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Kimberley Marine Offloading Facility Terrestrial Biological Survey

Broome, WA

Prepared for O2 Marine on behalf of Kimberley Marine Offloading Facility Pty Ltd by:

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Port Of Broome

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EXECUTIVE SUMMARY

Kimberley Marine Offloading Facility Pty Ltd is proposing to develop the Kimberley Marine Offloading Facility (KMOF) at the Port of Broome. Animal Plant Mineral was engaged by O2 Marine (O2M) to provide a Biological Survey of the Study Area. A Detailed Survey for flora and vegetation and an assessment of the habitat suitability for conservation significant fauna was made within the Study Area. A reconnaissance survey in the surrounding area was used to identify the presence of conservation significant values.

A number of locations in and surrounding the Study Area have been described here as the Threatened Ecological Community (TEC) 'Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula', despite previously not attracting this description from other flora surveys. The TEC in this area is of the type Group B as described by Black et al (2010) and accepted in the Interim Recovery Plan (DBCA 2018a) as the TEC. The Monsoon Vine Thicket in the Study Area was found to be in Very Good to Good condition. The main disturbance type was the presence of weed species. Where moderate threat weeds are present the vegetation condition is Very Good. Where high threat weeds are present the vegetation condition is Good.

A 430 m^2 area of Monsoon Vine Thicket in Poor condition occurs within the Disturbance Envelope. This small area occurs at the tail end of the vegetation type extent and consists of a few isolated shrubs that are common to the Vine Thicket vegetation type. The vegetation in this location is transitioning towards VA1 sand dune vegetation. The area is bordered by disturbed areas on the north and south and has a high density of the weed species **Cenchrus biflorus*. The landform appears to be previously disturbed or part of a built landform and the vegetation is likely spontaneous regeneration.

No conservation significant flora was recorded in the Disturbance Envelope. One species of conservation significant flora was recorded on the boundary of the Study Area. The Priority 3 *Acacia monticola* x *Tumida* var *kulparn* individuals are outside of the Development Envelope and are unlikely to be impacted by the proposed project.

No weeds declared under the Biosecurity and Agricultural Management Act were recorded.

Database searches identified 82 conservation significant (CS) terrestrial fauna species (excluding shorebirds) with records in the area, including 3 records within the Study Area all for *Sula leucogaster* (Brown Booby) listed under International Agreements (IA) under State and Federal legislation and as a Marine (M) bird under Federal legislation.

The Study Area contains suitable foraging habitat for 7 CS bird species with a High likelihood of occurrence and suitable foraging habitat for 4 CS bird species with a Moderate likelihood of occurrence. No suitable habitat occurs for nesting or breeding for conservation significant birds within the Study Area. The small amount of habitat area to be cleared is very small and in poor condition in comparison to the adjoining vegetation which is larger and of higher quality. All potential bird users are highly mobile and will move away from any disturbance.

No Database records of conservation significant reptiles or mammals occur within the Study Area. The Dampierland Burrowing Snake (P2) and Dampierland Plains Slider (P2) are known to occur in the region and potentially suitable habitat exists in the dunes of the Study Area. Prior to vegetation clearing the dune vegetation should be checked for the presence of these species.

Of the conservation significant mammals known from the area, suitable habitat is present in the Study Area only for the Bilby. Given the small area and degraded condition of the Dunes vegetation within the Development Envelope, it is very unlikely to provide suitable habitat for the Bilby.

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PROJECT TERMS

Abbreviation	Meaning
The Project	Kimberley Marine Offloading Facility (KMOF) Project

UNITS OF MEASURE

Unit	Measure
%	Percentage
°C	Degrees Celsius
ha	Hectare
km	Kilometre
m	Metre
m^2	Square meters

LIST OF ABBREVIATIONS

Abbreviation	Meaning
AHD	Australian Height Datum
APM	Animal Plant Mineral Pty Ltd
BAM Act	*Biosecurity and Agricultural Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016* (Western Australia)
BoM	Bureau of Meteorology
DBCA	Department of Biological Conservation and Attractions
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ESA	Environmentally Sensitive Area
IBRA	Interim Biogeographic Regionalisation for Australia
KMOF	Kimberley Marine Offloading Facility
PEC	Priority Ecological Community
P	Priority Flora, Fauna or Ecosystems
RAMSAR	The Ramsar Convention on Wetlands of International Importance
TEC	Threatened Ecological Community
T	Threatened Flora, Fauna or Ecosystems
WA	Western Australia
WONS	Weeds of National Significance
Woodman	Woodman Environmental Consulting Pty Ltd

1 INTRODUCTION

1.1 PROJECT AND LOCATION

Kimberley Marine Offloading Facility Pty Ltd is proposing to develop the Kimberley Marine Offloading Facility (KMOF) at the Port of Broome, approximately 200 m south of the existing Broome Wharf (Figure 1-1). The proposed development will consist of a floating deep-water wharf and associated hardstand facilities suitable for the loading and discharge of containers and general cargo into coastal vessels as well as berthing and mooring of Cruise Vessels and Roll-on/Roll-off ships. The KMOF will also provide general logistics and refuelling services to berthed vessels. The land is a small area of remnant dune system and sandy beach surrounded by disturbed areas used for Port related infrastructure.

Figure 1-1: Project Location.

1.2 SCOPE OF WORK

Animal Plant Mineral was engaged by O2 Marine (O2M) to provide a Biological Survey of the Terrestrial section of the 7.4 ha Study Area (Figure 1-2). The aim of this survey was to complete a Detailed flora and vegetation survey and an assessment of the suitability of habitat for fauna of conservation significance. Specifically, the objectives of the survey of the KMOF Study Area included:

- Undertake a desktop assessment to evaluate the known botanical values of the KMOF Study Area and surrounds to identify any matters of conservation significance.
- Review previous literature and data.
- Assess the potential for conservation significant species and communities to be present at the Study Area.
- Collect botanical data collection in quadrats that are representative of all potential vegetation communities within the Study Area of sufficient detail to permit appropriate analyses.
- Collect and identify the vascular plant species present in vegetation survey quadrats, as well as opportunistically within the KMOF Study Area to provide an inventory of flora species for the site.
- Within the KMOF Study Area, identify and record the locations of any Declared Organisms under the Biosecurity and Agricultural Management Act (BAM Act).
- Define and prepare a vegetation map of the vegetation communities within the KMOF Study Area.
- Assess the condition of the vegetation communities within the Study Area.
- Assess the fauna habitat suitability and the likelihood of occurrence of conservation significant fauna.
- Perform a reconnaissance survey in the area surrounding the KMOF Study Area to identify any Threatened flora or Threatened or Priority Ecological Communities; and
- Prepare a report detailing the findings.

Figure 1-2: Kimberley Marine Offloading Facility Study Area

Legend

- KMOF Study Area
- KMOF Development Envelope
- Reconnaissance Survey routes

0 100 200 m

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Date: 15/05/2020
Coordinate Reference System: GDA94 / MGA Zone 51

2 EXISTING ENVIRONMENT

2.1 BIOREGION

The Interim Biogeographic Regionalisation for Australia (IBRA) provides the planning framework for the systematic development of a comprehensive, adequate and representative national reserve system. There are 89 recognised IBRA regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna.

The Study Area lies within the Pindanland subregion of the Dampierland Bioregion. Dampierland, described by Cotching (2006) is in the Kimberley region and has a semi-arid monsoonal climate where rainfall occurs predominantly between December and April. The area includes the Canning Basin with dunefields and intermittent swales. The surface of the Canning Basin is gently undulating Aeolian sand plains that slope gently towards the coast. Isolated mesas and hills feature in the landscape as do dunefields of long linear sand dunes.

Dampierland is divided into two subregions, the Fitzroy Trough and Pindanland. The Pindanland subregion, described by Graham (2001), is the coastal semi-arid north-western margin of the Canning Basin comprised of Quaternary sandplains mantling Jurassic and Mesozoic sandstones. The major landforms of the subregion include sandplains with hummock grasslands, marine deposits on coastal plains with mangroves and Samphire and alluvial plains of tree savannahs and ribbon grass with riparian forests fringing the drainage channels.

The dominant land use is grazing and crown Reserve. Rare features include patches of rainforest found behind the coastal primary dune system, extensive mudflats of Roebuck Bay and Eighty Mile Beach, migratory birds of Roebuck Bay and Eighty Mile Beach, rare flora, vast grasslands of Roebuck Plains, coastal swamps adjacent to Eighty Mile Beach and claypans supporting uncommon aquatic plants.

2.2 CLIMATE

Broome experiences a dry hot sub-tropical climate dominated by two seasons the wet (warm) season and the dry (cool) season (Wright, 2013). The wet season extends from November to April and the dry season from May to October. Rainfall during the wet season is highly variable, primarily due to passage of tropical cyclones and thunderstorms that typically occur between November and April (BOM, 2020). The Broome Airport Weather Station (Bureau of Meterology Station Number 3003) opened in 1939 and has recorded average annual rainfall of 623 mm. Rainfall in the January to March period for 2020 was 433 mm, near to the long-term average of 470 mm.

Hotter temperatures (Average daily minimum and maximum: ~25 and 34°C) and high humidity are also experienced during the wet season compared to the low rainfall (~1–26 mm) and moderate temperatures (Average daily minimum and maximum: ~13°C and 34°C) during the dry season from (April to October) (BoM, 2020).

Analysis of annual winds show that north-east winds predominate in the morning and north-westerlies in the late afternoon (BoM, 2019). Winds vary seasonally with winds generally from the west (ranging from south west to north west) during the wet season and during the dry season south easterly winds prevail with these south easterly winds being strongest towards the end of the dry season. Most cyclones in the region pass to the north and west of Broome.

2.3 GEOLOGY

The Broome area is characterised by a low-lying, gently undulating plain of red Pindan dunes rising to between 3 and 8 m AHD (Cardno, 2014). The Pindan dunes were formed during the Quaternary and are composed of iron rich fine-grained sand to silt sediments. On the Broome Peninsular the Pindan soils overlay the cretaceous Broome Sandstone (Wright, 2013).

The Broome Sandstone forms the bedrock over a large part of the Dampier Peninsula and is formed from terrestrial sediments which were deposited in a deltaic environment (Salisbury & Romilio, 2018). Surficial exposure of the Broome Sandstone is generally limited to the nearshore environment, but the Sandstone deposit extends down to a depth ~300 m. Outcrops of the Broome Sandstone at the project site occur offshore where they form a series of complex reefs and onshore where it forms headlands and bluff features (which are overlain with vegetated dunes of Pindan).

2.4 LAND SYSTEMS

The Land Systems of the Kimberley Region were mapped by the Department of Agriculture and Food Western Australia, in Technical Bulletin No 98 (DAF, 2012). The Study Area is designated as 'Carpentaria 1 Low Capacity System' described as Bare coastal mudflats, minor sandy margins and seaward margins, little vegetation except for mangrove fringing thickets; Coastal plains, beaches, dunes, mudflats and cliffs; Various coastal vegetation. The land is considered unsuitable for grazing.

2.5 SURFACE WATER AND GROUND WATER

Surface water runoff in the Broome area is only generated after periods of heavy rainfall (typically associated with cyclone events) and is quickly discharged from the area, often as sheet wash (Laws, 1991; Kelly, 2015). These freshwater runoff events are known to strongly influence marine, surface and groundwater turbidity and nutrient concentrations (Bennelongia et al., 2009).

There are no wetlands our watercourses at the Study Area and surface water flows are limited to natural stormwater runoff through the sand dunes onto the beach.

The Pindan sands supports a fresh superficial aquifer which is underlain by the Broome Sandstone aquifer (Kelly, 2015). The Broome Sandstone aquifer is a shallow, fresh to brackish, unconfined aquifer system which is recharged by direct infiltration from rainfall and influenced by tides (Bennelogia et al., 2009; Ecological Australia, 2016; Wright, 2013). Both aquifers discharge to the coast, with some Broome Sandstone aquifer discharged below the low tide mark within Roebuck deeps (Wright, 2013). Groundwater levels in the area are at approximately +2 to 3 m AHD and vary seasonally with highest levels in April and lowest in November/December (Kelly, 2015).

Seaward flows of surface and ground water are considered to strongly influence the ecological character of Roebuck Bay through changes in salinity (that affect the distribution of species such as mangroves) and the transport of dissolved and particulate nutrients and carbon (Bennelongia et al., 2009; Ecological Australia, 2018).

2.6 WETLANDS

The Study Area is located approximately 10 km west of the Roebuck Bay RAMSAR Wetland. The Roebuck Bay RAMSAR Wetland is a tropical marine embayment with extensive, biologically diverse intertidal mudflats.

The Wetland is recognised as a site of international importance for at least 20 species of migratory shorebirds with total numbers of waders using the site each year estimated at over 300,000. This makes the Roebuck Bay RAMSAR Wetland one of the most important sites for shorebird conservation in the World.

2.7 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas (ESAs) are declared by the Minister for Environment under section 51B of the Environmental Protection Act.

Within the Study Area three environmentally sensitive areas are identified near the Port of Broome. One is the reserves that contain the Threatened Ecological Community (TEC) Monsoon Vine Thickets. The second is the Landscape Protection Area which is considered to have high aesthetic value under the Broome town planning scheme No 6. The third is the 50 m buffer areas surrounding locations of the Threatened (T) flora *Seringia extasia*.

3 METHODOLOGY

The survey was completed to the standards set out in Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) and Guidance Statement 56: Technical Guidance – Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia June 2004.

3.1 CONTRIBUTING AUTHORS

Environmental Scientist Arlen Hogan-West conducted and collated database searches and drafted the desktop report. Dr. Eleanor Hoy conducted fieldwork and taxonomy, statistical analysis, vegetation mapping and the final report. Dr. Genevieve Hayes assessed the habitat suitability for conservation significant fauna and completed the fauna likelihood of occurrence table. Dr Mitchell Ladyman provided expertise in the design and review phases.

3.2 CONSTRAINTS

There were no constraints in the delivery of the Biological Survey, as detailed in Table 3-1.

