



WA LIMESTONE

**Proposed Wilga Quarry Extension
Reconnaissance Flora, Vegetation and Fauna
Habitat Survey
November 2018**

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Environmental solutions for **MINING OIL & GAS CONSTRUCTION**

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1.0 INTRODUCTION

1.1 Overview

WA Limestone is proposing to expand the Wilga Quarry to include a granite outcrop immediately adjacent to the existing operation. The project will involve blasting and mining of the granite outcrop and subsequent crushing utilising the existing facilities at the Wilga Quarry operation.

Ecotec (WA) Pty Ltd (Ecotec) was engaged by WA Limestone to undertake an assessment of the flora, vegetation and fauna habitat of the areas to be disturbed by the proposed operation.

The purpose of the assessment was to:

- review available information for previous records of conservation-significant flora and fauna in the vicinity of the proposed development
- conduct a field assessment to determine the likelihood of conservation-significant flora and fauna being present in the area
- assess the fauna habitat present
- provide a broad description of the vegetation present
- assess the condition of vegetation in the area
- prepare a report outlining the findings of the assessment.

1.2 Location

The Wilga Quarry is located approximately 40 km east of Port Hedland, accessed via the Great Northern Highway. The operation mines and crushes granite which is used locally for various construction activities. The operation currently comprises two shallow open pit quarries, crushing and stockpiling areas, a laydown yard, temporary workshop and office/ablution facilities.

The existing operation is located on mining tenement M45/1249.

WA Limestone is proposing to extend the eastern quarry to incorporate part of a granite outcrop immediately to the south. The outcrop is currently located on exploration licence E45/4641, with a mining lease application to be submitted.

Figure 1.1 shows the location of the project and surrounds.

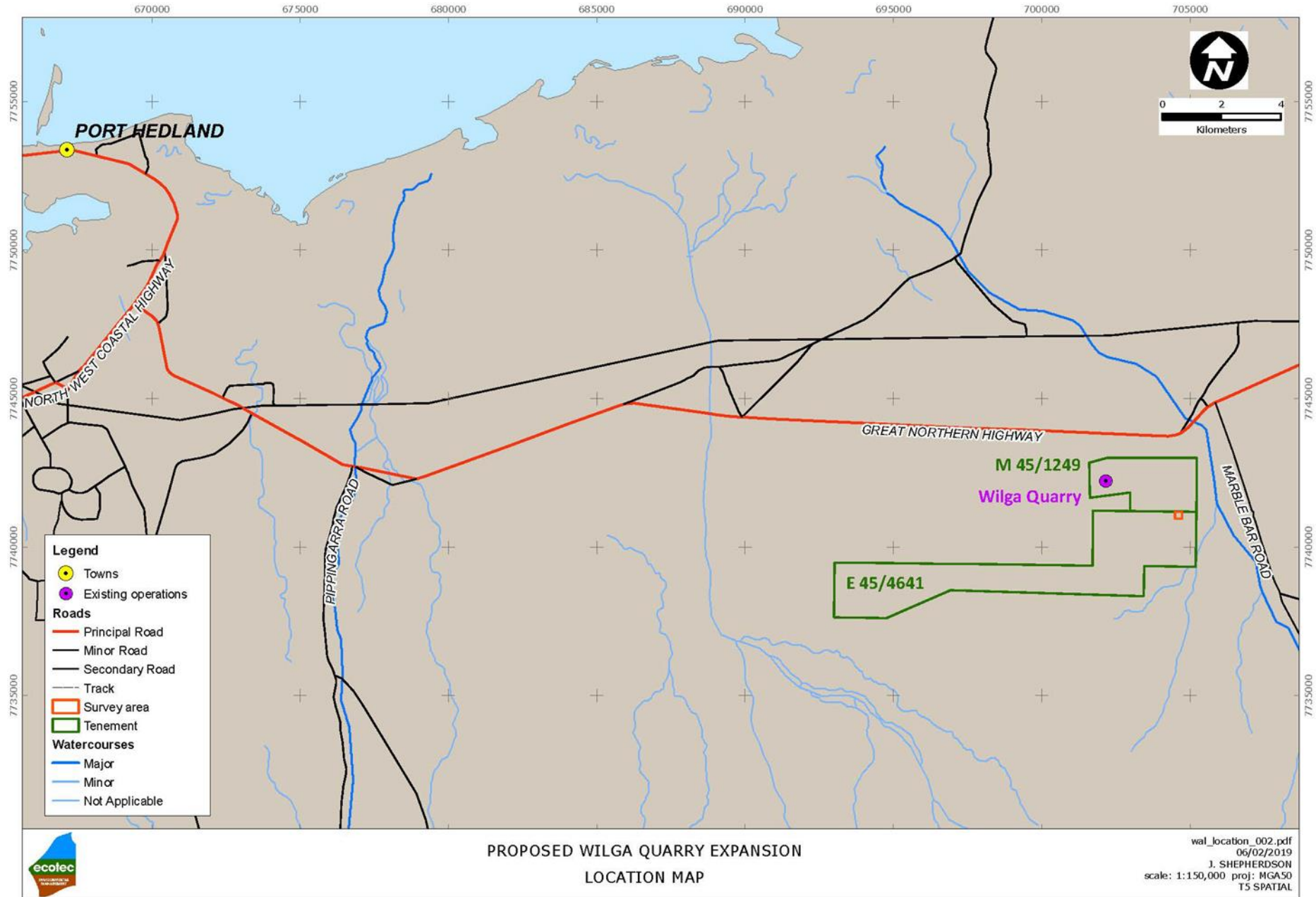


Figure 1.1: Location plan.

2.0 EXISTING ENVIRONMENT

2.1.1 Climate

The climate in the project area is characterised by very hot summers, mild winters and low and variable rainfall. The mean maximum temperature in summer is 36.8°C, with an annual mean maximum of 33.3°C. The coolest month is July with a mean minimum temperature of 12.4°C (Figure 2.1).

The mean annual rainfall recorded at the Bureau of Meteorology weather station No.004032 at Port Hedland airport is 319.2 mm (BoM 2018). Rainfall is variable across the region, ranging from 300–350 mm per year in the north-east to less than 250 mm in the south and west. Rainfall can occur throughout the year (refer to Figure 2.1) but is influenced by tropical and monsoonal drivers, which are predominantly active in summer and autumn. Port Hedland typically receives most of its total annual rainfall during the wet season, from December to March.

The evaporation rate in the Pilbara is considerably higher than the average rainfall and can exceed 3000 mm per year.

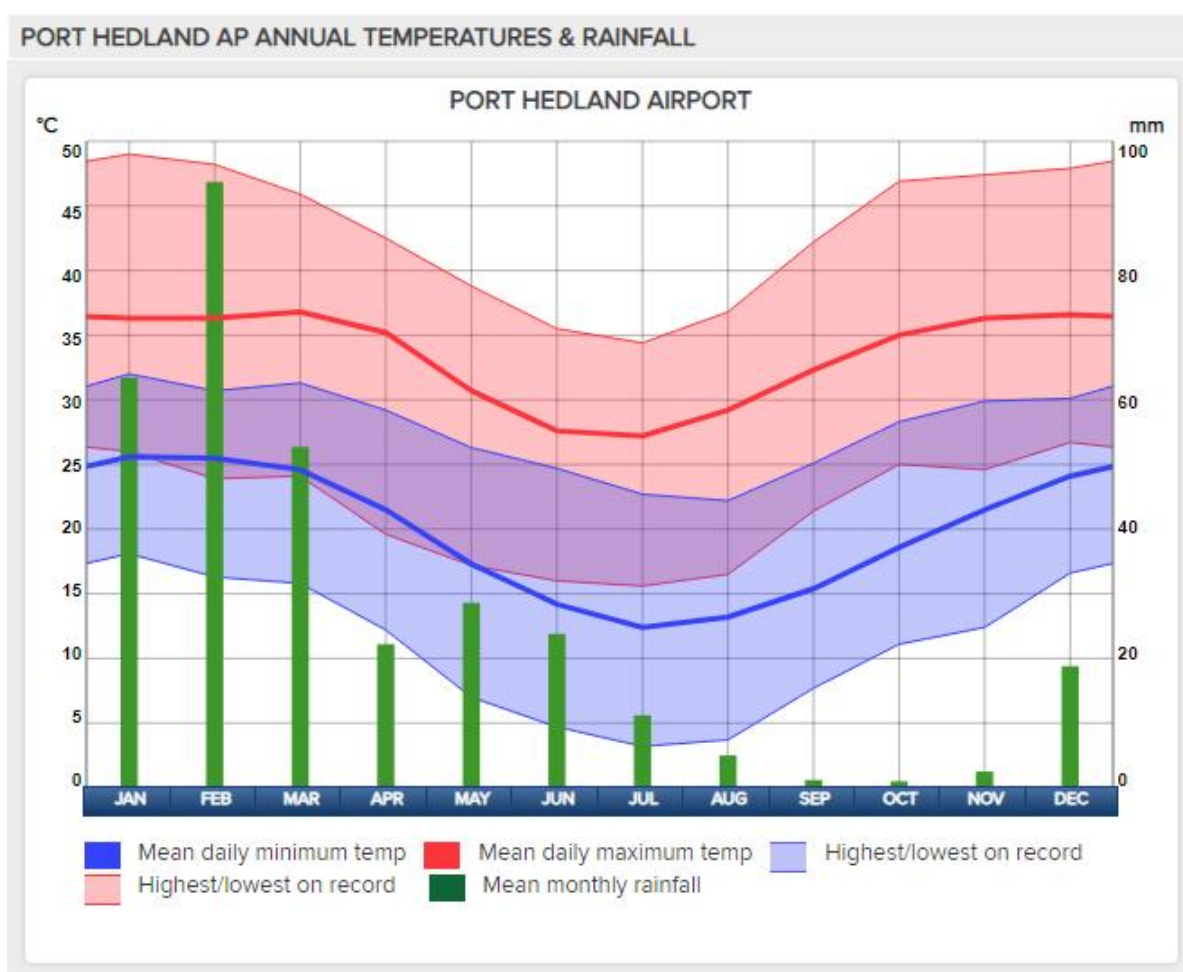


Figure 2.1: Climate data for Port Hedland Airport (Weatherzone 2018).

2.1.2 Interim Biogeographic Regionalisation for Australia

The study area is situated within the Pilbara Bioregion of the Interim Biogeographic Regionalisation for Australia (IBRA). The Pilbara Bioregion is further divided into four subregions: Chichester, Fortescue Plains, Hamersley and Roebourne. The study area is situated on the boundary in the Chichester (PIL1) subregion.

The Chichester subregion comprises the northern section of the Pilbara Craton. Undulating Archaean granite and basalt plains include significant areas of basaltic ranges. Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* (formerly *Triodia pungens*) hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges. The climate is Semi-desert-tropical and receives 300 mm of rainfall annually. Drainage

occurs to the north via numerous rivers (e.g. De Grey, Oakover, Nullagine, Shaw, Yule, Sherlock). The subregional area is 9,044,560 ha (Kendrick and Stanley 2001).

2.1.3 Geology, land systems and soils

The project area is located within the Pilbara Craton, which contains the oldest rocks in the Pilbara. The Pilbara Craton is subdivided into two sections. In the north is Archaean granite-greenstone terrain, and further to the south is the Archaean and Proterozoic Hamersley Basin. The Archaean granite-greenstone terrain underlies younger sediment along the coastal area, extending inland to Marble Bar. The granite contains a range of deformed and metamorphosed granitic phases, intruded by veins and dykes. The greenstone comprises volcanic and metasedimentary rocks that have significant volumes of intruding granite (van Vreeswyk et al. 2004).

The project is located in the De Grey-Roebourne Lowlands Zone, as defined by Tille (2006), located in the northern Pilbara between Karratha and the De Grey River. The De Grey-Roebourne Lowlands Zone occupies 19,350 km² and is characterised by alluvial plains and sandplains (and some floodplains and stony plains) on alluvial and marine deposits over rocks of the northern Pilbara Craton. Soils comprise red deep sandy duplexes with red loamy earths and some red/brown non-cracking clays, cracking clays, red sandy earths and red deep loamy duplexes. Vegetation is predominately spinifex grasslands with kanji and tussock grasslands (Tille 2006).

