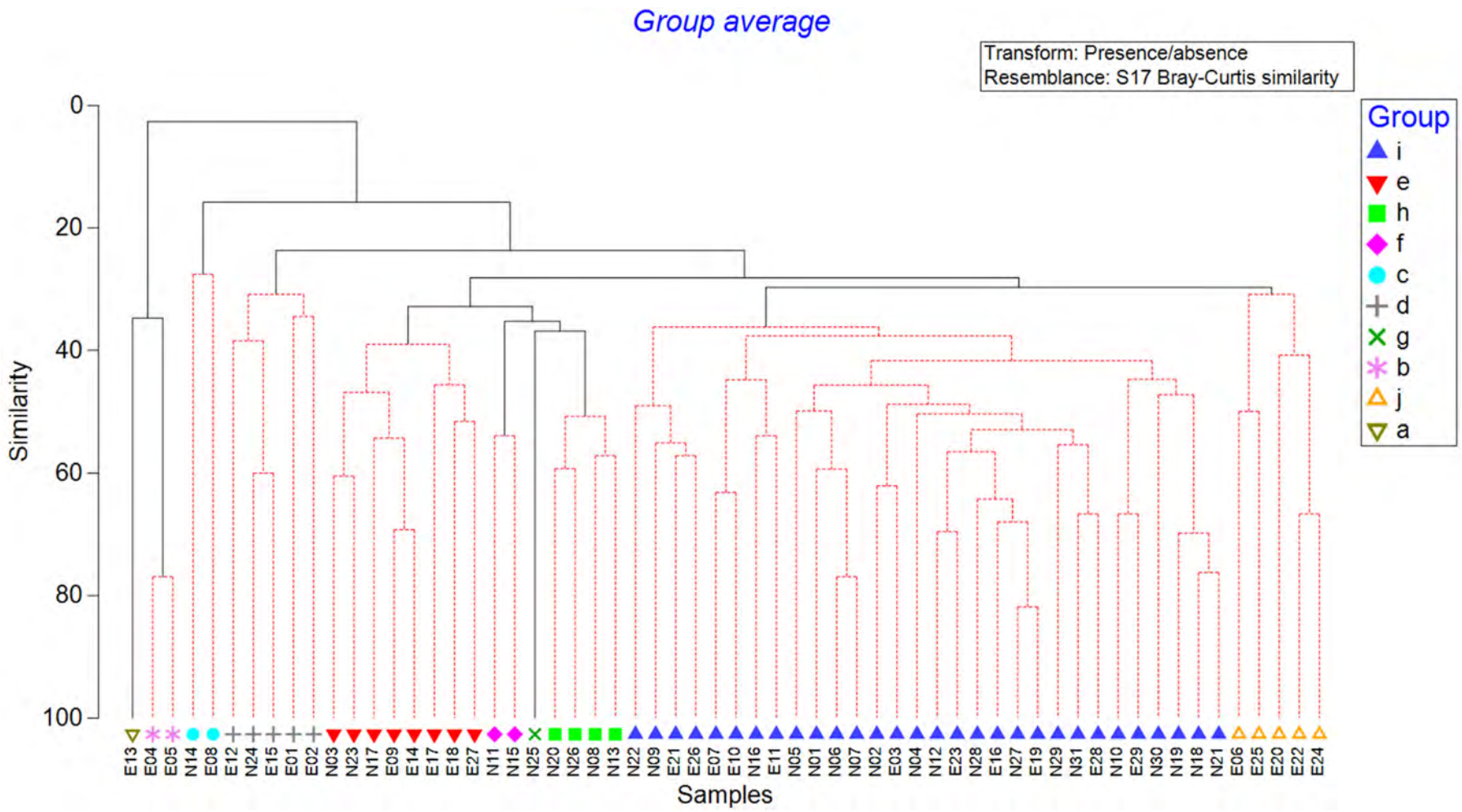

Figure C-1. Dendogram resulting from the cluster analysis of detailed vegetation sites

Site: N01	**WP-NW-(E)** 695413	**(N)** 7671041
Date: 14/07/2023	**WP-NE-(E)** 695427	**(N)** 7671061
Botanist: NP and TB	**WP-SE-(E)** 695505	**(N)** 7671000
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695490	**(N)** 7670979

Seasonal Conditions:	Dry	**Age Since Last Fire:**	< 5 years
Soil Type:	Loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 5 cm, angular	**Surface Rocks Cover (%):**	60
Rock Type:	Granite, Quartzite		
Landform	Stony slope toe between stony hills		
Slope aspect	Slight gradient to North		
Vegetation Description	Hummock grassland of *Triodia* with scattered emergent trees and tall shrubs		
Condition	Very good		
Disturbances	None		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	1	*Corymbia hamersleyana*
Midstory	2	5	*Grevillea wickhamii, Acacia adsurgens, Acacia acradenia*
Understorey	1.2	50	*Triodia epactia, T. angusta, Eriachne benthamii*

Conservation Significant Flora: *Triodia chichesterensis (P3)*

Site: N02	**WP-NW-(E)** 696663	**(N)** 7667334
Date: 14/07/2023	**WP-NE-(E)** 696708	**(N)** 7667322
Botanist: NP and TB	**WP-SE-(E)** 696688	**(N)** 7667277
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 696653	**(N)** 7667284

Seasonal Conditions:	Dry	**Age Since Last Fire:**	< 5 years
Soil Type:	Loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	2 – 20 cm, Angular	**Surface Rocks Cover (%):**	75
Rock Type:	Basalt, Quartzite		
Landform	Rocky hillslope midlsope		
Slope aspect	Moderate west slope		
Vegetation Description	*Triodia* hummock grassland		
Condition	Very Good		
Disturbances	Fairly recent fire		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	0.1	*Acacia inaequilatera*
Midstory	1.2	0.5	*Acacia acradenia*
Understorey	0.8	40	*Triodia wiseana, T. lanigera*

Conservation Significant Flora: None

Site: N03	**WP-NW-(E)** 695996	**(N)** 7666998
Date: 14/07/2023	**WP-NE-(E)** 696047	**(N)** 7666986
Botanist: NP and TB	**WP-SE-(E)** 696040	**(N)** 7666937
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695993	**(N)** 7666951

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	0.5 – 2 cm, Rounded	**Surface Rocks Cover (%):**	2
Rock Type:	Ironstone		
Landform	Depression and low drainage line with no defined channel		
Slope aspect	Flat		
Vegetation Description	Open woodland of *Corymbia hamersleyana* with mixed grass understorey		
Condition	Very good		
Disturbances	Some cattle grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	4.5	10	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.2	5	*Acacia cowleana, Cajanus cinereus, Petalostylis labicheoides*
Understorey	0.4	20	*Indigofera rugosa, Triodia epactia, T. wiseana*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: N04	**WP-N-(E)** 696527	**(N)** 7666762
Date: 14/07/2023	**WP-E-(E)** 696540	**(N)** 7666752
Botanist: NP and TB	**WP-S-(E)** 696475	**(N)** 7666676
Site Type / Size: Quadrat, 25 x 100 m	**WP-W-(E)** 696455	**(N)** 7666689

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.5 – 50 cm, Rounded	**Surface Rocks Cover (%):**	40
Rock Type:	Granite, Quartzite		
Landform	First order drainage line with defined channel		
Slope aspect	Very mild slope to SW		
Vegetation Description	Sparse woodland with hummock grass understorey		
Condition	Very good		
Disturbances	Moderate cattle grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	4	2	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.2	5	*Acacia acradenia , Grevillea wickhamii*
Understorey	0.9	30	*Triodia epactia, T. wiseana, T. angusta.*

Conservation Significant Flora: None

Site: N05	**WP-NW-(E)** 696084	**(N)** 7667455
Date: 14/07/2023	**WP-NE-(E)** 696131	**(N)** 7667461
Botanist: NP and TB	**WP-SE-(E)** 696134	**(N)** 7667414
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 696089	**(N)** 7667406

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay loam	**Soil Colour:**	Red / Brown
Surface Rocks Size/Shape:	0.5 – 5 cm, Angular	**Surface Rocks Cover (%):**	15
Rock Type:	Quartzite, Ironstone, Granite		
Landform	Flat open plain of poor drainage		
Slope aspect	Flat		
Vegetation Description	Hummock grassland with occasional emergent tree		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	3.5	0.5	*Acacia inaequilatera, Corymbia hamersleyana*
Midstory	1.5	0.2	*Acacia acradenia, Acacia adsurgens*
Understorey	0.9	40	*Triodia epactia,*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: N06	**WP-N-(E)** 695741	**(N)** 7666845
Date: 15/07/2023	**WP-E-(E)** 695772	**(N)** 7666804
Botanist: NP and TB	**WP-S-(E)** 695724	**(N)** 7666780
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 695697	**(N)** 7666820

Seasonal Conditions:	Dry	**Age Since Last Fire:**	2 years
Soil Type:	Loam / clay loam	**Soil Colour:**	Brown / red
Surface Rocks Size/Shape:	0.5 – 15 cm, Angular	**Surface Rocks Cover (%):**	70
Rock Type:	Quartzite		
Landform	Flat, stony plain		
Slope aspect	Flat		
Vegetation Description	Hummock grass plain with occasional emergent tree		
Condition	Very good		
Disturbances	Recent fire, Low intensity grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	3	0.5	*Acacia inaequilatera*
Midstory	0.8	5	*Acacia adsurgens, Acacia acradenia* (resprouting post fire)
Understorey	0.8	30	*Triodia epactia, T. wiseana*

Conservation Significant Flora: None

Site: N07	**WP-N-(E)** 695327	**(N)** 7666891
Date: 15/07/2023	**WP-E-(E)** 695363	**(N)** 7666858
Botanist: NP and TB	**WP-S-(E)** 695331	**(N)** 7666821
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 695293	**(N)** 7666854

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 10 cm, Angular	**Surface Rocks Cover (%):**	55
Rock Type:	Quartzite, Ironstone, Granite		
Landform	Flat, stony plain		
Slope aspect	Flat plain		
Vegetation Description	*Triodia* hummock grassland with some Acacia shrubs		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	0.5	*Acacia inaequilatera*
Midstory	1.8	5	*Acacia acradenia , A. adsurgens*
Understorey	0.8	40	*Triodia epcatia, T. lanigera*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: N08	**WP-NW-(E)** 693648	**(N)** 7666785
Date: 15/07/2023	**WP-NE-(E)** 693697	**(N)** 7666790
Botanist: NP and TB	**WP-SE-(E)** 693699	**(N)** 7666743
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 693649	**(N)** 7666736

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 1 cm, Rounded	**Surface Rocks Cover (%):**	2
Rock Type:	Ironstone, Quartzite		
Landform	Frontage country upslope of drainage line		
Slope aspect	Slight slope towards major drainage line to south		
Vegetation Description	*Corymbia* open woodland with hummock grass understorey		
Condition	Very good		
Disturbances	Some cattle grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	4.5	5	*Corymbia hamersleyana*
Midstory	2	10	*Acacia cowleana, Acacia colei, Grevillea wickhamii*
Understorey	0.7	30	*Triodia epactia, Chrysopogon fallax*

Conservation Significant Flora: None

Site: N09	**WP-N-(E)** 693629	**(N)** 7667437
Date: 15/07/2023	**WP-E-(E)** 693678	**(N)** 7667420
Botanist: NP and TB	**WP-S-(E)** 693662	**(N)** 7667374
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 693618	**(N)** 7667388

Seasonal Conditions:	Dry	**Age Since Last Fire:**	< 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.2 – 10 cm, Angular / Rounded	**Surface Rocks Cover (%):**	20
Rock Type:	Ironstone / quartz		
Landform	Flat, stony plain		
Slope aspect	Flat		
Vegetation Description	*Triodia* hummock grassland		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	0.1	*Acacia inaequilatera*
Midstory	1.4	2	*Acacia adsurgens, A. acradenia, Senna artemisioides*
Understorey	0.7	60	*Triodia lanigera, T. angusta*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: N10	**WP-N-(E)** 694552	**(N)** 7671021
Date: 15/07/2023	**WP-E-(E)** 694580	**(N)** 7670982
Botanist: NP and TB	**WP-S-(E)** 694538	**(N)** 7670958
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 694508	**(N)** 7670996

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.5 – 5 cm, Angular	**Surface Rocks Cover (%):**	75
Rock Type:	Quartzite, Bluestone		
Landform	Stony plain adjacent to drainage line		
Slope aspect	Flat		
Vegetation Description	Hummock grassland with very occasional emergent tree		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	0.1	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.2	5	*Acacia bivenosa, Acacia adsurgens*
Understorey	0.7	40	*Triodia lanigera, T, wiseana, T. epactia*

Conservation Significant Flora: None

Site: N11	**WP-N-(E)** 694120	**(N)** 7671135
Date: 15/07/2023	**WP-E-(E)** 694149	**(N)** 7671098
Botanist: NP and TB	**WP-S-(E)** 694109	**(N)** 7671070
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 694082	**(N)** 7671105

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam	**Soil Colour:**	Loam
Surface Rocks Size/Shape:	5 – 200+ cm, Rounded	**Surface Rocks Cover (%):**	10
Rock Type:	Granite, quartzite		
Landform	Riparian area with gallery woodland on a second order stream		
Slope aspect	Very moderate slope. Stream flowing west.		
Vegetation Description	Open riparian woodland		
Condition	Very good		
Disturbances	Moderate cattle grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	6	5	*Eucalyptus victrix, Corymbia hamersleyana*
Midstory	1.6	10	*Acacia trachycarpa, A. pyrifolia, Cajanus cinereus*
Understorey	0.6	15	Mixed perennial grasses

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: N12	**WP-NW-(E)** 695527	**(N)** 7670057
Date: 15/07/2023	**WP-NE-(E)** 695576	**(N)** 7670047
Botanist: NP and TB	**WP-SE-(E)** 695539	**(N)** 7670009
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695586	**(N)** 7669999

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.5 – 20 cm, Angular	**Surface Rocks Cover (%):**	70
Rock Type:	Granite, quartzite		
Landform	Flat, rocky plain		
Slope aspect	Flat		
Vegetation Description	Hummock *Triodia* grassland with scattered *Acacia* shrubs		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	1	*Grevillea wickhamii, Acacia inaequilatera*
Midstory	1.6	10	*Acacia acradenia , Petalostylis labicheoides*
Understorey	0.7	60	*Triodia wiseana, T. epactia, T. chichesterensis*

Conservation Significant Flora: *Triodia chichesterensis* (P3)

Site: N13	**WP-NW-(E)** 693617	**(N)** 7668772
Date: 16/07/2023	**WP-NE-(E)** 693717	**(N)** 7668740
Botanist: NP and TB	**WP-SE-(E)** 693705	**(N)** 7668720
Site Type / Size: Quadrat, 25 x 100 m	**WP-SW-(E)** 693612	**(N)** 7668748

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Sandy loam
Surface Rocks Size/Shape:	0.1 – 10 cm, Rounded	**Surface Rocks Cover (%):**	20
Rock Type:	Granite, Quartzite		
Landform	Small dry stony second order channel 5 m wide, well defined		
Slope aspect	Very low gradient west flowing		
Vegetation Description	Open gallery woodland along riparian fringe with hummock grassland 15 m from channel		
Condition	Very Good		
Disturbances	Some cattle grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	5	5	*Corymbia hamersleyana*
Midstory	2.5	5	*Acacia pyrifolia, A. cowleana, Petalostylis labicheoides*
Understorey	0.8	25	Mixed perennial grasses

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: N14	**WP-NW-(E)** 693889	**(N)** 7669785
Date: 16/07/2023	**WP-NE-(E)** 693939	**(N)** 7669780
Botanist: NP and TB	**WP-SE-(E)** 693926	**(N)** 7669730
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 693877	**(N)** 7669737

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam / clay loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 5 cm, Angular / Rounded	**Surface Rocks Cover (%):**	60
Rock Type:	Granite, Quartzite		
Landform	Flat stony plain interspersed with gilgai clay formations around 400 m^2		
Slope aspect	Flat		
Vegetation Description	*Triodia* hummock grassland with occasional shrub *Acacia* emergent and perennial grasses + herbs on gilgai soils		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Midstory	2	2	*Acacia adsurgens, Acacia bivenosa*
Understorey	0.7	50	*Triodia angusta, T. brizoides, Dichanthium sericeum*

Conservation Significant Flora: None

Site: N15	**WP-N-(E)** 695427	**(N)** 7671061
Date: 16/07/2023	**WP-E-(E)** 695505	**(N)** 7671000
Botanist: NP and TB	**WP-S-(E)** 695490	**(N)** 7670979
Site Type / Size: Quadrat, 25 x 100 m	**WP-W-(E)** 695413	**(N)** 7671041

Seasonal Conditions:	Dry river bed	**Age Since Last Fire:**	> 10 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 20 cm, Rounded	**Surface Rocks Cover (%):**	20
Rock Type:	Granite		
Landform	Ephemeral second order river (stream width 10 m) steep bank on south west side (3.5 m)		
Slope aspect	Very low gradient flow to the west		
Vegetation Description	Gallery open woodland along riparian band and within the channel. Tussock grassland upslope.		
Condition	Good		
Disturbances	Close to mining operation - moderate dust cover, occasional tracks, moderate grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	5	10	*Eucalyptus victrix, Corymbia hamersleyana*
Midstory	2.2	5	*Acacia cowleana, Cajanus cinereus*
Understorey	0.8	15	Mixed perennial grasses

Conservation Significant Flora: None

Site: N16	**WP-N-(E)** 695053	**(N)** 7670424
Date: 16/07/2023	**WP-E-(E)** 695093	**(N)** 7670395
Botanist: NP and TB	**WP-S-(E)** 695054	**(N)** 7670364
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 695015	**(N)** 7670393

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Orange
Surface Rocks Size/Shape:	0.1 – 30 cm, Angular	**Surface Rocks Cover (%):**	80
Rock Type:	Calcrete, Quartzite		
Landform	Sloping, stony plain		
Slope aspect	Low gradient slope to the east		
Vegetation Description	Hummock *Triodia* grassland with occasional emergent trees		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	2.5	2	*Acacia inaequilatera, Grevillea wickhamii, Corymbia hamersleyana*
Understorey	0.5	60	*Triodia wiseana, T. angusta*

Conservation Significant Flora: None

Site: N17	**WP-NW-(E)** 693785	**(N)** 7670694
Date: 16/07/2023	**WP-NE-(E)** 693833	**(N)** 7670700
Botanist: NP and TB	**WP-SE-(E)** 693838	**(N)** 7670649
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 693788	**(N)** 7670644

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 0.5 cm, Angular	**Surface Rocks Cover (%):**	80
Rock Type:	Granite, quartzite, ironstone		
Landform	Upper slope of low stony rise in the plain		
Slope aspect	Low gradient to the east		
Vegetation Description	Hummock grasses with occasional emergent tree		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	5	1	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	2	5	*Acacia acradenia , A. bivenosa, A. adsurgens*
Understorey	0.6	55	*Triodia wiseana, T. epactia*

Conservation Significant Flora: None

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Appendix C – Detailed Flora and Vegetation Sites

Site: N18	**WP-N-(E)** 696092	**(N)** 7675661
Date: 17/07/2023	**WP-E-(E)** 696108	**(N)** 7675614
Botanist: NP and TB	**WP-S-(E)** 696068	**(N)** 7675584
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 696051	**(N)** 7675632

Seasonal Conditions:	Dry	**Age Since Last Fire:**	< 5 years
Soil Type:	Sand	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 5 cm, Rounded	**Surface Rocks Cover (%):**	25
Rock Type:	Quartzite, Ironstone		
Landform	Broad, flat, sandy plain		
Slope aspect	Flat		
Vegetation Description	Tussock grassland with occasional emergent shrubs		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	3	1	*Corymbia hamersleyana*
Midstory	2.5	2	*Acacia acradenia , A. adsurgens, A. cowleana*
Understorey	0.7	45	*Triodia lanigera*

Conservation Significant Flora: None

Site: N19	**WP-N-(E)** 696399	**(N)** 7675866
Date: 17/07/2023	**WP-E-(E)** 696438	**(N)** 7675837
Botanist: NP and TB	**WP-S-(E)** 696403	**(N)** 7675803
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 696360	**(N)** 7675832

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loamy sand	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 5 cm, Angular	**Surface Rocks Cover (%):**	40
Rock Type:	Quartzite, Ironstone		
Landform	Stony flay plain		
Slope aspect	Flat, no slope		
Vegetation Description	Tussock grassland with occasional emergent tree		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3.5	1	*Acacia inaequilatera*
Midstory	2.5	5	*Acacia cowleana, A. adsurgens, A. acradenia*
Understorey	0.8	40	*Triodia lanigera*

Conservation Significant Flora: None

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Appendix C – Detailed Flora and Vegetation Sites

Site: N20	**WP-NW-(E)** 696515	**(N)** 7675378
Date: 17/07/2023	**WP-NE-(E)** 696608	**(N)** 7675421
Botanist: NP and TB	**WP-SE-(E)** 696618	**(N)** 7675399
Site Type / Size: Quadrat, 25 x 100 m	**WP-SW-(E)** 696526	**(N)** 7675359

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loamy sand	**Soil Colour:**	Loamy sand
Surface Rocks Size/Shape:	0.1 – 5 cm, Angular	**Surface Rocks Cover (%):**	5
Rock Type:	Quartzite, Ironstone		
Landform	Shallow drainage line across stony sandy plain		
Slope aspect	Very slight slope draining to west		
Vegetation Description	Dense Acacia shrubland in drainage channel. Tussock grassland away from the channel.		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3.5	1	*Corymbia hamersleyana*
Midstory	3	30	*Acacia cowleana, Acacia adsurgens*
Understorey	0.5	10	Mixed perennial grasses

Conservation Significant Flora: None

Site: N21	**WP-NW-(E)** 695790	**(N)** 7675442
Date: 17/07/2023	**WP-NE-(E)** 695838	**(N)** 7675436
Botanist: NP and TB	**WP-SE-(E)** 695857	**(N)** 7675389
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695806	**(N)** 7675394

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 10 cm, Rounded	**Surface Rocks Cover (%):**	25
Rock Type:	Quartzite, Ironstone		
Landform	Open, flat, sandy plain		
Slope aspect	Flat		
Vegetation Description	Tussock *Triodia* grassland with some emergent *Acacia* shrubs		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	3	1	*Acacia cowleana, Grevillea wickhamii*
Midstory	1.6	2	*Acacia adsurgens*
Understorey	0.7	40	*Triodia lanigera*

Conservation Significant Flora: None

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Appendix C – Detailed Flora and Vegetation Sites

Site: N22	**WP-N-(E)** 699835	**(N)** 7676289
Date: 17/07/2023	**WP-E-(E)** 699857	**(N)** 7676246
Botanist: NP and TB	**WP-S-(E)** 699815	**(N)** 7676220
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 699794	**(N)** 7676262

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	1 – 20 cm, Angular	**Surface Rocks Cover (%):**	80
Rock Type:	Granite, Quartz		
Landform	Rocky toe slope of granite hills with first order drainage line		
Slope aspect	Very moderate slope to the east		
Vegetation Description	Hummock *Triodia* grassland with scattered emergent Eucalyptus		
Condition	Very Good		
Disturbances	Low intensity grazing, Occasional tracks		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	4	1	*Eucalyptus leucophloia*
Midstory	2.5	0.5	*Acacia inaequilatera*
Understorey	0.4	30	*Triodia lanigera, Triodia brizoides*

Conservation Significant Flora: None

Site: N23	**WP-N-(E)** 699531	**(N)** 7676456
Date: 17/07/2023	**WP-E-(E)** 699560	**(N)** 7676420
Botanist: NP and TB	**WP-S-(E)** 699524	**(N)** 7676388
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 699493	**(N)** 7676388

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sand	**Soil Colour:**	Grey
Surface Rocks Size/Shape:	0.1 – 50 cm, Angular / Platy	**Surface Rocks Cover (%):**	20
Rock Type:	Granite		
Landform	Rocky hillslope and drainage line - modified by old mine working and construction, estimated 50 years abandoned		
Slope aspect	Slight gradient to west		
Vegetation Description	Hummock *Triodia* grassland with emergent Eucalypts		
Condition	Good		
Disturbances	Old working site, rock dam on the creekline		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	2	*Eucalyptus leucophloia, Corymbia hamersleyana*
Midstory	2.2	5	*Acacia acradenia, A. inaequilatera*
Understorey	0.5	40	*Triodia epactia, T. chichesterensis, T. brizoides*

Conservation Significant Flora: *Triodia chichesterensis* (P3)

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Appendix C – Detailed Flora and Vegetation Sites

Site: N24	**WP-NW-(E)** 699167	**(N)** 7676549
Date: 17/07/2023	**WP-NE-(E)** 699217	**(N)** 7676552
Botanist: NP and TB	**WP-SE-(E)** 699219	**(N)** 7676500
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 699169	**(N)** 7676502

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	0.1 – 30 cm, Angular	**Surface Rocks Cover (%):**	90
Rock Type:	Granite		
Landform	Foliated eroded granite hillslopes		
Slope aspect	Moderate slope east		
Vegetation Description	Hummock *Triodia* grassland with scattered emergent trees (*Acacia inaequilatera*)		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	0.1	*Acacia inaequilatera*
Midstory	1	0.1	*Acacia acradenia*
Understorey	0.4	50	*Triodia wiseana, T. chichesterensis*

Conservation Significant Flora: *Triodia chichesterensis* (P3)

Site: N25	**WP-N-(E)** 698917	**(N)** 7676546
Date: 17/07/2023	**WP-E-(E)** 698966	**(N)** 7676530
Botanist: NP and TB	**WP-S-(E)** 698944	**(N)** 7676484
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 698897	**(N)** 7676498

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 5 cm, Angular	**Surface Rocks Cover (%):**	80
Rock Type:	Granite		
Landform	Toe slope of a rocky rise that ends in a small first order stream channel		
Slope aspect	Slight gradient facing north		
Vegetation Description	Hummock *Triodia* grassland on toe slope with very open *Corymbia hamersleyana* woodland in the channel		
Condition	Very good		
Disturbances	Old mine workings. Small ephemeral dam constructed approx. 50 years ago.		