Table 3-1: Constraints

Factor	Impact of survey outcomes
Access Problems	Not a constraint. The entire Study Area was accessible on foot.
Experience levels	Not a constraint. Sufficient expertise and experience were available. Dr Eleanor Hoy has more than 10 years' industry experience and Dr Mitchell Ladyman has over 20 years industry experience. Dr Genevieve Hayes has 5 years industry experience and Arlen Hogan West has 2 years industry experience.
Scope: Flora	Not a constraint. The entire site was visited on foot at high resolution to identify the presence of conservation significant flora and provide a complete flora inventory.
Scope: Vegetation	Not a constraint. The entire site was visited on foot. Detailed survey was conducted at a suitable number of sites to adequately describe the vegetation and determine the conservation significance.
Scope: Fauna	No fauna inventory was completed for the site. Survey effort focused on assessing the suitability of habitat for conservation significant terrestrial vertebrate fauna.
Timing, weather, season, cycle	Not a constraint. Rainfall prior to survey was close to the long-term average for the January to March period. Field survey was completed on the 21-22 March 2020. EPA (2016) Guidelines suggest appropriate survey timing for flora and vegetation between January and March.
Sources of information	Not a constraint. The regional vegetation was mapped by Keneally et al (1996) and Trudgen (1988) and the Port of Broome was mapped by Woodman (2008). Current information is available for the identification of TEC's (DBCA 2018a) and PEC's in the region (DBCA 2020a).
Completeness: Flora and vegetation	Not a constraint. The average species diversity was 16.5 and 21.5 species in VA1 and VA2 respectively, comparative to 18.17 and 26.33 (respectively) recorded in the same vegetation types by Woodman (2008; FCT1 and FCT3) over a broader geographical area. The species accumulation curves show the observed number of species is equal to the expected number of species.

Factor	Impact of survey outcomes
Completeness: Fauna	No fauna inventory was made for the Study Area. An assessment of the suitability of the habitat for conservation significant fauna was made for which there was no constraint. All habitat types were visited on foot.

3.3 DATABASE SEARCHES

The desktop assessment was undertaken using the DBCA (2007-, 2018b, 2020a, 2020b, 2020c, 2020d) and DotE (2020a, 2020b) databases. A 50 km search radius about the approximate centre point of the Study Area was used. These databases were used to identify the known occurrences of threatened and priority flora and fauna, threatened and priority ecological communities and any other matters protected under the Biodiversity Conservation Act (BC Act) and the Environmental Protection and Biodiversity Conservation Act (EPBC Act) within and/or surrounding the Study Area.

Definitions of conservation categories are listed in Appendix A. Protected Matter Search Tool (PMST) Database Search results are included in Appendix B.

3.4 PRIOR SURVEYS

Vegetation surveys previously conducted in the area were consulted to obtain an idea of the expected vegetation types and condition in the Study Area. The previous surveys consulted for this report are:

- Trudgen (1988) surveyed the Broome coastline extending northwards from Riddell Point to a location 3.5km north of the Cable Beach resort area,
- McKenzie et al (1991) surveyed the Rainforests of the Kimberley including the vine thickets of the Dampier Peninsula,
- Woodman (2008) surveyed the Port of Broome and the coastal area to Cable Beach ,
- Black et al (2010) completed a comprehensive survey of the vine thickets on coastal sand dunes of the Dampier Peninsula.

3.5 FIELD SURVEY

3.5.1 Flora and Vegetation Survey Methodology

3.5.1.1 Study Area Detailed Survey

A Detailed Survey (EPA 2016) was conducted in the Study Area. The survey occurred over the 21st and 22nd March 2020. The rainfall for the period January to March was near the long-term average and conditions were suitable for survey.

An initial reconnaissance survey across the Study Area identified the presence of different landforms and vegetation types. Eight 50 m x 50 m quadrats were allocated to these to represent the diversity of vegetation at the site. As the site is small, quadrat boundaries went beyond the Study Area boundary where necessary. Two quadrats were covering patches where a 50 m x 50 m quadrat was not suitable, the dimensions were altered but the 2500 m^2 area was maintained.

Information collected in each quadrat included:

- site code
- location, with GPS coordinates, estimate of their accuracy and datum
- size and shape of quadrat
- photograph/s from north-west corner plus other aspects that best show the vegetation type
- landform and soil description
- dominant growth form, height, cover and species for the three traditional strata (upper, mid and ground) compatible with NVIS Level V (Executive Steering Committee for Australian Vegetation Information ESCAVI 2003)
- any other location information that might be useful in vegetation classification including slope, aspect, litter, fire history, vegetation/landform/soil correlations
- assessment of vegetation condition and description of disturbances
- a comprehensive species list, including weeds; and
- quadrat marking method.

Quadrats were scored for vegetation condition using the scale recommended in EPA (2018a) for the Northern and Eremaen provinces. The Condition rating scale is shown in Table 3-2.

Table 3-2: Vegetation Condition Rating Scale

Vegetation Condition	Description
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 frequentfires, 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

Threat level of weeds was allocated using the designation of Environs Kimberly (2010) and adopted by DBCA (2018a). Threat level of weeds and their status as a Weed of National Significance (WONS) and/or declared status under the BAM Act is listed in Table 3-3.

Table 3-3: Threat level of weed species

High threat species	Moderate threat species
• coffee bush (*Leucaena leucocephala)* • buffel grass (*Cenchrus ciliaris)* WONS • morning glory (*Ipomoea quamoclit)* • lantana (*Lantana camara)* WONS/Declared Weed • white convolvulus creeper (*Merremia dissecta)* • hairy Merremia (*Merremia aegyptia)* • bellyache bush (*Jatropha gossyipifolia)* Declared Weed • mint weed (*Mesosphaerum suaveolens)* • Gallon's curse (*Cenchrus biflorus)* • neem (*Azadirachta indica)* • siratro (*Macroptilium atropurpureum)* • passion vine (*Passiflora foetida)*	• Darwin pea (*Clitoria ternatea)* • caltrop (*Tribulus terrestris)* • snakeweed (*Stachytarpheta cayennensis)* • pie melon (*Citrullus lanatus)* • vinca (*Vinca major)* • rubber tree (*Calotropis procera)* • kapok (*Aerva javanica)* • coral vine (*Antigonon leptopus)*

Targeted searches were conducted on foot at intervals of approximately 20 m, searching 10 m either side for conservation significant flora, weeds and any flora species not recorded during the Quadrat sampling.

3.5.1.2 Surrounding area Reconnaissance Survey

A Reconnaissance Survey (EPA 2016) was conducted in the area surrounding the Study Area using the routes shown in Figure 1-2. Conservation significant features were identified.

3.5.2 Flora and Vegetation Data Analysis

As the vegetation in the locality and region has been frequently surveyed before from larger areas, a Structural vegetation classification system was used. This allows the small area mapped in this survey to be compared to broader, more regional survey efforts.

Species Accumulation Curves were calculated using the Primer 7 Statistical Package (Clarke & Gorley 2015), using the Species Accum Plot routines and selecting the S and UGE Indices. The S index plots the number of species observed in each quadrat by permuting the order of the plots 999 times. The UGE Index calculated the expected number of species using the methodology derived by Ugland et al (2003).

3.5.3 Terrestrial Vertebrate Fauna Habitat Survey Methodology

The Desktop investigation identified fauna of conservation significance that is known to occur in the local area. The habitat preferences of these species were investigated. The vegetation, landforms and habitats present in the Study Area were noted for their suitability for conservation significant species.

Habitat types present at the Study Area were mapped during a reconnaissance of the Study Area and in consideration of the vegetation, condition and landforms present.

4 FLORA AND VEGETATION RESULTS

4.1 DESKTOP SURVEY

4.1.1 General Site Description

The Study Area is on the outskirts of the Broome township, currently zoned for industrial and port facilities under the Broome Shire Town Planning Scheme No.4. Both the marine and terrestrial development envelopes are located within the Port of Broome jurisdiction. The Study Area consists of coastal dune with rock outcrops and an intertidal sandy beach area. The marine portion of the Project consists of sand and rock reef.

4.1.2 Previous Vegetation Surveys

Several Flora and Vegetation surveys have been conducted over the Broome Peninsular, including within the Study Area.

Within the Dampier Peninsula, the vegetation derives from a mix of species from the deserts to the south, and monsoonal areas to the north. Kenneally et. al. (1996) distinguished 11 vegetation types on the Dampier Peninsula, the majority of which occur on coastal and marine environments on the edge of the Peninsula, with the Pindan dominating the interior. A description of these plant communities are given in Table 4-1.

Table 4-1: Vegetation types of the Dampier Peninsula as described by Kenneally et al. (1996).

Vegetation Type	Description
Pindan	Dominates the red sandplains of the Peninsula. It is composed of a grassed woodland, with a sparse upper layer of mainly eucalyptus over dense thicket of wattles. Fire is the main controlling agent, with the density of particularly the wattles relating directly to the fire cycle. *Acacia eriopoda* dominates the middle stratum in the southern half of the Peninsula, with *Acacia tumida* dominating the northern half.
Fitzroy Sandplain	Occurs north-east of Broome towards Derby, the Fitzroy sandplain is associated with the Fitzroy drainage basin, with an obvious change being the introduction of *Adansonia gregorii* (boabs). The soils are mainly heavy yellow clay loams. Savanna dominated by *Eucalyptus tectifera* and *Lysiphyllum cunninghamii* replaces pindan vegetation and is generally heavily grazed.
Rocky Outcrops	Rare on the Peninsula, and include coastal limestones and sandstones, some of which are heavily ferruginised. Broome Sandstone is exposed on the coast as mudstone and red eroding claystone, and can support thickets of *Acacia tumida*, with *Gyrocarpus americanus* and *Ficus opposita* being common. Melligo Sandstone supports various types of vegetation depending upon location. The Emeriau Sandstone outcrops are heavily ferruginised, with few locations, best seen at the Carnot-Kings Peak area. Vine thickets are found in these areas.
Creeks, wetlands and seepage areas	Low-lying sandplains associated with sub-coastal drainage valleys and seasonally swampy areas occur on the northern peninsula, including near Martins Well, just north of Pender Bay, south of Rumble Bay, areas inland of Beagle Bay and Pender Bay. Riverine communities also occur in the Coulomb Point Nature Reserve, supporting low closed forests of *Melaleuca acacioides*. Freshwater swamps occur in areas where coastal dunes truncate drainage lines, supporting low woodlands of *Lophostemon grandiflorus*

Vegetation Type	Description
	subsp. *grandiflorus*, fringed by *Melaleuca nervosa* and *M. acacioides*. Small seasonal claypans and swamps occurring further inland also occur, supporting a fringing low woodland of *Lophostemon grandiflora* and/or *Melaleuca acacioides* with *M. viridiflora* or *M. nervosa. Melaleuca cajuputi* and *M. viridiflora* groves are supported near areas of permanent fresh water; these areas also contain *Nymphoides beaglensis*, which is endemic to the Peninsula. Mound springs, including the Bunda- Bunda mound spring also locally occur, as well as Nimalaica Claypan, inland from Willie Creek. The Fitzroy River is one of the largest permanent rivers in the Kimberley, supporting dense riverine vegetation found nowhere else on the Peninsula.
Vine Thickets	Vine thickets are found in discontinuous and discrete pockets of relatively dense vegetation directly behind coastal dune systems. They are allied to rainforest and contain a predominance of Indo-Malesian plant species. Further north from the Peninsula vine thickets are not associated with coastal dunes, but with rocky sites. Vine Thickets are best developed northwards along the Peninsula and are an important habitat for species such as the great bower bird, rose-crowned fruit pigeon and agile wallaby.
Coastal dunes, beaches and limestone outcrops	Holocene sand dunes run parallel to the coast, with large areas of mobile dunes encroaching inland in the northern Peninsula. Foredunes are sparsely vegetated, predominantly with *Spinifx longifolius*, and more patchily with *Fimbristylis cymosa*, *F. sericea* and *Cyperus bulbosus*. *Acacia bivenosa*, *Lysiophyllum cunninghamii* and *Canavalia rosea* are found on areas of more established dunes. Dense shrub communities are found behind the dune crests, on backslopes and hollows. Pleistocene dunes which are older and less exposed, have more species in common with the pindan; they are dominated by *Acacia monticola* and *Gyrostemon tepperi*, as well as *Plectrachne schinzii* in areas that have not been burnt. These areas can also contain the locally important community containing an open eucalypt community with several bloodwood species. Coastal and sub-coastal limestone outcrops occur sporadically, with *Acacia bivenosa* characteristic of these areas south of Barred Creek. North of Barred Creek *Acacia bivenosa* does not occur and the area is poorly vegetated. A karst formation is found on Packer Island.
Saline grasslands	*Sporobolus virginicus* grasslands are found on tidal flats above the high-water mark. Near Broome this is best developed on the Roebuck Plains, inland from Crab Creek. This formation is found widely across the Peninsula. These areas are subject to flooding and ponding after monsoonal rains.
Saltwater paperbark thickets	Fringing stands of *Melaleuca acacioides* are found on the inner, landward margin of saline grasslands; the width and density of this community varies from a discontinuous line to half a kilometre thick.
Samphire flats	Tidal flats occurring behind Mangroves feature wide expanses of bare mud, with *Ceriops tagal* and *Excoecaria agallocha* found on the seaward margins of the mud flats. Samphire species dominate the landward side, including *Halosarcia halocnemoides*, *Neobassia astrocarpa* and *Suaeda arbusculoides*.

Vegetation Type	Description
Mangroves	12 of the 17 mangrove species known in the State are located within the Peninsula. *Avicennia marina* is the commonest species. These areas are located between high spring tide and mean sea level.
Seagrass Meadows	Most species of seagrass occur on a wide range of sediments in the Peninsula. Extensive seagrass banks are found at Roebuck Bay, with *Halophila ovalis* and *Halodule uninervis* common in this area.

Vegetation of the Port Management Area was described by Trudgen (1988) as falling into 5 groups. These are described in Table 4-2 below.