The study area occurs within the Boolaloo land system, which is characterised by granite hills, domes and tor fields with gritty surfaced sandy plains and shrubby spinifex grasslands, with relief up to 50 m. The soils are generally red shallow sands and red deep sands over 1 m deep. The red shallow sands have sub groups over-laying granite, basalt or calcrete (van Vreeswyk et al. 2004). Further areas of this system exist to the west of the site.

An extensive area of Macroy land system surrounds the study area, consisting of stony plains and occasional tor fields based on granite, supporting hard and soft spinifex grasslands with relief up to 25 m. The majority of the soil is red shallow sands and red sandy earths (van Vreeswyk et al. 2004).

The surrounding area is predominately located in the Uaroo land system (Ua), consisting of broad, level sandy surfaced plains, with minor pebbly plains and tracts, which support shrubby hard and soft spinifex grasslands. The relief is mostly less than 10 m. The majority of the soil is red sandy earths and red loamy earths with a sandy surface grading to loam or clay by 80 cm and deep red loamy surfaced soils often grading to heavier textures.

To the east of the study area is River land system (Rir), encompassing Tabba Tabba Creek. This land system comprises active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands. Flood plains and river terraces of this land system are subject to fairly regular overbank flooding from major channels and watercourses. (van Vreeswyk et al. 2004).

Figure 2.2 shows the land systems of the study area and surrounds.

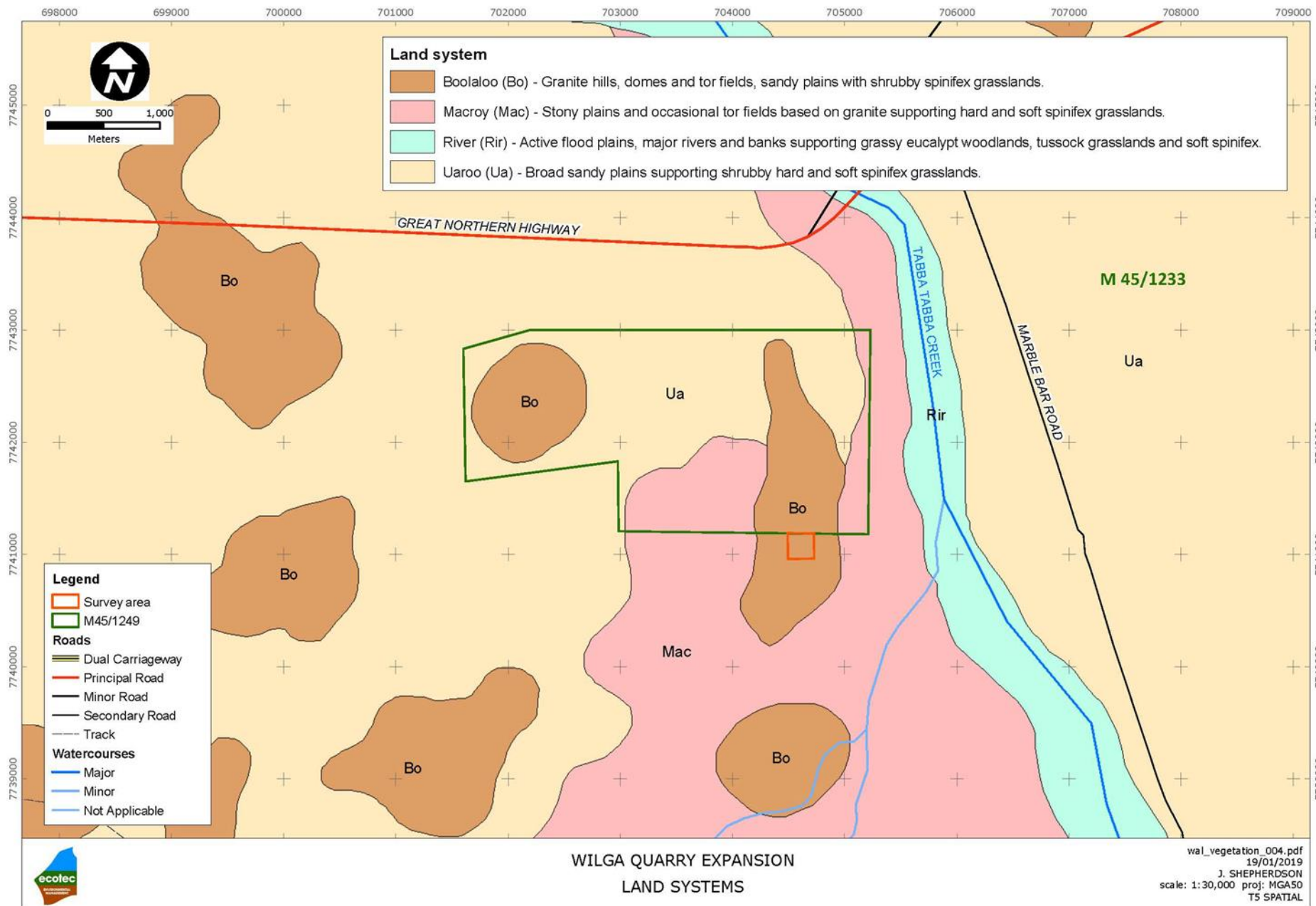


Figure 2.2: Land systems in and surrounding the project area.

Table 2.1 provides the area of the Boolaloo land system within the Pilbara Bioregion and within the proposed area of disturbance.

Table 2.1: Land systems of the survey area.

Land System	Within Pilbara Bioregion		Within Survey Area	
	Area (km ²)	% of Pilbara Bioregion	Area (km ²)	% of land system in Pilbara Bioregion
Boolaloo	1502	0.8	0.076	0.00005

2.1.4 Hydrology

The study area is located within the Port Hedland Coast Surface Water Catchment, which includes a number of major drainage systems that flow to the coast between the De Grey River and Fortescue River catchments (Figure 2.3, DoW 2010). The major rivers of the Pilbara Region discharge over the coastal flats towards the Indian Ocean, often through wide and braided flow paths. The discharge points are frequently a combination of direct ocean outlets and dispersal through marshy flats. The rivers also contribute significant recharge to groundwater resources in the alluvial aquifers on the coastal plains (DoW 2010).

Stream flow is predominately a direct response to rainfall, and is highly seasonal and variable. Most runoff occurs from January to March as a result of cyclones and low pressure systems. For the remainder of the year most of the smaller creeks are dry. The larger rivers cease to flow and pools form at the deepest points of the channels.

The project area is located to the west of Tabba Tabba Creek, an ephemeral drainage line flowing toward the De Grey River delta and Leslie Saltfields System, northeast of Port Hedland.

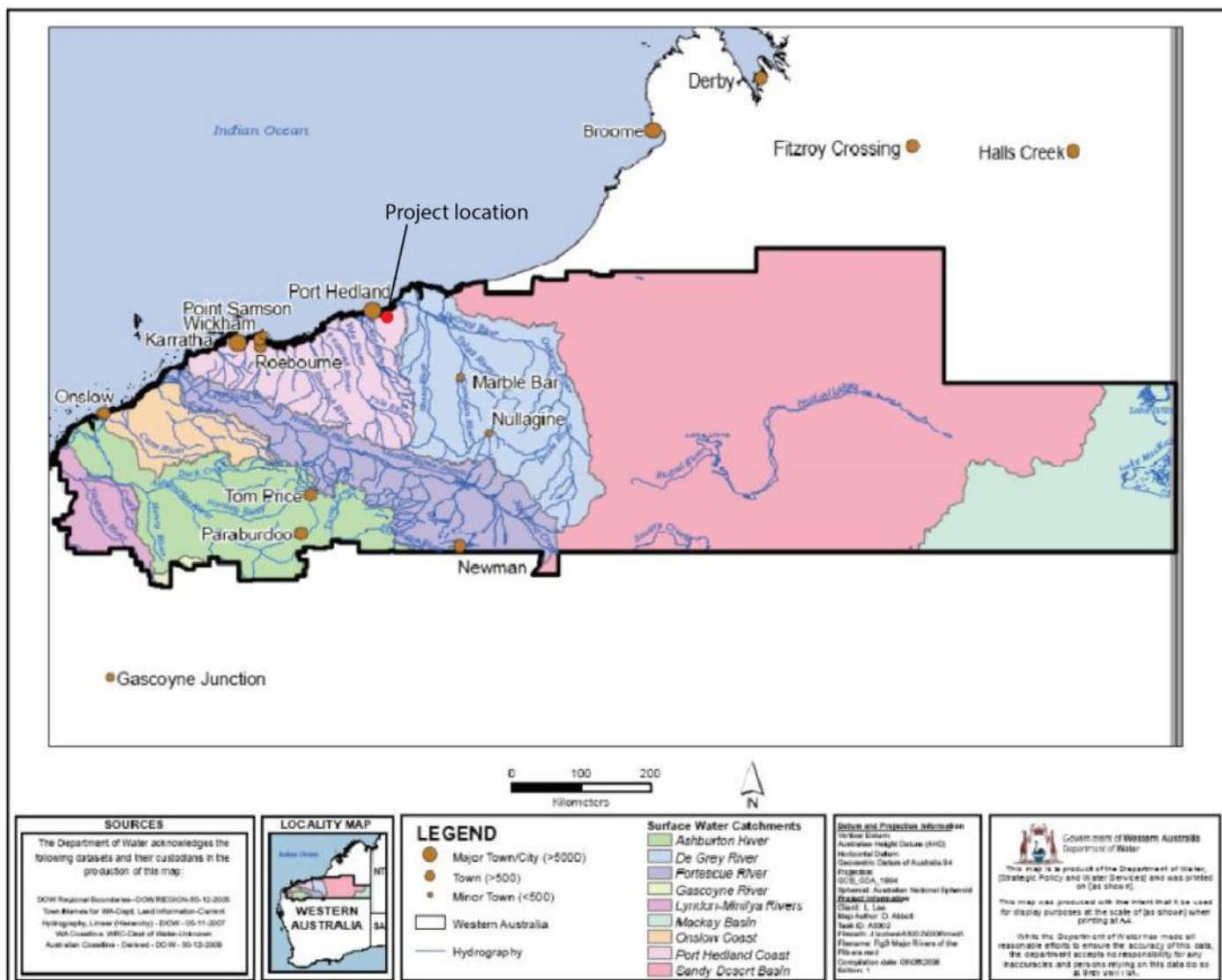


Figure 2.3: Surface water catchments of the Pilbara Region (DoW 2010).

2.1.5 Existing land uses

The project area is situated within Pippingarra Pastoral Lease and the area has been subject to grazing by cattle for decades. Cattle are active throughout the area. Pippingarra homestead is located approximately 15 km south west of the site.

The area surrounding the Wilga Quarry is occupied by a number of mining and quarrying operations including the Poondano Iron Ore Mine (inactive) approximately 20 km to the southwest and the Kimberley Quarries operation, approximately 6 km north east of the Wilga Quarry. WA Limestone also operates the Poondano Quarry, approximately 24 km west of the site.

Additionally, the area is used for recreational activities such as off road driving, camping and hunting.

3.0 METHODOLOGY

3.1 Desktop assessment

The initial desktop review was undertaken in October 2018, with a more detailed review undertaken in December 2018. The desktop review involved:

- searches of the NatureMap (DBCA 2018) and Protected Matters Search Tool databases (DoEE 2018)
- review of a number of fauna, flora and vegetation assessments previously undertaken in the surrounding area.

3.2 Field work

The field work was undertaken on 28 and 29 November by biologist/environmental consultant Jeremy Shepherdson and zoologist Dr Stuart Dawson.

The field work involved a series of relevés throughout the proposed areas of disturbance. The points were initially chosen based on obvious changes in vegetation and topographical features observed from aerial imagery. An assessment of the vegetation, flora species and fauna habitat was undertaken of the area surrounding each point (refer to Figure 4.1).

Given the possible presence of the ghost bat (*Macroderma gigas*) and the Pilbara leaf-nosed bat (*Rhinionictes aurantia*), a bat detector was deployed to record bat calls for later analysis.

3.3 Personnel

Jeremy Shepherdson has more than 20 years experience in biological surveys and environmental consulting, and has worked in a range of environments across the state. He undertook the flora and vegetation assessment for this survey.