Strata	Height (m)	Cover (%)	Species
Overstorey	3.5	2	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.8	5	*Acacia acradenia , Grevillea wickhamii*
Understorey	0.4	45	*Triodia angusta, T. lanigera*

Conservation Significant Flora: None

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Appendix C – Detailed Flora and Vegetation Sites

Site: N26	**WP-NW-(E)** 697137	**(N)** 7675654
Date: 18/07/2023	**WP-NE-(E)** 697185	**(N)** 7675668
Botanist: NP and TB	**WP-SE-(E)** 697198	**(N)** 7675620
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 697150	**(N)** 7675605

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.5 – 5 cm, Angular	**Surface Rocks Cover (%):**	10
Rock Type:	Quartzite, Ironstone		
Landform	Shallow drainage line within rocky flat plain		
Slope aspect	Very slight slope to west		
Vegetation Description	Hummock *Triodia* grassland with scattered emergent trees in the drainage line		
Condition	Very good		
Disturbances	Some cattle grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	2	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.2	15	*Acacia cowleana, A. adsurgens, Indigofera rugosa*
Understorey	0.8	60	*Triodia epactia, T. wiseana, Chrysopogon fallax, Themeda triandra*

Conservation Significant Flora: None

Site: N27	**WP-N-(E)** 696917	**(N)** 7676125
Date: 18/07/2023	**WP-E-(E)** 696947	**(N)** 7676086
Botanist: NP and TB	**WP-S-(E)** 696897	**(N)** 7676075
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 696869	**(N)** 7676115

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.5 – 5 cm, Angular	**Surface Rocks Cover (%):**	70
Rock Type:	Quartzite, Ironstone		
Landform	Top of a low rise on a stony plain		
Slope aspect	Slight slope to the east		
Vegetation Description	Hummock *Triodia* grassland with scattered emergent trees and shrubs		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	0.5	*Acacia inaequilatera*
Midstory	1.5	5	*Acacia adsurgens, Acacia stellaticeps*
Understorey	0.6	45	*Triodia lanigera, T. wiseana*

Conservation Significant Flora: None

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Appendix C – Detailed Flora and Vegetation Sites

Site: N28	**WP-N-(E)** 697224	**(N)** 7676588
Date: 18/07/2023	**WP-E-(E)** 697242	**(N)** 7676541
Botanist: NP and TB	**WP-S-(E)** 697196	**(N)** 7676521
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 697179	**(N)** 7676569

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loamy sand	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 5 cm, Angular	**Surface Rocks Cover (%):**	80
Rock Type:	Quartzite, Granite		
Landform	Stony toe slope of a stony hill on a flat plain		
Slope aspect	South facing low slope		
Vegetation Description	Hummock grassland with scattered emergent trees		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	0.5	*Acacia inaequilatera*
Midstory	1.8	0.5	*Acacia adsurgens, A. acradenia , Indigofera rugosa*
Understorey	0.6	45	*Triodia lanigera, T. wiseana, T. brizoides*

Conservation Significant Flora: None

Site: N29	**WP-N-(E)** 697365	**(N)** 7676109
Date: 18/07/2023	**WP-E-(E)** 697400	**(N)** 7676075
Botanist: NP and TB	**WP-S-(E)** 697371	**(N)** 7676035
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 697337	**(N)** 7676070

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sand	**Soil Colour:**	Sand
Surface Rocks Size/Shape:	0.1 – 2 cm, Angular	**Surface Rocks Cover (%):**	20
Rock Type:	Granite, Quartzite, Ironstone		
Landform	On the lower section of undulating plain at the lower part of the break of slope		
Slope aspect	Very gentle south facing slope		
Vegetation Description	Hummock *Triodia* grassland with scattered emergent trees		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	2	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.2	2	*Acacia acradenia , Indigofera rugosa*
Understorey	0.8	50	*Triodia wiseana, T. lanigera, T. epactia*

Conservation Significant Flora: None

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Site: N30	**WP-N-(E)** 698463	**(N)** 7676307
Date: 18/07/2023	**WP-E-(E)** 698485	**(N)** 7676261
Botanist: NP and TB	**WP-S-(E)** 698437	**(N)** 7676244
Site Type / Size: Quadrat, 50 x 50 m	**WP-W-(E)** 698414	**(N)** 7676289

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Sand	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 5 cm, Angular	**Surface Rocks Cover (%):**	30
Rock Type:	Granite, Quartzite		
Landform	Flat undulating plain		
Slope aspect	Flat		
Vegetation Description	Hummock *Triodia* grassland with scattered emergent trees		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	1	*Corymbia hamersleyana*
Midstory	1.6	1	*Acacia adsurgens, A. bivenosa*
Understorey	0.7	40	*Triodia lanigera, T. epactia, Paraneurachne muelleri*

Conservation Significant Flora: None

Site: N31	**WP-NW-(E)** 697479	**(N)** 7675598
Date: 18/07/2023	**WP-NE-(E)** 697528	**(N)** 7675607
Botanist: NP and TB	**WP-SE-(E)** 697538	**(N)** 7675557
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 697491	**(N)** 7675548

Seasonal Conditions:	Dry	**Age Since Last Fire:**	> 5 years
Soil Type:	Loamy sand	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.1 – 10 cm, Angular	**Surface Rocks Cover (%):**	10
Rock Type:	Quartzite, Granite		
Landform	Flat sandy, stony plain		
Slope aspect	Flat		
Vegetation Description	Hummock *Triodia* grassland with emergent shrubs and trees in run-on area		
Condition	Very good		
Disturbances	Low intensity grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	3	0.5	*Acacia inaequilatera*
Midstory	1.8	2	*Acacia adsurgens, A. acradenia*
Understorey	0.7	60	*Triodia wiseana, T. lanigera, T. epactia*

Conservation Significant Flora: None

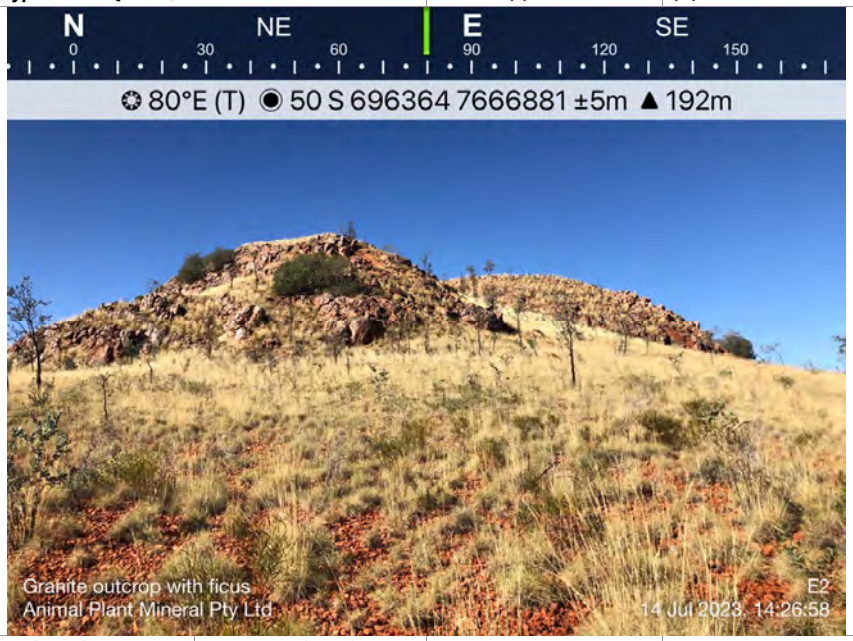
Site: E01	**WP-NW-(E)** 696781	**(N)** 7667628
Date: 14/07/2023	**WP-NE-(E)** 696831	**(N)** 7667629
Botanist: EH	**WP-SE-(E)** 696831	**(N)** 7667578
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 696781	**(N)** 7667579

Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam in cracks	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	10 – 100 cm, Platy	**Surface Rocks Cover (%):**	90
Rock Type:	Platy Granite		
Landform	Platy granite outcrop. No crevices or caves. Very little soil in cracks. Conical shapes.		
Slope aspect	Hillcrest and upper slopes		
Vegetation Description	Scattered mid *Acacia inaequilatera* over scattered *Hibiscus sturtii, Acacia acradenia* and *Euphorbia tanenensis* mid shrubs. Low hummock grassland of *Triodia wiseana, T. chichesterensis* and *Cymbopogon ambiguus*		
Condition	Very Good		
Disturbances	Light Lithium dust in soil cracks, occasional tracks		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	1.8	0.5	*Acacia inaequilatera*
Midstory	0.7	1	*Acacia acradenia , Hibiscus sturtii, Euphorbia tanenensis*
Understorey	0.3	50	*Triodia wiseana, T. chichesterensis* and *Cymbopogon ambiguus*

Conservation Significant Flora: *Triodia chichesterensis* (P3)

Site: E02	**WP-NW-(E)** 696413	**(N)** 7666939
Date: 14/07/2023	**WP-NE-(E)** 696463	**(N)** 7666939
Botanist: EH	**WP-SE-(E)** 696461	**(N)** 7666889
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 696412	**(N)** 7666890

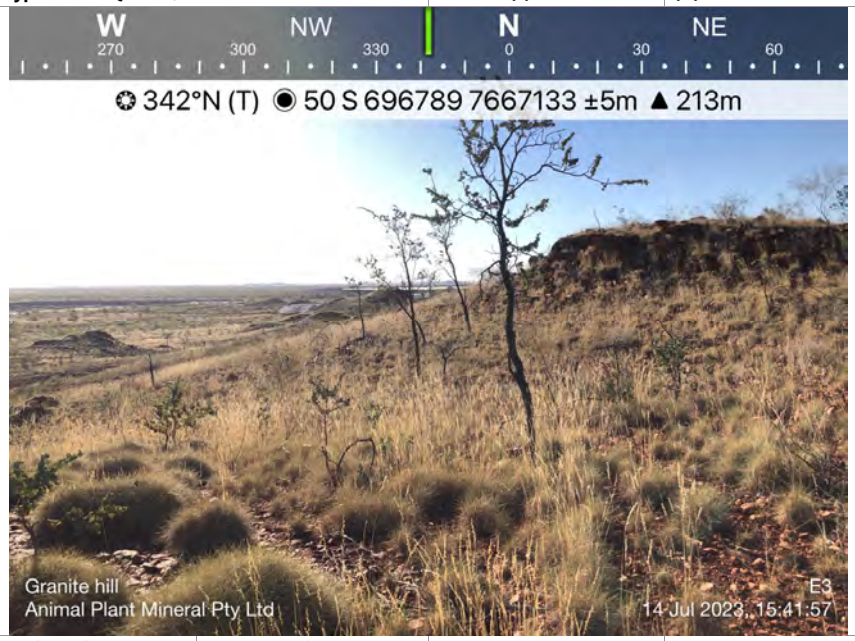


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	15 cm – 100 cm, Angular	**Surface Rocks Cover (%):**	50
Rock Type:	Granite, Quartzite		
Landform	Granite outcrop. Small crevices/cracks		
Slope aspect	Crest and upper slopes of hill		
Vegetation Description	Tall sparse *A. inaequilatera* and *Ficus brachypoda* over *A. acradenia, Triodia wiseana* and *T. epactia* hummock grassland.		
Condition	Very Good		
Disturbances	None		

Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	1	*Ficus brachypoda, Acacia inaequilatera*
Midstory	1	1	*Acacia acradenia , Senna glutinosa*
Understorey	0.5	50	*Triodia epactia, T. wiseana, T. lanigera*

Conservation Significant Flora: None

Site: E03	**WP-NW-(E)** 696792	**(N)** 7667186
Date: 14/07/2023	**WP-NE-(E)** 696842	**(N)** 7667186
Botanist: EH	**WP-SE-(E)** 696842	**(N)** 7667136
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 696793	**(N)** 7667136

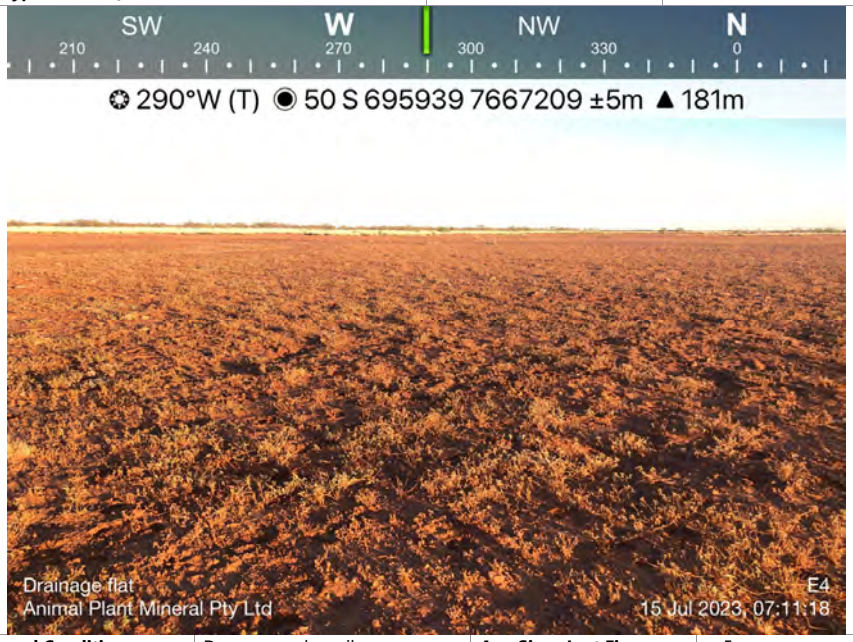


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red / brown
Surface Rocks Size/Shape:	3 – 10 cm, Angular	**Surface Rocks Cover (%):**	40
Rock Type:	Granite, Quartzite		
Landform	Hill crest and upper slopes		
Slope aspect	Crest		
Vegetation Description	Tall sparse *Acacia inaequilatera* over *T. wiseana* hummock grassland.		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	1	*Acacia inaequilatera*
Midstory	1	1	*Greville wickhamii, Acacia orthocarpa*
Understorey	0.3	50	*Triodia wiseana, T. lanigera*

Conservation Significant Flora: None

Site: E04	**WP-NW-(E)** 695891	**(N)** 7667205
Date: 15/07/2023	**WP-NE-(E)** 695940	**(N)** 7667206
Botanist: EH	**WP-SE-(E)** 695941	**(N)** 7667155
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695891	**(N)** 7667155



Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	2 – 5 cm, Rounded and Angular	**Surface Rocks Cover (%):**	5
Rock Type:	Granite, Quartzite		
Landform	Drainage depression, seasonally inundated.		
Slope aspect	Flat, slightly draining to NW		
Vegetation Description	Herb field of *Sida fibulifera*, *Portulacca oleraceae* and *Solanum diversiflorum*		
Condition	Good		
Disturbances	High intensity cattle grazing, altered hydrology - now drains to NW		

Strata	**Height (m)**	**Cover (%)**	**Species**
Understorey	0.1	30	*Sida fibulifera*, *Portulacca oleraceae* and *Solanum diversiflorum*

Conservation Significant Flora: None

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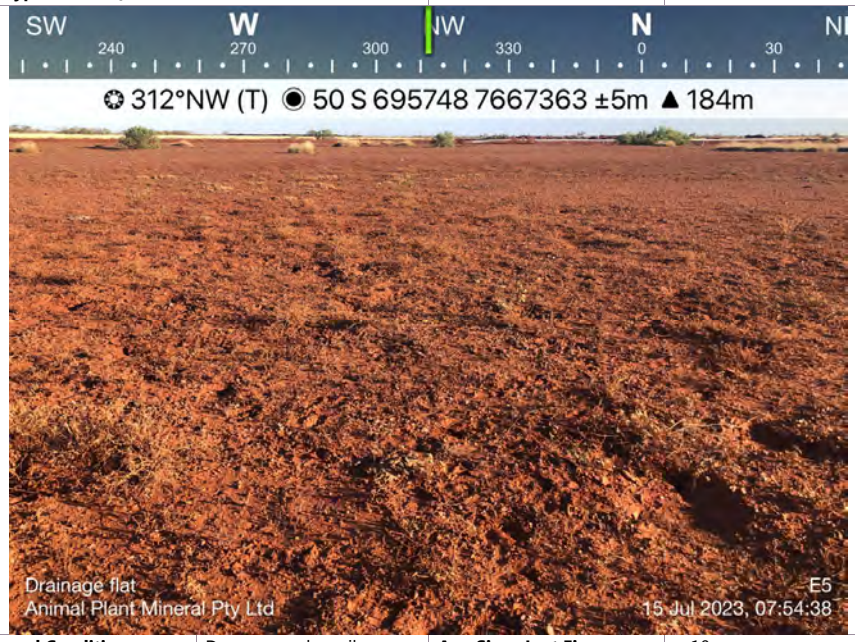
Site: E05	**WP-NW-(E)** 695700	**(N)** 7667364
Date: 15/07/2023	**WP-NE-(E)** 695750	**(N)** 7667364
Botanist: EH	**WP-SE-(E)** 695750	**(N)** 7667314
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695700	**(N)** 7667314

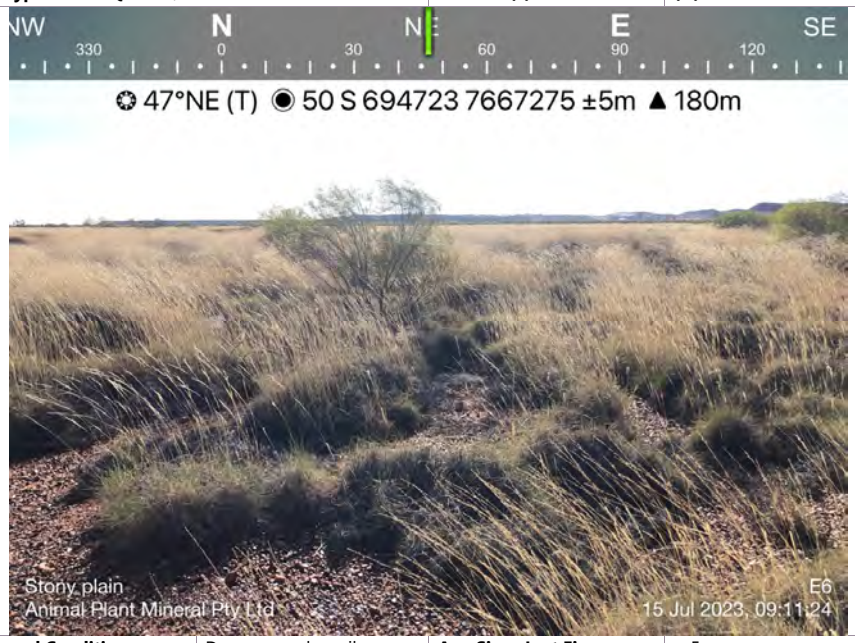


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 10 years
Soil Type:	Clay loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	2 – 4 cm, Blocky	**Surface Rocks Cover (%):**	10
Rock Type:	Granite, Quartzite		
Landform	Drainage depression. Seasonally inundated.		
Slope aspect	Flat. Slight drainage to NW		
Vegetation Description	Herb field of *Sida fibulifera, Neptunia dimorphantha* and *Eragrostis xerophila*		
Condition	Good		
Disturbances	High intensity grazing. Change to surface hydrology.		

Strata	**Height (m)**	**Cover (%)**	**Species**
Understorey	0.1	30	*Sida fibulifera, Neptunia dimorphantha* and *Eragrostis xerophila*

Conservation Significant Flora: None

Site: E06	**WP-NW-(E)** 694723	**(N)** 7667316
Date: 15/07/2023	**WP-NE-(E)** 694773	**(N)** 7667315
Botanist: EH	**WP-SE-(E)** 694772	**(N)** 7667265
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 694723	**(N)** 7667265



Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay sand	**Soil Colour:**	Red / orange
Surface Rocks Size/Shape:	2 – 4 cm	**Surface Rocks Cover (%):**	50
Rock Type:	Granite, Quartzite.		
Landform	Plain, occasional drainage depressions of mud (see E04 and E05). Moderately drained but likely saturates following rain.		
Slope aspect	Flat - drains to internal mud areas and small channels		
Vegetation Description	Sparse *Acacia adsurgens* mid shrubs *Triodia* hummock grassland.		
Condition	Very good		
Disturbances	No evidence of disturbance except occasional tracks and moderate grazing.		