Table 4-2: Vegetation of the Port Management Area as described by Trudgen (1988)

Vegetation Type	Description
Dune Vegetation	Dunal vegetation varies with dune aspect, slope and shoreline proximity, with species such as *Spinifex longifolius*, *Canavalia rosea* and *Acacia bivenosa* colonising eroding seaward faces; whereas the seaward ridge and backslopes are colonised by species such as *Crotolaria cunninghamii, Marsdenia cinerascens, Santalum lanceolatum* and *Acacia bivenosa*
Vine Thickets	Discontinuous vine thickets occur in depressions and swales between dune ridges, with species such as *Gyrocarpus americanus, Abrus precatorius, Passiflora foetida, Tinospora smilacina* and *Capparis lasiantha* present.
Woodland	Eucalypt and Gubinge woodland over hummock grassland of *Plectrachne pungens* occur on inland dune ridge and slopes, with other species such as *Gardenia pyriformis* and *Clerodendrum tomentosum* also present. These woodlands merge with Pindan vegetation where the rearward dunes slope down onto the Pindan plain.
Pindan	Pindan vegetation present lying between Port Drive and the base of the dunes is typical of the area and is comprised of mixed Acacia/Eucalypt woodland including *Acacia eriopoda, Eucalyptus dampieri* and *Terminalia petiolaris* with scattered shrubs and grasses including *Lysiphyllum cunninghamii, Hakea macrocarpa* and *Ventilago viminalis*.
Mangrove	Mangrove communities in the PMA are limited to minor patches along the Roebuck Bay shoreline.

Woodman (2008) defined six floristic community types (FCT's) and two sub-groups across the Port Management Area and the coastal area to Cable Beach. These are listed in Table 4-3. Woodman (2008) mapped the area within the Study Area as a combination of bare areas, disturbed areas and FCT 3d and is shown in Figure 4-1.

Table 4-3: Vegetation types of the Broome Peninsula as described by Woodman (2008).

Vegetation Code	Description
FCT 1	Shrubland dominated by *Acacia bivenosa* and *Crotalaria cunninghamii* subsp. *cunninghamii* with occasional *Bauhinia cunninghamii* and *Santalum lanceolatum* over grassland dominated by *Spinifex longifolius* on pale brown sand on foredunes and on leeward side of foredunes
FCT 2	Open Woodland of *Corymbia polycarpa* over open shrubland dominated by *Crotalaria cunninghamii* subsp. *cunninghamii* and *Tephrosia rosea* var. *rosea* over grassland dominated by *Triodia acutispicula* and Poaceae sp. 2 on orange sand on secondary dunes
FCT 3	Open Woodland of mixed species including *Bauhinia cunninghamii* and *Terminalia petiolaris* over occasional shrubland dominated by *Acacia bivenosa* over lower shrubland of mixed species including *Tephrosia rosea* var. *rosea*, *Euphorbia coghlanii* and *Abrus precatorius* subsp. *precatorius* on pale orange to brown sand on lower slopes behind dunes and secondary dunes
FCT 3d	Disturbed areas of FCT 3
FCT 4	Open Woodland of mixed *Corymbia* spp., *Hakea macrocarpa* and *Persoonia falcata* over Shrubland dominated by *Acacia colei* var. *colei* and other species such as *Ehretia saligna* var. *saligna* and *Waltheria indica* over grassland dominated by *Triodia pungens* and *Triodia acutispicula* on orange to red pindan soils on lower to upper slope positions
FCT 5	Open Woodland of *Corymbia damperi* and *Corymbia zygophylla* over sparse Shrubland of *Acacia colei* var. *colei* and *Acacia eriopoda* over grassland dominated by *Triodia acutispicula*, *Triodia microstachya* or *Triodia pungens* on orange to red pindan soils on lower to upper slope positions
FCT 6	Dense Low Heath of *Acacia tumida* var. *kulparn* over mixed shrubs including *Cassytha filiformis*, *Mukia maderaspatana* and *Pterocaulon sphacelatum* over Open Hummock Grassland of *Triodia pungens* and *Triodia schinzii* on red to brown pindan soils on rocky headlands
FCT 6d	Disturbed areas of FCT 6

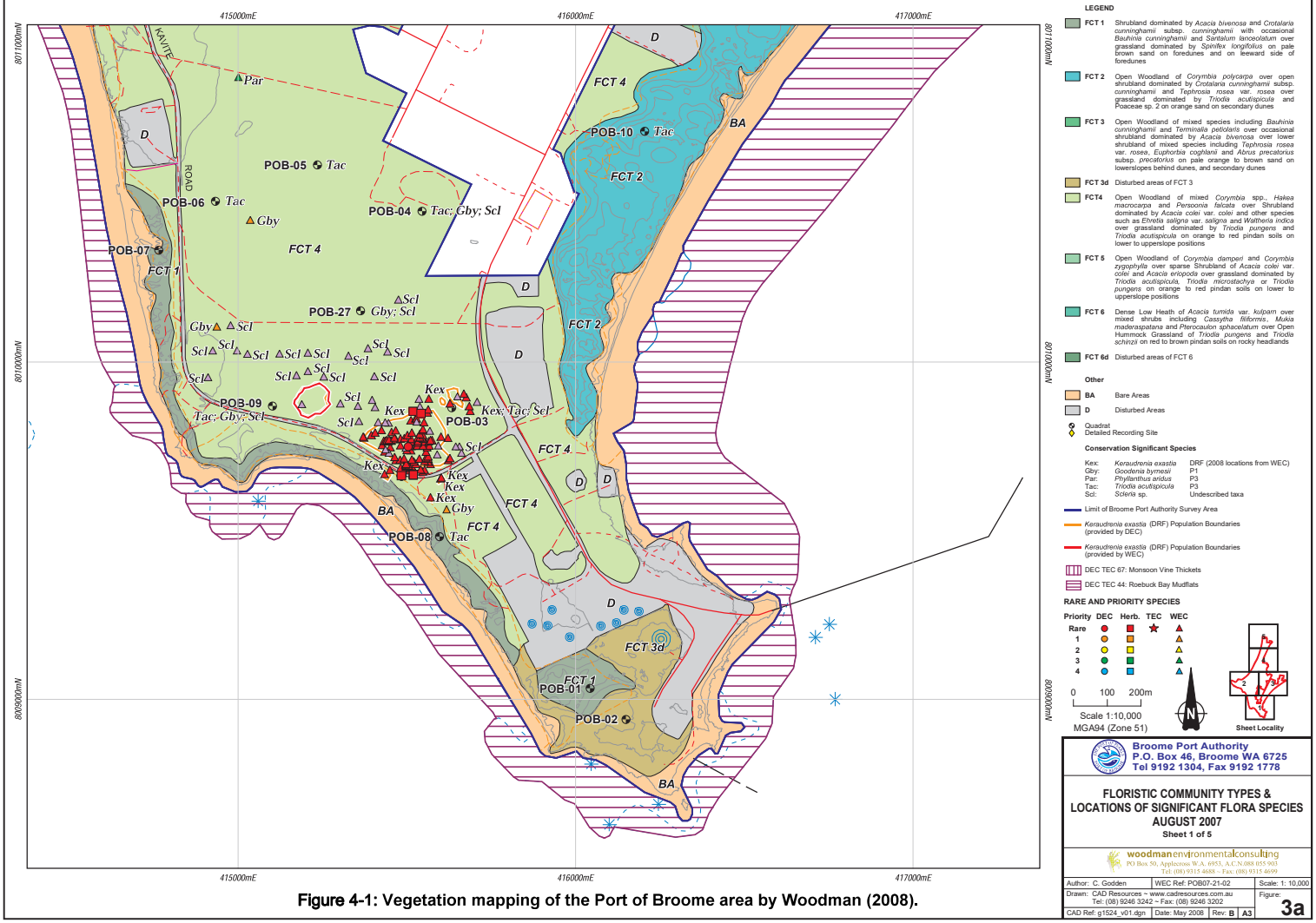


Figure 4-1: Vegetation mapping of the Port of Broome area by Woodman (2008).

LEGEND

FCT 1 Shrubland dominated by *Acacia bivenosa* and *Crotalaria cunninghamii* subsp. *cunninghamii* with occasional *Bauhinia cunninghamii* and *Santalum lanceolatum* over grassland dominated by *Spinifex longifolius* on pale brown sand on foredunes and on leeward side of foredunes

FCT 2 Open Woodland of *Corymbia polycarpa* over open shrubland dominated by *Crotalaria cunninghamii* subsp. *cunninghamii* and *Tephrosia rosea* var. *rosea* over grassland dominated by *Triodia aculispicula* and Poaceae sp. 2 on orange sand on secondary dunes

FCT 3 Open Woodland of mixed species including *Bauhinia cunninghamii* and *Terminalia petiolaris* over occasional shrubland dominated by *Acacia bivenosa* over lower shrubland of mixed species including *Tephrosia rosea* var. *rosea*, *Euphorbia coghlanii* and *Abrus precatorius* subsp. *precatorius* on pale orange to brown sand on lowerslopes behind dunes, and secondary dunes

FCT 3d Disturbed areas of FCT 3

FCT4 Open Woodland of mixed *Corymbia* spp., *Hakea macrocarpa* and *Persoonia falcata* over Shrubland dominated by *Acacia colei* var. *colei* and other species such as *Ehretia saligna* var. *saligna* and *Waltheria indica* over grassland dominated by *Triodia pungens* and *Triodia aculispicula* on orange to red pindan soils on lower to upperslope positions

FCT 5 Open Woodland of *Corymbia dampieri* and *Corymbia zygophylla* over sparse Shrubland of *Acacia colei* var. *colei* and *Acacia eriopoda* over grassland dominated by *Triodia acutispicula*, *Triodia microstachya* or *Triodia pungens* on orange to red pindan soils on lower to upperslope positions

FCT 6 Dense Low Heath of *Acacia tumida* var. *kulparn* over mixed shrubs including *Cassytha filiformis*, *Mukia maderaspatana* and *Pterocaulon sphacelatum* over Open Hummock Grassland of *Triodia pungens* and *Triodia schinzii* on red to brown pindan soils on rocky headlands

FCT 6d Disturbed areas of FCT 6

Other

BA Bare Areas

D Disturbed Areas

Quadrat
Detailed Recording Site

Conservation Significant Species

Kex:	*Keraudrenia exastia*	DRF (2008 locations from WEC)
Gby:	*Goodenia byrnesii*	P1
Par:	*Phyllanthus viridus*	P3
Tac:	*Triodia aculispicula*	P3
Scl:	*Solenia* sp.	Undescribed taxa

Limit of Broome Port Authority Survey Area

Keraudrenia exastia (DRF) Population Boundaries (provided by DEC)

Keraudrenia exastia (DRF) Population Boundaries (provided by WEC)

DEC TEC 67: Monsoon Vine Thickets

DEC TEC 44: Roebuck Bay Mudflats

RARE AND PRIORITY SPECIES

Priority	DEC	Herb.	TEC	WEC
Rare	●	■	★	▲
1	●	■		▲
2	●	■		▲
3	●	■		▲
4	●	■		▲

0 100 200m

Scale 1:10,000
MGA94 (Zone 51)

N

Sheet Locality

Broome Port Authority
P.O. Box 46, Broome WA 6725
Tel 9192 1304, Fax 9192 1778

FLORISTIC COMMUNITY TYPES & LOCATIONS OF SIGNIFICANT FLORA SPECIES AUGUST 2007

Sheet 1 of 5

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: C. Godden	WEC Ref: POB07-21-02	Scale: 1: 10,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3a
CAD Ref: g1524_v01.dgn	Date: May 2008	Rev: B A3

4.1.3 Conservation Significant Vegetation

One Threatened Ecological Community (TEC) listed under the EPBC Act is known to occur within the Port of Broome (TEC 67). Two TECs are listed under the BC Act are known to occur within the Port of Broome. These are:

- **Monsoon Vine Thickets of the Coastal Sand Dunes Dampier Peninsula ranked Endangered in February 2013 under the EPBC Act**. TEC 67: The TEC occurs as discontinuous patches of dense vegetation usually occurring on the leeward slopes and swales and sometimes the exposed crests of the coastal Holocene dune systems. Some patches may extend landward onto the red soil pindan plains. The canopy of the TEC is typically dominated by a mix of several tree or tall shrub species, including Goolnji, Ebony Wood, Mamajen, Mangarr, Gubinge and Blackberry Tree/Marool/Nawalu. The mid layer, when present, can contain semi-deciduous fruiting shrubs and small trees. The ground layer contains about 6 cm of organic matter and may have little cover where the canopy is intact. Vines and climber species may be present throughout all layers of the TEC. The relatively dense and closed nature of the TEC creates a shady and humid microclimate, with many species taking advantage of the abundance of fruiting species. The Protected Matters Search Tool (PMST) identified that this TEC is Likely to occur within a 5 km area of the Project.
  Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula Ranked as Vulnerable in Western Australia in 2001 under the (now) **BC Act** is described in the Interim Recovery Plan 2018-2023 (DBCA 2018). The community occurs as semi-deciduous vine thicket on leeward slopes of coastal sand dunes on the Dampier Peninsula. Many occurrences include scattered discrete vine thicket patches located in swales throughout the dune system and are likely to be indicators of the movement of the dune system over time. The community generally occurs on deep dune sands with a dark superficial grey organic layer, with a surface layer of moist leaf litter, but it can occur on other substrates due to other influences.

  The two are synonymous (DBCA 2018).

- **(BC Act) Roebuck Bay Mudflats.** TEC 44: species-rich faunal community of the intertidal mudflats of Roebuck bay. The intertidal sand flats of the Study Area are comprised of much coarser mobile sands than the characteristic mudflats which are found in the sheltered waters of Roebuck Bay. As such the sand flats of the Study Area do not support the same species-rich faunal community that is characteristic of the Roebuck Bay Mudflat TEC44 (O2 Marine 2019). The scope of this report is restricted to terrestrial habitats.