Dr Stuart Dawson (Animal Plant Mineral Pty Ltd) is a zoologist specialising in mammals. Stuart's PhD research explored the impacts of onshore seismic surveys on the vulnerable marsupial, the greater bilby (*Macrotis lagotis*). Stuart has experience working with a range of species including quolls, turtles, woylies, snakes, bilbies, kangaroos and introduced species such as foxes, cats and pigs. He has conducted biological surveys (including targeted fauna trapping, Level 1 surveys, vegetation mapping and targeted flora surveys) across a range of environments.

Post-field work plant identification of species unable to be identified in the field was undertaken by Catherine Krens (Anders Environmental Consulting), a botanist with extensive Pilbara experience.

4.0 RESULTS

4.1 Desktop assessment

The Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap database search was conducted for a 20 km radius from the centre of the project location.

The database search returned over 1700 records of flora and fauna species from within the search area including:

- 8 species listed as *Rare or likely to become extinct*
- 26 species listed as *Protected under international agreement*
- two species listed as *Priority 3*
- three species listed as *Priority 4*.

The database results show 154 species of flora and 242 species of fauna having previously been recorded in a 20 km radius of the Wilga Quarry.

Numerous marine and migratory fauna species were included in the list because the site is within 20 km of the coast. All of these species are considered to be not present, or very unlikely to be present in the project area.

The Department of the Environment and Energy EPBC Act Protected Matters Search Tool was also used to conduct a search of the area within a 20 km radius of the project location. This search returned 26 Threatened species and 50 Migratory species as potentially being present. Again, this list includes a number of marine and migratory fauna species that will not be found, or are very unlikely to inhabit the project area.

Table 4.1 lists the conservation significant flora species and Table 4.2 lists the conservation significant fauna species returned in the database searches. The presence of suitable habitat for each species and likelihood of presence within the study area is included. The database search reports are included as Appendix 1. Definitions of the conservation codes used in the tables are included as Appendix 2.

Table 4.1: Conservation significant flora returned from database searches.

Conservation Status	Species	Habitat (WAH 2019)	Annual / Perennial	Suitable Habitat	Likelihood
P3	<i>Eragrostis crateriformis</i>	Clayey loam or clay. Creek banks, depressions. Granite outcrop. Damp clayey edges of flood plains and creeks.	Annual	Yes	Possible
	<i>Heliotropium muticum</i>	Sandy soil. Flat sand plains.	Perennial	No	Unlikely

Table 4.2: Conservation significant fauna returned from database searches.

Common Name	Species	WA Status	EPBC Act Status	Preferred habitat	Likelihood of occurrence
Mammals					
Northern quoll	<i>Dasyurus hallucatus</i>	T-EN S2	EN	Occur in a wide range of habitats but are most common in rugged, rocky areas. In the Pilbara they inhabit mesas, rocky gorges and granite outcrops. Foraging occurs over a wide variety of habitats including dry water courses and spinifex plains.	Recorded – foraging and denning habitat identified within the surveyed area. 517 records within a 20km radius, mainly on rocky outcrops.
Ghost bat	<i>Macroderma gigas</i>	T-VU S3	VU	Roost sites used permanently are generally deep natural caves or disused mine shafts with a relatively stable temperature of 23°-28°C and moderate to high humidity.	Possible 61 records within a 20km radius. No suitable roosting habitat, most likely present while hunting for food.
Pilbara leaf-nosed bat	<i>Rhinioncteris aurantia</i> (Pilbara)	T-VU S3	VU	Warm, humid environments, including caves formed between ascending rock layers, in gorges, and within granite rock piles as well as disused mines and mine shafts where high humidity is maintained from seeping groundwater.	Possible No records returned from the NatureMap database within 20km radius. PMST database states “Species or species habitat known to occur in the area.” No suitable roosting habitat, most likely present while hunting for food.
Greater bilby	<i>Macrotis lagotis</i>	T-VU S3	VU	Sand plains with mature spinifex.	Unlikely – study area habitat is unsuitable. No records returned from the NatureMap database within 20km radius. PMST database states “Species or species habitat likely to occur in the area”. Surrounding sand plain may provide suitable habitat however frequent burning and grazing has reduced habitat quality.

Brush-tailed mulgara	<i>Dasyercus blythi</i>	P4	-	Sand plains with mature spinifex.	Unlikely – study area habitat is unsuitable. 1 record within a 20km radius. The surrounding sand plain may provide suitable habitat however frequent burning and grazing has reduced habitat quality.
Western pebble-mound mouse	<i>Pseudomys chapmani</i>	P4	-	Pebble mounds are usually found on gentle stony slopes vegetated by hard spinifex. Pebble mounds are constructed from small stones, which typically cover areas from 0.5-9.0 m ² .	Unlikely 4 records within a 20km radius. No suitable habitat is present in the survey area or immediate surroundings.
Birds					
Curlew sandpiper	<i>Calidris ferruginea</i>	T-VU & IA S3	CR & MI	Migratory. Known to frequent the Port Hedland salt works. Prefer mudflats in sheltered coastal areas, and ponds in salt works and sewage farms. Recorded inland around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.	Unlikely Possible short-term visitor.
Great knot	<i>Calidris tenuirostris</i>	T-VU & IA S3	CR & MI	Mudflats in sheltered coastal areas, and ponds in salt works and sewage farms. Recorded inland around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.	Unlikely Possible short-term visitor.
Greater sand plover	<i>Charadrius leschenaultii</i>	IA S5	VU & MI	Migratory. In Australia usually inhabits intertidal mudflats.	Unlikely Possible short-term visitor.
Lesser sand plover	<i>Charadrius mongolus</i>	T-EN & IA S2	EN & MI	Migratory. In Australia usually inhabits intertidal mudflats.	Unlikely Possible short-term visitor.
Eastern curlew	<i>Numenius madagascariensis</i>	T-VU & IA S3	CR & MI	Migratory. In Australia usually inhabits intertidal mudflats.	Unlikely Possible short-term visitor.

Grey-tailed tattler	<i>Tringa brevipes</i> (<i>Heteroscelus brevipes</i>)	IA & P4 S5	MI	Migratory marine species. Coastal habitats, forages in intertidal pools and shallow mudflats.	Unlikely Possible short-term visitor.
Rainbow Bee-eater	<i>Merops ornatus</i>		IA	Common and widespread species in WA, except the drier interior of the State and the far south-west. Occurs in lightly wooded sandy country, preferring areas near water. It nests in burrows excavated in sandy ground or banks, often at the margins of roads and tracks.	Likely No prior records within the 20km radius, however suitable habitat is present.
Night parrot	<i>Pezoporus occidentalis</i>	T-CR	EN	Highly elusive nocturnal ground dwelling parrot found in the arid and semi-arid zones of Australia. Thought to be extinct until 2013. Preferred habitat is dense spinifex or samphire on the margins of salt lakes.	Unlikely – no suitable habitat in the survey area. No records returned from the NatureMap database within 20km radius. PMST database states “Species or species habitat may occur in the area”. The surrounding sand plain may provide suitable habitat in some areas.
26 species listed as “Protected under an international agreement”		Refer to Appendix 1		Migratory and marine species predominately associated with coastal habitats.	Unlikely Possible short-term visitors.
Reptiles					
Olive python	<i>Liasis olivaceus barroni</i>	T-VU S3	VU	Gorges and gullies with permanent water present.	Unlikely – no suitable habitat in the survey area. No records returned from the NatureMap database within 20km radius. PMST database states “Species or species habitat known to occur in the area”. No suitable habitat is present in the survey area.

4.2 Reconnaissance survey

4.2.1 Limitations

Due to the survey being undertaken late in the year some annual species are unlikely to have been present, or were in the late stages of their life cycle. Given the vegetation quality and past disturbance, it is expected that the majority of flora species occurring within the study area were recorded during the survey.

The timing of the survey did not impact the fauna and habitat assessment.

4.2.2 Flora and vegetation

The reconnaissance survey was undertaken to produce a list of the flora species present at the time of the survey and to identify the broad vegetation types and vegetation condition occurring within the project area. Identification of habitat suitable for the conservation significant flora species identified in the desktop assessment was also included.

Six relevés were undertaken throughout the survey area, and were positioned to include the upper surface as well as the perimeter of the outcrop. Figure 4.1 shows the relevé locations. Appendix 3 provides the data collected from each of the relevé sites.

Flora

Twenty five species of flora from 12 families were recorded during the survey with the most abundant family being Fabaceae with eight species recorded. Due to the timing of the survey, it is expected that a number of annual species that would be present in the area following the wet season are not represented in the species list. The full list of species recorded is included in Appendix 4.

No conservation significant flora was recorded during the survey, however suitable habitat is potentially present for one of the two species returned from the database searches (refer to Table 4.1).

The introduced flora species *Cenchrus ciliaris* (Buffel grass) and *Aerva javanica* (Kapok) were recorded during the survey. Buffel grass is prolific around the perimeter of the granite outcrop where soil moisture is higher as a result of surface runoff from the rock. Buffel grass dominates the understorey in much of this area. The species is preferential fodder for cattle with the seed being spread predominately by surface water flow. Kapok was recorded in very low numbers in a number of locations, however is an annual species and seasonally prolific, particularly in disturbed areas. It is expected to be more abundant following the wet season.

Vegetation

Broadly, two main vegetation types dominate the survey area.

On the granite outcrop the vegetation is predominately isolated *Corymbia hamersleyana* trees over *Acacia inaequilatera* and *A. tumida* var. *pilbarensis* very open shrubland over *Triodia epactia* open to very open hummock grassland (Photograph 4.1). Soils are scarce and shallow on the rocky outcrop. Vegetation occurs mainly in crevices where soil and moisture collects. An area of bare rock, largely devoid of vegetation, occupies a large portion of the western and southern areas of the outcrop (Photograph 4.2).

Around the perimeter of the outcrop the vegetation consists of *Corymbia hamersleyana* very open low woodland over mixed *Acacia colei* var. *colei* and *A. tumida* var. *pilbarensis* mid-tall shrubland over *Triodia epactia* and *Cenchrus ciliaris* hummock grassland (Photograph 4.3). The substrate in this area comprises pebbles of quartz and granite with occasional granite outcroppings, typical of the Macroy land system. Photograph 4.4 shows the transition from the stony substrate to the sand plains beyond.

Further away from the granite outcrop on the surrounding sand plain, the vegetation tends to mixed *Acacia* very open shrubland over *Triodia* spp. hummock grassland (Photograph 4.4).

More detailed vegetation descriptions of each of the surveyed sites are provided in Appendix 3.

Vegetation condition throughout over the outcrop is generally classified as “Poor” (refer to Table 4.3), reflecting the low species diversity and vegetation health. Vegetation condition around the perimeter of the outcrop is generally considered to be “Good”, with increased diversity and better plant health, but high dust levels on the plants. The area is long unburnt (+ 5 years). At the time of the survey dust was evident on vegetation on the western side and upper surface of the outcrop. This is expected to be seasonal with an accumulation occurring through the dry season.



Photograph 4.1: Vegetation typical of the upper surface of the northern end of the rocky outcrop.



Photograph 4.2: Bare rock, largely devoid of vegetation, occupies a large portion of the western and southern area of the outcrop.



Photograph 4.3: Vegetation typical of the perimeter of the outcrop.



Photograph 4.4: Vegetation typical of the area surrounding the outcrop.

Table 4.3: Vegetation condition scale (Keighery 1994).

Vegetation Condition	Criterion
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.

Figure 4.2 shows the vegetation associations within and surrounding the survey area.

4.2.3 Fauna habitat

Fauna habitat was assessed during a foot traverse of the study area to assist in determining the likelihood of presence of conservation significant species identified during the desktop review.

Two main fauna habitats exist in the surveyed area, being rocky outcrop (the predominant habitat type of the survey area) and sand plain (surrounding the main survey area). Figure 4.2 shows the habitat types.

Rocky outcrop

This large rocky outcropping contains several relatively small boulder fields and exposed caprock, resulting in numerous caves and deeply incised rocks. The outcrop is very sparsely vegetated by hummock and tussock grasses, and some very widely spaced small trees. Photograph 4.5 and Photograph 4.6 show typical rocky outcrop habitat.

A small catchment area on the western side of the outcrop may hold water following rain and is expected to periodically attract a variety of fauna. At the time of the survey the catchment was overgrown by the vine *Passiflora foetida* and covered by the remnants of a water tank.