Strata	Height (m)	Cover (%)	Species
Midstory	1.8	1	*Acacia adsurgens*
Understorey	0.4	50	*Triodia wiseana, T. lanigera*

Conservation Significant Flora: None

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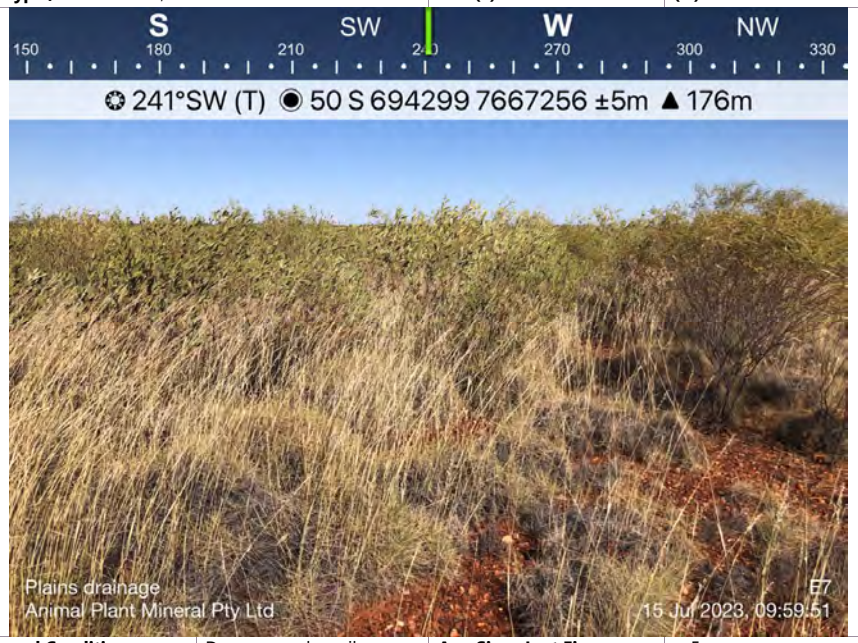
Site: E07	**Date:** 15/07/2023	**Botanist:** EH
Site Type / Size: Releve, 50 x 50 m	**WP-(E)** 694293	**(N)** 7667259

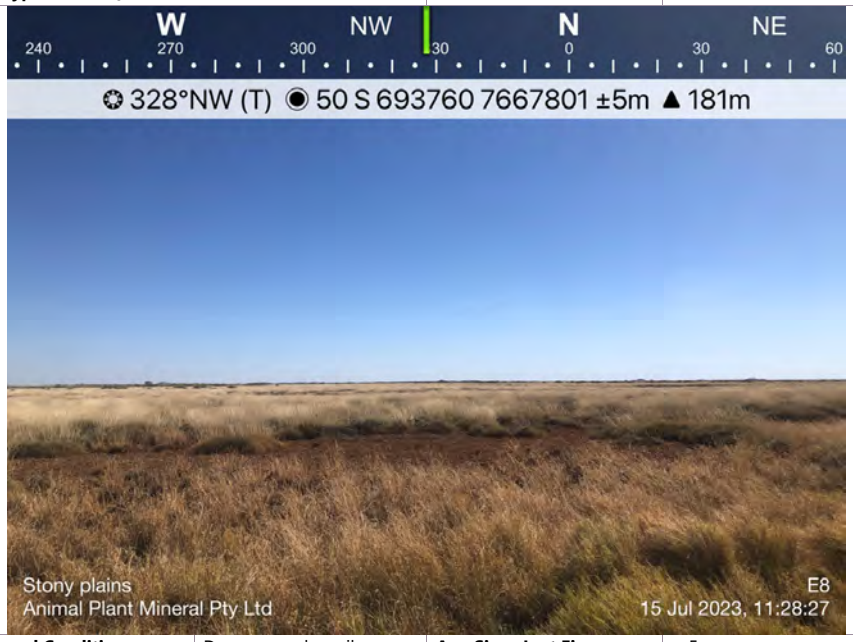


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Loamy sand	**Soil Colour:**	Red
Surface Rocks Size/Shape:	2 – 5 cm	**Surface Rocks Cover (%):**	30
Rock Type:	Granite, Quartzite		
Landform	Plains, shallow drainage		
Slope aspect	Gentle slope to SW (direction of drainage lines)		
Vegetation Description	Shrubland mid *A. adsurgens, A. bivenosa*. Mid *Triodia* hummock grassland.		
Condition	Very good		
Disturbances	No evidence, occasional tracks, low grazing.		

Strata	Height (m)	Cover (%)	Species
Midstory	1.8	40	*Acacia adsurgens, A. acradenia, Grevillea wickhamii*
Understorey	0.5	40	*Triodia wiseana, T. lanigera, T. angusta*

Conservation Significant Flora: None

Site: E08	**WP-NW-(E)** 693763	**(N)** 7667849
Date: 15/07/2023	**WP-NE-(E)** 693813	**(N)** 7667850
Botanist: EH	**WP-SE-(E)** 693813	**(N)** 7667799
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 693763	**(N)** 7667800

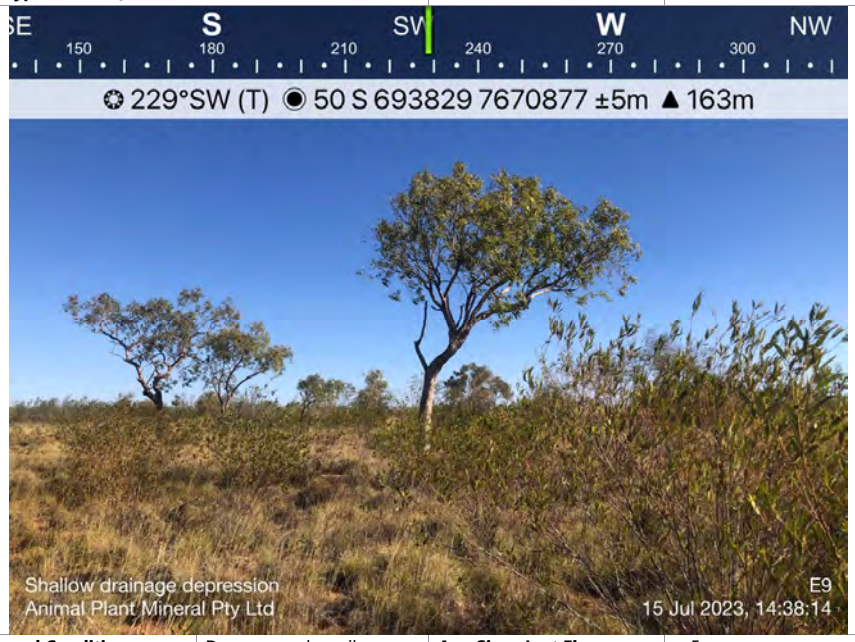


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	2 – 5 cm, Rounded	**Surface Rocks Cover (%):**	20
Rock Type:	Granite, Quartzite		
Landform	Plains with internal drainage, higher rises are stony with spinifex, lower areas are clay, often cracking with annual tussock grass		
Slope aspect	Internally draining but gentle slope to drainage lines		
Vegetation Description	Mid grassland of *Triodia* hummock and mixed annual tussock grasses.		
Condition	Good		
Disturbances	Low intensity grazing, infrequent tracks		

Strata	Height (m)	Cover (%)	Species
Understorey	0.5	60	*Eriachne mucronata, Triodia wiseana, Paspalidium clementii*

Conservation Significant Flora: None

Site: E09	**WP-NW-(E)** 693791	**(N)** 7670863
Date: 15/07/2023	**WP-NE-(E)** 693841	**(N)** 7670863
Botanist: EH	**WP-SE-(E)** 693841	**(N)** 7670813
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 693790	**(N)** 7670804



Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Pale brown
Surface Rocks Size/Shape:	0.5 – 2 cm, Rounded	**Surface Rocks Cover (%):**	25
Rock Type:	Granite, Quartzite		
Landform	Shallow drainage depression on a plain		
Slope aspect	Gently draining to the SE		
Vegetation Description	*Corymbia hamersleyana* low open woodland. *Acacia acradenia, A. inaequilatera, A. adsurgens* open shrubland. *Triodia wiseana* hummock grassland.		
Condition	Very Good		
Disturbances	None evident, occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	5	*Corymbia hamersleyana*
Midstory	1.9	20	*Acacia acradenia, A. inaequilatera, A. adsurgens*
Understorey	0.5	50	*Triodia wiseana*

Conservation Significant Flora: None

Site: E10	**WP-NW-(E)** 695180	**(N)** 7669934
Date: 15/07/2023	**WP-NE-(E)** 695230	**(N)** 7669934
Botanist: EH	**WP-SE-(E)** 695230	**(N)** 7669883
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695179	**(N)** 7669883

Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 5 cm, Rounded	**Surface Rocks Cover (%):**	30
Rock Type:	Ironstone, Quartzite, Calcrete		
Landform	Stony rise. Undulating plains with stony rises of *Triodia* grassland interspersed with drainage depressions of *Acacia* shrubland		
Slope aspect	Toe of rise, no aspect. Gently sloping to depressions.		
Vegetation Description	Sparse, tall shrubland of *Grevillea wickhamii*. Sparse mid shrubland of Acacia. Mid hummock grassland of *Triodia wiseana*.		
Condition	Very good		
Disturbances	Occasional tracks.		

Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	1	*Grevillea wickhamii*
Midstory	1	1	*Acacia acradenia*
Understorey	0.3	70	*Triodia wiseana*

Conservation Significant Flora: None

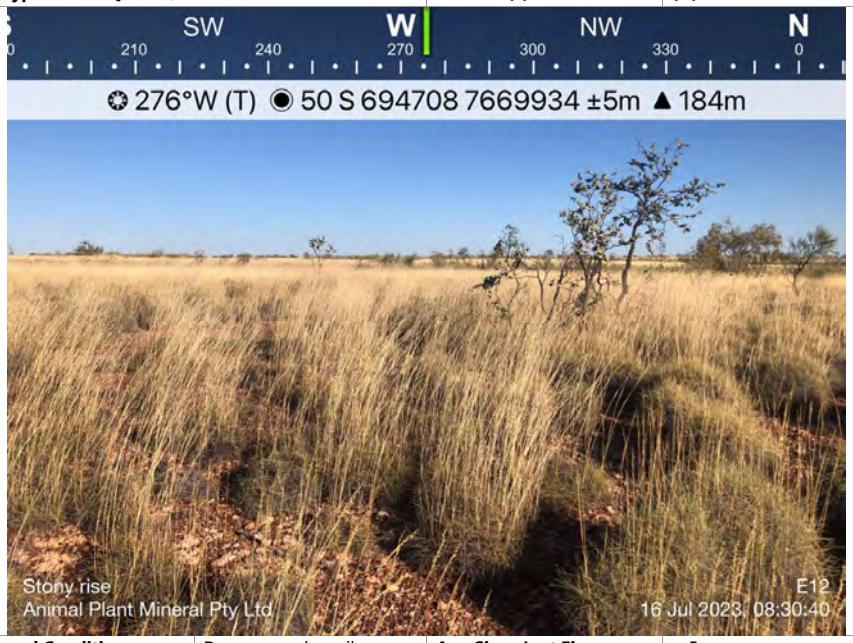
Site: E11	**WP-NW-(E)** 695328	**(N)** 7669656
Date: 16/07/2023	**WP-NE-(E)** 695378	**(N)** 7669655
Botanist: EH	**WP-SE-(E)** 695378	**(N)** 7669605
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695330	**(N)** 7669606

Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy clay loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 5 cm, Angular/Rounded	**Surface Rocks Cover (%):**	30
Rock Type:	Ironstone, Granite, Quartzite		
Landform	Drainage depression. No formed channel, but lower elevation than surrounding plains.		
Slope aspect	Gently sloping to NE (direction of drainage channel)		
Vegetation Description	*Corymbia hamersleyana* low scattered trees. *Acacia adsurgens* mid shrubland. *Triodia epactia* hummock grassland.		
Condition	Very Good		
Disturbances	Moderate intensity cattle grazing, occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	3.5	0.5	*Corymbia hamersleyana*
Midstory	1.9	50	*Acacia adsurgens, Grevillea wickhamii*
Understorey	0.3	40	*Triodia epactia*

Conservation Significant Flora: None

Site: E12	**WP-NW-(E)** 694659	**(N)** 7669978
Date: 16/07/2023	**WP-NE-(E)** 694709	**(N)** 7669978
Botanist: EH	**WP-SE-(E)** 694709	**(N)** 7669929
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 694659	**(N)** 7669927

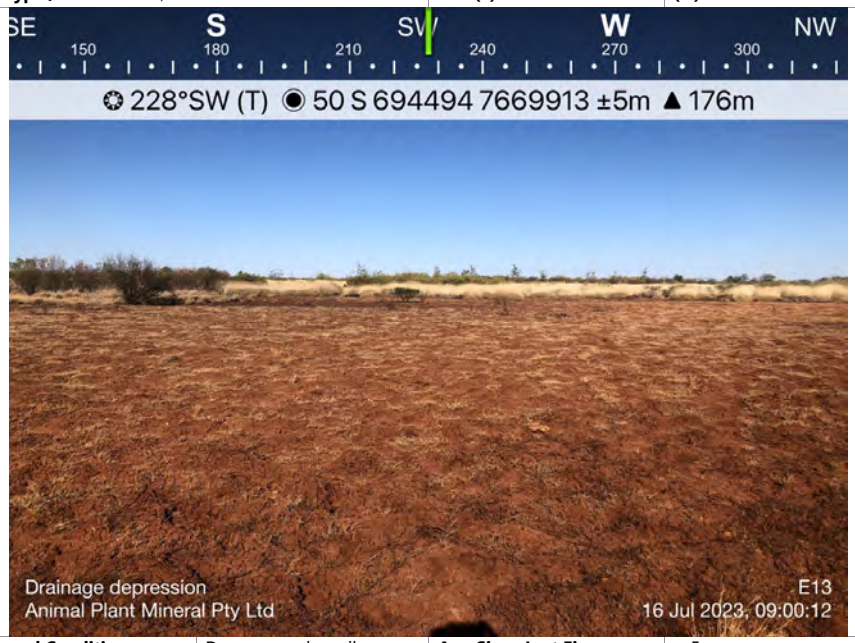


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy clay loam	**Soil Colour:**	Red / Brown
Surface Rocks Size/Shape:	1-5 cm, Rounded / Angular	**Surface Rocks Cover (%):**	50
Rock Type:	Calcrete, Quartzite		
Landform	Stony rise		
Slope aspect	East, towards drainage		
Vegetation Description	Scattered tall *Acacia inaequilatera* shrubs. *Triodia wiseana* hummock grassland.		
Condition	Very Good		
Disturbances	Occasional tracks		

Strata	Height (m)	Cover (%)	Species
Midstory	3	0.1	*Acacia inaequilatera, A. adsurgens, Petalostylis labicheoides*
Understorey	0.4	50	*Triodia wiseana*

Conservation Significant Flora: None

Site: E13	**Date:** 16/07/2023	**Botanist:** EH
Site Type / Size: Releve, 50 x 50 m	**WP-(E)** 694499	**(N)** 7669910

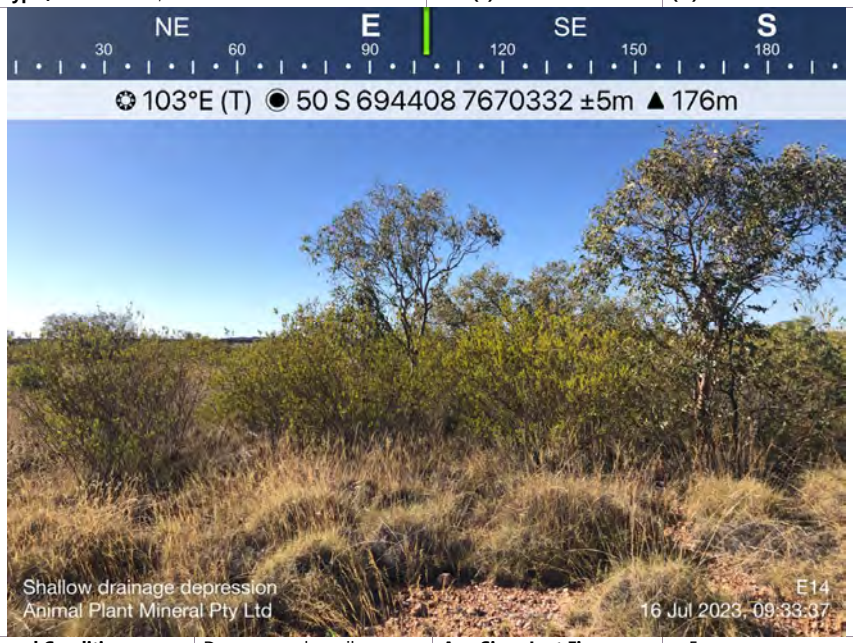


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 3 cm, Rounded	**Surface Rocks Cover (%):**	5
Rock Type:	Ironstone, Quartzite		
Landform	Drainage depression. Seasonally inundated. Poorly drained		
Slope aspect	Flat, internally draining		
Vegetation Description	Herb field of *Eriachne mucronata* and *Cynodon convergens*		
Condition	Good		
Disturbances	Moderate intensity grazing		

Strata	Height (m)	Cover (%)	Species
Understorey	0.1	15	*Eriachne mucronata, Cynodon convergens, Neptunia dimorphantha*

Conservation Significant Flora: None

Site: E14	**Date:** 16/07/2023	**Botanist:** EH
Site Type / Size: Releve, 50 x 50 m	**WP-(E)** 694409	**(N)** 7670329



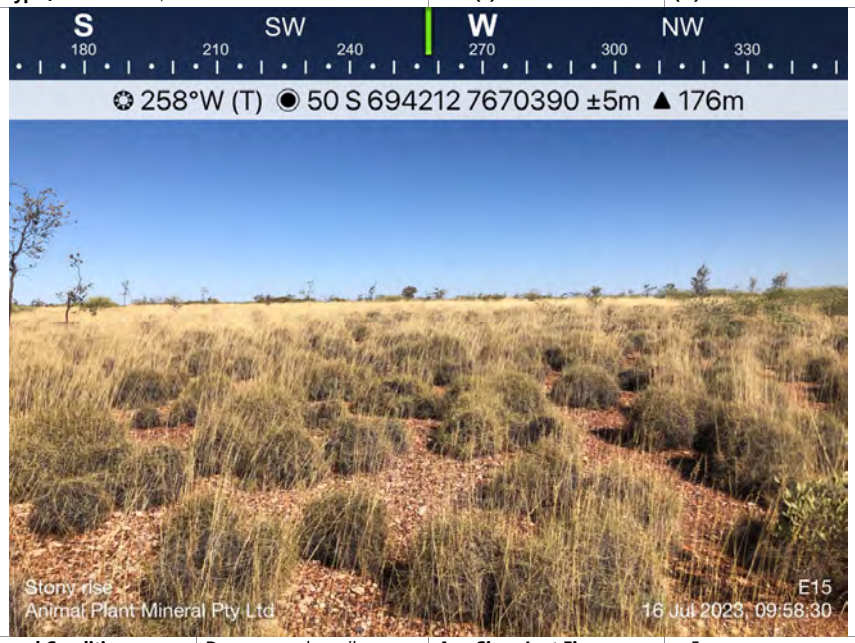
Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy clay loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 5 cm, Angular/Rounded	**Surface Rocks Cover (%):**	30
Rock Type:	Ironstone, Granite, Quartzite		
Landform	Drainage depression		
Slope aspect	Gently sloping in direction of drainage channel		
Vegetation Description	Acacia shrubland with scattered *Corymbia hamersleyana*		
Condition	Very Good		
Disturbances	Grazing		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	2.5	2	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.5	20	*Acacia acradenia, Acacia bivenosa*
Understorey	0.35	50	*Triodia wiseana, T. epactia*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: E15	**Date:** 16/07/2023	**Botanist:** EH
Site Type / Size: Releve, 50 x 50 m	**WP-(E)** 694217	**(N)** 7670390

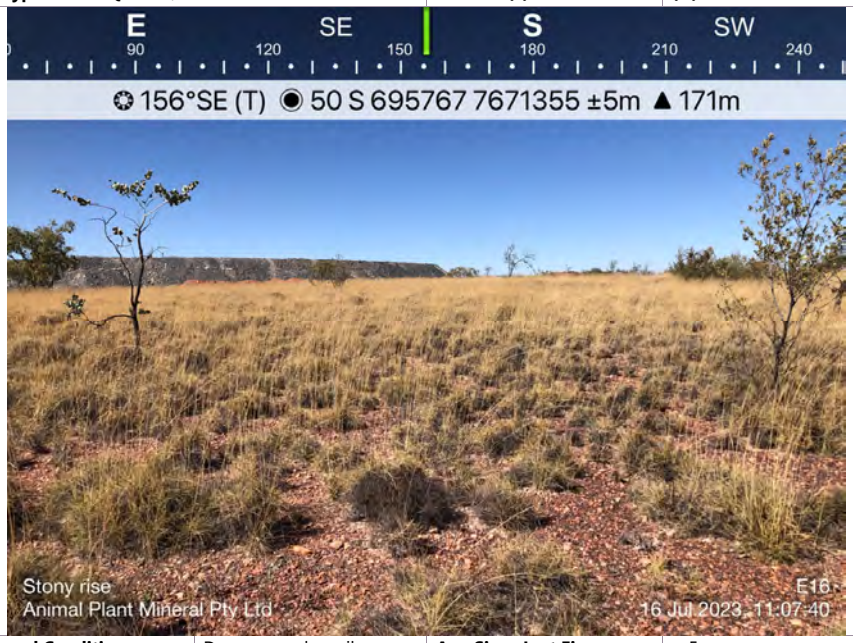


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 3 cm, Rounded	**Surface Rocks Cover (%):**	80
Rock Type:	Quartzite, Ironstone		
Landform	Stony rise		
Slope aspect	N/A		
Vegetation Description	*Triodia wiseana* hummock grassland with scattered *Acacia inaequilatera*		
Condition	Very Good		
Disturbances	None		

Strata	**Height (m)**	**Cover (%)**	**Species**
Overstorey	2.5	0.1	*Acacia inaequilatera*
Midstory	1.5	0.1	*Grevillea wickhamii, Petalostylis labicheoides*
Understorey	0.3	40	*Triodia wiseana*

Conservation Significant Flora: None

Site: E16	**WP-NW-(E)** 695768	**(N)** 7671359
Date: 16/07/2023	**WP-NE-(E)** 695820	**(N)** 7671359
Botanist: EH	**WP-SE-(E)** 695820	**(N)** 7671309
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 695770	**(N)** 7671310



Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 4 cm, Angular	**Surface Rocks Cover (%):**	60
Rock Type:	Ironstone, Quartzite		
Landform	Stony rise		
Slope aspect	N/A		
Vegetation Description	Scattered low *Corymbia hamersleyana*. Scattered tall Acacia shrubs. *Triodia wiseana* hummock grassland		
Condition	Good		
Disturbances	Dust from processing and occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	5	1.5	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	2	0.5	*Acacia adsurgens, A. acradenia, Grevillea wickhamii*
Understorey	0.3	40	*Triodia wiseana*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

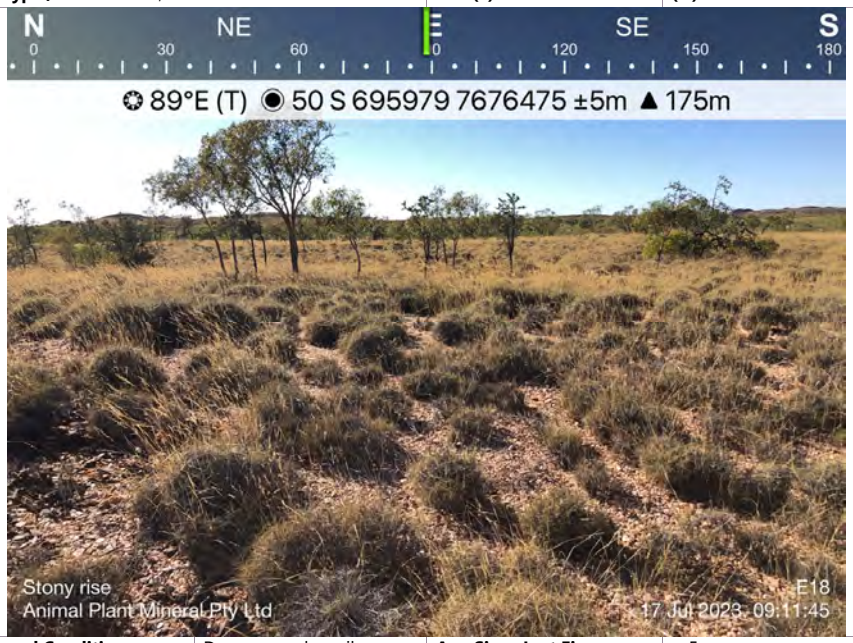
Site: E17	**WP-NW-(E)** 696136	**(N)** 7676436
Date: 17/07/2023	**WP-NE-(E)** 696186	**(N)** 7676437
Botanist: EH	**WP-SE-(E)** 696186	**(N)** 7676386
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 696136	**(N)** 7676386

Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sand	**Soil Colour:**	Red
Surface Rocks Size/Shape:	0.5 – 1 cm, Angular	**Surface Rocks Cover (%):**	5
Rock Type:	Quartzite		
Landform	Shallow drainage depression		
Slope aspect	Gentle slope to north		
Vegetation Description	*Corymbia hamersleyana* open woodland. *Acacia cowleana* open shrubland. *Triodia epactia* hummock grassland.		
Condition	Good		
Disturbances	Moderate grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	5	*Corymbia hamersleyana*
Midstory	1.8	15	*Acacia cowleana*
Understorey	0.4	60	*Triodia epactia. T. wiseana, Chrysopogon fallax*

Conservation Significant Flora: None

Site: E18	**Date:** 17/07/2023	**Botanist:** EH
Site Type / Size: Releve, 50 x 50 m	**WP-(E)** 695979	**(N)** 7676475