Two Priority Ecological Communities (PECs) are known to occur within the Port of Broome. These are:

- **Kimberley Community #11**. Priority 1: *Corymbia paractia dominated community on dunes. Corymbia paractia* occurs mostly behind the dunes, Broome township area and Dampier Peninsula. A transitional zone is evident where the coastal dunes, with vine thickets, merge with Pindan (desert) vegetation.

- **Kimberley Community #12**. Priority 1: Relict dune system dominated by extensive stands of *Sersalisia* (formerly *Pouteria*) *sericea* (Mangarr) (Plate 3 and 4). The community is recorded as a Eucalyptus, Sersalisia low woodland unit that occurs on parallel dunes in the area south east of Gantheaume Point. The community also contains numerous woodland species such as: *Erythropleum chlorostachys*

(ironwood), *Eucalyptus zygophylla* (Broome bloodwood), *Hakea macrocarpa* and *Corynotheca micrantha* (zig-zag Lilly).

4.1.4 Conservation Significant Flora

DBCA Database Searches identified 19 Priority flora species and their locations previously recorded within 50 km of the Port of Broom. Record Locations are shown in Figure 4-2. No records occur in the Study Area.

Table 4-4 identifies known habitat associations, distribution and flowering times of these taxa and makes an assessment of the likelihood of occurrence for each taxon given the habitats present in the Study Area and an assessment is made about the likelihood of detection given the climatic conditions during survey, habit and phenology of the species.

4.1.4.1 Seringia exastia

One flora species, *Seringia exastia*, declared Critically Endangered under the *BC Act* is known from the Port of Brome. The species is also listed as Critically Endangered under the *EPBC Act* under its former name *Keraudrenia exastia.* The species is known from one small area approximately 650 m north east of the Study Area. The known location was visited during the field survey and healthy plants with immature flowers were observed (Plate 4-1). The species was in a suitable condition for detection during targeted search of the Study Area.

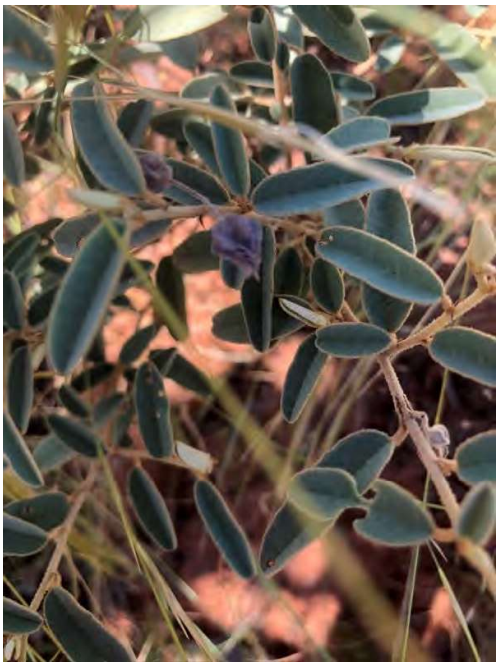


Plate 4-1. *Seringia extasia* observed during Reconnaissance survey from a known location 650 m north east of the Study Area.

S. exastia is an erect, compact, multi-stemmed shrub 0.7 to 0.9 m high. It flowers purple from April to December (DBCA 2007-). The species grows in relict desert dune swale in red sand (pindan), in Acacia shrubland, with *Gyrostemon*, *Triodia*, *Hakea* and *Eucalyptus*. Associated species include *Acacia colei var. colei, A. adoxa, Sida cardiophylla, Corchorus sidoides, Yakirra australiensis* var*. australiensis, Cucumis maderaspatana* and *Carissa lanceolata* (Trudgen 2006). The main threats to the species are road maintenance, inappropriate fire regimes, lack of tenure security, industrial development, competition, weeds, poor genetic diversity and recreational use.

Figure 4-2: Threatened flora database records

Table 4-4: Conservation significant flora identified from database searches. Likelihood of occurrence assessed for the habitats present in the Study Area.

Species	Current WA Conservation Status	Description & Habitat	Likelihood of Occurrence in Study Area and likelihood of Detection if Present
Seringia exastia	T	Erect, compact, multi-stemmed shrub that can grow to 0.9 m high. The flowers are purple and the flowering period is from April to December. Pindan heathland.	Possibly occurs, High chance of detection
Aphyllodium parvifolium	P1	Trailing shrub, to 0.3 m high. Fl. purple-pink, Apr or Jul. Sand. Sandhills.	Possibly occurs, High chance of detection
Corymbia paractia	P1	Tree (often several-stemmed), 4-6(-12) m high, bark smooth, white, shedding in thin scales. Fl. white, Apr to May or Oct to Dec. Skeletal soils. In transition zone between coastal beach dunes & red pindan soils.	Possibly occurs. High chance of detection
Jacquemontia sp. Broome (A.A. Mitchell 3028)	P1	Brown orange sand on plains.	Possibly occurs, High chance of detection
Thespidium basiflorum	P1	Densely tufted, multi-stemmed perennial, herb, to 0.2 m high. Fl. green, May to Aug. Sandy soils. Creeks.	Possibly occurs, Moderate chance of detection
Gomphrena pusilla	P2	Slender branching annual, herb, to 0.2 m high. Fl. white, Mar to Apr or Jun. Fine beach sand. Behind foredune, on limestone.	Possibly occurs, High chance of detection
Acacia monticola x tumida var. *kulparn*	P3	Plants of this presumed hybrid that occur in wind-swept coastal habitats such as Point Gantheaume, Broome, often grow as low-domed (semi-prostrate), spreading shrubs; these individuals were formerly known under the Phrase Name, Acacia sp. Riddell Beach (T. Willing 71). Further inland, however, the plants assume a taller habit (reaching 4 m in some places); these individuals were formerly known under the Phrase Name, Acacia sp. Broome (B.R. Maslin 4918).	Possibly occurs, High chance of detection
Aphyllodium glossocarpum	P3	Spreading or erect shrub, to 1.2 m high. Fl. pink-purple, Apr to Oct. Sand. Pindan.	Possibly occurs, High chance of detection
Bonamia oblongifolia	P3	Perennial, herb or shrub. Fl. blue, Feb. Sandy or gravelly soils.	Possibly occurs, High chance of detection
Glycine pindanica	P3	Prostrate or scrambling perennial, herb or climber. Fl. pink/blue-purple, Feb to Mar or Jun. Pindan soils.	Possibly occurs, High chance of detection

Species	Current WA Conservation Status	Description & Habitat	Likelihood of Occurrence in Study Area and likelihood of Detection if Present
Goodenia byrnesii	P3	Prostrate to decumbent herb, stems to 30 cm. Fl. yellow, Jan to Feb. Sand. Edge of creek.	Possibly occurs. Moderate chance of detection
Hibiscus panduriformis	P3	Shrub to 2.5 m. Flowers May to September. Sandplain.	Possibly occurs. High chance of detection
Lophostemon grandiflorus subsp. *grandiflorus*	P3	Tree, 4-8 m high. Fl. cream-white, apparently Jan to Dec. Damp habitats (swamps, seepages).	Unlikely to occur. High chance of detection
Polymeria sp. Broome (K.F. Kenneally 9759)	P3	Trailing herb, leaves greyish green, flowers mauve, March, May. In red pindan soil on road verge and in drain; near coastal plain.	Possibly occurs. High chance of detection
Seringia katatona	P3	Erect, multi-stemmed shrub to 40 cm high, 4-5-merous flowers with pink/purple calyx, May. Pindan, red sand	Possibly occurs. Moderate chance of detection
Stylidium pindanicum	P3	Annual herb to 25 cm. Flowers pink, May. Clay flat.	Unlikely to occur. Low chance of detection
Tephrosia andrewii	P3	Ascending, multistemmed shrub, to 0.8 m high. Fl. orange, Apr or Oct. Sand. In pindan country.	Possibly occurs. High chance of detection
Terminalia kumpaja	P3	Tree to 6 m, bark deeply fissured and corky.	Possibly occurs. High chance of detection
Tetragonia coronata	P3	Decumbent annual, herb. Fl. yellow, Jul. Red clay loam. Calcrete outcrops.	Unlikely to occur. Low chance of detection

4.1.5 Introduced Flora

Environmental weeds were identified during a 2004 survey of the Broome townsite (Shire of Broome, 2004), the most common of which included:

- *Leucaena leucocephala* (Coffee Bush)
- *Azadirachta indica* (Neem)
- *Jatropha gossypifolia* (Bellyache Bush)
- *Macroptilium atropurpureum* (Siratro)
- *Merremia aegyptia*
- *Merremia dissecta*
- *Passiflora foetida* (wild passionfruit)
- *Tribulus terrestris* (Caltrop)
- *Alternanthera pungens* (Khaki weed)
- *Cenchrus biflorus* (Gallon's curse)
- *Cenchrus ciliaris* (Buffel Grass)
- *Parkinsonia aculeata* (Jerusalem Thorn)
- *Prosopis* spp. (Mesquite)

Environs Kimberly (2010) nominated the weeds listed in Table 3-3 as being present in the TEC Monsoon Vine Thickets of the Coastal Sand Dunes.

The invasive flora species listed in the PMST as Species or Species Habitat likely to occur within 40 km of the Port of Broome are:

- *Cenchrus ciliaris*
- *Dolichandra unguis-cati*
- *Jatropha gossypifolia*
- *Prosopis* spp.

4.2 FIELD SURVEY

4.2.1 Summary of the Quadrat data

A total of 56 vascular plant taxa, from 23 families, were recorded from the quadrat surveys and opportunistic collections during the detailed survey. The most well-represented families were Fabaceae (13 taxa), Poaceae (9 taxa, including 3 introduced taxa) and Malvaceae (5 taxa). Appendix C displays the site data for each quadrat. Appendix D presents a list of vascular plant taxa recorded during the survey. Figure 4-3 shows the locations of quadrats. Appendix E shows the Species Accumulation Curve calculated from the data collected in the Detailed Survey quadrats, and indicates the observed number of species is equal to the expected number of species.

4.2.2 Conservation Significant Flora

One conservation significant flora taxa was recorded in the detailed survey – the Priority 3 *Acacia monticola* x *Tumida* var *kulparn.* This putative hybrid is described by Maslin (2018) as being sometimes similar to *A. eriopoda* x *monticola* which has generally narrower phyllodes. The relationship between these two putative hybrids needs further study.

The characters of bark morphology (i.e. pseudo Minni Ritchi), phyllode nervature (i.e. sparingly anastomosing) and short spikes (c. 1 cm long) are all intermediate between *A. monticola* and *A. tumida* var. *kulparn* and suggest possible hybrid origin for plants assigned to this entity. *Acacia monticola* and *A. tumida* var. *kulparn* are relatively common in the west Kimberley area and are sympatric with the putative hybrid, at least around Broome. Pods are unknown for this entity, perhaps indicating that it is a sterile hybrid. Further field and laboratory studies are needed to assess this presumed hybridity.

Plants of this presumed hybrid that occur in wind-swept coastal habitats such as Point Gantheaume, Broome, often grow as low-domed (semi-prostrate), spreading shrubs; these individuals were formerly known under the Phrase Name, Acacia sp. Riddell Beach (T. Willing 71). Further inland, however, the plants assume a taller habit (reaching 4 m in some places); these individuals were formerly known under the Phrase Name, Acacia sp. Broome (B.R. Maslin 4918). The 4 plants recorded in the survey are of the latter, taller habit.

Two conservation significant taxa were recorded in the reconnaissance survey of the surrounding area. The Threatened flora *Seringia extasia* was observed in a known location 250 m from the Study area. The Priority 1 *Corymbia paractia* was recorded approximately 50 m from the Study Area.

4.2.3 Introduced Flora

A total of 7 introduced (weed) species were recorded during the detailed survey. These species and their recording locations are shown in Figure 4-4, and their species names are also listed in Appendix D, denoted with a * prior to the species. None of these species are listed as Declared Plants. **Cenchrus ciliaris* is listed as a WONS.

Environs Kimberley (2010) considers **Passiflora foetida* **Mesosphaerum suaveolens* and **Cenchrus ciliaris* to be High Threat weeds and **Aerva javanica* and **Tribulus terrestris* to be Moderate Threat weeds to the Monsoon Vine Thicket vegetation.

4.2.4 Vegetation Associations

The vegetation within the Study Area is described in 2 Vegetation Associations (VA), with the remainder of the area being beach sand and rocky outcrops (vegetation free) or disturbed (Figure 4-3).