This habitat type is likely to provide appropriate habitat for a variety of common reptile and amphibian species, as well as a range of mammal species. During the survey, scats of the northern quoll (*Dasyurus hallucatus*) and the euro (*Osphranter robustus*) were frequently recorded. In addition, the northern quoll and a feral cat (*Felis catus*) were recorded on cameras traps deployed at the site. The rocky outcrop provides appropriate denning and foraging habitat for the northern quoll.



Photograph 4.5: The western side of the rocky outcrop with exposed caprock.



Photograph 4.6: The eastern side of the rocky outcrop with boulder field.

Sand plain

Sand plain habitat surrounds the rocky outcrop and is ubiquitous throughout much of the region. This habitat is characterised by low vegetation (shrubs and hummock grasses) on flat sandy soils. This habitat is generally homogenous, with any heterogeneity driven by the fire mosaic. This habitat is suitable for burrowing animals and, in suitable areas, may be occupied by the brush-tailed mulgara (*Dasyercus blythi*) and the greater bilby (*Macrotis lagotis*). In addition, this habitat type provides appropriate habitat for a variety of reptiles including dragons and goannas.

The sand plain area is predominately outside the survey area and disturbance to this habitat resulting from the proposed quarry expansion is expected to be minimal. Photograph 4.7 shows typical sand plain habitat surrounding the rocky outcrop.



Photograph 4.7: Sand plain habitat to the east of the rocky outcrop, typical of the surroundings.

4.2.4 Fauna

Northern quoll (*Dasyurus hallucatus*)

A database search of a 20 km radius from the study area returned 517 prior records of the northern quoll, with most records occurring on rocky outcrops. During the foot traverse quoll scat was observed on the rocky outcrop (Photograph 4.8). Five motion detecting cameras were subsequently deployed across the survey area and left for two nights. Figure 4.1 shows the camera locations. Each of the cameras captured multiple records of northern quoll over the two nights. Photograph 4.9 was recorded at site A002.

It is estimated that the area of suitable denning habitat available within the survey area totals less than 1 ha.



Photograph 4.8: Quoll scat found in the vicinity of site A001.



Photograph 4.9: A Northern quoll captured on the motion detecting camera at site A002.

Ghost bat (*Macroderma gigas*) and Pilbara leaf-nosed bat (*Rhinonictis aurantia*)

The NatureMap database search returned 61 records of the ghost bat in a 20 km radius of the survey area. While the Pilbara leaf-nosed bat is not included in the NatureMap database, it is listed in the Protected Matters Search Tool database as “Species or species habitat known to occur with area”.

Investigation of the rocky outcrop habitat revealed no appropriate roosting sites for either species, nor are there any known roosting sites in the immediate area.

A single bat detector was set up at point A007B. Three common species of bat from three families were identified following analysis of the recordings. Neither the ghost bat nor the Pilbara leaf-nosed bat was recorded. The species present at the time of the survey are listed in Table 4.4. The report is included as Appendix 5 (data relating to Table 4.4 is AnaBat Swift 450083).

Table 4.4: Bat species identified in the rocky outcrop survey area.

Common name	Species
Little Broad-nosed Bat	<i>Scotorepens greyii</i>
Finlayson's Cave Bat	<i>Vespadelus finlaysoni</i>
Greater Northern Free-tailed Bat	<i>Chaerephon jobensis</i>

Figure 4.2 shows the location of the fauna habitats identified during the survey.

The NatureMap database report (Appendix 1) lists all fauna species previously recorded in a 20 km radius of the survey area.

4.2.5 Environmentally Sensitive Areas

The nearest environmentally sensitive area is the Leslie (Port Hedland) Saltfields System, listed as a Nationally Important Wetland (DoEE 2018), located on the coast approximately 20 km northeast of the project area.

There are no Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) within the project area, or in the nearby vicinity.

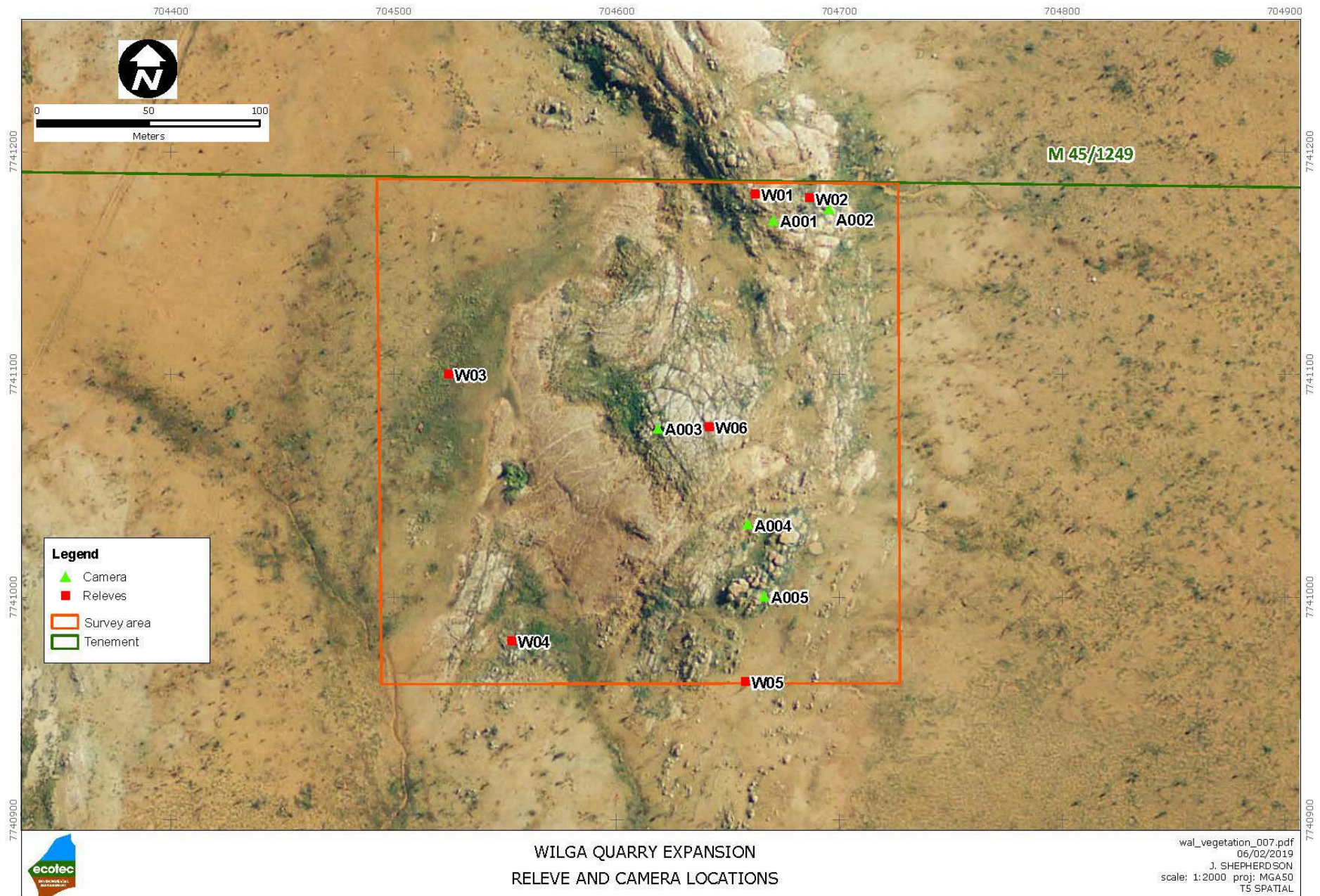


Figure 4.1: Survey area, relevé and camera trap locations.

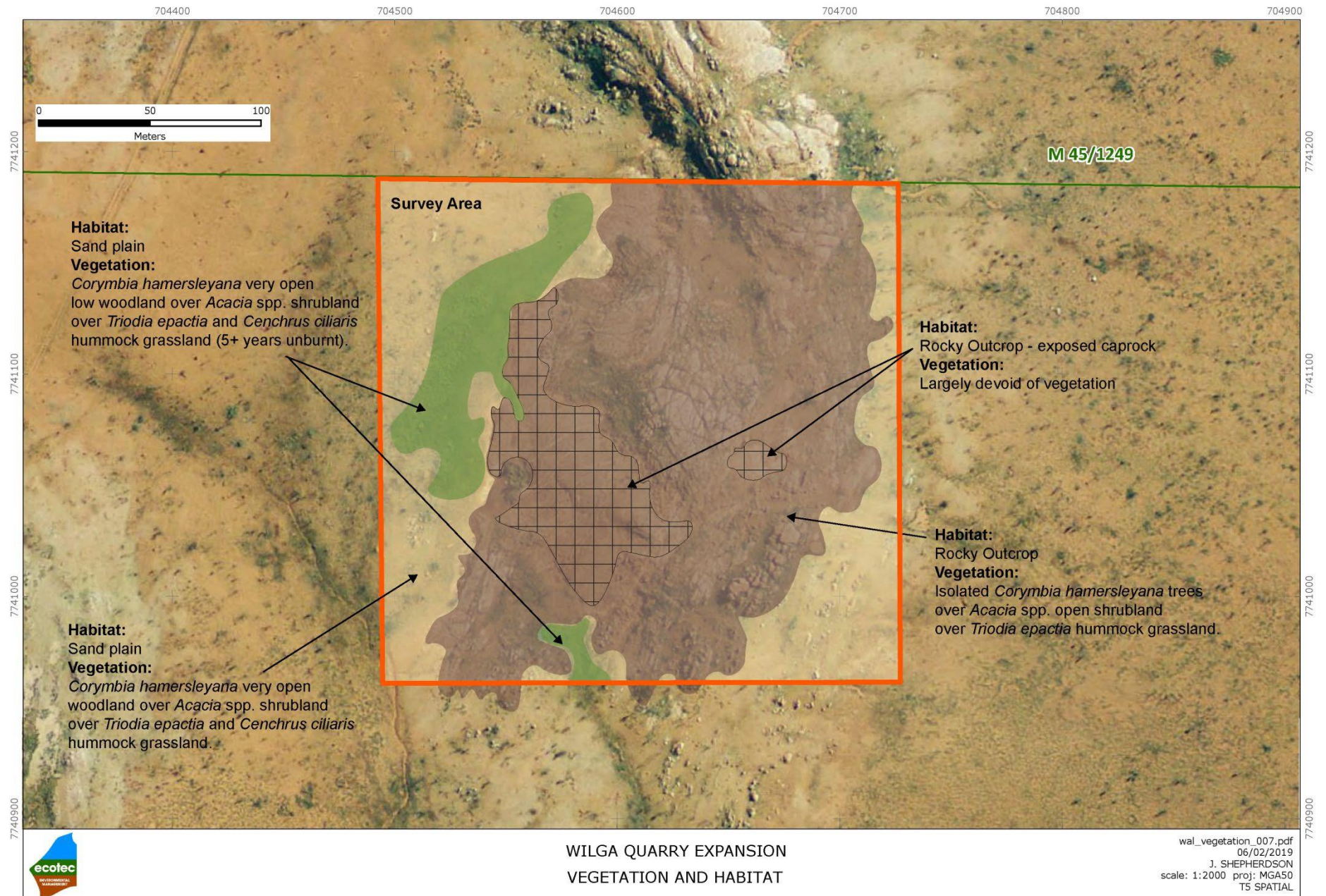


Figure 4.2: Vegetation and fauna habitat of the survey area.

5.0 DISCUSSION

The survey area supports two broad vegetation types and two main fauna habitats.

There is potential for one of the two conservation-significant flora species - *Eragrostis crateriformis*, Priority 3 - to be found in the survey area, as granite outcrop is one of the known habitats for the species. *Heliotropium muticum*, Priority 3, is known to exist in sand plain habitat and could therefore be found in the wider area surrounding the outcrop. Neither species was located during the survey, although they are generally annual species, so may be present following the wet season. The areas of suitable habitat are common and widespread throughout the surrounding region. Development of the area is considered unlikely to have an impact on the survival or conservation significance of either of these species of flora.

Vegetation on the rocky outcrop at the time of the survey was generally considered to be in poor condition due to limited species diversity and general poor plant health. Vegetation around the perimeter of the outcrop was generally in better condition. Dust was apparent on vegetation on the western side and upper surface of the outcrop, mainly on the northern half. Lower than average rainfall experienced in the region, and the timing of the survey are considered to be contributing factors to vegetation condition.