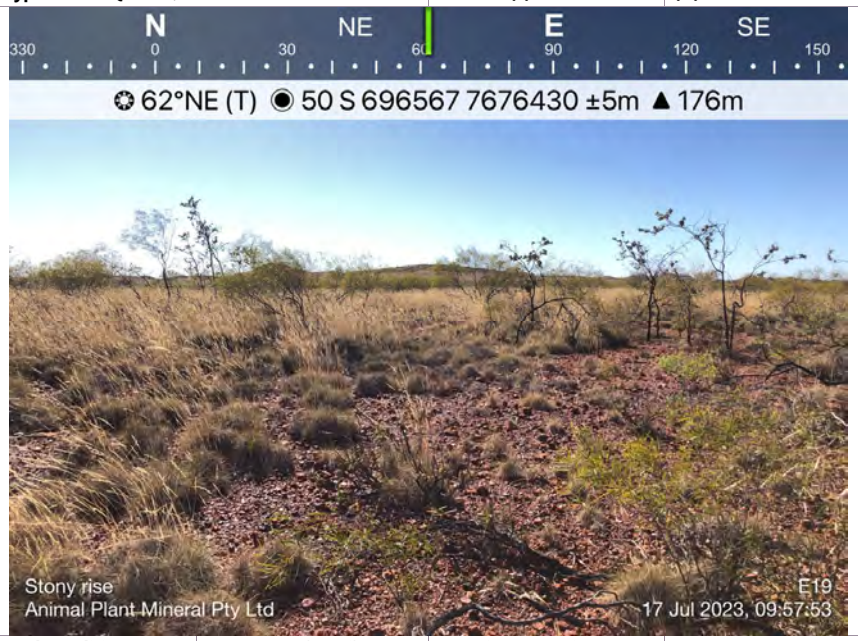
Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	2 – 5 cm, Angular	**Surface Rocks Cover (%):**	60
Rock Type:	Granite, Quartzite, Laterite		
Landform	Stony rise sloping towards North to shallow gully		
Slope aspect	North		
Vegetation Description	*Corymbia hamersleyana* low scattered. *Acacia inaequilatera* tall sparse shrubland. *Triodia wiseana* hummock grassland.		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	1.5	*Corymbia hamersleyana, Acacia inaequilatera*
Midstory	1.5	0.5	*Acacia bivenosa, Acacia maitlandii*
Understorey	0.3	30	*Triodia wiseana, T. chichesterensis*

Conservation Significant Flora: *Triodia chichesterensis* (P3)

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: E19	**WP-NW-(E)** 696560	**(N)** 7676483
Date: 17/07/2023	**WP-NE-(E)** 696610	**(N)** 7676482
Botanist: EH	**WP-SE-(E)** 696610	**(N)** 7676432
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 696560	**(N)** 7676432

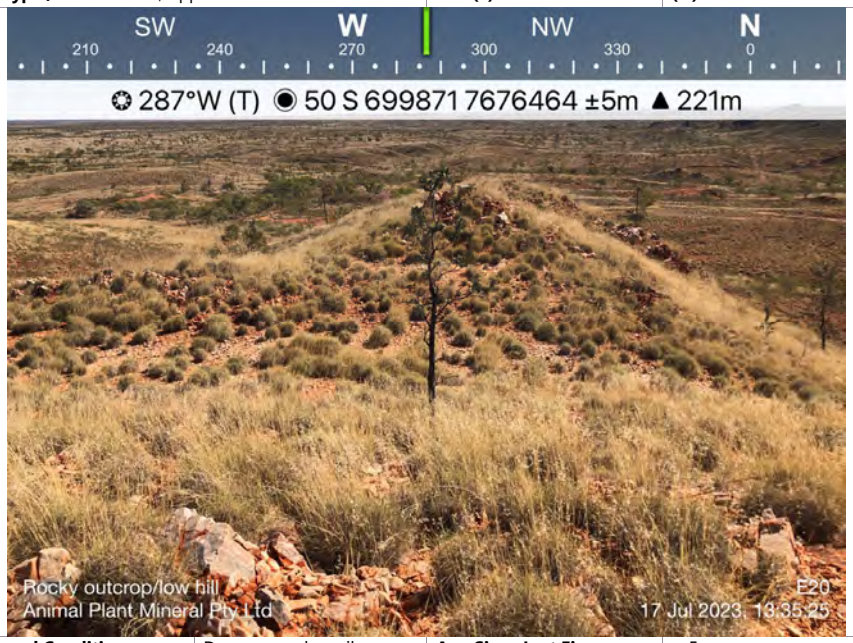


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red brown
Surface Rocks Size/Shape:	1 – 10 cm, Angular	**Surface Rocks Cover (%):**	50
Rock Type:	Ironstone, Granite, Quartzite		
Landform	Stony rise. Lowest rise of a range higher to North		
Slope aspect	Crest and upper slope		
Vegetation Description	Tall sparse shrubland of *Acacia inaequilatera*. Open shrubland of *Acacia adsurgens*. *Triodia wiseana* hummock grassland.		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	3	0.5	*Acacia inaequilatera*
Midstory	1.6	10	*Acacia adsurgens, A. acradenia*
Understorey	0.3	40	*Triodia wiseana, T. lanigera*

Conservation Significant Flora: None

Site: E20	**Date:** 17/07/2023	**Botanist:** EH
Site Type / Size: Releve, Approx 50 x 50 m	**WP-(E)** 699870	**(N)** 7676467



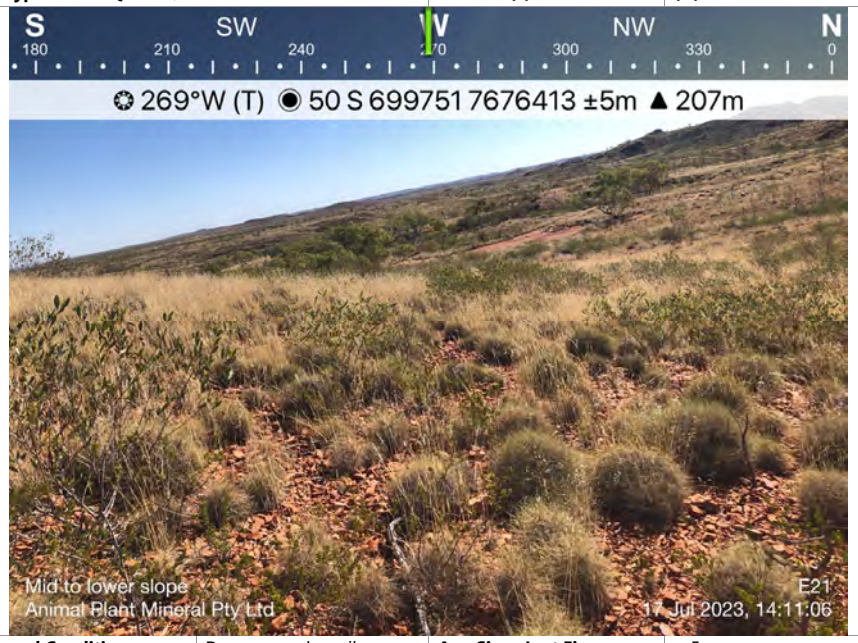
Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Silty loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 20 cm, Blocky / Angular	**Surface Rocks Cover (%):**	70
Rock Type:	Quartzite, Granite		
Landform	Hill crest and upper slopes. Rocky outcrop/low hill.		
Slope aspect	Crest and all upper slopes		
Vegetation Description	Scattered mid *Acacia inaequilatera*, scattered low shrubs of *Acacia. Triodia lanigera* hummock grassland.		
Condition	Excellent		
Disturbances	None		

Strata	Height (m)	Cover (%)	Species
Overstorey	2	0.1	*Acacia inaequilatera*
Midstory	1.5	1.5	*Acacia spondylophylla, Senna artemisioides*
Understorey	0.2	30	*Triodia lanigera*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: E21	**WP-NW-(E)** 699703	**(N)** 7676460
Date: 17/07/2023	**WP-NE-(E)** 699753	**(N)** 7676459
Botanist: EH	**WP-SE-(E)** 699752	**(N)** 7676410
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 699703	**(N)** 7676409

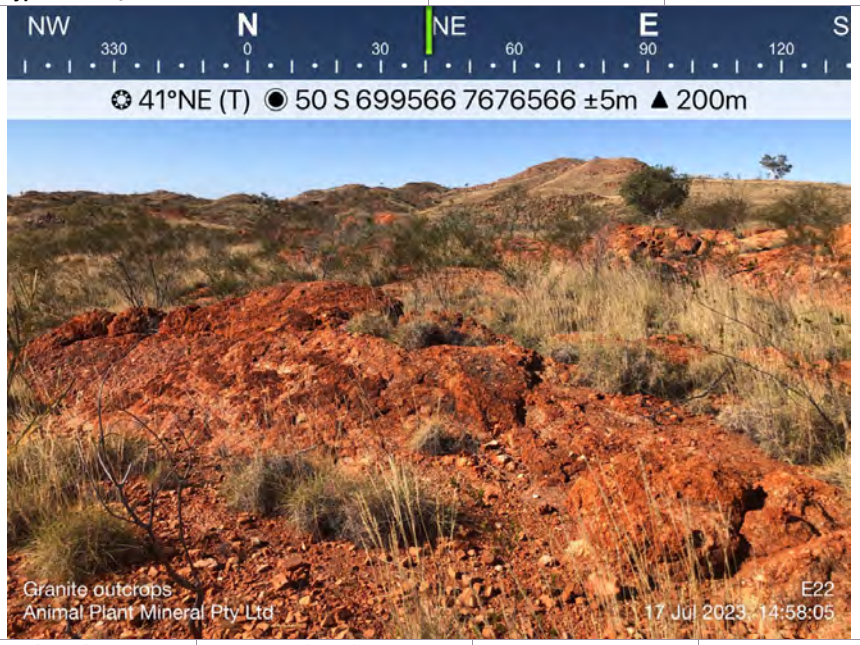


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	4 – 10 cm, Blocky / Platy	**Surface Rocks Cover (%):**	70
Rock Type:	Granite		
Landform	Mid to lower slope of a granite outcrop/low hill.		
Slope aspect	North		
Vegetation Description	Isolated tall *Acacia inaequilatera* shrubs over open mid shrubland of *Acacia acradenia* and *Acacia maitlandii* over *Triodia lanigera* hummock grassland.		
Condition	Very Good		
Disturbances	Low intensity grazing		

Strata	Height (m)	Cover (%)	Species
Overstorey	2	0.05	*Acacia inaequilatera*
Midstory	1	15	*Acacia acradenia , A. maitlandii, A. stellaticeps*
Understorey	0.3	30	*Triodia lanigera*

Conservation Significant Flora:

Site: E22	**WP-NW-(E)** 699558	**(N)** 7676621
Date: 17/07/2023	**WP-NE-(E)** 699608	**(N)** 7676621
Botanist: EH	**WP-SE-(E)** 699608	**(N)** 7676571
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 699559	**(N)** 7676571

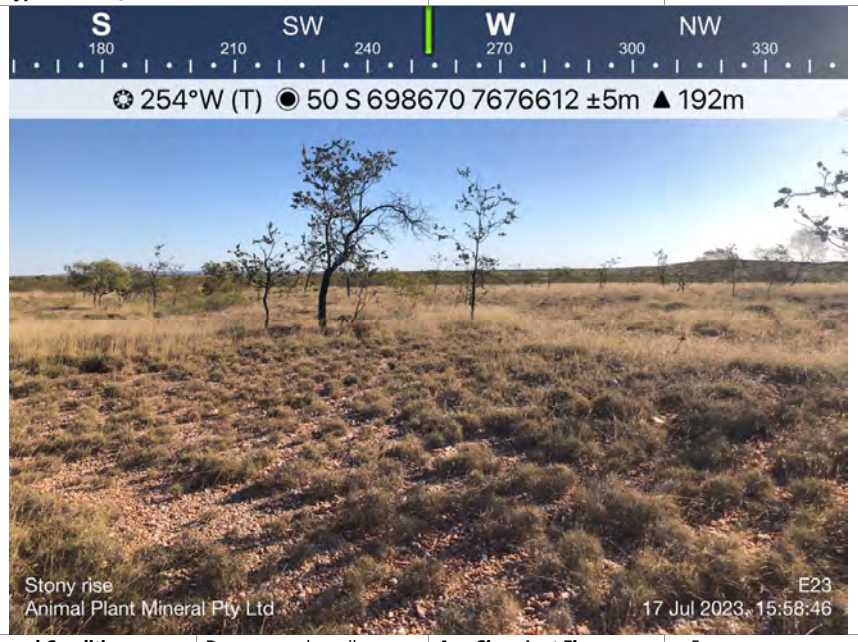


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	2 – 10 cm and 1 – 20 m, Blocky and large Granite boulders	**Surface Rocks Cover (%):**	70
Rock Type:	Granite		
Landform	Granite outcrops on undulating hills/rises		
Slope aspect	North		
Vegetation Description	Scattered low *Corymbia* and *Eucalyptus*. Mid shrubland of *Acacia*. Hummock grassland of *Triodia*		
Condition	Very Good		
Disturbances	Occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	0.1	*Corymbia hamersleyana, Eucalyptus leucophloia*
Midstory	1.8	10	*Acacia adsurgens, A. maitlandii*
Understorey	0.3	30	*Triodia epactia, T. lanigera*

Conservation Significant Flora: None

Site: E23	**WP-NW-(E)** 698621	**(N)** 7676607
Date: 17/07/2023	**WP-NE-(E)** 698671	**(N)** 7676608
Botanist: EH	**WP-SE-(E)** 698671	**(N)** 7676557
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 698621	**(N)** 7676557

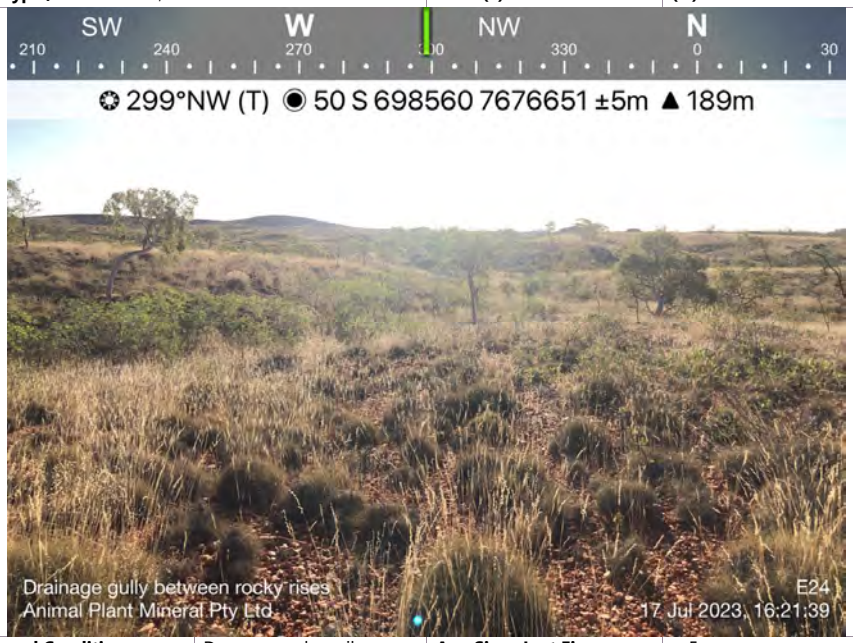


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	2 – 5 cm, Rounded	**Surface Rocks Cover (%):**	60
Rock Type:	Quartzite		
Landform	Stony rise		
Slope aspect	Crest of rise		
Vegetation Description	Tall sparse shrubland of *Acacia inaequilatera*. Sparse mid shrubland of *Acacia acradenia*. Hummock grassland of *Triodia*.		
Condition	Very good		
Disturbances	Occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	3.5	1	*Acacia inaequilatera*
Midstory	1.2	1	*Acacia acradenia*
Understorey	0.15	40	*Triodia chichesterensis, T. wiseana, T. lanigera*

Conservation Significant Flora: *Triodia chichesterensis* (P3)

Site: E24	**Date:** 17/07/2023	**Botanist:** EH
Site Type / Size: Releve, 50 x 50 m	**WP - (E)** 698563	**(N)** 7676658



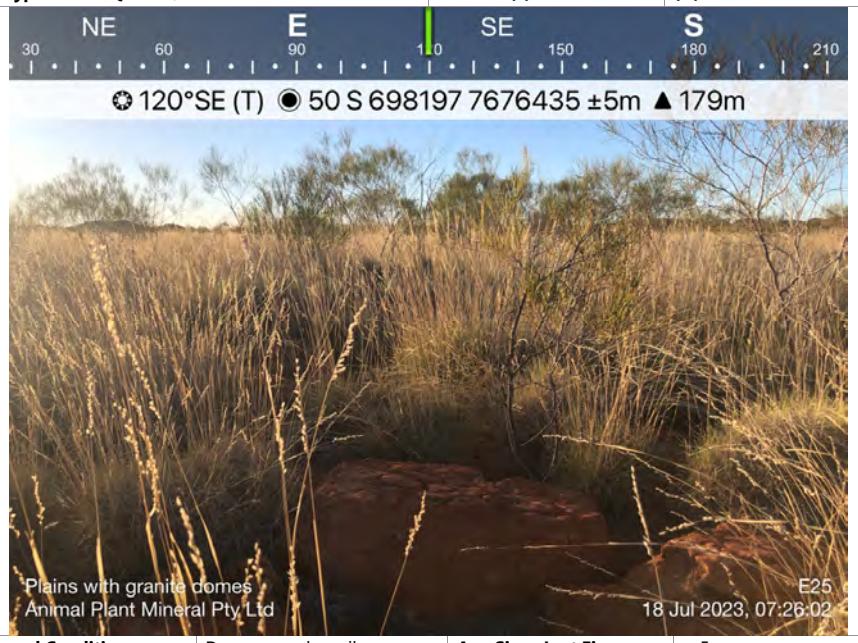
Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	1 – 15 cm, Angular	**Surface Rocks Cover (%):**	50
Rock Type:	Quartzite		
Landform	Drainage gully between rocky rises.		
Slope aspect	West		
Vegetation Description	*Corymbia* and *Eucalyptus* open woodland. *Acacia cowleana* open shrubland. *Triodia lanigera* hummock grassland.		
Condition	Very Good		
Disturbances	Occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	3.5	4	*Corymbia hamersleyana, Eucalyptus leucophloia*
Midstory	1.9	15	*Acacia cowleana, A. inaequilatera, A. adsurgens*
Understorey	0.4	50	*Triodia lanigera,*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: E25	**WP-NW-(E)** 698201	**(N)** 7676448
Date: 18/07/2023	**WP-NE-(E)** 698250	**(N)** 7676447
Botanist: EH	**WP-SE-(E)** 698250	**(N)** 7676398
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 698200	**(N)** 7676397

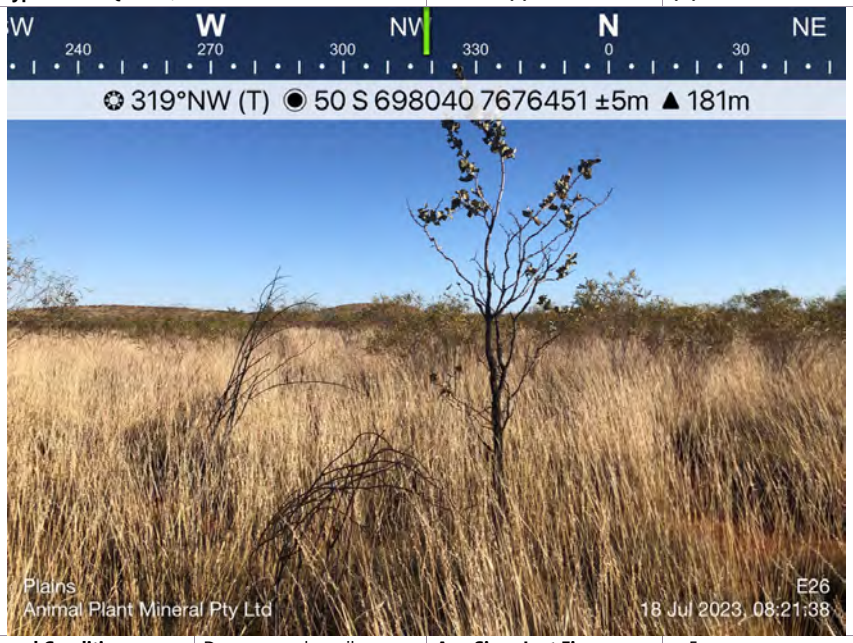


Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay sand	**Soil Colour:**	Red brown
Surface Rocks Size/Shape:	1 cm ironstone pebbles and 1 – 10 m wide granite domes	**Surface Rocks Cover (%):**	30
Rock Type:	Granite, Ironstone		
Landform	Plain with low granite outcropping		
Slope aspect	Gently sloping to South but fairly flat		
Vegetation Description	Tall sparse shrubland of *Acacia adsurgens* Low shrubland of *A. stellaticeps.*		
Condition	Good		
Disturbances	Moderate grazing, occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	10	*Acacia adsurgens*
Midstory	0.8		*Acacia stellaticeps*
Understorey	0.5	60	*Triodia epactia, T. laigera*

Conservation Significant Flora: None

Site: E26	**WP-NW-(E)** 697991	**(N)** 7676503
Date: 18/07/2023	**WP-NE-(E)** 698041	**(N)** 7676504
Botanist: EH	**WP-SE-(E)** 698042	**(N)** 7676453
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 697991	**(N)** 7676454



Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Clay sand	**Soil Colour:**	Red brown
Surface Rocks Size/Shape:	1 cm, Angular	**Surface Rocks Cover (%):**	2
Rock Type:	Ironstone		
Landform	Plain, granite hills to North		
Slope aspect	Gently sloping to South		
Vegetation Description	Scattered tall *Acacia inaequilatera* shrubs. Mid open shrubland of *Acacia acradenia.* Hummock grassland of *Triodia lanigera.*		
Condition	Very Good		
Disturbances	Moderate grazing, occasional tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	0.5	*Acacia inaequilatera*
Midstory	1.7	2	*Acacia acradenia*
Understorey	0.3	65	*Triodia lanigera,*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

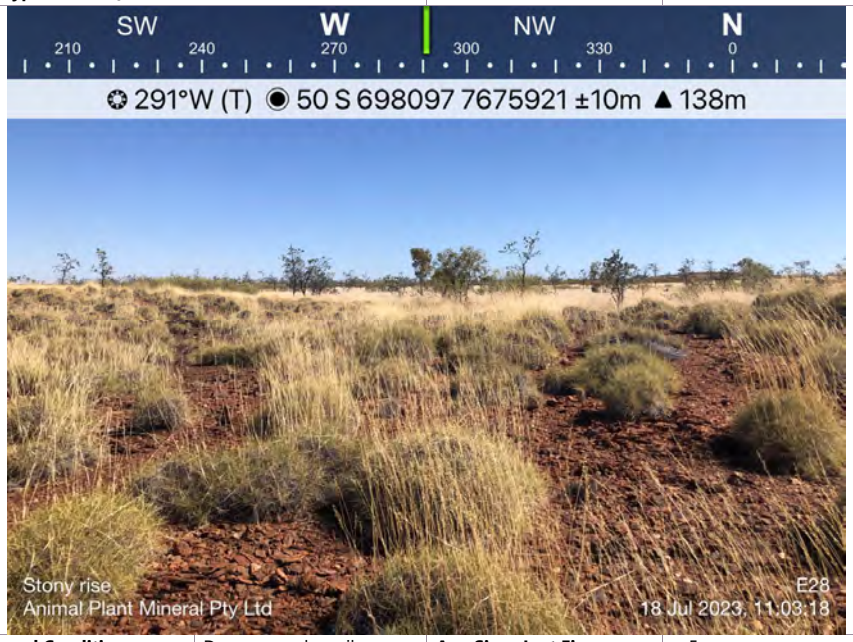
Site: E27	**WP-NW-(E)** 697736	**(N)** 7676482
Date: 18/07/2023	**WP-NE-(E)** 697786	**(N)** 7676481
Botanist: EH	**WP-SE-(E)** 697786	**(N)** 7676432
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 697736	**(N)** 7676432

Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy with gravel	**Soil Colour:**	Red brown
Surface Rocks Size/Shape:	Quartz 5 cm, Granite boulders 10 m wide	**Surface Rocks Cover (%):**	10
Rock Type:	Granite, Quartzite		
Landform	Gully/drainage line between stone rises.		
Slope aspect	Drains to East		
Vegetation Description	Scattered tall *Acacia inaequilatera* shrubs. Mid open shrubland of *Acacia adsurgens.* Hummock grassland of *Triodia wiseana.*		
Condition	Very Good		
Disturbances	Occasional Tracks		

Strata	Height (m)	Cover (%)	Species
Overstorey	4	2	*Corymbia hamersleyana*
Midstory	1.9	30	*Acacdia adsurgens, Indigofera rugosa*
Understorey	0.4	50	*Triodia wiseana. T. epactia*

Conservation Significant Flora: *Triodia chichesterensis* (P3)

Site: E28	**WP-NW-(E)** 698042	**(N)** 7675983
Date: 18/07/2023	**WP-NE-(E)** 698092	**(N)** 7675983
Botanist: EH	**WP-SE-(E)** 698092	**(N)** 7675932
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 698042	**(N)** 7675932



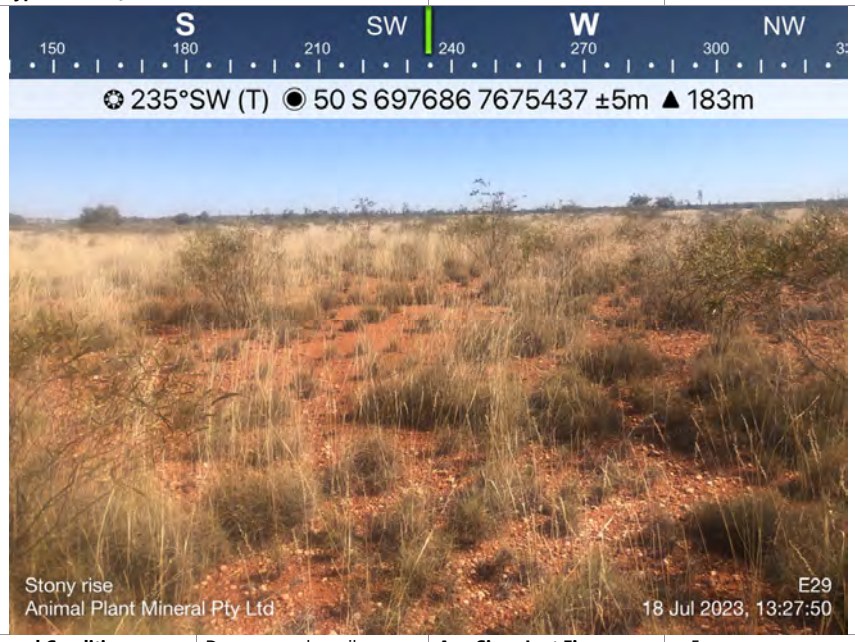
Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Brown
Surface Rocks Size/Shape:	2 – 7 cm, Platy	**Surface Rocks Cover (%):**	60
Rock Type:	Granite		
Landform	Stony rise with a sandy swale behind		
Slope aspect	Crest of rise and swale to north		
Vegetation Description	Low scattered *Corymbia*. Tall sparse *Acacia inaequilatera*. Mid hummock grassland.		
Condition	Very Good		
Disturbances	Moderate grazing, occasional tracks.		