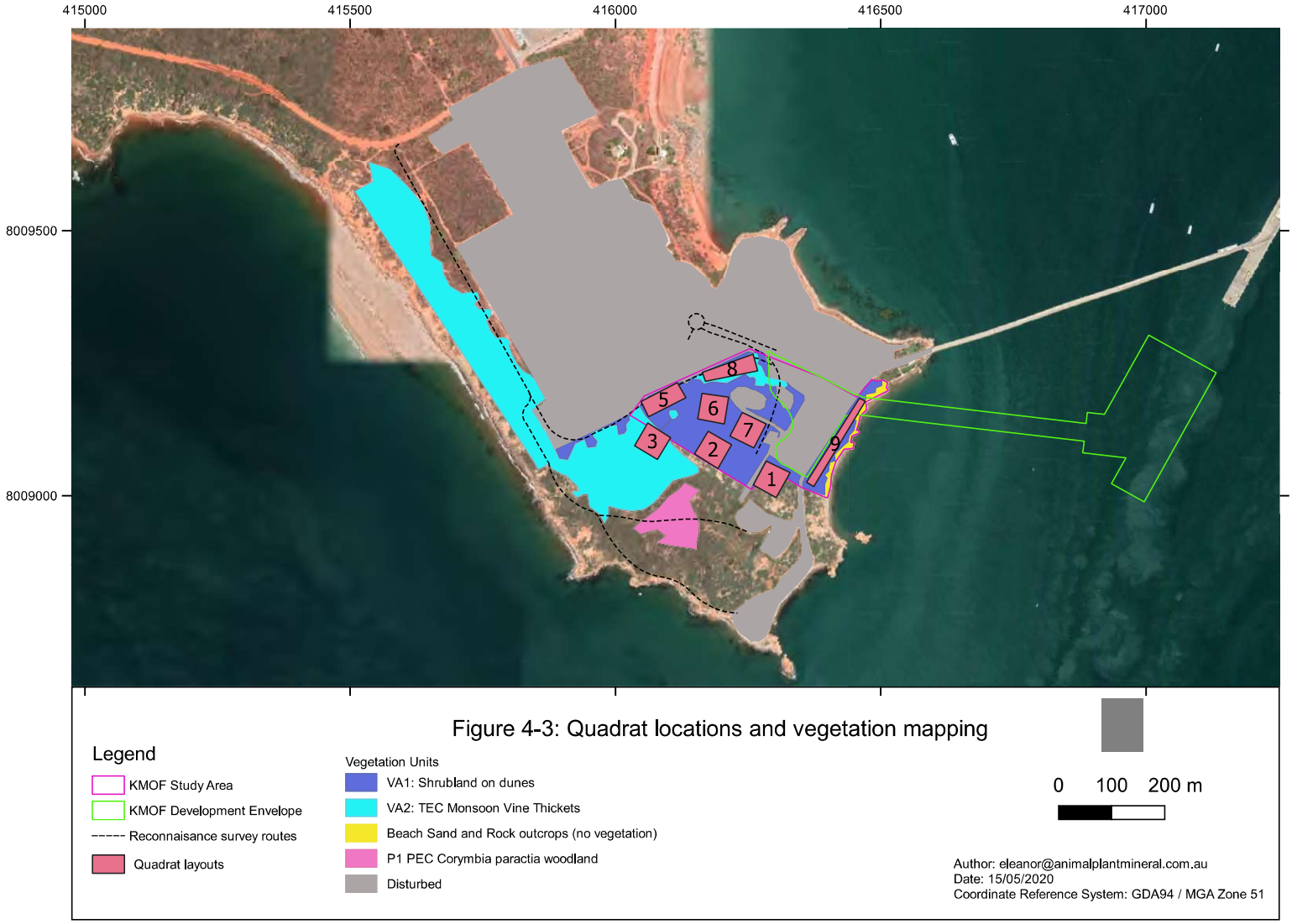


Figure 4-3: Quadrat locations and vegetation mapping

Legend

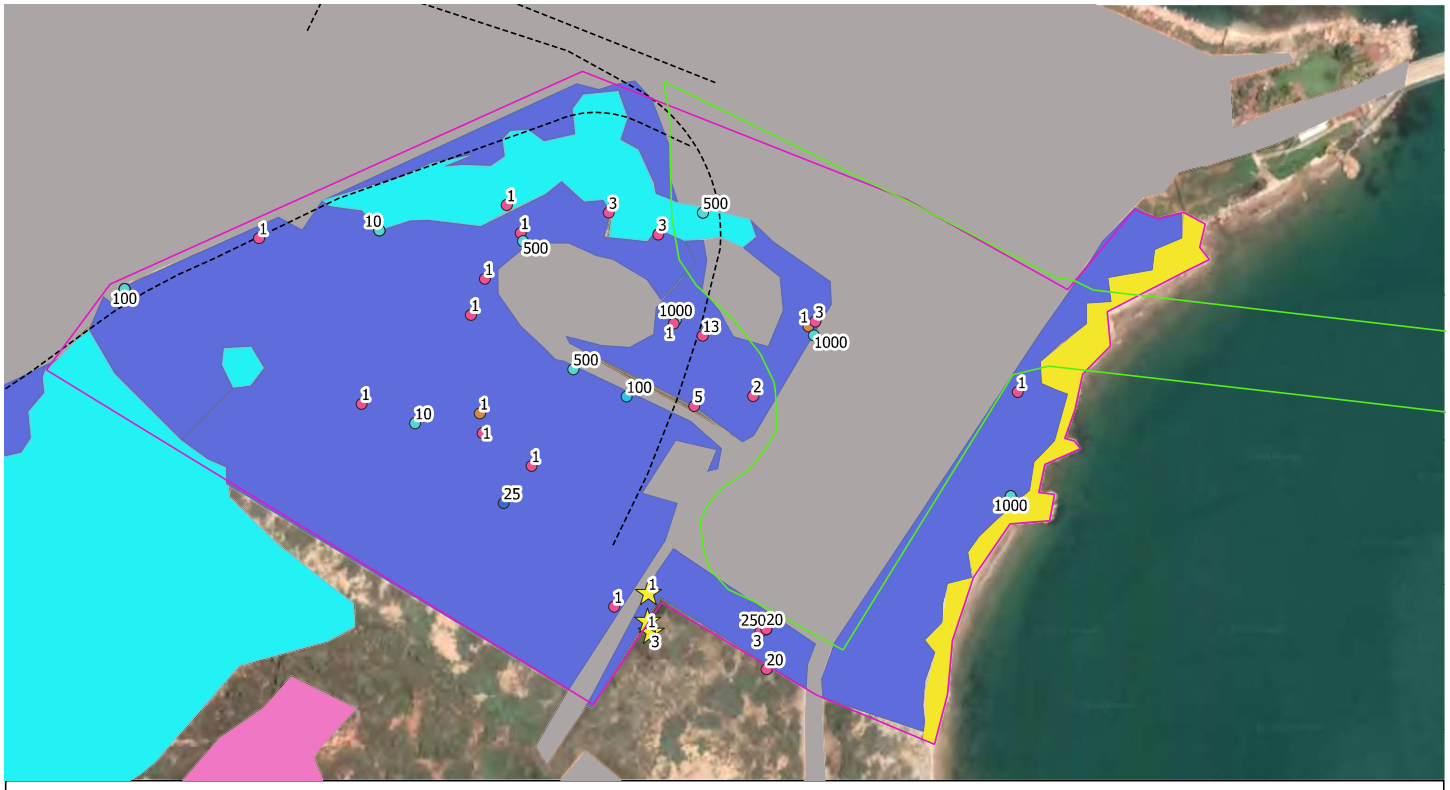
- KMOF Study Area
- KMOF Development Envelope
- Reconnaisance survey routes
- Quadrat layouts

Vegetation Units

- VA1: Shrubland on dunes
- VA2: TEC Monsoon Vine Thickets
- Beach Sand and Rock outcrops (no vegetation)
- P1 PEC Corymbia paractia woodland
- Disturbed

0 100 200 m

Author: eleanor@animalplantmineral.com.au
Date: 15/05/2020
Coordinate Reference System: GDA94 / MGA Zone 51



Legend

KMOF Study Area

KMOF Development Envelope

Targeted Search tracklogs

Threatened flora

Acacia monticola x Tumida var kulparn

Corymbia paractia

Weeds

*Aerva javanica

*Cenchrus biflorus

*Cenchrus ciliaris

*Cenchrus setiger

*Passiflora foetida

*Tribulus terrestris

Vegetation units

VA1

VA2

Beach sand and rock outcrops

Disturbed

Figure 4-4: Locations of conservatiion significant flora and weeds

0 50 100 m

Author: eleanor@animalplantmineral.com.au
Date: 13/04/2020
Coordinate Reference System: GDA94 / MGA Zone 51

VA 1

VA 1 was described by 6 quadrats (1, 2, 5, 6, 7, 9) and contained *Acacia bivenosa* and *Crotalaria cunninghamii* subsp. *cunninghamii* shrubland over *Spinifex longifolius* and *Panicum decompositum* grassland. Common species included *Ipomoea pes-caprae* subsp. *brasiliensis*, *Rhynchosia minima*, *Tephrosia rosea*, *Euphorbia coghlanii* and *Boerhavia gardneri*. This vegetation type was present on the foredune and the leeward dunes on deep sandy soils of the undulating sand dunes.

This vegetation fits within the description by Kenneally et al (1996) of coastal dunes, beaches and outcrops - on areas of more established dunes, and of Dune vegetation as described by Trudgen (1988), and FCT1 as described by Woodman Environmental Consulting (2008).

This vegetation type was generally in Very Good condition. Disturbances include occasional weeds (including **Aerva javanica*, **Cenchrus biflorus*, **Cenchrus ciliaris*, **Cenchrus setiger* and **Tribulus terrestris*) in low densities through the greater undisturbed vegetation with **Cenchrus echinatus* being more frequent next to disturbed areas.

The area of VA1 inside the Development Envelope is of Poor condition, having frequent disturbances including erosion and a high density of the weed **Cenchrus biflorus.*

This vegetation type was sampled from 6 quadrats. Quadrats 1 and 5 included a number of herbaceous and small shrub species more frequently found in sandplain vegetation (Woodman Environmental Consulting 2008), however the dominant species in all strata remained those found on the dune systems. The areas covered by Quadrats 1 and 5 show some transition towards sandplain vegetation.

Elements of Vine Thicket vegetation were also recorded in this vegetation type such as occasional *Terminalia ferdinandiana*, *Gyrocarpus americanus* subsp *pachyphyllus* and *Tinospora smilacina* but not to an extent where they were the dominant species.

The distribution of VA1 is shown in Figure 4-3 and Plate 4-1.

Plate 4-1: Vegetation Association 1, looking towards Quadrat 2 towards the Toll shed to the east.

VA2

VA2 was described by 2 quadrats (3 and 8) and contained *Gyrocarpus americanus* subsp *pachyphyllus* and *Bauhinia cunninghamii* closed woodland with *Ficus aculeata* var *indecora* open shrubland and *Spinifex longifolius* and *Triodia microstachya* grassland. Common species included *Abrus precatorius* subsp. *precatorius Jasminum didymum* subsp *lineare* and *Tinospora smilacina.* This vegetation was present in 2 areas of the leeward dunes, on deep sands with a litter layer.

This vegetation fits within the Vine Thickets description by Kenneally et al (1996) and Trudgen (1988) and FCT3 as described by Woodman Environmental Consulting (2008).

This vegetation is accepted as one of the floristic associations of the TEC Monsoon Vine Thickets on the coastal sand dunes of the Dampier Peninsula (DBCA 2018). This floristic association is described by Black et al (2010) as Group B. Group B patches occur at and towards the southern end of the distribution of thickets on each of the west and east coasts of the Peninsula. In comparison with the other patch groups of the TEC, Group B patches are situated on low dunes and other relatively exposed locations, are depauperate in evergreen trees, and have a more open shrubby structure.

This vegetation type was generally in Very Good condition. Disturbances include occasional weeds (including **Passiflora foetida* and **Cenchrus echinatus*) in low densities. The area of VA2 inside the Disturbance Envelope is in Poor condition – it is the tail end of the vegetation type, is disturbed on the on the northern and southern edges and is very sparse, transitioning into VA1 which is also in Poor condition in this area.

Quadrats of this vegetation type included species from the surrounding VA1 including *Acacia bivenosa* and *Crotalaria cunninghamii* subsp. *cunninghamii* as the areas containing this vegetation are small. Quadrat 8 also contained a few species more common to sandplain vegetation such as *Hakea macrocarpa* and *Solanum cunninghamii* – it is likely that prior to development on the northern and western sides some sandplain vegetation was present.

The distribution of VA2 is shown in Figure 4-3 and Plate 4-2, Plate 4-3, and Plate 4-4.

Plate 4-2: VA2 vegetation at Quadrat 8.

Plate 4-3: VA2 Vegetation at Quadrat 3.

Plate 4-4: Litter accumulation in VA2 vegetation at Quadrat 3.

Beach sand and rocky outcrops on the margin of the intertidal zone did not have any vegetation but are mapped in Figure 4-3 and shown in Plate 4-5. The extent of the vegetation types within the Study Area are shown in Table 4-5. Vegetation condition is shown in Figure 4-5.

Table 4-5: Extent of vegetation types in the Study Area

Type	Condition	Extent in Study Area (ha)	Extent in Development Envelope (ha)
VA1	Very Good	2.985	0.031
	Good	0.698	0.013
	Poor	0.197	0.118
VA2	Very Good	0.465	0.000
	Good	0.028	0.000
	Poor	0.053	0.043
Beaches and Rocky Outcrops	NA	0.204	0.026
Disturbed	Completely Degraded	2.770	1.834

Figure 4-5: Vegetation condition

Legend

KMOF Study Area

KMOF Development Envelope

Vegetation Condition

Very Good

Good

Poor

Completely Degraded

No Vegetation

0 75 150 m

Author: eleanor@animalplantmineral.com.au
Date: 13/04/2020
Coordinate Reference System: GDA94 / MGA Zone 51

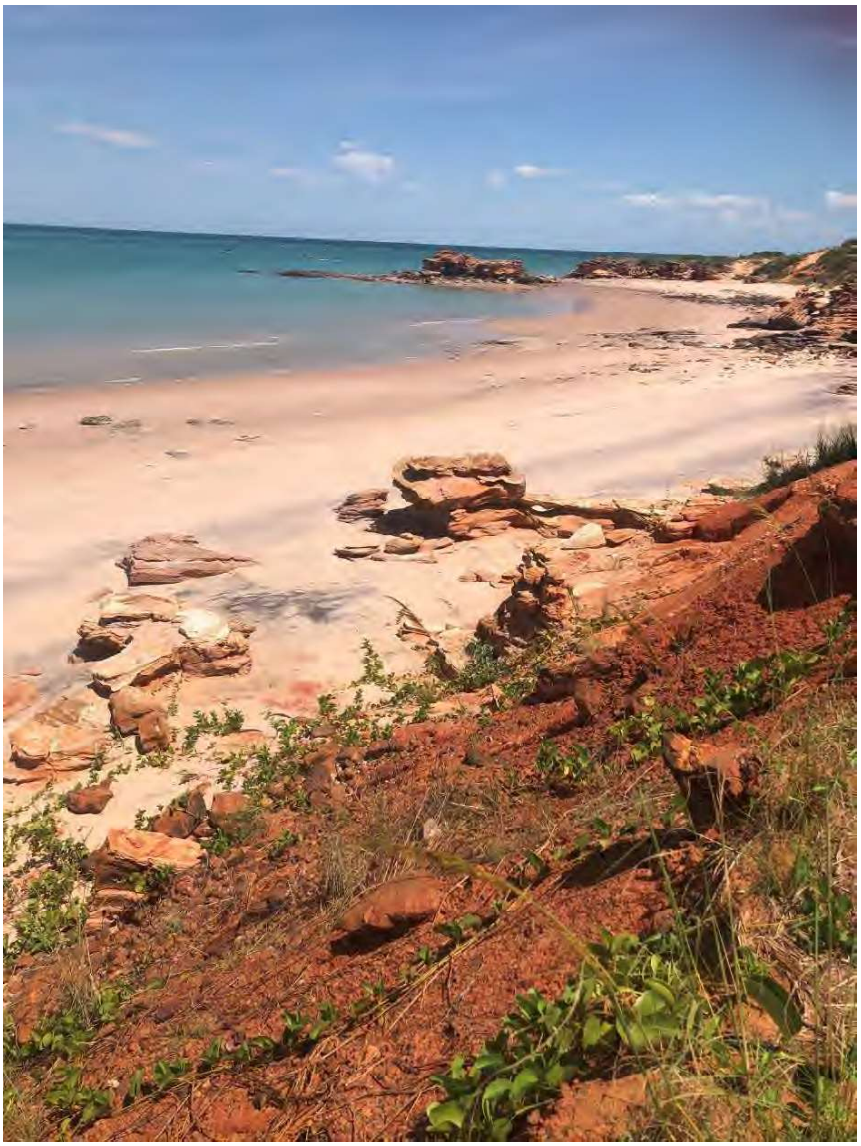


Plate 4-5: The narrow band of sand and rock outcrops between the vegetated dunes and the intertidal zone.