The database search returned over 500 records of the northern quoll in a 20 km radius of the survey area. Recorded activity is predominately concentrated on the rocky outcrops in the surrounding region. The study area provides suitable denning habitat and the high level of activity observed (scats and camera captures) indicates an active colony is present. Prior records of the northern quoll in the surrounding area are over 5 km from the site, which is at the recorded limit of travel distance for the species (Henderson 2015), and may suggest that this colony is isolated from the surrounding population. However it is considered highly likely that other colonies exist nearby, as potentially suitable habitat exists within 2 km to the north and south of the site. Given the small area of denning habitat available in the study area (estimated at less than 1 ha), and the proximity to the active quarry, the colony is not expected to be large. The majority of recent records of the northern quoll in the Pilbara Region have come from the Rocklea, Macroy and Robe land systems (DoE 2018). The survey area is predominately within the Boolaloo land system, characterised by granite hills, domes and tor fields (van Vreeswyk et al. 2004), and surrounded by an area of Macroy land system. The Macroy land system extends to the north and south of the site, and may provide connectivity between suitable denning habitat and other colonies.

Tabba Tabba Creek, to the east of the site is likely to provide foraging habitat for the ghost and Pilbara leaf-nosed bats. The survey area is not considered likely to provide habitat particularly suitable for foraging by these species and does not provide any suitable roosting habitat.

There is no suitable habitat in the survey area to support the olive python.

Sand plain habitat occupies most of the surrounding area. As a result of frequent fires in the area, most of this habitat comprises low hummock grass land and very widely spaced small trees. Long unburnt areas (+ 5 years) support much larger spinifex hummocks and denser stands of *Acacia*. Sand plain habitat is suitable for a variety of burrowing mammals, with potential to support the mulgara (long unburnt spinifex) and the bilby, however the bilby is considered unlikely to be found in the area due to the long history of grazing, frequent fire and presence of predators.

There is no suitable habitat for the western pebble-mound mouse in the survey area or immediate surrounds.

The night parrot is listed as potentially occurring in the area, however preferred habitat (dense spinifex) does not exist within the study area. The species may exist in the wider surrounding area of sand plain, however the long history of livestock grazing and frequent fires have substantially reduced the area of preferred habitat.

Twenty six species of bird protected under an international agreement as migratory species were returned in the database search (refer to Appendix 2). Most of these birds are dependent on coastal habitat for feeding and resting prior to migrating to the northern hemisphere. It is considered very unlikely that any of these species would be found in the area due to lack of suitable habitat. Fly-overs by some of these species during short term visits to lasting pools in Tabba Tabba Creek may occur infrequently.

The flora and vegetation that will be impacted by expansion of the quarry is common and widespread. No impact to the conservation status of Priority listed flora previously recorded in the vicinity is expected as a result of expansion of the quarry.

With the exception of the northern quoll, the potential for impact to fauna species of conservation significance as a result of the quarry expansion is considered to be unlikely.

While the granite outcrop provides suitable habitat for northern quoll denning, the total area of habitat available is relatively small. The area is immediately adjacent to the active quarry and subsequently subject to noise, dust and vibration associated with the quarrying activity. The colony is not expected to be large and is considered likely to form part of a much larger population supported by suitable habitat in the surrounding area. Studies at the nearby Poondano iron ore mine (inactive) and the Atlas Iron Mt Dove operations have suggested that quolls may successfully recolonise habitat created by the mining operation, such as waste rock dumps and constructed rock piles. Over time, this artificial habitat could conceivably replace the lost habitat. With appropriate management it is expected that the quarry expansion could be undertaken without impact to the wider northern quoll population.

6.0 REFERENCES

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Appendix 1

Desktop Survey Results

NatureMap Species Report

Created By Jeremy Shepherdson on 05/02/2019

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 118° 57' 36" E, 20° 26' 24" S
Buffer 20km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	358	1128
Priority 3	2	2
Priority 4	3	8
Protected under international agreement	26	61
Rare or likely to become extinct	8	591
TOTAL	397	1790

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Rare or likely to become extinct				
1.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
2.	24790 <i>Calidris tenuirostris</i> (Great Knot)		T	
3.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
4.	25576 <i>Charadrius mongolus</i> (Lesser Sand Plover)		T	
5.	24093 <i>Dasyurus hallucatus</i> (Northern Quoll)		T	
6.	24180 <i>Macroderma gigas</i> (Ghost Bat)		T	
7.	25344 <i>Natator depressus</i> (Flatback Turtle)		T	
8.	24798 <i>Numenius madagascariensis</i> (Eastern Curlew)		T	
Protected under international agreement				
9.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
10.	25736 <i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
11.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
12.	24780 <i>Calidris alba</i> (Sanderling)		IA	
13.	25738 <i>Calidris canutus</i> (Red Knot, knot)		IA	
14.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
15.	41332 <i>Chlidonias leucopterus</i> (White-winged Black Tern, white-winged tern)		IA	
16.	24478 <i>Fregata ariel</i> (Lesser Frigatebird)		IA	
17.	47954 <i>Gelochelidon nilotica</i> (Gull-billed Tern)		IA	
18.	24481 <i>Glareola maldivarum</i> (Oriental Pratincole)		IA	
19.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
20.	25739 <i>Limicola falcinellus</i> (Broad-billed Sandpiper)		IA	
21.	24795 <i>Limnodromus semipalmatus</i> (Asian Dowitcher)		IA	
22.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
23.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
24.	25742 <i>Numenius phaeopus</i> (Whimbrel)		IA	
25.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
26.	24801 <i>Phalaropus lobatus</i> (Red-necked Phalarope)		IA	
27.	24802 <i>Philomachus pugnax</i> (Ruff, reeve)		IA	
28.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
29.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
30.	48593 <i>Sternula albifrons</i> (Little Tern)		IA	
31.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
32.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
33.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
34.	41351 <i>Xenus cinereus</i> (Terek Sandpiper)		IA	
Priority 3				
35.	16730 <i>Eragrostis crateriformis</i>		P3	
36.	10891 <i>Heliotropium muticum</i>		P3	
Priority 4				
37.	48395 <i>Dasyercus</i> sp. (mulgara)		P4	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
38.	24233 <i>Pseudomys chapmani</i> (Western Pebble-mound Mouse, Ngadjji)		P4	
39.	24803 <i>Tringa brevipes</i> (Grey-tailed Tattler)		P4	
Non-conservation taxon				
40.	4901 <i>Abutilon otocarpum</i> (Desert Chinese Lantern)			
41.	3214 <i>Acacia ancistrocarpa</i> (Fitzroy Wattle)			
42.	3241 <i>Acacia bivenosa</i>			
43.	13403 <i>Acacia colei</i>			
44.	17013 <i>Acacia colei</i> var. <i>colei</i>			
45.	3377 <i>Acacia inaequilatera</i> (Baderi)			
46.	3447 <i>Acacia monticola</i> (Gawar, Lilwardi)			
47.	3471 <i>Acacia orthocarpa</i> (Needleleaf Wattle)			
48.	19456 <i>Acacia stellaticeps</i>			
49.	3579 <i>Acacia trachycarpa</i> (Minni Ritchi, Balgali)			
50.	23521 <i>Acacia trudgeniana</i>			
51.	20319 <i>Acacia tumida</i> var. <i>pilbarensis</i>			
52.	<i>Acanthophis</i> GT NOTHERN species			Y
53.	25243 <i>Acanthophis pyrrhus</i> (Desert Death Adder)			
54.	<i>Acariformes</i> sp.			
55.	2646 <i>Aerva javanica</i> (Kapok Bush)	Y		
56.	2651 <i>Alternanthera nana</i> (Hairy Joyweed)			
57.	17147 <i>Alysicarpus muelleri</i>			
58.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
59.	<i>Aname ellenae</i>			
60.	24312 <i>Anas gracilis</i> (Grey Teal)			
61.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
62.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
63.	25318 <i>Antaresia perthensis</i> (Pygmy Python)			
64.	25670 <i>Anthus australis</i> (Australian Pipit)			
65.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
66.	25559 <i>Ardea intermedia</i> (Intermediate Egret)			
67.	41324 <i>Ardea modesta</i> (great egret, white egret)			
68.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
69.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
70.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
71.	<i>Areacandona</i> 'iuno' (PSS)			
72.	<i>Areacandona</i> 'jessicae' (PSS)			
73.	207 <i>Aristida contorta</i> (Bunched Kerosene Grass)			
74.	210 <i>Aristida holathera</i>			
75.	211 <i>Aristida hygrometrica</i> (Northern Kerosene Grass)			
76.	212 <i>Aristida inaequiglumis</i> (Feathertop Threeawn)			
77.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
78.	25567 <i>Artamus leucorhynchus</i> (White-breasted Woodswallow)			
79.	<i>Australobolbus pseudobscurius</i>			
80.	<i>Blackburnium neocavicolle</i>			
81.	2770 <i>Boerhavia coccinea</i> (Tar Vine, Wituka)			
82.	2774 <i>Boerhavia repleta</i>			
83.	<i>Bolboleas truncatus</i>			
84.	6603 <i>Bonamia alatisemina</i>			
85.	11167 <i>Bonamia erecta</i>			
86.	6605 <i>Bonamia linearis</i>			
87.	24251 <i>Bos taurus</i> (European Cattle)	Y		
88.	7047 <i>Buchnera linearis</i> (Blackrod)			
89.	750 <i>Bulbostylis barbata</i>			
90.	47897 <i>Butorides striata</i> (Striated Heron, Mangrove Heron)			
91.	25715 <i>Cacatua roseicapilla</i> (Galah)			
92.	10972 <i>Cajanus marmoratus</i>			
93.	11150 <i>Cajanus pubescens</i>			
94.	40825 <i>Calandrinia pentavalvis</i>			
95.	2870 <i>Calandrinia stagnensis</i>			
96.	2872 <i>Calandrinia tepperiana</i>			
97.	<i>Carenum pulchrum</i>			
98.	<i>Carenum venustum</i>			
99.	6567 <i>Carissa lanceolata</i> (Conkerberry, Marnuwiji)			
100.	25017 <i>Carlia triacantha</i> (Desert Rainbow Skink)			
101.	2949 <i>Cassytha capillaris</i>			
102.	2950 <i>Cassytha filiformis</i> (Love Vine, Jirawan)			
103.	<i>Cavisternum clavatum</i>			
104.	258 <i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
105.	29721 <i>Cenchrus setiger</i> (Birdwood Grass)	Y		
106.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattleed Bat)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
107.	24377	<i>Charadrius ruficapillus</i> (Red-capped Plover)		
108.		<i>Chilibathynella</i> sp.		
109.		<i>Chlaenius australis</i>		
110.		<i>Chroicocephalus novaehollandiae</i>		
111.	24431	<i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)		
112.	273	<i>Chrysopogon fallax</i> (Golden Beard Grass)		
113.	24289	<i>Circus assimilis</i> (Spotted Harrier)		
114.	24774	<i>Cladorhynchus leucocephalus</i> (Banded Stilt)		
115.	2987	<i>Cleome uncifera</i>		
116.	2988	<i>Cleome viscosa</i> (Tickweed, Tjinduwadhu)		
117.	13689	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>		
118.	25568	<i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)		
119.	4857	<i>Corchorus elachocarpus</i>		
120.	17339	<i>Corchorus incanus</i>		
121.	25847	<i>Corchorus incanus</i> subsp. <i>incanus</i>		
122.	17661	<i>Corchorus tectus</i>		
123.	4865	<i>Corchorus tridens</i>		
124.	25593	<i>Corvus orru</i> (Torresian Crow)		
125.	17073	<i>Corymbia aspera</i>		
126.	17083	<i>Corymbia deserticola</i> subsp. <i>deserticola</i>		
127.	14650	<i>Corymbia flavescens</i>		
128.	17092	<i>Corymbia opaca</i>		
129.	17084	<i>Corymbia zygophylla</i>		
130.	24420	<i>Cracticus nigrogularis</i> (Pied Butcherbird)		
131.	20179	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>		
132.	19398	<i>Crotalaria ramosissima</i>		
133.	25458	<i>Ctenophorus caudicinctus</i> (Ring-tailed Dragon)		
134.	24865	<i>Ctenophorus caudicinctus</i> subsp. <i>caudicinctus</i> (Ring-tailed Dragon)		
135.	25459	<i>Ctenophorus isolepis</i> (Crested Dragon, Military Dragon)		
136.	24876	<i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)		
137.	24882	<i>Ctenophorus nuchalis</i> (Central Netted Dragon)		
138.	25036	<i>Ctenotus duricola</i>		
139.	25462	<i>Ctenotus grandis</i>		
140.	25043	<i>Ctenotus grandis</i> subsp. <i>titan</i>		
141.	25044	<i>Ctenotus hanloni</i>		
142.	25045	<i>Ctenotus helenae</i>		
143.	25463	<i>Ctenotus pantherinus</i> (Leopard Ctenotus)		
144.	25064	<i>Ctenotus pantherinus</i> subsp. <i>ocellifer</i> (Leopard Ctenotus)		
145.	25073	<i>Ctenotus saxatilis</i> (Rock Ctenotus)		
146.	25077	<i>Ctenotus serventyi</i>		
147.	41720	<i>Cucumis argenteus</i>		
148.	41721	<i>Cucumis variabilis</i>		
149.	17439	<i>Cullen lachnostachys</i>		
150.	15714	<i>Cullen stipulaceum</i>		
151.	24322	<i>Cygnus atratus</i> (Black Swan)		
152.	12801	<i>Cyperus blakeanus</i>		
153.	290	<i>Dactyloctenium radulans</i> (Button Grass)		
154.	24091	<i>Dasykaluta rosamondae</i> (Little Red Kaluta)		
155.	25000	<i>Delma haroldi</i>		
156.	25002	<i>Delma pax</i>		
157.	25004	<i>Delma tincta</i>		
158.	3853	<i>Desmodium filliforme</i>		
159.		<i>Diacyclops cockingi</i>		
160.		<i>Diacyclops humphreysi humphreysi</i>		
161.		<i>Diacyclops scanloni</i>		
162.		<i>Diacyclops sobeprolatus</i>		
163.	24926	<i>Diplodactylus conspicillatus</i> (Fat-tailed Gecko)		
164.	24899	<i>Diporiphora valens</i> (Southern Pilbara Tree Dragon)		
165.	42402	<i>Diporiphora vescus</i> (Northern Pilbara Tree Dragon)		
166.	4759	<i>Dodonaea coriacea</i>		
167.	48390	<i>Dolichandrone occidentalis</i>		
168.	24470	<i>Dromaius novaehollandiae</i> (Emu)		
169.	2504	<i>Dysphania plantaginella</i>		
170.	2506	<i>Dysphania rhadinostachya</i>		
171.	25092	<i>Egernia depressa</i> (Southern Pygmy Spiny-tailed Skink)		
172.		<i>Egretta novaehollandiae</i>		
173.	25540	<i>Elanus caeruleus</i> (Black-shouldered Kite)		
174.	24290	<i>Elanus caeruleus</i> subsp. <i>axillaris</i> (Australian Black-shouldered Kite)		
175.		<i>Elaphoidella humphreysi</i>		
176.	47937	<i>Eiseyornis melanops</i> (Black-fronted Dotterel)		