Strata	Height (m)	Cover (%)	Species
Overstorey	2	0.5	*Corymbia hamersleyana*
Midstory	2.2	2	*Acacia inaequilatera, A. acradenia , A. adsurgens*
Understorey	0.3	40	*Triodia wiseana, T. epactia, T. lanigera*

Conservation Significant Flora: None

NVCP Application Area – Biological Survey
Appendix C – Detailed Flora and Vegetation Sites

Site: E29	**WP-NW-(E)** 697635	**(N)** 7675442
Date: 18/07/2023	**WP-NE-(E)** 697685	**(N)** 7675443
Botanist: EH	**WP-SE-(E)** 697686	**(N)** 7675392
Site Type / Size: Quadrat, 50 x 50 m	**WP-SW-(E)** 697634	**(N)** 7675393



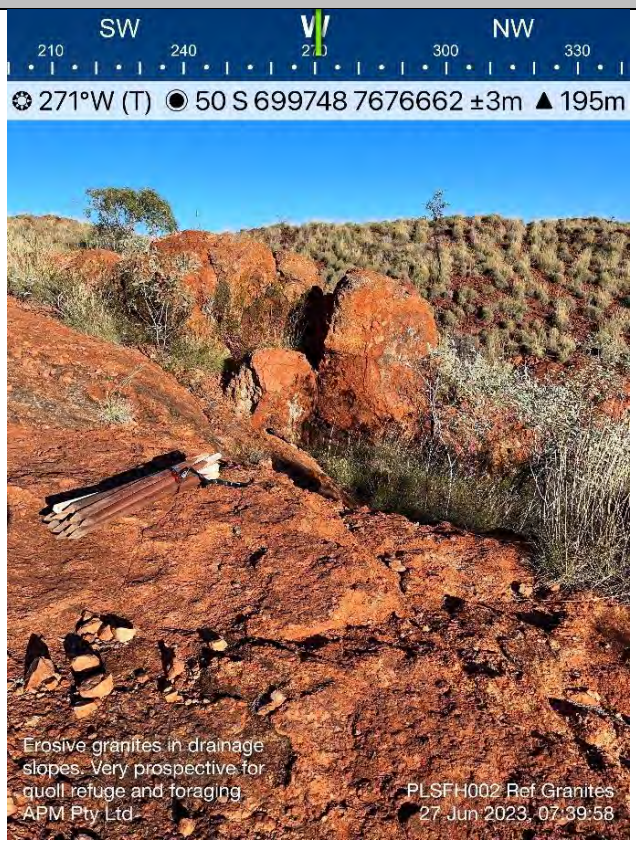
Seasonal Conditions:	Dry season, dry soil.	**Age Since Last Fire:**	> 5 years
Soil Type:	Sandy loam	**Soil Colour:**	Red brown
Surface Rocks Size/Shape:	1 – 4 cm, Angular	**Surface Rocks Cover (%):**	20
Rock Type:	Granite, Quartzite		
Landform	Plain, slight stony rise		
Slope aspect	Flat		
Vegetation Description	Scattered *Acacia inaequilatera* tall shrubs. Sparse *Acacia adsurgens* mid shrubs. *Triodia lanigera* mid hummock grassland.		
Condition	Very Good		
Disturbances	Moderate grazing, occasional tracks		

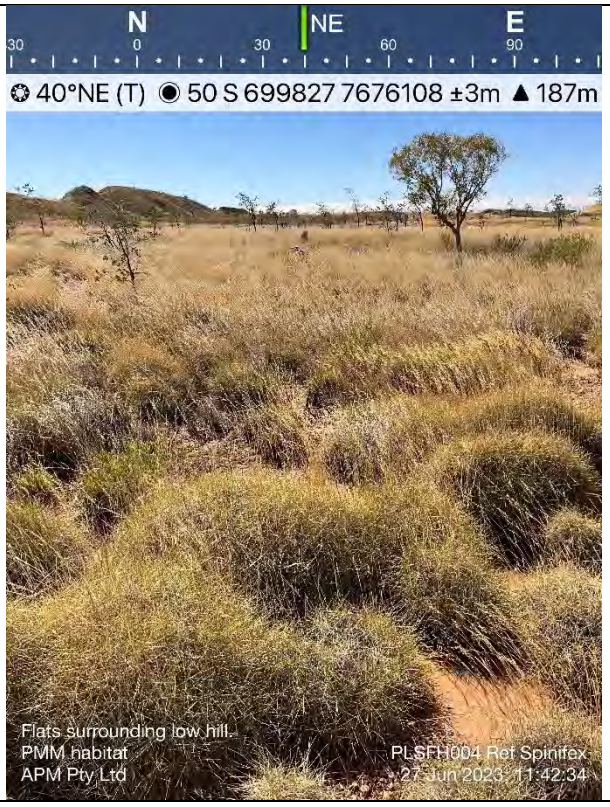
Strata	Height (m)	Cover (%)	Species
Overstorey	2.5	0.2	*Acacia inaequilatera*
Midstory	1.2	3	*Acacdia adsurgens, A. bivenosa*
Understorey	0.3	40	*Triodia lanigera*

Conservation Significant Flora: None

APPENDIX D: FAUNA HABITAT PHOTOS

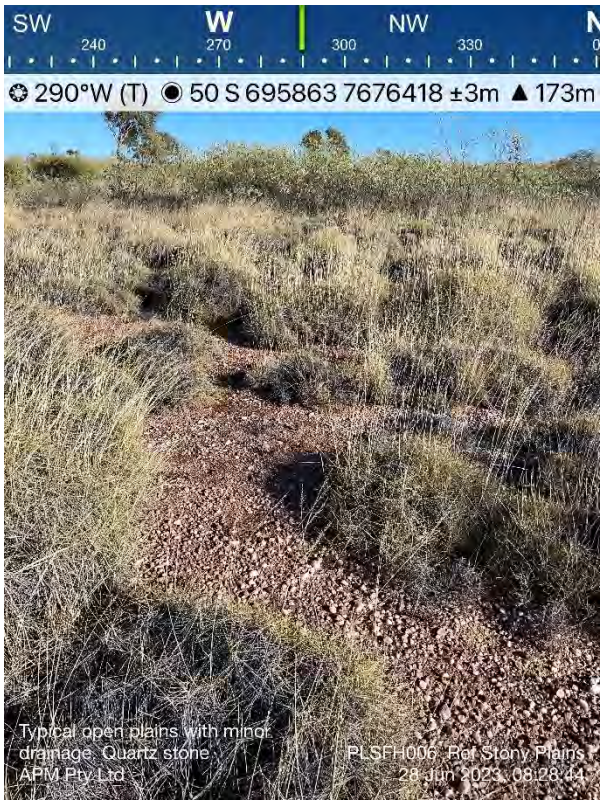
Fauna Habitat Assessment Locations





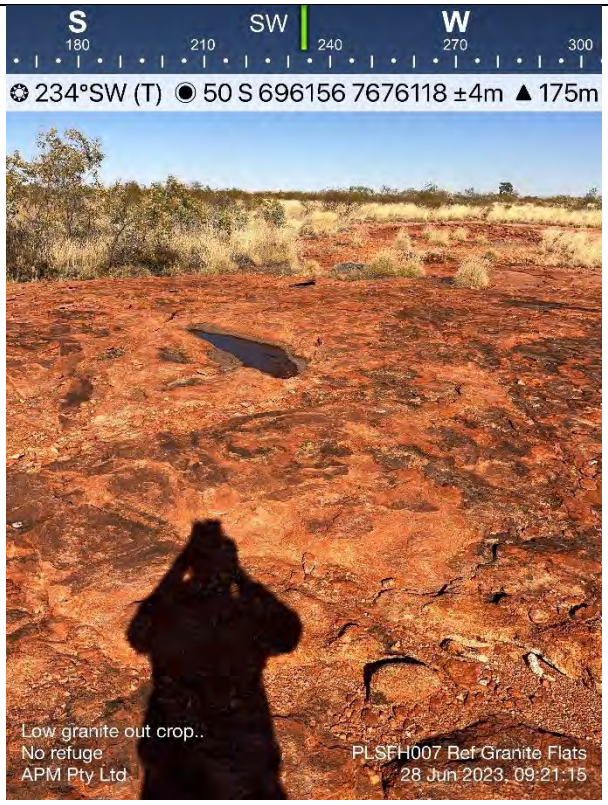

N
NE
E
0
0
30
60
90
42°NE (T) 50 S 699209 7676484 ±3m 189m
Rolling low hill. Marginal PMM habitat
APM Pty Ltd
PLSFH005 Ref
27 Jun 2023, 12:41:21

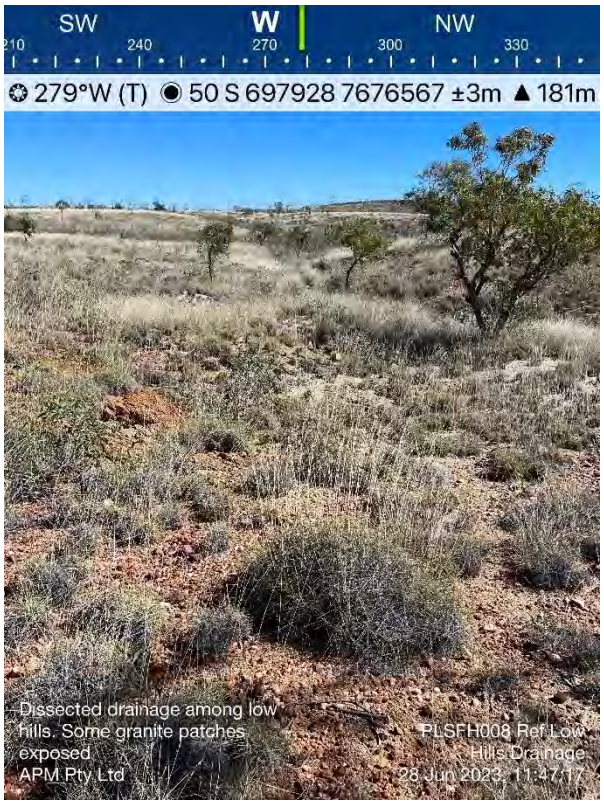

SE
S
SW
120
150
180
210
240
178°S (T) 50 S 696122 7676579 ±4m 169m
Typical open stony plains. Quartz with minor drainage
APM Pty Ltd
PLSFH006 Ref Stony open plains
28 Jun 2023, 08:45:51


SW
W
NW
240
270
300
330
290°W (T) 50 S 695863 7676418 ±3m 173m
Typical open plains with minor drainage. Quartz stone
APM Pty Ltd
PLSFH006 Ref Stony Plains
28 Jun 2023, 08:28:44


SE
S
SW
120
150
180
210
240
187°S (T) 50 S 696923 7675838 ±3m 174m
Typical open sandy gravel plains of spinifex and acacia with minor drainage
APM Pty Ltd
PLSFH006 gravelly open plains
28 Jun 2023, 09:50:56

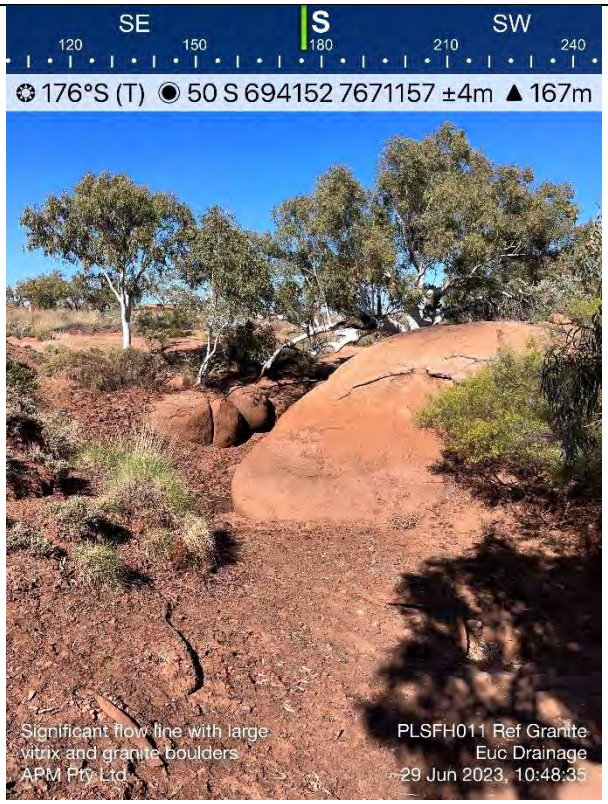

SW
W
NW
10
240
270
300
330
280°W (T) 50 S 693661 7666726 ±3m ▲170m
Spinifex on clay loam soils
Buffel grass
APM Pty Ltd
PLS FH006b Ref Spinifex treed plain
30 Jun 2023, 08:28:32


S
SW
W
180
210
240
270
300
234°SW (T) 50 S 696156 7676118 ±4m ▲175m
Low granite out crop..
No refuge
APM Pty Ltd
PLSFH007 Ref Granite Flats
28 Jun 2023, 09:21:15

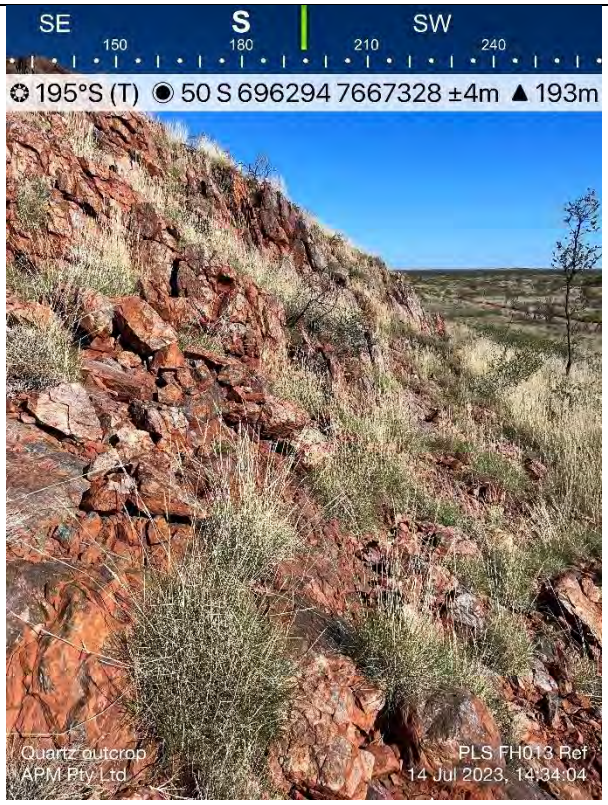

SW W NW
210 240 270 300 330
279°W (T) 50 S 697928 7676567 ±3m 181m
Dissected drainage among low hills. Some granite patches exposed
APM Pty Ltd
PLSFH008 Ref Low Hills Drainage
28 Jun 2023, 11:47:17


S SW W
180 210 240 270 300
232°SW (T) 50 S 698018 7675810 ±3m 178m
Minor drainage and surrounding depression very clayey
APM Pty Ltd
PLSFH009 Ref Flood out
29 Jun 2023, 07:23:50

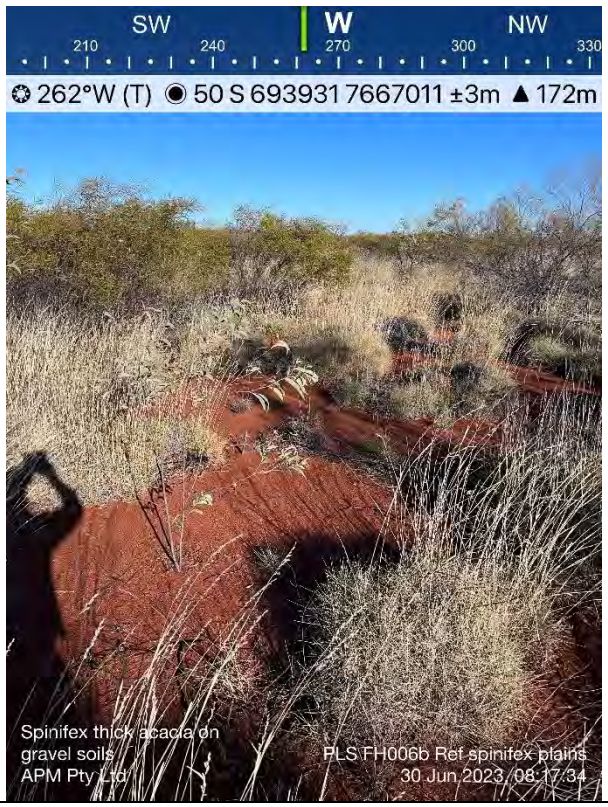

S SW W
180 210 240 270
221°SW (T) 50 S 698898 7676511 ±3m 187m
Intermediate between FH006 and 004
APM Pty Ltd
PLSFH010 Ref Rolling flats
29 Jun 2023, 06:39:11

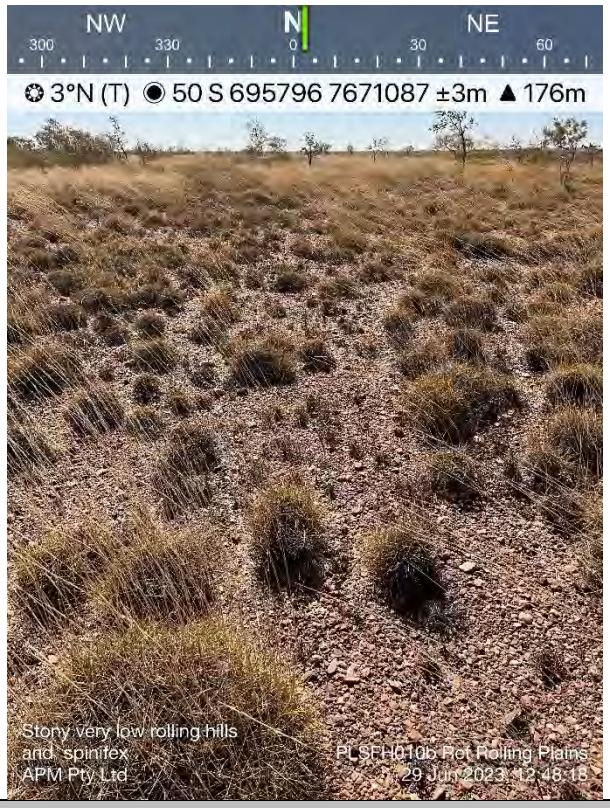

SE S SW
120 150 180 210 240
176°S (T) 50 S 694152 7671157 ±4m 167m
Significant flow line with large vitrix and granite boulders
APM Pty Ltd
PLSFH011 Ref Granite Euc Drainage
29 Jun 2023, 10:48:35


SE
S
SW
120
150
180
210
240
181°S (T) 50 S 693953 7670850 ±4m 164m
Spinifex on deep clay soils with stones and gravel. Subject to inhinfation in parts.
APM Pty Ltd
PLS FH012 Ref
Spinifex Floodplain
30 Jun 2023, 06:53:49

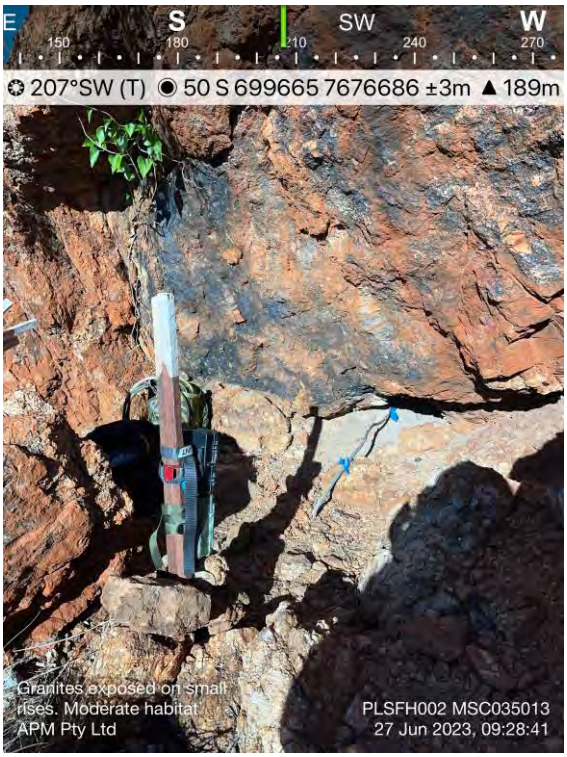

SE
S
SW
150
180
210
240
195°S (T) 50 S 696294 7667328 ±4m 193m
Quartz outcrop
APM Pty Ltd
PLS FH013 Ref
14 Jul 2023, 14:34:04