During the reconnaissance survey of the surrounding area the Priority 1 PEC *Corymbia paractia* woodland was also recorded (Figure 4-3, Plate 4-6). The occurrence is located approximately 50 m to the south of the Study Area. The Kimberley Region PEC number 11: *Corymbia paractia* dominated community on dunes is common between Gantheaume Point and Cable Beach, however it is apparently restricted to a narrow coastal zone in the Broome area where beach dunes merge into pindan soils (Kenneally et. al., 1996). The weed **Passiflora foetida* was recorded in this PEC in low densities.

Plate 4-6: *Corymbia paractia* woodland recorded 50 m south of the Study Area.

5 TERRESTRIAL VERTEBRATE FAUNA RESULTS

5.1 DESKTOP SURVEY

Shorebirds have been omitted from this assessment as a detailed shorebird assessment for the Project has been completed separately.

5.1.1 Conservation Significant Fauna

Database searches identified 82 conservation significant terrestrial species (excluding shorebirds) that may occur in the area. Table 5-1 lists these species, the conservation significant category they are listed in for both Western Australia and the Commonwealth, notes on known habitat preferences, whether suitable habitat occurs in the Study Area and an assessment of the likelihood of occurrence.

Table 5-1 lists 75 bird species, including seven state-listed, 14 federally listed threatened species and 14 non-migratory and 61 migratory species. For some of these species suitable foraging habitat may occur in the sand dunes. No suitable habitat occurs for nesting or breeding within the Study Area. Figure 5-1 shows the location of records from the database searches for birds of conservation significance. There are 3 records within the Study Area all for *Sula leucogaster* (Brown Booby) listed under International Agreements (IA) and as a Marine (M) bird under State and Federal legislation. Multiple observations of *Pandion cristatus* (Osprey) and one observation of *Apus pacificus* (Fork-tailed Swift) have been recorded in close proximity to the Study Area.

No Database records of conservation significant reptiles occur within the Study Area. The Dampierland Burrowing Snake (P2) and Dampierland Plains Slider (P2) are known to occur in the region and potentially suitable habitat exists in the dunes of the Study Area.

There are no terrestrial mammal records in the DBCA conservation significant fauna database for the Study Area. Records from the Broome area are shown in Figure 5-2. Of the conservation significant mammals known from the area, suitable habitat is present only for the Bilby.

Figure 5-1. Database bird records excluding Shorebirds

Legend

KMOF Study Area

KMOF Development Envelope

Conservation Category

CR

EN

VU

P1

P2

P3

P4

IA

OS

0 1 2 km

Author: eleanor@animalplantmineral.com.au
Date: 13/04/2020
Coordinate Reference System: GDA94 / MGA Zone 51

Figure 5-2. Database terrestrial reptile and mammal records

Table 5-1. Conservation significant fauna species identified in Database Searches

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
BIRDS										
APODIFORMES										
Apus pacificus	Fork-tailed Swift	IA, M	IA	The Fork-tailed Swift is a non-breeding migrant to Australia (arrive: October; leave: April). In WA, this species is widespread between Augusta and Carnarvon, including subcoastal areas, and some nearshore and offshore islands, with scattered records along the remaining coast and some inland areas (DoE, 2020a). It occupies low to very high airspace over a range of habitat types, from rainforest to semi-arid environments (Morcombe, 2010).	High	Y	Y	Y	-	Suitable foraging habitat exists in the Study Area and nearby recordings exist. This species is **likely to occur** in the airspace over the Study Area.
Hirundapus caudacutus	White-throated Needletail	VU, IA, M	IA	The White-throated Needletail is a non-breeding migrant to Australia (arrive: October; leave: March/April). It hawks for prey high in open spaces of sky above most habitat types, including oceans (Morcombe, 2010).	High	Y	Y	Y	-	Suitable foraging habitat exists in the Study Area and nearby recordings exist. This species is **likely to occur** in the Study Area.
CICONIIFORMES										
Ixobrychus dubius	Australian Little Bittern	-	P4	The Australian Little Bittern inhabits freshwater swamps, lakes, and rivers with dense reedbeds, tall sedges, and well-vegetated margins. It also	Low	-	-	-	-	No suitable habitat exists in the Study Area; however, the species has previously been

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				occurs in brackish and saline wetlands, such as mangroves, saltmarsh, and coastal lagoons. Populations tend to be localised (Morcombe, 2010).						recorded nearby. This species is **unlikely** to occur in the Study Area.
Ixobrychus flavicollis australis (southwest subpop.)	Black Bittern (southwest subpop.)	-	P2	The Black Bittern inhabits various wetlands. It requires dense water-edge vegetation, and inhabits freshwater springs and billabongs, and tidal reaches of creeks and rivers (Morcombe, 2010). It nests in trees, and largely forages from shady trees over water, as well as in open areas of short, marshy vegetation (Australian Museum, 2020b).	Low	-	-	-	-	No suitable habitat exists in the Study Area; however, the (broader) species has previously been recorded nearby. This species is **unlikely** to occur in the Study Area..
Plegadis falcinellus	Glossy Ibis	IA, M	IA	The Glossy Ibis inhabits shallows of swamps, floodwaters, sewage ponds, and flooded or irrigated pastures. It occasionally feeds on moist pastures or in sheltered marine habitats (Morcombe, 2010).	Low	-	-	-	-	While this species is common across the coastal north of Australia, no suitable habitat exists in the Study Area. This species is **unlikely to occur** in the Study Area.
CUCULIFORMES										
Cuculus optatus	Oriental Cuckoo	IA	IA	The Oriental Cuckoo migrates to Australia during the northern autumn and leaves during the southern autumn/winter. It inhabits rainforest margins, monsoon forest,	Low	-	-	-	-	No suitable habitat exists in the Study Area. This species is **unlikely to occur** in the Study Area.

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				vine scrubs, riverine thickets, wetter, densely-canopied Eucalypt forests, paperbark swamps, and mangroves (Morcombe, 2010).						
FALCONIFORMES										
Elanus scriptus	Letter-winged Kite	-	P4	The Letter-winged Kite occurs in semi-arid and arid areas in Australia. It inhabits tree-lined creeks, and hunts over low vegetation, such as grasslands (Morcombe, 2010). It roosts by day in the high canopy of leafy trees.	Moderate	-	-	Y	-	Suitable foraging habitat may exist in the Study Area; however, roost sites are unlikely to exist. This species **may occur** in the Study Area when foraging.
Falco hypoleucos	Grey Falcon	-	VU	The Grey Falcon typically inhabits lightly timbered country, especially stony plains and lightly timbered Acacia scrublands (Morcombe, 2010). It is usually found in shrubland, grassland, and wooded areas of arid/semi-arid regions, although it also occurs in open, coastal woodlands (OEH, 2017).	Moderate	-	-	Y	-	Suitable habitat exists in the Study Area. This species **may occur** in the Study Area.
Falco peregrinus	Peregrine Falcon	-	OS	The Peregrine Falcon inhabits diverse environments, from rainforest to arid scrublands, and altitudes, from coastal heath to alpine; it prefers coastal and inland cliffs, or open woodlands near water. It requires abundant prey (birds) and secure nest sites (Morcombe, 2010).	Moderate	-	Y	Y	-	Suitable foraging habitat may exist in the Study Area, but appropriate trees for nesting are not available. This species **may occur** in the Study Area when foraging.

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
Pandion cristatus	Osprey	IA*, M*	IA	The Osprey is typically associated with water around coastal Australia and is common in northern Australia. It inhabits littoral and coastal habitats, and terrestrial wetlands in tropical and temperate Australia, and prefers coastal cliffs and elevated islands (DoE, 2020f). It is also known to follow major water bodies inland, even into arid regions (Morcombe, 2010). This species requires open water for foraging (DoE, 2020f).	High	-	Y	Y	-	Suitable habitat exists in the Study Area. This species is **likely to occur** in the Study Area.
PASSERIFORMES										
Erythrura gouldiae	Gouldian Finch	EN	P4	The Gouldian Finch is sparsely distributed across northern Australia. The species is dependent on select grasses for its diet, especially native Sorghum and Spinifex species, and nearby water sources. During the breeding season, the species inhabits small patches of open woodland, with hollow-bearing Eucalyptus trees (required for nests) and a grassy understorey (TSSC, 2016).	Low	-	-	Y	-	Suitable foraging habitat may exist in the Study Area but of low quality. Although there are recordings nearby, this species is **unlikely to occur** in the Study Area.
Cecropis daurica	Red-rumped Swallow	IA*, M*	IA	The Red-rumped Swallow inhabits open country, coastal grasslands, forest, shrubland, and rocky areas. It	High	-	Y	Y	-	Suitable habitat exists in the Study Area. This

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				is a rare vagrant in Australia (Morcombe, 2010).						species is **likely to occur** in the Study Area.
Hirundo rustica	Barn Swallow	IA	IA	The Barn Swallow inhabits open country, often near water, and can be found in/near towns; it tends to be noticed when perched on overhead wires. It is a vagrant species in Australia but is seen regularly in the north and northeast of Australia (Morcombe, 2010).	High	Y	Y	Y	Y	Suitable habitat exists in the Study Area. This species is **likely to occur** in the Study Area.
Motacilla cinerea	Grey Wagtail	IA, M	IA	The Grey Wagtail is a vagrant to Australia, with rare, disjunct records along the coast of the mainland. In Australia, it has been recorded near fresh sandy or rocky streams, as well as on disturbed land (Morcombe, 2010).	High	-	-	-	Y	Suitable habitat may exist in the Study Area. This species has been recorded nearby and is **likely to occur** in the Study Area**.**
Motacilla flava	Yellow Wagtail	IA, M	IA	The Yellow Wagtail is a summer migrant to northern Australia, especially in the northwest between Broome and Darwin. It inhabits open habitats, often near water, including disturbed and undisturbed habitats, and occasionally inhabits drier inland plains (Morcombe, 2010).	High	Y	Y	-	Y	Suitable habitat exists in the Study Area. This species is **likely to occur** during migration periods in the Study Area.
PELECANIFORMES										
Fregata ariel	Lesser Frigatebird	IA, M	IA	The Lesser Frigatebird is common in northern Australia. It inhabits marine environments, including airspace	Low	-	-	-	-	This species typically only comes ashore to breed and only breeds on

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				over tropical seas, and is usually pelagic. It is often encountered far from land, as well as over shelf waters, in places close inshore, and inland over continental coastlines (Morcombe, 2010).						remote islands. This species is **unlikely to occur** in the Study Area.
Fregata minor	Greater Frigatebird	IA, M	IA	The Greater Frigatebird is regularly encountered around northern, tropical coasts of Australia, from Pt Cloates, WA, to North Stradbroke, QLD (Morcombe, 2010). It is a marine species, but breeds on small, remote tropical and sub-tropical islands, in mangroves or bushes, or occasionally on bare ground (BirdLife International, 2012).	Low	-	-	-	-	This species typically only comes ashore to breed and only breeds on remote islands. This species is **unlikely to occur** in the Study Area.
Papasula abbotti	Abbott's Booby	EN, M		The Abbott's Booby is endemic to Christmas Island and its surrounding seas (Morcombe, 2010). It is a marine species, but comes to shore to breed. It nests in tall plateau forest and upper terrace forest on Christmas Island, where the trees are associated with uneven terrain and uneven canopy (DoE, 2020g).	Low	-	-	-	-	This species only comes to shore to breed, and no suitable breeding habitat exists in the Study Area. While it is only known to breed on Christmas Island, this species has previously been recorded at Eco Beach, south of Broome (the first recording of the species outside of Christmas Island and