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
177.	24631 <i>Emblema pictum</i> (Painted Finch)			
178.	20377 <i>Enneapogon robustissimus</i>			
179.	<i>Eolophus roseicapillus</i>			
180.	25578 <i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)			
181.	24568 <i>Epthianura aurifrons</i> (Orange Chat)			
182.	375 <i>Eragrostis cumingii</i> (Cuming's Love Grass)			
183.	380 <i>Eragrostis eriopoda</i> (Woollybutt Grass, Wangumu)			
184.	25109 <i>Eremiascincus richardsonii</i> (Broad-banded Sand Swimmer)			
185.	400 <i>Eriachne aristidea</i>			
186.	414 <i>Eriachne obtusa</i> (Northern Wandarrie Grass)			
187.	417 <i>Eriachne pulchella</i> (Pretty Wanderrie)			
188.	24379 <i>Erythronyctes cinctus</i> (Red-kneed Dotterel)			
189.	35307 <i>Euphorbia australis</i> var. <i>australis</i>			
190.	35303 <i>Euphorbia australis</i> var. <i>subtomentosa</i>			
191.	4623 <i>Euphorbia coghlanii</i> (Namana)			
192.	42870 <i>Euphorbia psilosperma</i>			
193.	12097 <i>Euphorbia tannensis</i> subsp. <i>eremophila</i> (Desert Spurge)			
194.	42879 <i>Euphorbia trigonosperma</i>			
195.	42876 <i>Euphorbia vaccaria</i> var. <i>vaccaria</i>			
196.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
197.	<i>Euryscaphus waterhousei</i>			
198.	11416 <i>Evolvulus alsinoides</i> var. <i>decumbens</i>			
199.	11200 <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>			
200.	25621 <i>Falco berigora</i> (Brown Falcon)			
201.	24471 <i>Falco berigora</i> subsp. <i>berigora</i> (Brown Falcon)			
202.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
203.	24472 <i>Falco cenchroides</i> subsp. <i>cenchrus</i> (Australian Kestrel, Nankeen Kestrel)			
204.	25623 <i>Falco longipennis</i> (Australian Hobby)			
205.	24041 <i>Felis catus</i> (Cat)	Y		
206.	841 <i>Fimbristylis caespitosa</i>			
207.	851 <i>Fimbristylis dichotoma</i> (Eight Day Grass)			
208.	870 <i>Fimbristylis oxystachya</i>			
209.	878 <i>Fimbristylis rara</i>			
210.	25727 <i>Fulica atra</i> (Eurasian Coot)			
211.	25301 <i>Furina ornata</i> (Moon Snake)			
212.	42314 <i>Gavicalis virescens</i> (Singing Honeyeater)			
213.	24956 <i>Gehyra pilbara</i>			
214.	24958 <i>Gehyra punctata</i>			
215.	24959 <i>Gehyra variegata</i>			
216.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
217.	25585 <i>Geopelia striata</i> (Zebra Dove)			
218.	24404 <i>Geophaps plumifera</i> (Spinifex Pigeon)			
219.	24276 <i>Gerygone tenebrosa</i> (Dusky Gerygone)			
220.	18257 <i>Gomphrena leptoclada</i> subsp. <i>leptoclada</i>			
221.	11131 <i>Gomphrena sordida</i>			
222.	7509 <i>Goodenia forrestii</i>			
223.	7526 <i>Goodenia microptera</i>			
224.	12552 <i>Goodenia muelleriana</i>			
225.	10982 <i>Goodenia stobbsiana</i>			
226.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
227.	<i>Grayenulla australensis</i>			
228.	19570 <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>			
229.	24484 <i>Grus rubicunda</i> (Brolga)			
230.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
231.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
232.	25541 <i>Haliastur indus</i> (Brahminy Kite)			
233.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
234.	<i>Halicyclops (Rochacyclops) calm</i>			
235.	6705 <i>Heliotropium crispatum</i>			
236.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
237.	24962 <i>Heteronotia spelea</i> (Desert Cave Gecko, Pilbara Cave Gecko)			
238.	4933 <i>Hibiscus leptocladus</i>			
239.	11651 <i>Hibiscus sturtii</i> var. <i>campylochlamys</i>			
240.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
241.	5215 <i>Hybanthus aurantiacus</i>			
242.	3973 <i>Indigofera colutea</i> (Sticky Indigo)			
243.	3978 <i>Indigofera hirsuta</i> (Hairy Indigo)			
244.	3980 <i>Indigofera linifolia</i>			
245.	3981 <i>Indigofera linnaei</i> (Birdsville Indigo)			
246.	3982 <i>Indigofera monophylla</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
247.	6633 <i>Ipomoea muelleri</i> (Poison Morning Glory, Yumbu)			
248.	6637 <i>Ipomoea polymorpha</i>			
249.	24367 <i>Lalage tricolor</i> (White-winged Triller)			
250.	<i>Lampona ampeinna</i>			
251.	<i>Lamponina scutata</i>			
252.	25125 <i>Lerista bipes</i>			
253.	30928 <i>Lerista clara</i>			
254.	25005 <i>Lialis burtonis</i>			
255.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
256.	<i>Loxandrus laevigatus</i>			
257.	30933 <i>Lucasium stenodactylum</i>			
258.	<i>Lycidas</i> sp. 1			
259.	24135 <i>Macropus robustus</i> subsp. <i>erubescens</i> (Euro, Biggada)			
260.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
261.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
262.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
263.	<i>Marsilea</i> sp.			
264.	<i>Masasteron tealei</i>			
265.	5875 <i>Melaleuca argentea</i> (Silver Cadjeput, Bandaran)			
266.	5051 <i>Melhania oblongifolia</i>			
267.	Melitidae sp.			
268.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
269.	25184 <i>Menetia greyii</i>			
270.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
271.	<i>Minasteron minusculum</i>			
272.	25545 <i>Mirafra javanica</i> (Horsfield's Bushlark, Singing Bushlark)			
273.	<i>Monopylephorus</i> n. sp. WA29 (ex <i>Pristina</i> WA3) (PSS)			
274.	25495 <i>Morethia ruficauda</i>			
275.	25193 <i>Morethia ruficauda</i> subsp. <i>exquisita</i>			
276.	1167 <i>Murdannia graminea</i> (Baniyu)			
277.	<i>Naididae</i> (ex <i>Tubificidae</i>)			
278.	<i>Nedsia nr hurlberti</i>			
279.	<i>Nedsia</i> sp.			
280.	<i>Nematoda</i> sp.			
281.	No invertebrates			
282.	25430 <i>Notaden nichollsi</i> (Desert Spadefoot)			
283.	24224 <i>Notomys alexis</i> (<i>Spinifex</i> Hopping-mouse)			
284.	25499 <i>Notoscincus ornatus</i>			
285.	25197 <i>Notoscincus ornatus</i> subsp. <i>ornatus</i>			
286.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
287.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
288.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
289.	<i>Onthophagus margaretensis</i>			
290.	24618 <i>Oreoica gutturalis</i> (Crested Bellbird)			
291.	<i>Ostracoda</i> (unident.)			
292.	24620 <i>Pachycephala lanioides</i> (White-breasted Whistler)			
293.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
294.	<i>Parastenocaris jane</i>			
295.	24627 <i>Pardalotus rubricatus</i> (Red-browed Pardalote)			
296.	523 <i>Paspalidium rarum</i> (Rare Paspalidium)			
297.	525 <i>Paspalidium tabulatum</i>			
298.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
299.	546 <i>Perotis rara</i> (Comet Grass)			
300.	3675 <i>Petalostylis labicheoides</i> (Slender Petalostylis)			
301.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
302.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
303.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
304.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
305.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
306.	<i>Phorticosomus gularis</i>			
307.	<i>Phreodrilid with dissimilar ventral chaetae</i>			
308.	<i>Phreodrilid with similar ventral chaetae</i>			
309.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
310.	42306 <i>Platyplectrum spenceri</i> (Centralian Burrowing Frog)			
311.	8170 <i>Pluhea tetranthera</i>			
312.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
313.	24908 <i>Pogona minor</i> subsp. <i>mitchelli</i> (Dwarf Bearded Dragon)			
314.	2898 <i>Polycarpaea corymbosa</i>			
315.	12075 <i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>			
316.	41363 <i>Polygala galeocephala</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
317.	17513 <i>Polymeria lanata</i>			
318.	25706 <i>Pomatostomus temporalis</i> (Grey-crowned Babbler)			
319.	2884 <i>Portulaca oleracea</i> (Purslane, Wakati)			
320.	2886 <i>Portulaca pilosa</i> (Djanggarra)	Y		
321.	25199 <i>Proablepharus reginae</i>			
322.	24106 <i>Pseudantechinus woolleyae</i> (Woolley's Pseudantechinus)			
323.	24235 <i>Pseudomys desertor</i> (Desert Mouse)			
324.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			
325.	25263 <i>Pseudonaja modesta</i> (Ringed Brown Snake)			
326.	41224 <i>Pterocaulon intermedium</i>			
327.	8192 <i>Pterocaulon sphacelatum</i> (Apple Bush, Fruit Salad Plant)			
328.	<i>Ptilonorhynchus guttatus</i>			
329.	25724 <i>Ptilonorhynchus maculatus</i> (Spotted Bowerbird)			
330.	2695 <i>Ptilotus arthrolasius</i>			
331.	2725 <i>Ptilotus fusiformis</i>			
332.	2747 <i>Ptilotus obovatus</i> (Cotton Bush)			
333.	<i>Ramphotyphlops</i> GT NOTHERN species			Y
334.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
335.	<i>Rendahlia jaubertensis</i>			
336.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
337.	24457 <i>Rhipidura phasiana</i> (Mangrove Grey Fantail)			
338.	4191 <i>Rhynchosia minima</i> (Rhynchosia)			
339.	24200 <i>Scotorepens greyii</i> (Little Broad-nosed Bat)			
340.	12152 <i>Senna curvistyla</i>			
341.	12312 <i>Senna notabilis</i>			
342.	612 <i>Setaria surgens</i> (Pigeon Grass)			
343.	4988 <i>Sida rohlenae</i>			
344.	33698 <i>Sida</i> sp. <i>Pilbara</i> (A.A. Mitchell PRP 1543)			
345.	24120 <i>Sminthopsis youngsoni</i> (Lesser Hairy-footed Dunnart)			
346.	6998 <i>Solanum cleistogamum</i>			
347.	7002 <i>Solanum diversiflorum</i>			
348.	7029 <i>Solanum phlomoides</i>			
349.	619 <i>Sorghum plumosum</i> (Plume Canegrass)			
350.	12489 <i>Stemodia lathraia</i>			
351.	7102 <i>Stemodia viscosa</i> (Pagurda)			
352.	24482 <i>Stiltia isabella</i> (Australian Pratincole)			
353.	8240 <i>Streptoglossa odora</i>			
354.	24927 <i>Strophurus elderi</i>			
355.	<i>Stygonitocrella trispinosa</i>			
356.	12353 <i>Stylosanthes hamata</i> (Verano Stylo)	Y		
357.	25307 <i>Suta punctata</i> (Spotted Snake)			
358.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
359.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
360.	24175 <i>Taphozous georgianus</i> (Common Sheath-tailed Bat)			
361.	4272 <i>Tephrosia leptoclada</i>			
362.	19529 <i>Tephrosia rosea</i> var. <i>rosea</i>			
363.	17768 <i>Tephrosia</i> sp. <i>Bungaroo Creek</i> (M.E. Trudgen 11601)			
364.	15949 <i>Tephrosia</i> sp. <i>D Kimberley Flora</i> (R.D. Royce 1848)			
365.	<i>Tesserodon novaehollandiae</i>			
366.	25202 <i>Tiliqua multifasciata</i> (Central Blue-tongue)			
367.	2942 <i>Tinospora smilacina</i> (Snakevine, Oondala)			
368.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
369.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
370.	19043 <i>Trachymene oleracea</i> subsp. <i>oleracea</i>			
371.	44305 <i>Trianthema pilosum</i>			
372.	4368 <i>Tribulopsis angustifolia</i>			
373.	4377 <i>Tribulus hirsutus</i>			
374.	<i>Trichocycclus gnalooma</i>			
375.	48201 <i>Trigastrotheca molluginea</i>			
376.	13131 <i>Triodia epactia</i>			
377.	689 <i>Triodia lanigera</i>			
378.	4873 <i>Triumfetta appendiculata</i>			
379.	13481 <i>Triumfetta ramosa</i>			
380.	24851 <i>Turnix velox</i> (Little Button-quail)			
381.	25439 <i>Uperoleia glandulosa</i> (Glandular Toadlet)			
382.	25446 <i>Uperoleia talpa</i> (Ratcheting Toadlet)			
383.	11321 <i>Urochloa holosericea</i> subsp. <i>velutina</i>			
384.	25209 <i>Varanus acanthurus</i> (Spiny-tailed Monitor)			
385.	25210 <i>Varanus brevicauda</i> (Short-tailed Pygmy Monitor)			
386.	25212 <i>Varanus eremius</i> (Pygmy Desert Monitor)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
387.	25216 <i>Varanus giganteus</i> (Perentie)			
388.	25224 <i>Varanus pilbarensis</i> (Pilbara Rock Monitor, Northern Pilbara Rock Goanna)			
389.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
390.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		
391.	5106 <i>Waltheria indica</i>			
392.	728 <i>Whiteochloa cymbiformis</i>			
393.	28181 <i>Xanthoparmelia taractica</i>			
394.	732 <i>Yakirra australiensis</i>			
395.	<i>Zebraplatys keyserlingi</i>			
396.	24857 <i>Zosterops luteus</i> (Yellow White-eye)			
397.	24248 <i>Zyzomys argurus</i> (Common Rock-rat)			