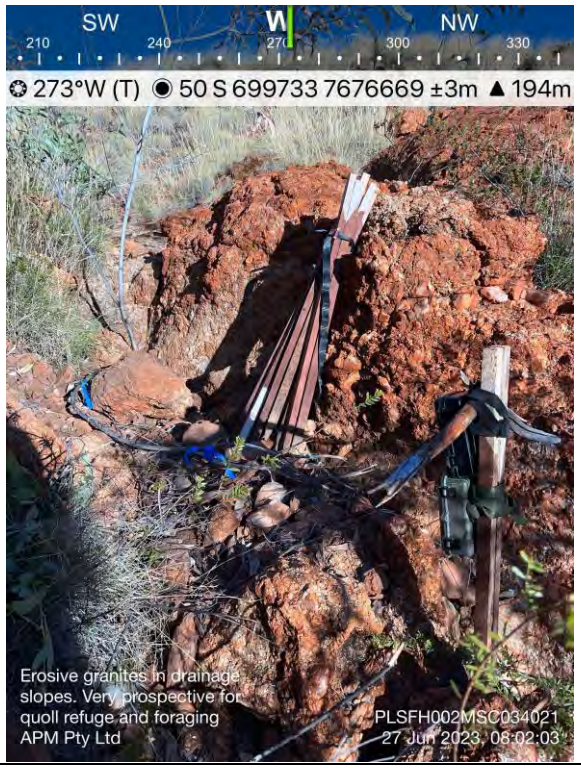

W
NW
N
240
270
300
330
0
306°NW (T) 50 S 696188 7667250 ±4m 185m
Giant clay pan devoid of vege
APM Pty Ltd
PLS FH014 Giant Clay Pan
15 Jul 2023, 09:37:51

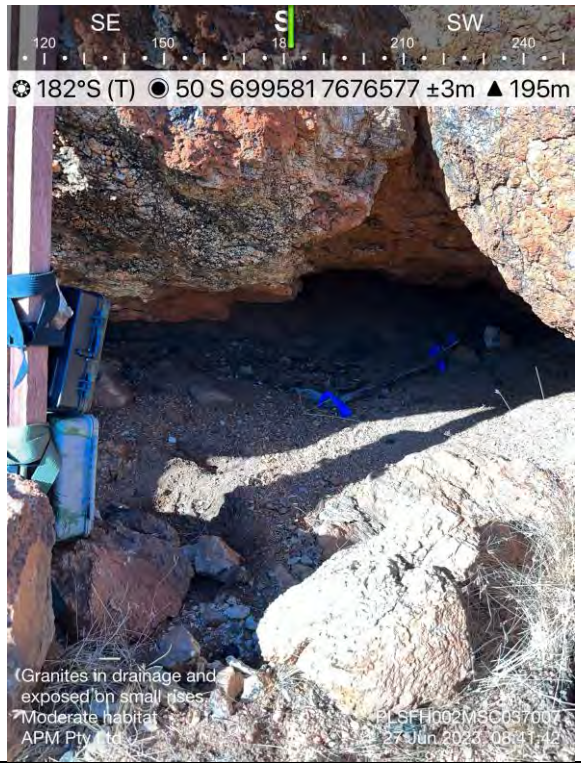

SW
W
NW
210
240
270
300
330
262°W (T) 50 S 693931 7667011 ±3m 172m
Spinifex thick acacia on gravel soils
APM Pty Ltd
PLS FH006b Ref spinifex plains
30 Jun 2023, 08:17:34



Camera Trap Locations



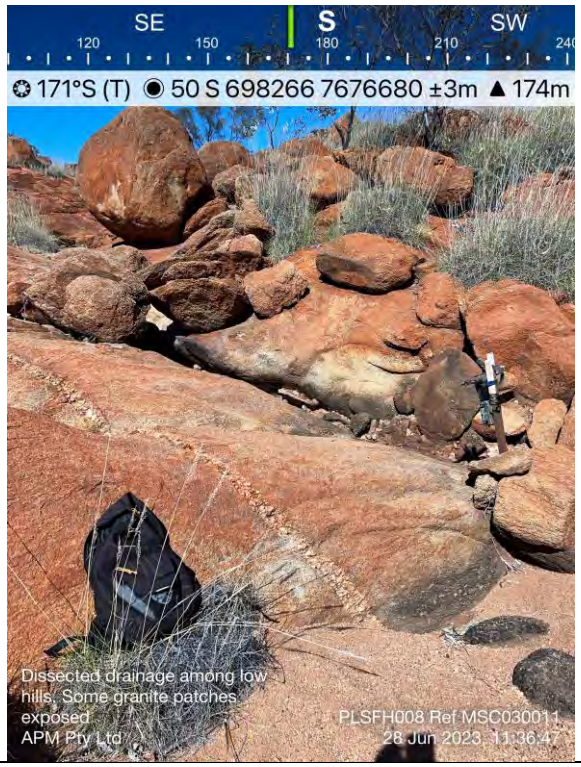


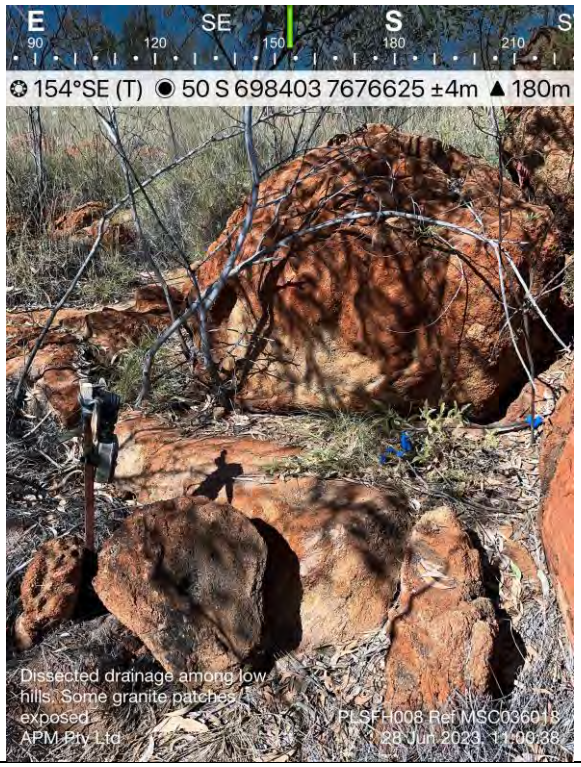

SE S SW
120 150 180 210 240
182°S (T) 50 S 699581 7676577 ±3m ▲195m
Granites in drainage and exposed on small rises. Moderate habitat
APM Pty Ltd
PLSFH002 MSC031007
27 Jun 2023, 08:41:42

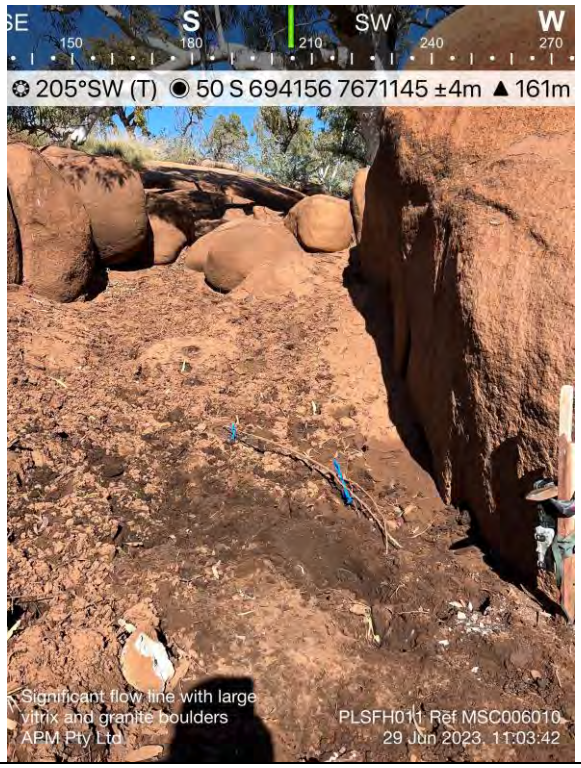

NW N NE
300 330 0 30 60
351°N (T) 50 S 699468 7676509 ±4m ▲187m
Artificial dam wall
APM Pty Ltd
PLSFH003 MSC032020
27 Jun 2023, 10:59:37


E SE S
60 90 120 150 180
121°SE (T) 50 S 697597 7675798 ±3m ▲176m
Typical open plains with minor drainage. Stony loams
APM Pty Ltd
PLSFH006 Ref MSC031021x
28 Jun 2023, 07:01:21


SE S SW
120 150 180 210
168°S (T) 50 S 698184 7676016 ±3m ▲181m
Open plains with minor drainage
APM Pty Ltd
PLSFH006 Ref MSC033009
29 Jun 2023, 07:16:32

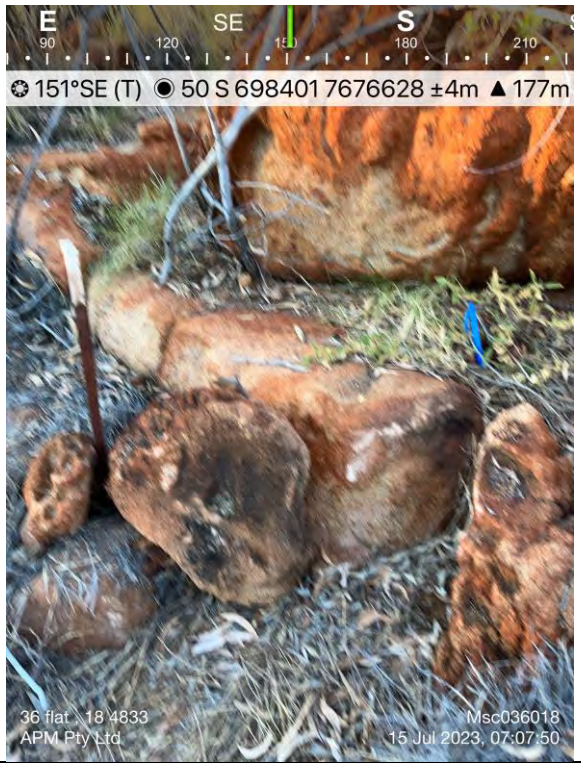

SE
S
SW
120
150
180
210
171°S (T) 50 S 698266 7676680 ±3m ▲174m
Dissected drainage among low hills. Some granite patches exposed
APM Pty Ltd
PLSFH008 Ref MSC030011
28 Jun 2023, 11:36:47


E
SE
S
90
120
150
180
210
154°SE (T) 50 S 698403 7676625 ±4m ▲180m
Dissected drainage among low hills. Some granite patches exposed
APM Pty Ltd
PLSFH008 Ref MSC030018
28 Jun 2023, 11:00:38

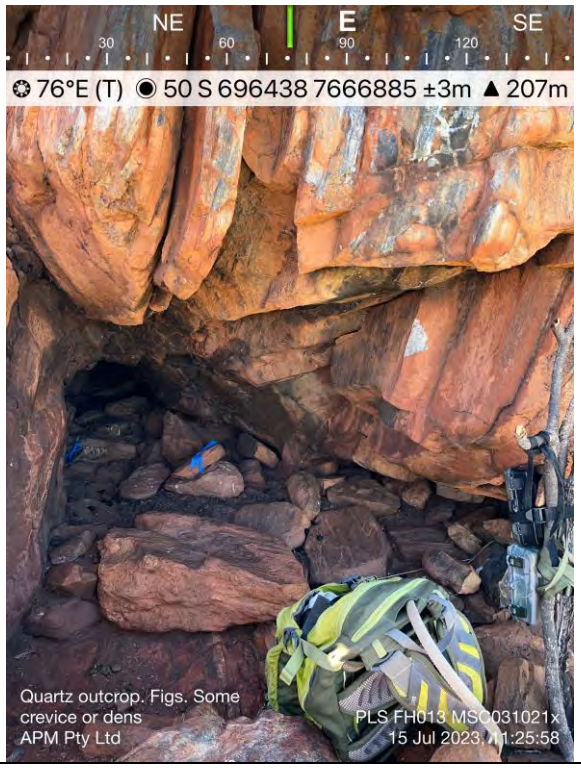

S
SW
W
150
180
210
240
270
205°SW (T) 50 S 694156 7671145 ±4m ▲161m
Significant flow line with large vitrix and granite boulders
APM Pty Ltd
PLSFH011 Ref MSC006010
29 Jun 2023, 11:03:42

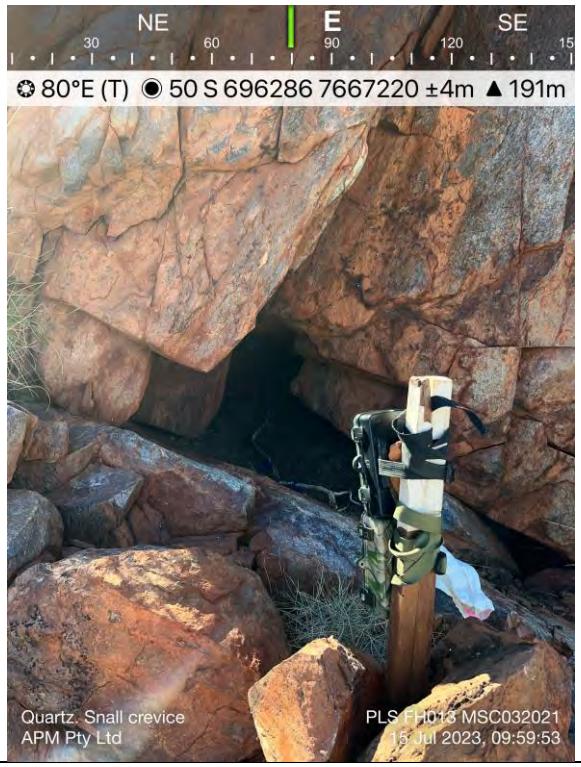

NW
N
NE
300
330
0
30
60
353°N (T) 50 S 697432 7672024 ±9222m ▲170m
Granite extrusions in drainage line
APM Pty Ltd
PLSFH011 Ref MSC016014
29 Jun 2023, 15:09:06

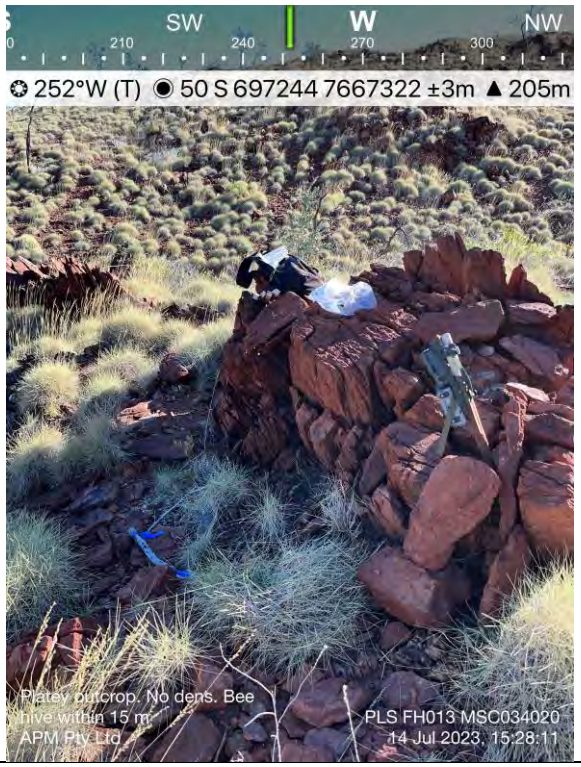

SE
S
SW
120
150
180
210
167°S (T) 50 S 698263 7676677 ±4m ▲175m
30 flat, 011 4829
APM Pty Ltd
Msc03013
15 Jul 2023, 07:17:24


E
SE
S
90
120
180
210
151°SE (T) 50 S 698401 7676628 ±4m ▲177m
36 flat, 18 4833
APM Pty Ltd
Msc036018
15 Jul 2023, 07:07:50

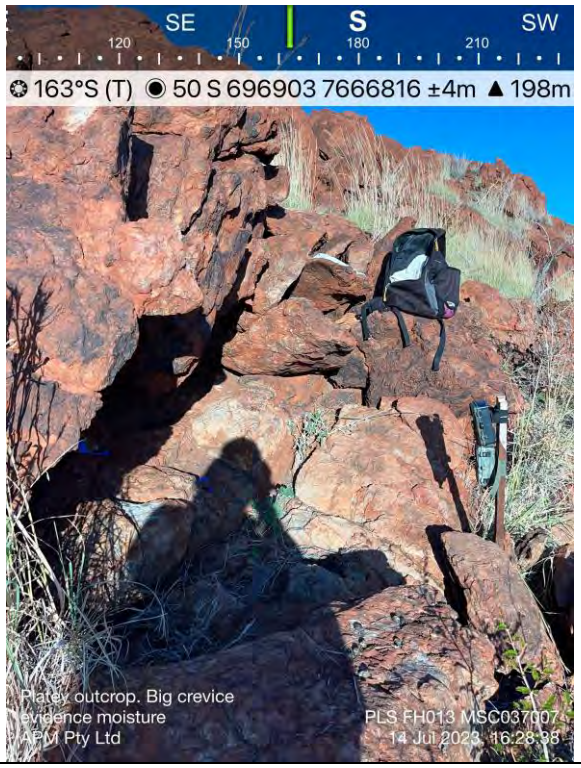

NE
E
SE
30
60
90
120
72°E (T) 50 S 694291 7667311 ±4m ▲176m
Spinifex floodplain cracking clay sumps
APM Pty Ltd
PLS FH012 Ref MSC033009
15 Jul 2023, 16:07:01


NE
E
SE
30
60
90
120
76°E (T) 50 S 696438 7666885 ±3m ▲207m
Quartz outcrop. Figs. Some crevice or dens
APM Pty Ltd
PLS FH013 MSC031021x
15 Jul 2023, 11:25:58

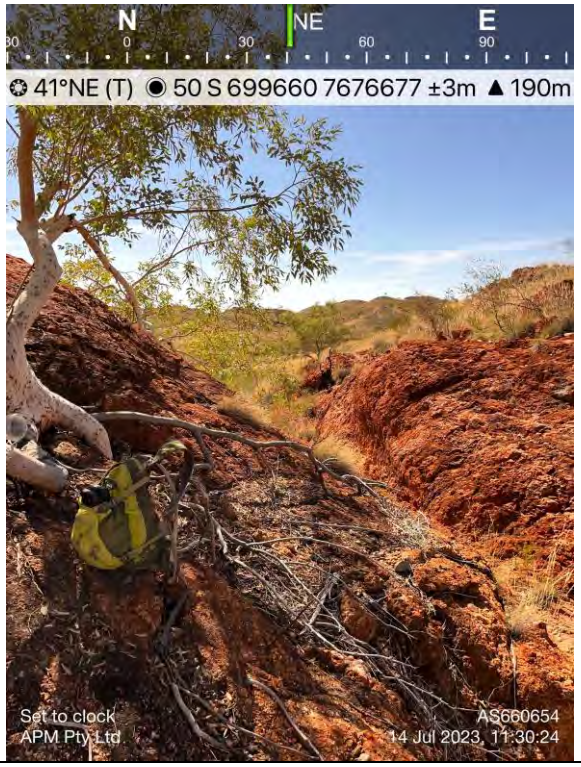

NE E SE
80°E (T) 50 S 696286 7667220 ±4m ▲191m
Quartz. Snall crevice
APM Pty Ltd
PLS FH013 MSC032021
15 Jul 2023, 09:59:53

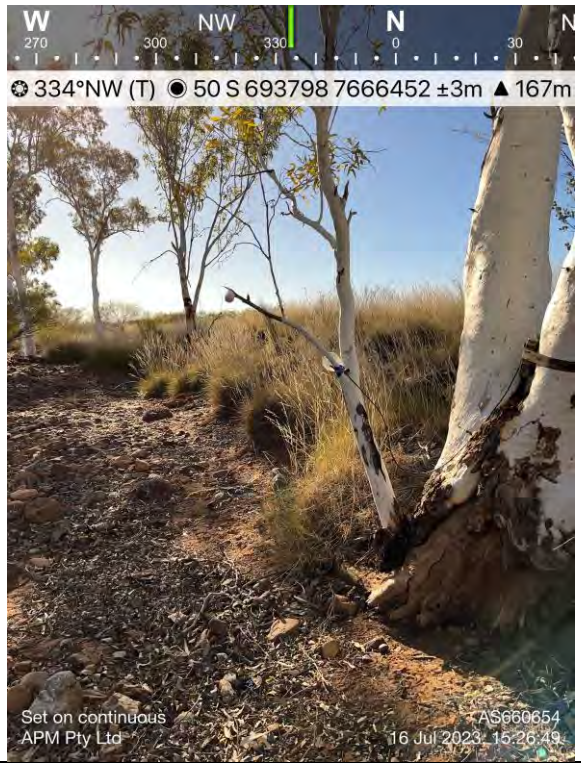

SW W NW
252°W (T) 50 S 697244 7667322 ±3m ▲205m
Platey outcrop. No dens. Bee
hive within 15 m
APM Pty Ltd
PLS FH013 MSC034020
14 Jul 2023, 15:28:11

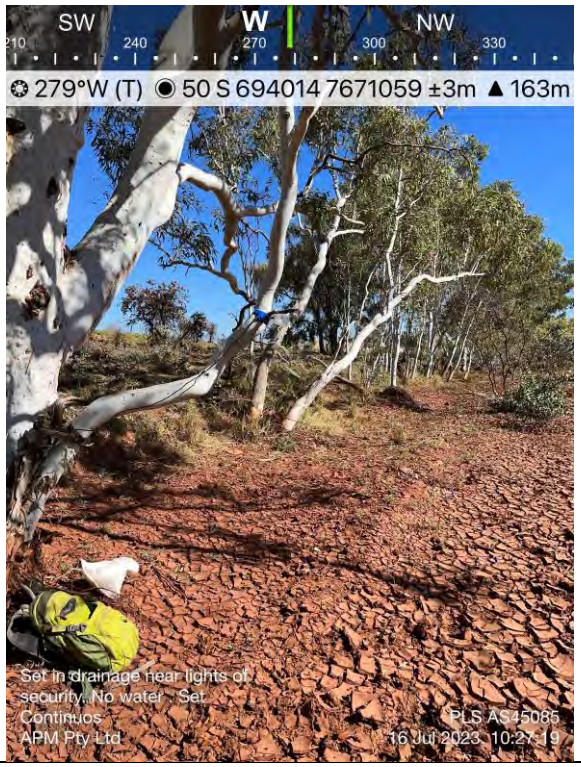

SW W NW
281°W (T) 50 S 696918 7666788 ±3m ▲194m
Platey outcrop. Big crevice
evidence moisture
APM Pty Ltd
PLS FH013 MSC035013
14 Jul 2023, 16:00:10


SE S SW
163°S (T) 50 S 696903 7666816 ±4m ▲198m
Platey outcrop. Big crevice
evidence moisture
APM Pty Ltd
PLS FH013 MSC037007
14 Jul 2023, 16:28:38

Acoustic Bat Detector Locations




W NW N
270 300 330 0 30
334°NW (T) 50 S 693798 7666452 ±3m ▲167m
Set on continuous
APM Pty Ltd
AS660654
16 Jul 2023, 15:26:49


SW W NW
210 240 270 300 330
279°W (T) 50 S 694014 7671059 ±3m ▲163m
Set in drainage near lights of security. No water. Set
Continuos
APM Pty Ltd
PLS AS 45085
16 Jul 2023, 10:27:19

APPENDIX E: SPECIALISED ZOOLOGICAL TECHNICAL REPORT

Acoustic analysis and bat call identification from the NVCP Application Area, Western Australia: July 2023

Prepared for **Animal Plant Mineral Pty Ltd**

Version **3 October 2023**

SZ project reference **SZ703**

Prepared by **Dr Kyle Armstrong and Yuki Konishi**

Specialised Zoological ABN 92 265 437 422
Tel +61 (0)404 423 264
kyle.n.armstrong@gmail.com

This report should be included as an appendix in any larger submission to Government, and cited as:

Specialised Zoological (2023). Acoustic analysis and bat call identification from the NVCP Application Area, Western Australia: July 2023. Unpublished report by Specialised Zoological for Animal Plant Mineral Pty Ltd, 3 October 2023, project reference SZ703.

Summary

The outcome is provided of the analysis of acoustic (bat detector) recordings made in July 2023 in the NVCP Application Area, located in the Pilbara region of Western Australia.