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
										surrounding waters). This species is **unlikely to occur** in the Study Area.
Sula leucogaster	Brown Booby	IA, M	IA	The Brown Booby is a marine, largely tropical species, associated with deep waters and inshore shallows. It is common along the northern coast of Australia, from North West Cape, WA, to southeast QLD (Morcombe, 2010).	Moderate	Y	Y	-	-	This species breeds on islands and does not typically come within 18 km of mainland. However, suitable habitat may exist in the Study Area. This species **may occur** in the Study Area.
PROCELLARIIFORMES										
Ardenna pacifica	Wedge-tailed Shearwater	IA, M	IA	The Wedge-tailed Shearwater is a pelagic species and inhabits tropical and subtropical seas. It is common in coastal and oceanic waters of east and west Australia (Morcombe, 2010).	Low	-	-	-	-	This species only comes ashore to breed. No suitable breeding habitat exists in the Study Area, and, as such, this species is **unlikely to occur** in the Study Area.
Ardenna tenuirostris	Short-tailed Shearwater	IA, M	IA	The Short-tailed Shearwater is a marine, pelagic species. It is typically found over continental shelf waters (Morcombe, 2010).	Low	-	-	-	-	This species is not typically found along the west coast and is **unlikely to occur** in the Study Area.
Bulweria bulwerii	Bulwer's Petrel	IA, M	IA	The Bulwer's Petrel is a marine, pelagic species. It is typically found over warmer waters. It may be quite common from Sep to Apr in	Low	-	-	-	-	This species only comes ashore to breed. No suitable breeding habitat exists in the Study Area,

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				northwest waters of Australia (Morcombe, 2010).						and, as such, this species is **unlikely to occur** in the Study Area.
Calonectris leucomelas	Streaked Shearwater	IA, M	IA	The Streaked Shearwater is a pelagic species, found over shelf water and further out, and rarely inshore. It is a common summer-autumn visitor to the north, west, and east coasts of Australia (Morcombe, 2010).	Low	-	-	-	-	This species only comes ashore to breed. No suitable breeding habitat exists in the Study Area, and, as such, this species is **unlikely to occur** in the Study Area.
Oceanites oceanicus	Wilson's Storm-petrel	IA, M	IA	The Wilson's Storm-petrel is found over deep pelagic seas, shelf slopes, and shallower shelf and inshore waters. Its range extends from Antarctic pack-ice to subtropical areas. It is widespread and abundant (Morcombe, 2010).	Low	-	-	-	-	This species only comes ashore to breed. No suitable breeding habitat exists in the Study Area, and, as such, this species is **unlikely to occur** in the Study Area.
Puffinus huttoni	Hutton's Shearwater	M	EN	The Hutton's Shearwater is preferentially found in continental shelf waters; however, it can also occur in estuaries, bays, and channels. It is migratory around most of the Australian coast (Morcombe, 2010). It digs burrows high on gentle mountain slopes, under tussock grass or low alpine scrubland in New Zealand (BirdLife International, 2019).	Low	-	-	Y	-	Suitable burrowing habitat does not exist in the Study Area. This species is **unlikely to occur** in the Study Area.

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
PSITTACIFORMES										
Polytelis alexandrae	Princess Parrot	VU	P4	The Princess Parrot is sparsely distributed across arid regions of WA, SA, and the NT. It inhabits sand dunes and sand flats and occurs in open savanna woodlands and shrublands. It requires hollowing-bearing Eucalyptus trees near waterways for nesting but will occasionally nest in *Allocasuarina decaisneana* trees away from water (TSSC, 2018).	Low	-	-	Y	-	Suitable foraging habitat may exist in the Study Area, but no hollow-bearing trees exist or proximity to freshwater. This species is **unlikely** to occur in the Study Area.
STRIGIFORMES										
Ninox connivens connivens	Barking Owl	-	P3	The Barking Owl inhabits open country, with stands of trees, tree-lined watercourses, or paperbark swamps in north and northwest Australia (Morcombe, 2010). It is most common in savannah woodland, as well as forested hill and riverine woodlands. It nests in hollows of tree trunks (Australian Museum, 2020a).	Low	-	-	-	-	Suitable habitat exists in the Study Area. This species **may occur**.
Tyto novaehollandiae kimberli	Masked Owl (northern)	VU	P1	The Masked Owl roosts and nests in heavy forests, and hunts over open woodlands or farmlands. It is uncommon to rare in Australia (Morcombe, 2010). The distribution of the northern subspecies is poorly	Low	-	-	-	-	No suitable habitat in the Study Area. This species is **unlikely** to occur in the Study Area.

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				known, but three subpopulations have been suggested: Kimberley, NT, and Cape York. The subspecies has been recorded in riparian, rain-, and open forest, Melaleuca swamps, and the edges of mangroves (DoE, 2020h).						
Tyto novaehollandiae novaehollandiae	Masked Owl (southern)	-	P3	The Masked Owl roosts and nests in heavy forests, and hunts over open woodlands or farmlands. It is uncommon to rare in Australia (Morcombe, 2010).	Low	-	-	-	-	No suitable habitat exists at the Study Area. This subspecies has not been recorded in northern Australia and is **unlikely to occur** in the Study Area.
REPTILES										
ELAPIDAE										
Simoselaps minimus	Dampierland Burrowing Snake	-	P2	The Dampierland Burrowing Snake is known only from Dampier Land, in the southwest Kimberley. It inhabits coastal dunes and sandy junctions between dunes and adjacent Acacia shrublands (Wilson and Swan, 2010).	High	-	-	Y	-	Suitable habitat exists in the Study Area. This species is **likely to occur**.
SCINCIDAE										
Ctenotus angusticeps	Airlie Island Ctenotus	-	P3	The Airlie Island Ctenotus is known from 12 localities in WA. Roebuck Bay individuals inhabit coastal mudflats vegetated with samphire, while other mainland populations inhabit fringes of salt marsh	Low	-	-	-	-	No suitable habitat exists in the Study Area. This species is **unlikely** to occur.

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				communities in samphire shrubland or marine couch grassland (Wilson and Swan, 2010; DoE, 2020c).						
Lerista separanda	Dampierland Plain Slider	-	P2	The Dampierland Plain Slider inhabits sandy areas of the southwest Kimberley coast, between Kimbolton and Nita Downs (Wilson and Swan, 2010).	High	-	-	Y	-	Suitable habitat exists in the Study Area. This species is **likely to occur**.
MAMMALS										
EMBALLONURIDAE										
Saccolaimus saccolaimus nudicluniatus	Bare-rumped Sheath-tailed Bat	VU	P3	The Bare-rumped Sheath-tailed Bat is uncommon, with deficient information. it inhabits lowland areas, typically in a range of woodland, forest, and open environments (DoE, 2020i). It roosts in tree hollows, and forages above the canopy or lower in forest clearings (Menkhorst and Knight, 2011).	Low	-	-	Y	-	The species' range is not known to extend to the southwest Kimberley. However, suitable habitat may occur within the Study Area, if nearby trees are hollow-bearing. The species is **may occur**.
MOLOSSIDAE										
Ozimops cobourgianus	North-western Free-tailed Bat	-	P1*	The North-western Free-tailed Bat typically inhabits forests and woodlands, as well as near-coastal Melaleuca forests, rainforests, Eucalypt forests, woodlands, open floodplains, and saline coastal flats (Reardon *et al*., 2017).	Low	-	-	Y	-	Suitable habitat may exist in the Study Area. This species is **may occur**.

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
MURIDAE										
Hydromys chrysogaster	Water-rat (Rakali)	-	P4	The Rakali is widespread and common in much of coastal north, east, and southwest Australia. It inhabits a variety of aquatic environments, including subalpine streams, slow inland rivers, lakes, farm dams, and sheltered marine waters. It typically forages in water or adjacent vegetation, and lives in burrows alongside rivers or lake banks (Menkhorst and Knight, 2011).	Low	-	-	-	-	This species has not been recorded on the Dampier Peninsula. This species is **unlikely to occur** in the Study Area.
Mesembriomys macrurus	Golden-backed Tree-rat	-	P4	The Golden-backed Tree-rat is restricted to the northwest Kimberley. It is arboreal, but spends a large amount of time on the ground; it shelters and nests in tree hollows or in dense cover, such as pandanus foliage (Menkhorst and Knight, 2011). It inhabits rainforest and riparian areas, Eucalypt-dominated woodlands and savannas, *Livistona* palm woodlands, and rugged sandstone plateaux and screes (TSSC, 2019).	Low	-	-	-	-	This species' range no longer includes the Study Area, and suitable habitat does not exist. This species is **unlikely to occur** in the Study Area.
Xeromys myoides	Water Mouse, False Water-rat	VU	-	The Water Mouse occurs in the NT and QLD. It inhabits saline grassland, mangroves, margins of freshwater swamps, and lakes close to	Low	-	-	-	-	While suitable habitat may exist in the northern Kimberley, this species has never been recorded

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				foredunes. It constructs leaf nests in networks of burrows in muddy banks or clay mounds, with entrances in raised mounds (Menkhorst and Knight, 2011).						in WA, and suitable habitat does not exist in the Study Area. This species is **unlikely to occur** in the Study Area.
DASYURIDAE										
Dasyurus hallucatus	Northern Quoll	EN	EN	The Northern Quoll is predominantly nocturnal. It dens in rock crevices, tree holes or occasionally termite mounds (TSSC, 2005). In WA, it is restricted to the Pilbara and Kimberley regions (TSSC, 2005). The Northern Quoll occurs in a variety of habitats across their range, including low open eucalypt woodland and hummock grass, and deciduous vine thicket and open eucalypt woodland over dense grasses. Rocky habitat constitutes habitat critical to the survival of this species (Hill and Ward, 2010).	Low	-	-	-	-	No suitable habitat exists in the Study Area. This species has not previously been recorded on the Dampier Peninsula, and is **unlikely to occur** in the Study Area.
PHALANGERIDAE										
Trichosurus vulpecula arnhemensis	Northern Brushtail Possum	-	VU	The Northern Brushtail Possum occurs in northern WA and the NT. It inhabits most treed environments in Australia, including closed and open forests and woodlands in sub-/tropical areas (AFD, 2015). It dens in tree hollows or other sheltered	Low	-	-	-	-	This species has been recorded near Broome previously; however, no suitable habitat exists in the Study Area. This species is **unlikely to occur**.

Species		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments
Scientific	Common	Cth	WA			Beach	Rocky outcrops	Dunes	Disturbed areas	
				areas, sometimes at ground level (Menkhorst and Knight, 2011).						
Wyulda squamicaudata	Scaly-tailed Possum	-	P4	The Scaly-tailed Possum is patchily distributed in the northwest Kimberley in low open woodlands, riparian forest, and vine thickets where tumbled boulders provide shelter. It shelters in rock crevices during the day, and is active nocturnally (Menkhorst and Knight, 2011).	Low	-	-	-	-	No suitable habitat exists in the Study Area. This species has not been recorded on the Dampier Peninsula, and is **unlikely to occur** in the Study Area.
THYLACOMYIDAE										
Macrotis lagotis	Bilby	VU	VU	The distribution of the Greater Bilby has greatly declined since European settlement, with populations now restricted to the north of Australia. Currently, this species occupies three habitat types: i) open tussock grassland on uplands and hills; ii) mulga woodland/shrubland on ridges and rises; and iii) hummock grassland on sand plains and dunes, drainage systems, salt lake systems, and other alluvial areas. The species is solitary and shelters in burrows during daylight (Pavey, 2006a).	High	-	-	Y	-	Suitable habitat is known to occur, and the current range of the species includes the Study Area. This species is considered **likely to occur** in the Study Area.

CR Critically Endangered; **EN** Endangered; **VU** Vulnerable, **NT** Near Threatened. **IA** Listed as a 'Migratory species' under International Agreement under the EPBC Act. **M** Listed as a 'Marine species' under the EPBC Act. **OS** Listed as 'Other specially protected fauna' under the BC Act. **P1-3** Listed as 'Priority 1-3: Poorly-known species' under the BC Act. **P4** Listed as 'Priority 4: Rare, Near Threatened and other species in need of monitoring' under the BC Act. * Listed under a different scientific name.

5.1.2 Fauna Habitats

Four habitat types occur in the Study Area – Beach, Rocky Outcrops, Dunes and Disturbed Areas. Fauna Habitats are shown in Figure 5-3. Within the Disturbance Envelope there are all four habitat types, with Disturbed Areas being the predominant type, a small area of degraded dunes habitat and a small area of beach and rocky outcrop (Table 5-2).

Table 5-2: Fauna Habitat extents in the Study Area

Habitat Type	Extent in the Study Area (ha)	Extent in the Development Envelope (ha)
Dunes	2.426	0.205
Beaches and Rocky Outcrops	0.204	0.026
Disturbed Areas.	2.770	1.834

Figure 5-3. Fauna Habitat

Legend

KMOF Study Area
KMOF Development Envelope

Fauna Habitat
Dunes
Sand and Rocky Outcrops
Disturbed Areas

0 75 150 m

Author: eleanor@animalplantmineral.com.au
Date: 15/05/2020
Coordinate Reference System: GDA94 / MGA Zone 51

6 CONCLUSIONS

6.1 VEGETATION OF CONSERVATION SIGNIFICANCE

Woodman (2008) noted that vegetation communities vary significantly on the Broome Peninsula moving northwards from the Port of Broome, due to the effect of the ocean on the climate at either end of the Broome Peninsula. The location of the Port of Broome is at the southernmost extent of the Dampier Peninsula, and as such is the driest.

A number of locations have been described here as the Threatened Ecological Community 'Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula', despite previously not attracting this description from other flora surveys.

Black et al., (2010) describe the TEC in this location as Group B. Group B patches occur at and towards the southern end of the distribution of thickets on each of the west and east coasts of the Peninsula. In comparison with the other patch groups, Group B patches are situated on low dunes and other relatively exposed locations, are depauperate in evergreen trees, and have a more open shrubby structure. The observed occurrences in this survey are of this structure. Prior to the comprehensive survey and description of the TEC by Black et al (2010), previous surveys may have considered the density of vine thicket species in this area to be insufficient to merit designation as the TEC. Description of the Group B by Black et al (2010) and acceptance of those occurrences in the Interim Recovery Plan (DBCA 2018) lead to a reinterpretation of the vegetation as the TEC.