Conservation Codes

T - Rare or likely to become extinct
 X - Presumed extinct
 IA - Protected under international agreement
 S - Other specially protected fauna
 1 - Priority 1
 2 - Priority 2
 3 - Priority 3
 4 - Priority 4
 5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/10/18 13:55:02

[Summary](#)

[Details](#)

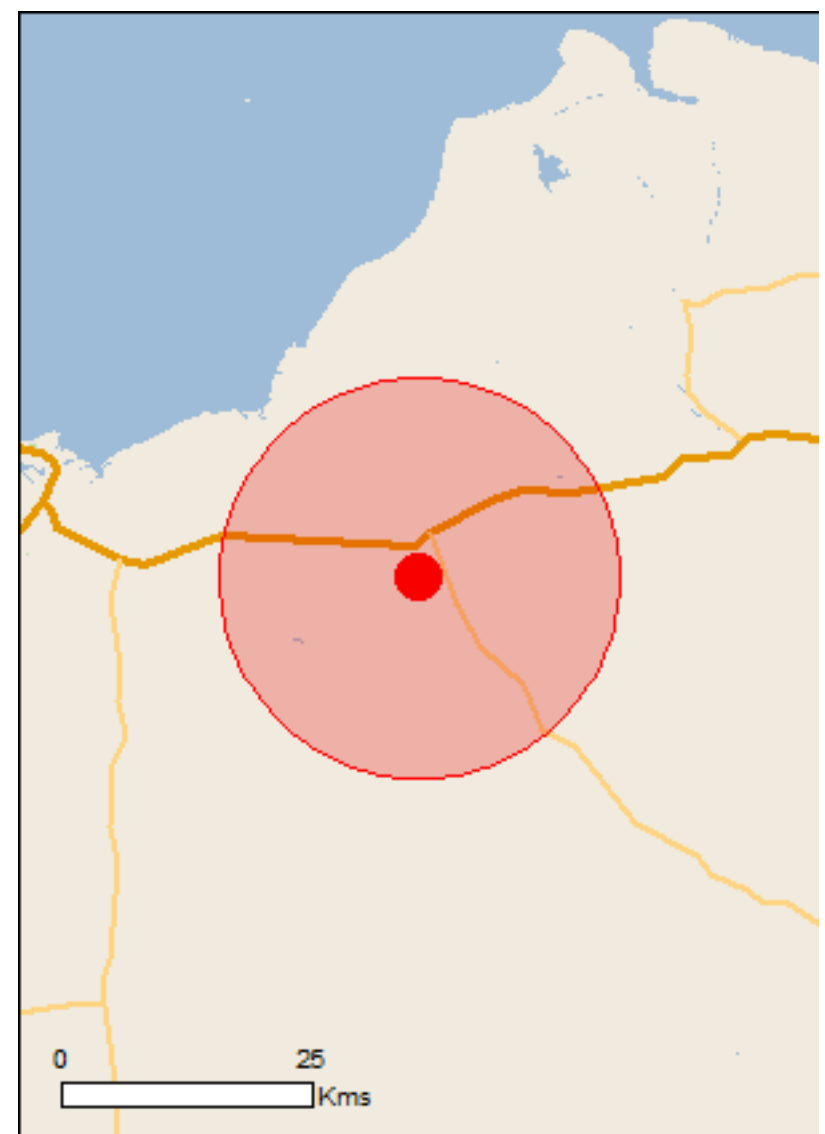
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

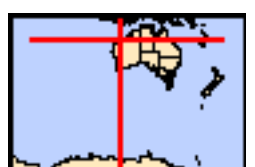
[Acknowledgements](#)



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[Coordinates](#)

Buffer: 20.0Km



Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	26
Listed Migratory Species:	50

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 <http://www.environment.gov.au/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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	48
Whales and Other Cetaceans:	4
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Rhinonictoris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Ctenotus angusticeps Northwestern Coastal Ctenotus, Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species

Name	Threatened	Type of Presence
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		habitat may occur within area Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species

Name	Threatened	Type of Presence
Hirundo rustica Barn Swallow [662]		habitat may occur within area Species or species habitat known to 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		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	habitat known to occur within area Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species	[Resource Information]	
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		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
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Reptiles

Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans

[Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area

Extra Information

Invasive Species

[\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
<i>Columba livia</i> Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
<i>Passer montanus</i> Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Mammals		
<i>Camelus dromedarius</i> Dromedary, Camel [7]		Species or species habitat likely to occur within area
<i>Canis lupus familiaris</i> Domestic Dog [82654]		Species or species habitat likely to occur within area
<i>Equus asinus</i> Donkey, Ass [4]		Species or species habitat likely to occur within area
<i>Equus caballus</i> Horse [5]		Species or species habitat likely to occur within area
<i>Felis catus</i> Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
<i>Sus scrofa</i> Pig [6]		Species or species habitat likely to occur within area
<i>Vulpes vulpes</i> Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
<i>Cenchrus ciliaris</i> Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
<i>Jatropha gossypifolia</i> Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
<i>Parkinsonia aculeata</i> Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
<i>Prosopis</i> spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Reptiles		
<i>Hemidactylus frenatus</i> Asian House Gecko [1708]		Species or species habitat likely to occur within area
<i>Ramphotyphlops braminus</i> Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat may occur within area

Nationally Important Wetlands

[\[Resource Information \]](#)

Name

State

[Leslie \(Port Hedland\) Saltfields System](#)

WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-20.42088 118.96168

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.

Appendix 2

Conservation Codes and Definitions

Conservation codes for Western Australian flora and fauna (BC Regulations 2018).

Code	Definition
T	<p><u>Threatened species</u></p> <p>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).</p> <p>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.</p> <p>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.</p> <p>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.</p>
CR	<p>Critically endangered species</p> <p>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”.</p> <p>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.</p>
EN	<p>Endangered species</p> <p>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”.</p> <p>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.</p>
VU	<p>Vulnerable species</p> <p>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.</p>
	<p><u>Extinct species</u></p> <p>Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.</p>
EX	<p>Extinct species</p> <p>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).</p> <p>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.</p>
EW	<p>Extinct in the wild species</p> <p>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).</p> <p>Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a</p>

	species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
	<p><u>Specially protected species</u></p> <p>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.</p> <p>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.</p>
MI	<p>Migratory species</p> <p>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).</p> <p>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.</p> <p>Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p>
CD	<p>Species of special conservation interest (conservation dependent fauna)</p> <p>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).</p> <p>Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p>
OS	<p>Other specially protected species</p> <p>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).</p> <p>Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p>
	<p><u>Priority species</u></p> <p>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.</p> <p>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.</p> <p>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.</p>
P1	<p>Priority 1: Poorly-known species</p> <p>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</p>

	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	<p>Priority 2: Poorly-known species</p> <p>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.</p>
P3	<p>Priority 3: Poorly-known species</p> <p>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.</p>
P4	<p>Priority 4: Rare, Near Threatened and other species in need of monitoring</p> <p>(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.</p> <p>(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.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
	Specially protected fauna as defined by the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
S1	Schedule 1—Fauna that is rare or is likely to become extinct as critically endangered fauna.
S2	Schedule 2—Fauna that is rare or is likely to become extinct as endangered fauna.
S3	Schedule 3—Fauna that is rare or is likely to become extinct as vulnerable fauna.
S4	Schedule 4—Fauna presumed to be extinct.
S5	Schedule 5—Migratory birds protected under an international agreement.
S6	Schedule 6—Fauna that is of special conservation need as conservation dependent fauna.

Conservation codes for species listed under the Environmental Protection and Biodiversity Conservation Act 1999

Status	Definition
Extinct	There is no reasonable doubt that the last member of the species has died.
Extinct in the wild	<p>It is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range, or</p> <p>It has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.</p>
Critically Endangered	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	<p>It is not critically endangered; and</p> <p>It is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</p>
Vulnerable	<p>It is not critically endangered or endangered; and</p> <p>It is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.</p>
Conservation dependant	<p>The species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or</p> <p>The following subparagraphs are satisfied:</p> <ul style="list-style-type: none"> - The species is a species of fish - The species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised - The plan of management is in force under a law of the Commonwealth or of a State or Territory - Cessation of the plan of management would adversely affect the conservation status of the species.