The scope of the analysis was limited to the detection of the Threatened-listed Ghost Bat *Macroderma gigas* (Megadermatidae) and Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (Rhinonycteridae).

The recording dataset comprised a total of 49 recording nights from five bat detector units placed at five recording sites (**Table 1**; **Figure 1**). Note that two bat detector units provided by Specialised Zoological had a technical issue that truncated the recordings, and all recordings in the first half of July were problematic.

Acoustic processing of the bat detector recordings was conducted separately for each of the two target bat species using methods optimised for the detection of their unique echolocation call types.

A total of 21 echolocation call sequences of the Pilbara Leaf-nosed Bat were detected at three separate recording sites (**Table 2**; **Figures 1** and **2**).

The detection of echolocation call sequences well after sunset and well before sunrise, and away from areas of rocky outcrop containing deep caves, is indicative of individuals of this species out foraging away from a diurnal roost.

No calls of the Ghost Bat were observed in the recordings.

Further information is available should verification be required.

Methods

The data provided were recorded in full spectrum WAV format with Titley Scientific Anabat Swift bat detectors (sampling rate 500 kHz, set to record between sunset and sunrise).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong et al. 2021a,b) was applied to the recordings made on the survey. Firstly, the WAV files were scanned in the software SCAN'R version 1.8.3 (Binary Acoustic Technology) for bat echolocation calls using a parameter set optimised for the detection of each of the two target species. This process provides measurements (SCAN'R parameters) from each putative pulse of the target species. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be attributed to the two target species. This was done in two ways.

First, all WAV files containing putative calls of the Pilbara Leaf-nosed Bat were inspected in Adobe Audition version 23.1 software, and listings of files containing false positive identifications were discarded. Custom R language scripts assisted with summarisation of the remaining data, and the calculation of times of first detection after sunset and last detection before sunrise.

Second, a custom [R] language 'shiny' app was used to aid recognition of the calls of the Ghost Bat. The app assisted with three tasks:

1. Performed a Discriminant Function Analysis on training data from representative calls from cave-roosting bats in the Pilbara;
2. From the measurements of each putative Ghost Bat echolocation pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the signal types derived from the analysis of training data, and plotted these resulting coordinates over confidence regions for the defined signal types; and
3. Facilitated an inspection in a spectrogram of chosen examples of interest (within the confidence region for Ghost Bat calls) for each recording night by opening the original WAV files in Adobe Audition version 23.1.

Species were identified based on information in Armstrong and Coles (2007) and the author's own unpublished material.

Limitations

The identifications presented in this report have been made within the following context:

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of two target bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was set up and supplied by Specialised Zoological. The equipment was operated by the third party on the survey.

4. Specialised Zoological has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
8. The most reliable way of detecting the Ghost Bat with bat detectors is to place the equipment with the microphone facing into a potential cave roosting site. The echolocation calls of this species are of low amplitude, and therefore most detectable when a Ghost Bat flies close to the bat detector as it exits the underground structure. If there is uncertainty about whether Ghost Bats are present in a cave, then video recordings can be a useful addition to the survey. The detection of Ghost Bats with bat detectors away from cave entrances is less reliable, unless an approach based on an acoustic lure is used (e.g. see the new method described in a paper accepted recently by Ruykys et al. 2023 in press).
9. This version of the document supersedes any previous version. Previous drafts are not authorised by us for submission to the regulator or the public domain.

References

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Table 1. Summary of bat detector recordings analysed. [Ra: number of echolocation sequences of the Pilbara Leaf-nosed Bat *Rhinonicteris aurantia*; Note that there were issues with the units (beyond the responsibility of Animal Plant Mineral Pty Ltd) that lead to loss of date and time information; the units recorded data between 14 July and 2 August 2023; date ranges in 2003 are incorrect and the result of an issue with units obtaining a GPS fix—these were adjusted to calculate time since first detection after sunset, last detection before sunrise]

Swift Serial No.	Latitude	Longitude	No. recording nights	Nights of	Ra calls
450007	*Not available*	*Not available*	5	'2003-11-28 – 2003-12-03'	0
450085	-21.051113	118.867217	3	'2003-11-30 – 2003-12-03'	4
642022	-21.054677	118.884608	17	2023-07-15 – 2023-08-01	0
660630	-21.001420	118.919222	7	2023-07-14 – 2023-07-20	2
660654	-20.999712	118.920870	17	2023-07-14 – 2023-07-30	15
Totals			**49**	**2023-07-14 – 2023-08-01**	**21**

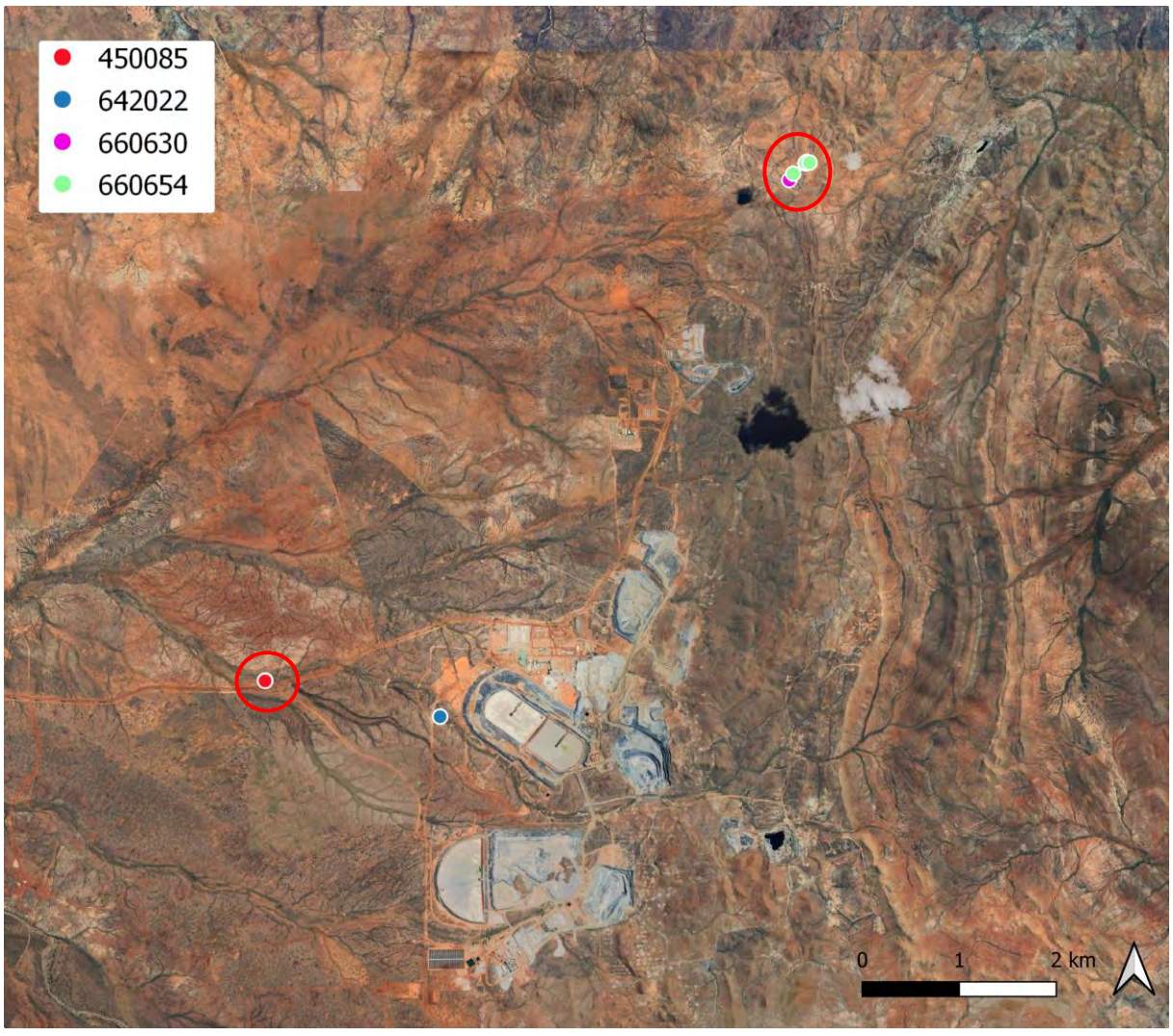

Figure 1. The location of the bat detector recording sites within the project area (tracked by unit serial number; unit 450007 recorded no GPS coordinates). The Pilbara Leaf-nosed Bat was detected at the sites circled in red.

Table 2. Summary of detections of the Pilbara Leaf-nosed Bat from Lynas Find (alternating blue highlight distinguishes different sites).

Serial	Night of	Passes	Sunset	Dusk	Dawn	Sunrise	Time first detection	Time last detection	Time since sunset	Time until dawn
450085	*14/07/2023*	2	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	22:59:42	0:27:25	5H 19M 57S	6H 15M 0S
450085	*15/07/2023*	2	15/07/2023 17:40	15/07/2023 18:03	16/07/2023 6:18	16/07/2023 6:42	22:57:54	1:43:31	5H 17M 46S	4H 58M 44S
660630	17/07/2023	2	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	22:34:08	1:14:19	4H 53M 15S	5H 27M 32S
660654	14/07/2023	4	14/07/2023 17:39	14/07/2023 18:03	15/07/2023 6:18	15/07/2023 6:42	21:08:43	23:28:39	3H 28M 58S	7H 13M 46S
660654	16/07/2023	1	16/07/2023 17:40	16/07/2023 18:04	17/07/2023 6:18	17/07/2023 6:42	22:22:32	22:22:32	4H 42M 2S	8H 19M 324S
660654	17/07/2023	1	17/07/2023 17:40	17/07/2023 18:04	18/07/2023 6:18	18/07/2023 6:41	21:23:34	21:23:34	3H 42M 41S	9H 18M 17S
660654	18/07/2023	3	18/07/2023 17:41	18/07/2023 18:05	19/07/2023 6:17	19/07/2023 6:41	21:31:09	23:09:21	3H 49M 53S	7H 32M 17S
660654	22/07/2023	3	22/07/2023 17:42	22/07/2023 18:06	23/07/2023 6:16	23/07/2023 6:40	4:39:16	4:40:50	10H 56M 26S	1H 59M 43S
660654	24/07/2023	1	24/07/2023 17:43	24/07/2023 18:07	25/07/2023 6:16	25/07/2023 6:39	23:08:36	23:08:36	5H 24M 59S	7H 31M 19S
660654	25/07/2023	1	25/07/2023 17:44	25/07/2023 18:07	26/07/2023 6:16	26/07/2023 6:39	23:28:16	23:28:16	5H 44M 16S	7H 11M 18S
660654	28/07/2023	1	28/07/2023 17:45	28/07/2023 18:08	29/07/2023 6:15	29/07/2023 6:38	21:51:48	21:51:48	4H 6M 38S	8H 46M 37S

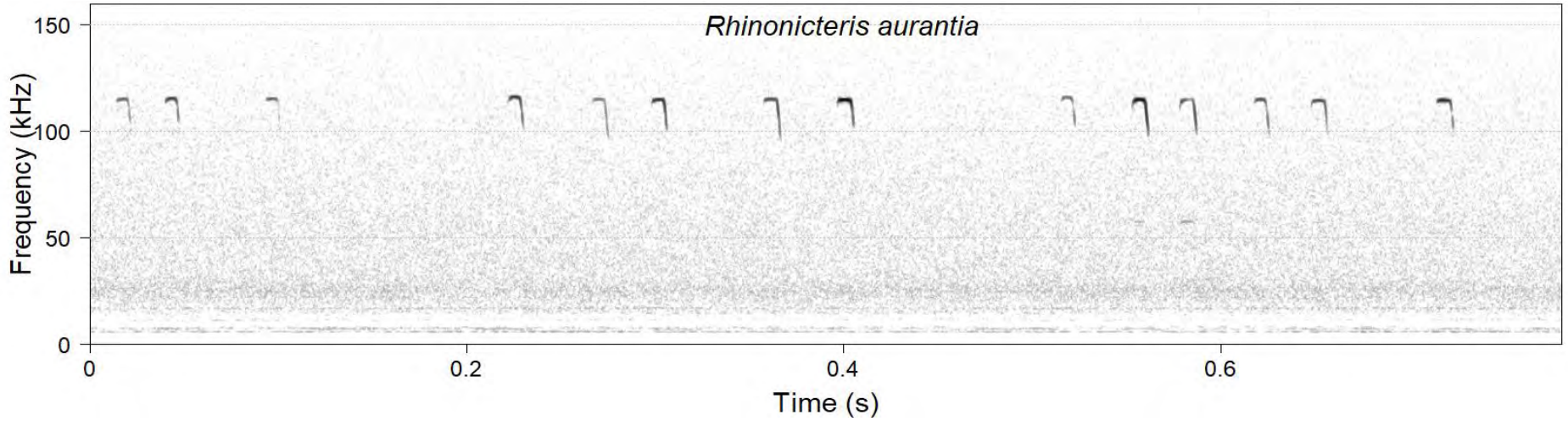

Figure 2. Example echolocation call sequence of the Pilbara Leaf-nosed Bat.

APPENDIX F: SPECIES BY SITE MATRIX - FLORA

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26
Amaranthaceae																										
**Aerva javanica*											0.1						0.1									
Alternanthera nodiflora			0.1																							
Ptilotus astrolasius	0.1			0.1	0.1	0.1	0.1			0.1			0.1				0.1	0.2	0.1	0.1	0.1					0.1
Ptilotus axillaris								0.1																		
Ptilotus calostachyus	0.1	0.1		0.1	0.1		0.1		0.1			0.1						0.1	0.1	0.1	0.1					
Ptilotus clementii																	0.1									
Ptilotus exaltatus																										
Ptilotus gomphrenoides																										
Asteraceae																										
Pluchea tetranthera					0.5			0.1			0.1												0.1			
Pterocaulon sphacelatum							0.1		0.1		0.1															
Streptoglossa bubakii																										
Boraginaceae																										
Euploca chrysocarpa																										
Trichodesma zeylanicum											0.1															
Caryophyllaceae																										
Polycarpaea corymbosa																										
Cleomaceae																										
Arivela uncifera	0.1	0.1				0.1	0.1										0.1									
Convolvulaceae																										
Bonamia erecta	0.1							0.1	0.1	0.1			0.1					0.1	0.5	0.1	0.1	0.1				0.1
Bonamia media																						0.1			0.1	
Bonamia pilbarensis		0.1				0.1	0.1					0.1			0.1	0.1										
Evolvulus alsinoides															0.1					0.1						
Operculina aequisepala											0.1						0.1									
Polymeria ambigua			0.1					0.1			0.1		0.1													
Cucurbitaceae																										
Cucumis argenteus							0.1																			
Cyperaceae																										
Bulbostylis ?turbinata																										
Bulbostylis barbata																				0.1						
Fimbristylis dichotoma																										
Fimbristylis microcarya																						0.1				
Fimbristylis nuda																										
Euphorbiaceae																										
Euphorbia careyi											0.1			0.1	0.1											

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26
Euphorbia coghlanii											0.1															
Euphorbia mitchelliana			0.1								0.1			0.1	0.1								0.1			
Euphorbia tannensis																										
Euphorbia vaccaria																										
Fabaceae																										
Acacia acradenia	0.5	0.5	0.1	2	2	2	2		1			6				2	5	2	1			0.5	5	0.1	2	
Acacia adsurgens	5		0.5		2.5	2	0.5	0.1	2	10			1	2			1	1	1	5	5					0.5
Acacia ancistrocarpa																			0.1							
Acacia bivenosa			1							2				2	0.5		2						0.1			0.5
Acacia colei								2					0.5		1											0.1
Acacia cowleana			2					1					2		2			2	5	25	2		0.5			1
Acacia inaequilatera	0.1	0.1	0.1	0.5	1	0.5	0.5	0.5	0.1	0.1		0.1	0.5			0.1	0.1		0.5	0.1		0.5	0.5	0.1	0.1	0.1
Acacia maitlandii																										
Acacia orthocarpa		0.1																				0.5				
Acacia pyrifolia											1		2		0.1											0.5
Acacia spondylophylla																										
Acacia stellaticeps									0.1			2	0.1			0.1						0.1				
Acacia synchronicia																										
Acacia trachycarpa								0.1			1															
Alysicarpus muelleri													0.1												0.1	
Cajanus cinereus			2	1				0.5			2.5		0.5		2								0.1			
Crotalaria cunninghamii											0.5				0.1											
Cullen pallidum																										
Indigofera colutea								0.1			0.1															
Indigofera hirsuta		0.1	0.5			0.1														0.1						
Indigofera monophylla	0.1	0.1	2	0.1		0.1	0.1		0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.1			0.1	0.1		0.1	0.1		0.1	0.1
Indigofera rugosa				0.1							0.1															5
Leptosema anomalum																		2								
Neptunia dimorphantha																										
Neptunia monosperma														0.1												
Petalostylis labicheoides			5									2	2		0.5								0.5			
Rhynchosia minima					0.1			0.1	0.1		0.1		0.1	0.1	0.1		0.1						0.1			
Senna artemisioides																				0.1					0.1	0.1
Senna artemisioides subsp *oligophylla*									0.5																	
Senna glutinosa															0.1					0.1			0.1			0.1
Senna glutinosa subsp *chatelainiana*																						0.1				
Senna notabilis			0.5					0.1			0.1			0.1						0.1					0.1	0.1

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26
Senna ferraria														0.1												
Sesbania cannabina														0.1												
Swainsona formosa											0.1															
Tephrosia arenicola				0.1														0.1		0.1						
Tephrosia rosea				0.5							0.1				0.1										0.1	0.1
Goodeniaceae																										
Dampiera candicans	0.1			0.1																						
Goodenia microptera											0.1				0.1											
Goodenia scaevolina								0.1																		0.1
Goodenia stobbsiana		0.1		0.1				0.1		0.1		0.1			0.1		0.1	0.1	0.1		0.1	0.1			0.1	
Scaevola amblyanthera	0.1			0.1							0.1		0.1		0.1	0.1	0.1								0.1	
Lamiaceae																										
Dicrastylis doranii																										
Lauraceae																										
Cassytha capillaris												0.1			0.1		0.1							0.1	0.1	
Malvaceae																										
Corchorus incanus	0.1	0.1	0.5	0.1		0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1		0.1			0.1			1			0.1
Gossypium robinsonii											0.1				0.2											
Hibiscus burtonii											0.1															
Hibiscus sturtii								0.1			0.1		0.1							0.1			0.1			0.1
Sida arenicola													0.1		0.1											
Sida cardiophylla																				0.1						
Sida clementii								0.1	0.1		0.1		0.1	0.1	0.1										0.1	0.1
Sida echinocarpa																										
Sida fibulifera																										
Triumfetta appendiculata				0.1				0.1																		
Triumfetta johnsonii																										
Triumfetta propinqua																										
Molluginaceae																										
Trigastrotheca molluginea	0.1					0.1	0.1										0.1									0.1
Moraceae																										
Ficus aculeata											0.5															
Ficus brachypoda																										
Myrtaceae																										
Corymbia hamersleyana	1		10	5	0.5			5		0.1	5		5		5	0.1	1	1		1			0.5		1	0.5
Eucalyptus leucophloia																						1	2.5			
Eucalyptus victrix											5				5											

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26
Phrymaceae																										
Mimulus gracilis																										
Phyllanthaceae																										
Phyllanthus maderaspatensis															0.1											
Plantaginaceae																										
Stemodia grossa															0.1										0.1	
Poaceae																										
Aristida holathera																										
Aristida inaequiglumis																				0.1						0.1
Aristida latifolia																	0.1									
**Cenchrus ciliaris*								0.5			5		0.1		5								2			
**Cenchrus setiger*																							2			
Chrysopogon fallax								2			0.1				0.1		0.1			1						5
Cymbopogon ambiguus											0.5														0.1	
Cynodon convergens																										
Dicanthium sericeum													5	1												
Enneapogon caerulescens														0.1												
Enneapogon lindleyanus											0.5				0.5											
Eragrostis eriopoda															0.1											
Eragrostis tenellula															0.1											
Eragrostis xerophila																										
Eriachne benthamii	2																									
Eriachne mucronata			5								0.5			1												
Eriachne obtusa																					0.1					
Eriachne pulchella																										
Heteropogon contortus											0.1		0.5		0.1											0.5
Iseilema membranaceum																										
Iseilema sp																										
Paraneurachne muellei																0.1				0.1						
Paspalidium clementii																										
Sorghum plumosum													5	0.1												
Sporobolus australasicus			0.1					0.1					0.1	0.1						0.1			0.1		0.1	0.1
Sporobolus caroli											0.1															
Themeda triandra			0.1					0.5					2		1										0.1	2
Triodia angusta	15		2	5					5				1	40	5	35				1					30	
Triodia brizoides														10								5	2.5			
Triodia chichesterensis (P3)	5											10					0.1						5	15		

Species	N01	N02	N03	N04	N05	N06	N07	N08	N09	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	N22	N23	N24	N25	N26
Triodia epactia	20		15		40	25	30	30		2	5	15	10		10		1			2			30			50
Triodia lanigera		10		20			10		50	30								45	40	10	40	25			15	
Triodia wiseana		20	10	10		10				10		40				2	50						2	35		10
Portulacaeae																										
Portulaca oleracea																										
Proteaceae																										
Grevillea pyramidalis								0.1																		0.1
Grevillea wickhamii	2			0.1				1				0.5				2		0.1		0.5	2				0.5	
Hakea lorea														0.1												
Rubiaceae																										
Dolichocarpa crouchiana																										
Santalaceae																										
Santalum lanceolatum													0.5													
Solanaceae																										
Solanum cleistogamum																										
Solanum diversiflorum											0.1				0.1											
Solanum phlomoides	0.1										0.1															
Violaceae																										
Afrohybanthus aurantiacus				0.1																						
Zygophyllaceae																										
Tribulus hirsutus																	0.1									
Tribulus suberosus		0.1																								
**Tribulus terrestris*											0.1															

* denotes introduced flora.
Highlight denotes flora not previously recorded at the Pilgangoora project.

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
Amaranthaceae																									
**Aerva javanica*																									
Alternanthera nodiflora																									
Ptilotus astrolasius	0.1	0.1		0.1										0.1	0						0		0	0.01	
Ptilotus axillaris																									
Ptilotus calostachyus	0.1			0.1		0		0.01				0			0						0.01			0.01	
Ptilotus clementii																	0								
Ptilotus exaltatus																									
Ptilotus gomphrenoides										0															
Asteraceae																									
Pluchea tetranthera						0		0.01													0.01				
Pterocaulon sphacelatum																					0.01				
Streptoglossa bubakii															0										
Boraginaceae																									
Euploca chrysocarpa														0.01											
Trichodesma zeylanicum																									
Caryophyllaceae																									
Polycarpaea corymbosa						0																			
Cleomaceae																									
Arivela uncifera																									
Convolvulaceae																									
Bonamia erecta					0.1											0						0			
Bonamia media																									
Bonamia pilbarensis	0.1				0.1																				
Evolvulus alsinoides				0.1				0.01														0	0.1		
Operculina aequisepala																									
Polymeria ambigua																									
Cucurbitaceae																									
Cucumis argenteus				0.1			0																		
Cyperaceae																									
Bulbostylis ?turbinata																						0			
Bulbostylis barbata			0.1	0.1																					
Fimbristylis dichotoma																									
Fimbristylis microcarya		0.1											0.01												
Fimbristylis nuda																								0	
Euphorbiaceae																									
Euphorbia careyi						0.1																			

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
Euphorbia coghlanii																									
Euphorbia mitchelliana																									
Euphorbia tannensis						0.1																			
Euphorbia vaccaria							0																		
Fabaceae																									
Acacia acradenia	0.1	0.5	0.5	0.1	0.5	0.1	0.1	0.2				20		15	1	0.1	0.1		40		0.2			0.01	
Acacia adsurgens	1	2		0.6	0.5						1	10		4		50					0.1			10	
Acacia ancistrocarpa				0.1																					
Acacia bivenosa				0.5										0.1					0.5				0.1		
Acacia colei																									
Acacia cowleana				0.1																		12			
Acacia inaequilatera	0.5	0.5	1		0.5	0.5	1	1						1		0.05	0.1		0.5	1	0.5		1	0.5	0.05
Acacia maitlandii		0.1																					0.2		0.01
Acacia orthocarpa								0.5																	
Acacia pyrifolia																									
Acacia spondylophylla																									1
Acacia stellaticeps	5														0	0.5									
Acacia synchronicia																									
Acacia trachycarpa																									
Alysicarpus muelleri																									
Cajanus cinereus														1					0.1						
Crotalaria cunninghamii																									
Cullen pallidum																									
Indigofera colutea																									
Indigofera hirsuta																									
Indigofera monophylla		0.1		0.1				0.01			0.01	0			0.1	0.1			0.1		0.01	0.1			0.01
Indigofera rugosa		0.5	0.5																			0	0		
Leptosema anomalum																									
Neptunia dimorphantha									0.01	0.01								0.1							
Neptunia monosperma																									
Petalostylis labicheoides												0.5		0.5	0.1	0.05	0.1								
Rhynchosia minima											0		0.1					0							
Senna artemisioides		0.1									0														0.02
Senna artemisioides subsp *oligophy*																									
Senna glutinosa				0.1			0.1																		0.01
Senna glutinosa subsp *chatelainiana*																									
Senna notabilis							0										0	0				0	0		

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
Senna ferraria																									
Sesbania cannabina																									
Swainsona formosa																									
Tephrosia arenicola			0.1	0.1																					
Tephrosia rosea																									
Goodeniaceae																									
Dampiera candicans				0.1				1																	
Goodenia microptera													0.01												
Goodenia scaevolina																									
Goodenia stobbsiana	0.1	0.1	0.1	0.1																	0.01	0		0.1	0.01
Scaevola amblyanthera														0.01		0			0						
Lamiaceae																									
Dicrastylis doranii																									0.01
Lauraceae																									
Cassytha capillaris	0.1	0.1	0.1											1		0.1			1	0.1	0.1	0.1	1	0.01	
Malvaceae																									
Corchorus incanus	0.1	0.1	0.1	0.1	0.1		0.01	0.01			0		0.01	0.01					0.1		0.1	0.1			
Gossypium robinsonii																									
Hibiscus burtonii																									
Hibiscus sturtii					0.1	0.5		0.01														0			
Sida arenicola				0.1																					
Sida cardiophylla																									
Sida clementii																									
Sida echinocarpa																						0			
Sida fibulifera									30	30	0.01							0	0						
Triumfetta appendiculata																									
Triumfetta johnsonii								0.01																	
Triumfetta propinqua						0	0																		
Molluginaceae																									
Trigastrotheca molluginea			0.1	0.1																					
Moraceae																									
Ficus aculeata																									
Ficus brachypoda							1																		
Myrtaceae																									
Corymbia hamersleyana			2	1										5		0.5			1		1	5	0.1		
Eucalyptus leucophloia																									
Eucalyptus victrix																									

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
Phrymaceae																									
Mimulus gracilis													0.01												
Phyllanthaceae																									
Phyllanthus maderaspatensis																									
Plantaginaceae																									
Stemodia grossa												0													
Poaceae																									
Aristida holathera																						0.1			
Aristida inaequiglumis			0.1																						
Aristida latifolia																									
**Cenchrus ciliaris*																0.01									
**Cenchrus setiger*																									
Chrysopogon fallax																10						5			
Cymbopogon ambiguus						0.1																0.1			
Cynodon convergens																		0							
Dicanthium sericeum																									
Enneapogon caerulescens																									
Enneapogon lindleyanus																									
Eragrostis eriopoda			0.1	0.1																					
Eragrostis tenellula																									
Eragrostis xerophila									0.1	0.01	0.01														
Eriachne benthamii																									
Eriachne mucronata							0	0.01	0.1		0.1		10					0.5							
Eriachne obtusa																									
Eriachne pulchella																									
Heteropogon contortus																0.1									
Iseilema membranaceum																									
Iseilema sp																		0							
Paraneurachne muellei				0.1																					
Paspalidium clementii							0						10							0.1					
Sorghum plumosum																									
Sporobolus australasicus																									
Sporobolus caroli																		0.1							
Themeda triandra																									
Triodia angusta												2	5												
Triodia brizoides		3																							
Triodia chichesterensis (P3)						1																	10		

Species	N27	N28	N29	N30	N31	E01	E02	E03	E04	E05	E06	E07	E08	E09	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20
Triodia epactia			5	5	5		30				5					40			10			55			
Triodia lanigera	35	30	20	40	15		0.5	5			10	1												10	30
Triodia wiseana	10	12	25		40	45	20	50			50	40	40	50	70		50		50	40	40	0.5	30	30	
Portulacaeae																									
Portulaca oleracea									0.01	0															
Proteaceae																									
Grevillea pyramidalis																	0								
Grevillea wickhamii					0.1			0.5				0.01			1	0.1			0.1	0.1	0.2				
Hakea lorea																	0.1								
Rubiaceae																									
Dolichocarpa crouchiana																									
Santalaceae																									
Santalum lanceolatum																									
Solanaceae																									
Solanum cleistogamum						0																			
Solanum diversiflorum									0.1	0															
Solanum phlomoides										0															
Violaceae																									
Afrohybanthus aurantiacus																						0			
Zygophyllaceae																									
Tribulus hirsutus																									
Tribulus suberosus						0.1	0.1	0.5																	0.01
**Tribulus terrestris*																									
* denotes introduced flora.																									
Highlight denotes flora not previously rec																									

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col
Amaranthaceae										
**Aerva javanica*										
Alternanthera nodiflora										
Ptilotus astrolasius	0							0.1		
Ptilotus axillaris										
Ptilotus calostachyus										
Ptilotus clementii										
Ptilotus exaltatus										X
Ptilotus gomphrenoides										
Asteraceae										
Pluchea tetranthera					0.02					
Pterocaulon sphacelatum										
Streptoglossa bubakii										
Boraginaceae										
Euploca chrysocarpa										
Trichodesma zeylanicum										
Caryophyllaceae										
Polycarpaea corymbosa										
Cleomaceae										
Arivela uncifera										
Convolvulaceae										
Bonamia erecta	0					0.1			0.1	
Bonamia media										
Bonamia pilbarensis										
Evolvulus alsinoides							0.01			
Operculina aequisepala										
Polymeria ambigua										
Cucurbitaceae										
Cucumis argenteus										
Cyperaceae										
Bulbostylis ?turbinata										
Bulbostylis barbata					0.01					
Fimbristylis dichotoma										X
Fimbristylis microcarya							0.01			
Fimbristylis nuda		0.01		0.01	0.05					
Euphorbiaceae										
Euphorbia careyi										

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col
Euphorbia coghlanii										
Euphorbia mitchelliana							0.01			
Euphorbia tannensis							0.01			
Euphorbia vaccaria										
Fabaceae										
Acacia acradenia	15		5			12		1		
Acacia adsurgens		5		0.02	10		15	0.5	3	
Acacia ancistrocarpa										
Acacia bivenosa									0.3	
Acacia colei										
Acacia cowleana		0.02		15						
Acacia inaequilatera	0.1		1	0.5		0.5	0.1	1	0.2	
Acacia maitlandii	5	5		0.05						
Acacia orthocarpa										
Acacia pyrifolia										
Acacia spondylophylla										
Acacia stellaticeps	1				10					
Acacia synchronicia										X
Acacia trachycarpa										
Alysicarpus muelleri										
Cajanus cinereus										
Crotalaria cunninghamii										
Cullen pallidum										X
Indigofera colutea										
Indigofera hirsuta										
Indigofera monophylla		0.01	0.05		0.02	0.1	2	0.01		
Indigofera rugosa							15	0.5		
Leptosema anomalum										
Neptunia dimorphantha										
Neptunia monosperma										
Petalostylis labicheoides			0.01	0.03			0.01			
Rhynchosia minima										
Senna artemisioides										
Senna artemisioides subsp *oligophy*	0									
Senna glutinosa	0									
Senna glutinosa subsp *chatelainiana*										
Senna notabilis							0.1			

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col					
Senna ferraria															
Sesbania cannabina															
Swainsona formosa								0.1							
Tephrosia arenicola								0.1							
Tephrosia rosea															
Goodeniaceae															
Dampiera candicans															
Goodenia microptera															
Goodenia scaevolina															
Goodenia stobbsiana		0.01	0.02	0.01											
Scaevola amblyanthera															
Lamiaceae															
Dicrastylis doranii		0.01													
Lauraceae															
Cassytha capillaris							2	0.1							
Malvaceae															
Corchorus incanus			0.02		0.02		2	0.1	0.01						
Gossypium robinsonii															
Hibiscus burtonii															
Hibiscus sturtii							0.01	0.1							
Sida arenicola															
Sida cardiophylla															
Sida clementii															
Sida echinocarpa															
Sida fibulifera															
Triumfetta appendiculata															
Triumfetta johnsonii															
Triumfetta propinqua															
Molluginaceae															
Trigastrotheca molluginea				0.01	0.01		0.01								
Moraceae															
Ficus aculeata															
Ficus brachypoda															
Myrtaceae															
Corymbia hamersleyana		0.05		2			2	0.5							
Eucalyptus leucophloia		0.05		2											
Eucalyptus victrix															

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col					
Phrymaceae															
Mimulus gracilis															
Phyllanthaceae															
Phyllanthus maderaspatensis															
Plantaginaceae															
Stemodia grossa															
Poaceae															
Aristida holathera					0.01										
Aristida inaequiglumis															
Aristida latifolia															
**Cenchrus ciliaris*															
**Cenchrus setiger*															
Chrysopogon fallax															
Cymbopogon ambiguus															
Cynodon convergens															
Dicanthium sericeum															
Enneapogon caerulescens															
Enneapogon lindleyanus															
Eragrostis eriopoda															
Eragrostis tenellula															
Eragrostis xerophila															
Eriachne benthamii															
Eriachne mucronata		0.01			0.02										
Eriachne obtusa															
Eriachne pulchella										X					
Heteropogon contortus															
Iseilema membranaceum					0.01										
Iseilema sp															
Paraneurachne muellei							0.1								
Paspalidium clementii															
Sorghum plumosum															
Sporobolus australasicus															
Sporobolus caroli															
Themeda triandra															
Triodia angusta															
Triodia brizoides															
Triodia chichesterensis (P3)			35				10								

Species	E21	E22	E23	E24	E25	E26	E27	E28	E29	Op Col
Triodia epactia		5			30		20	10		
Triodia lanigera	30	20	2	50	30	65		10	40	
Triodia wiseana			5				20	20		
Portulacaeae										
Portulaca oleracea										
Proteaceae										
Grevillea pyramidalis										
Grevillea wickhamii		0.03						0.5		
Hakea lorea							0.1			
Rubiaceae										
Dolichocarpa crouchiana										X
Santalaceae										
Santalum lanceolatum										
Solanaceae										
Solanum cleistogamum										
Solanum diversiflorum										
Solanum phlomoides										
Violaceae										
Afrohybanthus aurantiacus										
Zygophyllaceae										
Tribulus hirsutus										
Tribulus suberosus										
**Tribulus terrestris*										
* denotes introduced flora.										
Highlight denotes flora not previously rec										

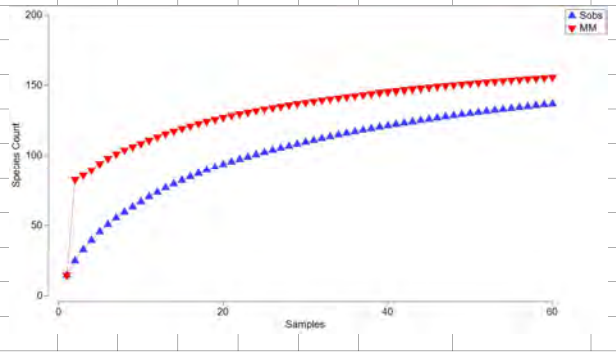

Figure AF-1. Flora species accumulation curve (Sobs = Sample observations; MM = Michaelis Menton model)

APPENDIX G: FAUNA LIKELIHOOD OF OCCURRENCE ASSESSMENT - FAUNA

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
-- Birds --					
Actitis hypoleucos	Common Sandpiper	MI	MI	Edge of sheltered waters salt or fresh (*e.g.* estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations where low perches are available (Johnstone and Storr, 1998). Shallow, pebbly, muddy or sandy edges of rivers and streams coastal to far inland; dams, lakes, sewage ponds; margins of tidal rivers, waterways in mangroves or saltmarshes; mudflats: rocky or sand beaches; causeways, riverside lawns, drains, street gutters. (Pizzey and Knight, 2012).	Unlikely. Perching opportunities available in the creeks however water pooling is limited and ephemeral. Two records 20 km to the west from a semi-permanent pool in a tributary of the Turner River.
Apus pacificus	Fork-tailed Swift	MI	MI	Broadly distributed aerial species that is not specifically limited to any particular habitat type. Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. (Pizzey and Knight, 2012). Occurs over dry or open habitats comprising of riparian woodland, low scrub, heathland, or saltmarsh, also grasslands and sandplains with spinifex. (Morcombe, 2011).	Possible. Listed by the PMST as Likely to occur. Seven records are reported from 1998 – 2014 over a wide variety of habitats. This species is distributed across Australia. It is an aerial species that rarely comes to land. Individuals would not be specifically dependant on any habitats present in the Survey Area.
Calidris acuminata	Sharp-tailed Sandpiper	MI	MI	Scarce to moderately common (much more plentiful near coasts than in interior). (Johnstone and Storr, 1998).	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				Tidal mudflats, saltmarshes, mangroves; shallow fresh, brackish or saline inland wetlands; floodwaters, irrigated pastures and crops; sewage ponds, saltfields. Widespread summer migrant to coastal and inland Australia. (Pizzey and Knight, 2012).	Seasonally inundated areas limited to the gilgai claypans. No records in the local area. PMST considers the species May occur.
Calidris ferruginea	Curlew Sandpiper	CR	CR, MI	Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds. (Johnstone and Storr, 1998) Tidal mudflats; saltmarsh, saltfields; fresh, brackish or saline wetlands; sewage ponds. (Pizzey and Knight, 2012)	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans. No records in the local area. PMST considers the species May occur.
Calidris melanotos	Pectoral Sandpiper		MI	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also, samphire flats around estuaries and saltlakes. (Johnstone and Storr, 1998) Shallow fresh waters, often with low grass or other herbage; swamp margins, flooded pastures, sewage ponds, occasionally tidal areas, saltmarshes. (Pizzey and Knight, 2012)	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans. No records in the local area. PMST considers the species May occur.
Charadrius veredus	Oriental Plover	MI	MI	Open plains; bare, rolling country, often far from water; ploughed land; muddy or sandy wastes near inland swamps or tidal mudflats; bare claypans; margins of coastal marshes; grassy fields and lawns. (Pizzey and Knight, 2012).	Possible. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans. One local historic record from an area that is now cleared.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Erythrotriorchis radiatus	Red Goshawk	VU	VU	Well-wooded country. (Johnstone and Storr, 1998) Open forests, woodlands, especially near rivers, wetlands; rainforest fringes. (Pizzy and Knight, 2012)	Unlikely. No records are known from the Pilbara and not within the range of the species known distribution (BirdLife International 2022, TSSC 2015).
Falco hypoleucos	Grey Falcon	VU	VU	Mainly lightly wooded and coastal riverine flats. (Johnstone and Storr, 1998) Lightly treed and inland plains; gibber deserts, sandridges, pastoral lands, timbered watercourses; seldom in driest deserts (Pizzey and Knight, 2012).	Likely. The Survey Area is potentially suitable foraging habitat. Listed by EPBC as Known to Occur in the feature area and five records since 2012 occur near the Turner River and larger tributaries. The closest record is 10 km south west of the Survey Area. All habitats in the Survey Area are suitable foraging habitat for this species.
Falco peregrinus	Peregrine Falcon	OS	-	Mainly about cliffs along coasts, rivers and ranges, and about wooded watercourses and lakes (Johnstone and Storr, 1998). Cliffs, gorges, timbered watercourses, environs of rivers, wetlands, plains, open woodlands, pylons, spires, buildings. (Pizzey and Knight, 2012)	Likely. All habitats are suitable. One record from 2002 is nearby the Survey Area. This location is now the site of the Pilgangoora mine.
Glareola maldivarum	Oriental pratincole	MI	MI	Feeding in air and roosting on bare ground beside water, *e.g.* tidal flats and floodwaters (Johnstone and Storr, 1998). Plains; shallow wet and dry edges of open bare wetlands; tidal mudflats, beaches (Pizzey and Knight, 2012).	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans. No records in the local area. PMST considers the species May occur.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Hirundo rustica	Barn swallow	MI	MI	Mainly towns and wetlands (sewage and saltworks ponds, river pools, swamps, tidal creeks and reservoirs). (Johnstone and Storr, 2004) Open country; agricultural land, especially near water; railyards, towns, overhead wires. (Pizzey and Knight, 2012)	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans. No records in the local area. PMST considers the species May occur.
Motacilla cinerea	Grey Wagtail	MI	MI	Mainly banks and rocks in fast-running fresh water habitats; rivers, creeks, streams and around waterfalls, both in forest and open country; but occurs almost anywhere during migration. Flits from rock to rock, and often enters water after insects (or performs flycatcher sallies after them). (Johnstone and Storr, 2004) In Australia, near running water in disused quarries; sandy, rocky streams in escarpments and rainforests; sewage ponds, ploughed fields, airfields. (Pizzey and Knight, 2012)	Unlikely. The drainage lines in the Survey Area are highly ephemeral and would only flow for brief period of time. Drainage lines are in plains habitat where fast running channel flow is limited. There are no previous records in the local area and the species is uncommonly recorded in Australia. No records in the local area. PMST considers the species May occur.
Motacilla flava	Yellow Wagtail	MI	MI	Damp short-grass flats: rice stubbles and edge of swamps, sewage ponds, bore overflows, grazed or mowed grass and irrigated areas. (Johnstone and Storr, 2004)	Unlikely. Limited pooling of water in the ephemeral drainage lines. No Permanent pools. Seasonally inundated areas limited to the gilgai claypans. No records in the local area. PMST considers the species Likely to occur.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Numenius madagascariensis	Eastern Curlew	CR	CR, MI	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds). (Johnstone and Storr, 1998) Estuaries, tidal mudflats, sandspits, saltmarshes, mangroves; occasionally fresh or brackish lakes; bare grasslands near water. (Pizzey and Knight, 2012)	Unlikely, prefers saline habitats. Seasonally inundated areas limited to the gilgai claypans.. Listed in the PMST as suitable habitat may occur. No local database records.
Pezoporus occidentalis	Night Parrot	CR	EN	Treeless or sparsely wooded spinifex *Triodia* spp. near water (including artesian bores) (Johnstone and Storr, 1998). Seeding spinifex on stony rises, breakaway country, sandy lowlands; shrubby glasswort, chenopods; succulents on flats around salt lakes; flooded claypans saltbush, bluebush, bassia associations (Pizzey and Knight, 2012).	Possible. No local records. Habitat modelling includes the Survey Area at the extremity of the species potential extent. Foraging resources are limited.
Rostratula australis	Australian Painted-Snipe	EN	EN	Common in south and north-east Kimberley swampy plains before their degradation by cattle, but only five records since 1909. Rare summer visitor to North-west, single birds recorded at man-made ponds in the Hamersley and Ophthalmia Ranges in December and January and a male collected at Carnarvon in November. In arid interior a female about to lay collected at Brockman Creek in August 1896 (Johnstone and Storr, 1998). Well-vegetated shallows and margins of wetlands, dams, sewage ponds; wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub, open timber. (Pizzey and Knight, 2012)	Unlikely. No habitat occurs in the Survey Area. Seasonally inundated areas limited to the gilgai claypans where no dense vegetation is available. Vegetation fringing creeks is too open to provide suitable cover. No records in the local area. PMST considers the species May occur.
-- Mammals --					

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Dasycercus blythi	Brush-tailed Mulgara	P4	-	Inhabits spinifex grasslands and burrows on the flats between low sand dunes (Van Dyck and Strahan, 2008).	Likely. Stony Plains habitat is suitable. Multiple database records from 2012 are less than 15 km to the southwest.
Dasyurus hallucatus	Northern Quoll	EN	EN	The Northern Quoll will usually den in hollow tree trunks (Hill and Ward, 2010) or in small caves and crevices in rocky outcrops.	Present. Denning and foraging habitat is available in Rocky Outcrop habitat, however this is limited to a small areas. Foraging and Denning habitat is available in the Major Drainage Line habitat, however no evidence of Northern Quoll was recorded there. Confirmed to occur in the Rocky Outcrop Habitats. Know to occur in the local area, with records restricted to Rocky Outcrop habitat.
Lagorchestes conspicillatus leichardti	Spectacled Hare-Wallaby	P4	-	Open *Acacia* forests, open woodlands and tall shrubland over tussock or hummock grasslands (Van Dyck and Strahan, 2008).	Present. Multiple historic records nearby. Suitable shelter habitat in the Shallow Drainage Depression and Creeks Habitat. A scat suspected to belong to this species was recorded during survey.
Macroderma gigas	Ghost Bat	VU	VU	Their distribution is influenced by the availability of suitable caves and mines for roost sites (Churchill 2008). 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 (Bat Call WA 2021a).	Likely. Foraging habitat available across the Survey Area. No roosting habitat available. The Survey Area is within foraging range of database record locations.

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
Macrotis lagotis	Bilby	VU	VU	Occupy a variety of inland habitats including grass and stony downs country on cracking clays, desert sandplains and dune fields of laterite with hummock grassland and massive red earths with *Acacia* shrubland (Van Dyck and Strahan, 2008).	Possible. Suitable habitat includes the Stony Plains habitat. Historic record nearby, recent records 16 km to the west.
Pseudomys chapmani	Western Pebble-mound Mouse	P4	-	Found on stony hillsides with hummock grassland (Menkhorst and Knight, 2009)	Present. Mounds located in the Stony Plains and Low Hills habitats.
Rhinonicteris aurantia	Pilbara Leaf-Nosed Bat	VU	VU	Dependant on deep and complex cave systems. Roosting and foraging habitats defined by TSSC (2016) and Bat Call WA (2021b)	Present. No roosting habitat available. Foraging habitat is present.
Sminthopsis longicaudata	Long-tailed Dunnart	P4		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.	Unlikely. No suitable habitat.
				-- Reptiles --	
Anilios ganei	Gane's blind snake (Pilbara)	P1		Known from widely separated areas between Newman and Pannawonica. Possibly associated with moist gorges and gullies (Wilson and Swan 2008).	Unlikely. Suitable habitat unlikely to be present as drainage lines are small and highly ephemeral. Limited termite mounds present for foraging resource.
Liasis olivaceus subsp. *baronni*	Pilbara Olive Python	VU	VU	Recorded in areas with gorges and escarpments in close proximity to water holes (Doughty *et al.* 2011). During the cooler months they will typically hide in caves, crevices and	Unlikely. No suitable habitat. There are no gorges or significant water filled gullies in the Survey Area. No permanent or semi-

Species	Common Name	Conservation Code		Relevant Habitat Preference	Assessment of Occurrence
		BC Act	EPBC Act		
				fissures away from water sources. However, in the warmer months they become active and tend to stay near rocky outcrops and water.	permanent pools in the creeks. Caves, crevices or fissures are limited to a small area that has no proximity to permanent pools.
Liopholis kintorei	Great Desert Skink		VU	A nocturnal burrowing and social lizard, living in family groups and creating extensive burrows that are typically 1 m deep and up to 10 m in diameter with multiple entrances (McAplin 2001). Typically occupy hummock grass sandplains and some adjacent dunefield swales, though they can occur in a variety of habitats (McAplin 2001). Vegetation usually consists of hummock grassland (*Triodia basedowii*, *T. pungens* and *T. schinzii*), with some scattered shrubs and occasional trees (*e.g.* Acacia spp., Eucalyptus spp., Hakea spp., Grevillea spp. and *Allocasuarina decaisneana*) (McAlpin 2001). Tend to utilise areas of habitat that have been burnt within the previous 2-15 years (McAplin 2001; Morre *et al*. 2015).	Unlikely. No records in the local area. PMST considers the species May occur in the buffer area only. The area where suitable habitat may occur is 10 km to the east of the Survey Area and separated by a rocky range.

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