Appendix 3

Site Data

Site: W01

Location: Wilga Quarry expansion



Vegetation description

Isolated *Corymbia hamersleyana* trees over *Acacia colei* and *A. inaequilatera* very open shrubland over *Triodia epactia*, *Cenchrus ciliaris* open hummock grassland and scattered herbs.

Habitat

Rocky outcrop

Vegetation condition

Poor – high levels of dust on vegetation, poor health, limited diversity.

Flora species present

Acacia colei var. *colei*

Ptilotus axillaris

Acacia inaequilatera

Ptilotus calostachyus

Corymbia hamersleyana

Triodia epactia

Cymbopogon ambiguus

Comments

High level of dust on vegetation, a lot of fly rock present as a result of nearby blasting.

Site: W02

Location: Wilga Quarry expansion



Vegetation description

Isolated stand of *Ficus brachypoda* over *Triodia epactia* and *Cenchrus ciliaris* open hummock grassland and scattered herbs.

Habitat

Rocky outcrop

Vegetation condition

Poor – high levels of dust on vegetation, poor health, limited diversity.

Flora species present

Acacia inaequilatera

Passiflora foetida

**Aerva javanica*

Senna notabilis

**Cenchrus ciliaris*

Solanum diversiflorum

Cleome viscosa

Tinospora smilacina

Corchorus laniflorus

Triodia epactia

Ficus brachypoda

Comments

Ficus appears to be a food source for quolls.

Site: W03

Location: Wilga Quarry expansion



Vegetation description

Isolated *Corymbia hamersleyana* trees over *Acacia colei* and *A. inaequilatera* mid-tall shrubland over *Triodia epactia*, *Cenchrus ciliaris* dense hummock grassland and scattered herbs.

Habitat

Sand plain

Vegetation condition

Good – high levels of dust present, moderate species diversity, buffel grass is abundant.

Flora species present

Acacia colei var. *colei*

Ehretia saligna var. *saligna*

Acacia inaequilatera

Passiflora foetida

Cajanus cinereus

Pluchea rubelliflora

**Cenchrus ciliaris*

Sida sp. *Pilbara*

Corymbia hamersleyana

Triodia epactia

Cymbopogon ambiguus

Comments

Buffel grass is abundant, high level of dust on vegetation.

Site: W04

Location: Wilga Quarry expansion



Vegetation description

Isolated *Corymbia hamersleyana* trees over *Acacia tumida* var. *pilbarensis*, *A. colei* and *A. inaequilatera* mid-tall shrubland over *Triodia epactia*, *Cenchrus ciliaris* dense hummock grassland and scattered herbs.

Habitat

Sand plain

Vegetation condition

Good – moderate species diversity, buffel grass is abundant.

Flora species present

Acacia colei var. *colei*

Corymbia hamerslyana

Acacia inaequilatera

Cymbopogon ambiguus

Acacia tumida var. *pilbarensis*

Senna notabilis

**Aerva javanica*

Triodia epactia

Comments

Buffel grass is abundant, rocky substrate.

Site: W05

Location: Wilga Quarry expansion



Vegetation description

Acacia tumida var. *pilbarensis* and *A. inaequilatera* very open shrubland over *Triodia epactia*, *Cenchrus ciliaris* dense hummock grassland and scattered herbs.

Habitat

Rocky outcrop

Vegetation condition

Good – moderate species diversity, buffel grass is abundant.

Flora species present

Acacia inaequilatera

Cymbopogon ambiguus

Acacia tumida var. *pilbarensis*

Senna notabilis

**Cenchrus ciliaris*

Solanum lasiophyllum

Cajanus cinereus

Triodia epactia

Cajanus sp

Comments

Site: W06

Location: Wilga Quarry expansion



Vegetation description

Acacia tumida var. *pilbarensis*, *A. inaequilatera*, *A. trachycarpa* isolated shrubs over *Triodia epactia* open hummock grassland.

Habitat

Rocky outcrop

Vegetation condition

Poor – high level of dust on vegetation, low species diversity.

Flora species present

**Aerva javanica*

Acacia tumida var. *pilbarensis*

Acacia inaequilatera

Triodia epactia

Acacia trachycarpa

Comments

Appendix 4

Flora Species Recorded

Appendix 5

Bat call identification report.



Bat call identification from near Port Hedland, WA

Type: Acoustic analysis

Prepared for: Animal Plant Mineral Pty Ltd

Date: 17 December 2018

Job No.: SZ474

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Specialised Zoological (2018). Bat call identification from near Port Hedland, WA. Acoustic analysis. Unpublished report by Specialised Zoological for Animal Plant Mineral Pty Ltd, 17 December 2018, Job number SZ474.

Summary

Bat identifications from acoustic recordings are provided from near Port Hedland, in the Pilbara region of Western Australia. Four species of bat were identified as being present (**Tables 1** and **2**). Attribution of call types to species was straightforward for this dataset. Representative echolocation calls for each identification are illustrated (**Figure 1**), as recommended by the Australasian Bat Society (ABS 2006). Further data are available should verification be required.

Methods

Data were recorded in full spectrum WAV format with Titley Scientific AnaBat Swift and Pettersson Elektronik D500X bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong and Aplin 2014; Armstrong et al. 2016) was then applied to the recordings made on the survey. Firstly, the WAV files were scanned for bat echolocation calls using several parameter sets in the software SCAN'R version 1.8.3 (Binary Acoustic Technology), which also provides measurements (in "SonoBat™ compatible output") from each putative bat pulse. The output was then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language script that performed three tasks: 1. undertook a Discriminant Function Analysis on training data from representative calls from the Pilbara region; 2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates over confidence regions for the defined call types; and 3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in Adobe Audition CS6 version 5.0.2. Species were identified based on information in McKenzie and Bullen (2009), and nomenclature follows Jackson and Groves (2015).

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 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 during the survey.
4. Other than the general locality of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a site 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 of this bat survey, including its timing, recording site placement, nor 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.

References

- ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6–9. [ISSN 1448-5877]
- Armstrong, K.N. and Aplin, K.P. (2014). Identifying bats in an unknown acoustic realm using a semi-automated approach to the analysis of large full spectrum datasets. Oral presentation at the 16th Australasian Bat Society Conference 22–25 April 2014, Townsville, Queensland. *The Australasian Bat Society Newsletter* 42: 35–36.
- Armstrong, K.N., Aplin, K.P. and Crotty, S. (2016). A pipeline and app for massive filtering, and assisted inspection of enormous acoustic datasets. Poster presentation at the 17th Australasian Bat Society Conference, 29 March-1 April 2016, Hobart, Tasmania, Australia. *The Australasian Bat Society Newsletter* 46: 51.
- Jackson, S.M. and Groves, C.P. (2015). *Taxonomy of Australian mammals*. CSIRO Publishing, Victoria.
- McKenzie, N.L. and Bullen, R.D. (2009). The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats. *Records of the Western Australian Museum Supplement* 78: 123–155.

Table 1. Species identified in the present survey from all sites combined.

EMBALLONURIDAE	
Common Sheath-tailed Bat	<i>Taphozous georgianus</i>
VESPERTILIONIDAE	
Little Broad-nosed Bat Finlayson's Cave Bat	<i>Scotorepens greyii</i> <i>Vespadelus finlaysoni</i>
MOLOSSIDAE	
Greater Northern Free-tailed Bat	<i>Chaerephon jobensis</i>

Table 2. Species identifications, with the degree of confidence indicated by a code. Date and serial/unit number correlates with site; see **Table 1** for full species names.

	<i>C. jobensis</i>	<i>S. greyii</i>	<i>T. georgianus</i>	<i>V. finlaysoni</i>
D500X 1009				
28/11/2018	◆	—	—	◆
29/11/2018	—	◆	—	◆
AnaBat Swift 450057				
28/11/2018	◆	—	◆	—
29/11/2018	◆	—	◆	◆
AnaBat Swift 450083				
28/11/2018	◆	◆	—	—
29/11/2018	—	◆	—	◆

Definition of confidence level codes:

— Not detected.

◆ Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or a DNA sequence.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the *Comments on identifications* section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

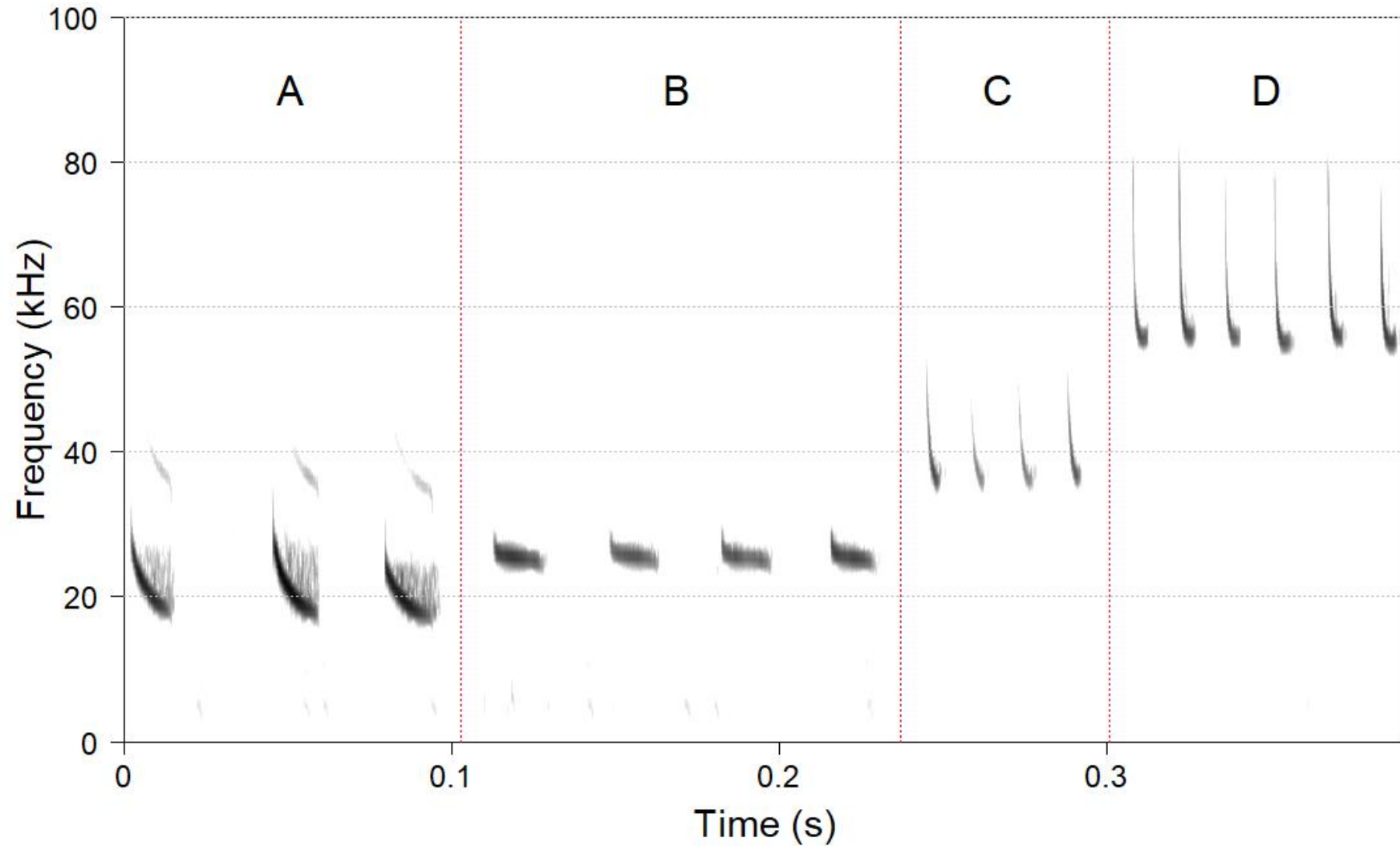


Figure 1. Representative call sequence portions of the species identified (**A:** *Chaerephon jobensis*; **B:** *Taphozous georgianus*; **C:** *Scotorepens greyii*; **D:** *Vespadelus finlaysoni*; time between pulses has been compressed).