Woodman Environmental Consultants (2008) mapped the area in the south western corner of the peninsula as being FCT1 and FCT3d. Woodman Environmental Consultants (2008) considered the vegetation 3d to be disturbed. It is possible that the development area to the north has altered the surface and groundwater flows in the locality such that the remnant dunes no longer receive runoff from the north. This would reduce the available water and lead to a reduction in the condition of the vegetation. However, the vine thickets of the Dampier Peninsula were on the margins of the sites sampled by McKenzie et al., (1991) in the assessment of Kimberly Rainforest, as well as the margin of rainforest distribution in the south western Kimberley. It is considered here that the sparser canopy and occurrence of non-vine thicket species is more a reflection of the marginal suitability of the site rather than any human induced disturbance, and the vegetation is considered to be generally in Very Good to Good condition.

There are approximately 2,887 hectares in 90 occurrences of the Monsoon Vine Thicket community recorded on Biodiversity, Conservation and Attractions' TEC database. The average area of occurrences is about 33ha (DBCA. 2018). The occurrences in the Broome Port Authority area are comparatively small.

The main disturbance is the presence of weeds considered High Threat by Environs Kimberly (2010). Although present their distribution is generally quite restricted and much of the vegetation is weed free and in Very Good condition.

Yet the area of Monsoon Vine Thicket within the Disturbance Envelope is in Poor condition. This small area (430 m^2) occurs at the tail end of the vegetation type extent and consists of a few isolated shrubs that are common to the Vine Thicket vegetation type. The vegetation in this location is transitioning towards VA1 sand dune vegetation. The area is bordered by disturbed areas on the north and south and has a high density of the weed species **Cenchrus biflorus*. The landform appears to be previously disturbed or part of a built landform and the vegetation is likely spontaneous regeneration.

An area of the P1 PEC *Corymbia paractia* woodland was recorded outside of the Study Area. This area is unlikely to be impacted by the Proposed KMOF Project, given the majority of the Disturbance Envelope is on previously disturbed land.

A small area of VA1 vegetation in Poor condition is within the Disturbance Envelope, this vegetation is not of conservation significance.

6.2 FLORA OF CONSERVATION SIGNIFICANCE

No conservation significant flora was recorded in the Disturbance Envelope.

One species of conservation significant flora was recorded on the boundary of the Study Area. The Priority 3 *Acacia monticola* x *Tumida* var *kulparn* individuals are outside of the Development Envelope and are unlikely to be impacted by the proposed KMOF project. The hybrid is common in the Broome area.

The Threatened flora *Seringia extasia* was observed from a known location 250 m from the Study Area. This area is unlikely to be impacted by the Proposed KMOF Project. The species was found to be in a healthy condition and immature flowers were present on the shrubs. The species was in a suitable condition to be detected during targeted searches. The species was not recorded within the Study Area or in any new locations during the reconnaissance survey. The species does not occur in the Development Envelope and habitat within the Development envelope is not suitable, given the known and highly restricted distribution.

The P1 flora *Corymbia paractia* was recorded outside of the Study Area. This area is unlikely to be impacted by the Proposed KMOF Project. The species does not occur within the Development Envelope or the Study Area. Suitable habitat does not occur within the Development Envelope.

Of the 16 conservation significant flora assessed as possibly present in the Study Area from the desktop study, 11 species are known to inhabit pindan or sandplain. These species were included despite the majority of the landform being deep sand dunes. That was due to a very small amount of area near Quadrats 1 and 5 having some transition towards sandplain soil and vegetation. These species were not recorded in the Study Area during the Targeted Searches. The land within the Disturbance Envelope is not suitable habitat for these species.

6.3 FAUNA HABITATS OF CONSERVATION SIGNIFICANCE

Database searches identified 82 conservation significant terrestrial species (excluding shorebirds) that may occur in the area. Within the DBCA conservation significant fauna database there are 3 records within the Study Area all for *Sula leucogaster* (Brown Booby) listed under International Agreements (IA) under State and Federal legislation and as a Marine (M) bird under Federal legislation.

The Study Area contains suitable foraging habitat for 7 bird species with a High likelihood of occurrence and suitable foraging habitat for 4 bird species with a Moderate likelihood of occurrence. No suitable habitat occurs for nesting or breeding for conservation significant birds within the Study Area.

No Database records of conservation significant reptiles occur within the Study Area. The Dampierland Burrowing Snake (P2) and Dampierland Plains Slider (P2) are known to occur in the region and potentially suitable habitat exists in the dunes of the Study Area.

There are no terrestrial mammal records in the DBCA conservation significant fauna database for the Study Area. Records from the Broome area are shown in Figure 5-2. Of the conservation significant mammals known from the area, suitable habitat is present only for the Bilby.

Given the small area and degraded condition of the Dunes vegetation within the Development Envelope, it is very unlikely to provide suitable habitat for the Bilby. Prior to vegetation clearing the dune vegetation should be checked for the presence of Dampierland Burrowing Snake (P2) and Dampierland Plains Slider (P2) and any individuals translocated under appropriate licenses. The small amount of area to be cleared is very small and in poor condition in comparison to the adjoining vegetation which is larger and of higher quality.

Whilst a number of conservation significant bird species may find the area within the Development Envelope potentially suitable habitat for foraging, the small amount of area to be cleared is very small and in poor condition in comparison to the adjoining vegetation which is larger and of higher quality. All potential bird users are highly mobile and will move away from any disturbance.

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APPENDICES

APPENDIX A: DBCA CATEGORIES

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

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

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be *"facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines"*.

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

Threatened species considered to be *"facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines"*.

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU **Vulnerable species**

Threatened species considered to be *"facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines"*.

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that "*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P **Priority species**

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

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

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

1 **Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small, or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 **Priority 2: Poorly-known species**

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.

3 **Priority 3: Poorly-known species**

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.

4 **Priority 4: Rare, Near Threatened and other species in need of monitoring**

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

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

APPENDIX B: PMST SEARCH RESULTS

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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: 17/03/20 14:14:34

Coordinates
Buffer: 40.0Km

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:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	30
Listed Migratory Species:	67

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:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	104
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

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

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	19
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The West Kimberley	WA	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Roebuck bay	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Ecological Communities [Resource Information]

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.

Name	Status	Type of Presence
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area

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	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
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 known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Keraudrenia exastia Fringed Keraudrenia [66301]	Critically Endangered	Species or species habitat known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to 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	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area

Name	Status	Type of Presence
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding 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 pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may 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 likely to 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 habitat known to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sternula albifrons		
Little Tern [82849]		Breeding known to 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
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to 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

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely 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 may 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 may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		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 pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
[Cuculus optatus](#) Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat known to occur within area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat known to occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat known 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]		Roosting known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Roosting known to occur within area
[Calidris alba](#) Sanderling [875]		Roosting 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]		Roosting known to occur within area
[Calidris tenuirostris](#) Great Knot [862]	Critically Endangered	Roosting known to occur within area
[Charadrius bicinctus](#) Double-banded Plover [895]		Roosting known to occur within area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
[Charadrius mongolus](#) Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
[Gallinago megala](#) Swinhoe's Snipe [864]		Roosting likely to occur within area
[Gallinago stenura](#) Pin-tailed Snipe [841]		Roosting likely to occur within area
[Glareola maldivarum](#) Oriental Pratincole [840]		Roosting known to occur within area
[Limicola falcinellus](#) Broad-billed Sandpiper [842]		Roosting known to occur

Name	Threatened	Type of Presence within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known 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]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting 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]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Defence - BROOME TRAINING DEPOT

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

Name	Threatened	Type of Presence
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		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]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting 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]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting 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]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		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]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to 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 known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known 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]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting 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]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Foraging, feeding or related behaviour known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		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	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may 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
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		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 known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Name	Label
Roebuck	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Broome Bird Observatory	WA
Broome Wildlife Centre	WA
Unnamed WA51105	WA
Unnamed WA51162	WA
Unnamed WA51497	WA
Unnamed WA51583	WA
Unnamed WA51617	WA
Unnamed WA51932	WA
Unnamed WA52354	WA
Yawuru	WA

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 Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Jatropha gossypifolia 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
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat known to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Roebuck Bay	WA
Roebuck Plains System	WA
Willie Creek Wetlands	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

-18.00536 122.21101

Acknowledgements

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

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

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

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

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APPENDIX C: SURVEY SITE DETAILS

Kimberley Marine Support Base - Biological Survey

Appendix C - Quadrat Site Data

Quadrat	Date	Site Type	Datum	x	y	Landscape position	Aspect
1	21/03/2020	Quadrat 50 x 50 m	GDA 94 UTM Zone 50	416254	8009066	Sandplain	none, probably very gently slope to water in the south
2	21/03/2020	Quadrat 50 x 50 m	GDA 94 UTM Zone 50	416176	8009122	Sand dune	undulating
3	21/03/2020	Quadrat 70 x 30 m	GDA 94 UTM Zone 50	416061	8009135	Sand dune	undulating
5	21/03/2020	Quadrat 50 x 50 m	GDA 94 UTM Zone 50	416049	8009180	Sand dune	undulating
6	21/03/2020	Quadrat 50 x 50 m	GDA 94 UTM Zone 50	416162	8009192	Sand dune	undulating
7	21/03/2020	Quadrat 50 x 50 m	GDA 94 UTM Zone 50	416238	8009159	Sand dune	undulating
8	21/03/2020	Quadrat 100 x 25 m	GDA 94 UTM Zone 50	416165	8009232	Swale	low point between dunes and plain
9	21/03/2020	Quadrat 50 x 50 m	GDA 94 UTM Zone 50	416459	8009182	Foredune	south east

Quadrat	Vegetation u	Condition	Disturbances	Time since fire	Soil texture	Soil colour
1	VA1	Very Good	Occasional weeds	Long unburned	Clay sand/sand	Red brown
2	VA1	Very Good	Occasional weeds		Sand	Pale brown
3	VA3	Very Good	Occasional weeds		Sand	Pale brown
5	VA1	Very Good	Occasional weeds		Sand	Pale brown
6	VA1	Very Good	Occasional weeds		Sand	Pale brown
7	VA1	Very Good	Occasional weeds		Sand	Red brown
8	VA3	Very Good	Occasional weeds		Sand	Red brown
9	VA1	Good	Occasional weeds high		Sand	Red brown

Quadrat	Litter	Comments
1		Some elements of sandplain
2		
3	litter 100% cover under canopy to 5 cm deep	
5		Some elements of sandplain
6		Has a rock armoured drain
7		Has a rock armoured drain
8		
9		

Kimberley Marine Support Base - Biological Survey

Appendix C - Quadrat Site Data

Quadrat	Vegetation unit	Condition	Disturbances	Time since fire	Soil texture	Soil colour	Litter
1	VA1	Very Good	Occasional weeds	Long unburned	Clay sand/sand	Red brown	
2	VA1	Very Good	Occasional weeds	Long unburned	Sand	Pale brown	
3	VA3	Very Good	Occasional weeds	Long unburned	Sand	Pale brown	litter 100% cover under canopy to 5 cm deep
5	VA1	Very Good	Occasional weeds	Long unburned	Sand	Pale brown	
6	VA1	Very Good	Occasional weeds	Long unburned	Sand	Pale brown	
7	VA1	Very Good	Occasional weeds	Long unburned	Sand	Red brown	
8	VA3	Very Good	Occasional weeds	Long unburned	Sand	Red brown	
9	VA1	Good	Occasional weeds highly fragmented	Long unburned	Sand	Red brown	
Quadrat							
1							
2							
3							
5							
6							
7							
8							
9							
Quadrat							
1							
2							
3							
5							
6							
7							
8							
9							

Kimberley Marine Support Base - Biological Survey
Appendix C - Quadrat Site Data

Quadrat	Comments
1	Some elements of sandplain
2	
3	
5	Some elements of sandplain
6	Has a rock armoured drain
7	Has a rock armoured drain
8	
9	

Quadrat
1
2
3
5
6
7
8
9

Quadrat
1
2
3
5
6
7
8
9

APPENDIX D: SPECIES BY SITE MATRIX

Kimberley Marine Support Base - Biological Survey

Appendix D - Flora species by site matrix

Family	Taxon	1	2	3	5	6	7	8	9	Opportunistic records
Amaranthaceae	**Aerva javanica*	0.1			0.1	0.01	0.1		0.01	
Apocynaceae	*Carissa lanceolata*			0.1				0.1		
Arecaceae	*Livistona* sp.									Y
Boraginaceae	*Ehretia saligna*							1		
	Heliotropium leptaleum						0.01			
	Trichodesma zeylanicum var. *zeylanicum*						5	0.1		
Cleomaceae	*Cleome viscosa*	0.1	0.1	0.1		1	0.1		1	
Combretaceae	*Terminalia ferdinandiana*						0.1			
	Terminalia petiolaris									
Convolvulaceae	*Ipomoea pes-caprae* subsp. *brasiliensis*	5			1	20	5	1	30	
Euphorbiaceae	*Euphorbia coghlanii*	0.1	0.05	1	2		0.1		0.1	
	Mallotus nesophilus				0.1			2		
Fabaceae	*Abrus precatorius* subsp. *precatorius*			1				1		
	Acacia bivenosa	50	1	1	15	20	20	0.1	2	
	Acacia monticola x Tumida var *kulparn*	0.1								
	Acacia monticola	0.5								
	Acacia pyrifolia var *pyrifolia*	0.1								
	Bauhinia cunninghamii			60				5		
	Canavalia rosea		25							
	Crotalaria cunninghamii subsp. *cunninghamii*	0.1	40	0.1	30	20	5	1	15	
	Crotalaria medicaginea							0.1		
	Cullen martinii	1							0.1	
	Indigofera hirstua				1					
	Rhynchosia minima	0.5			0.1		5		0.1	
	Tephrosia rosea	0.5	0.1		0.1			0.1	0.1	
Goodeniaceae	*Goodenia armitiana*									Y
Hernandiaceae	*Gyrocarpus americanus* subsp *pachyphyllus*		0.1	30			1	70		
Lamiaceae	**Mesosphaerum suaveolens*									Y
Lauraceae	*Cassytha filiformis*			0.1	0.1			0.1	1	
Malvaceae	*Adansonia gregorii*					0.5				
	Corchorus sidoides	0.5								
	Gossypium australe			25						
	Grewia savannicola							0.1		
	Sida rohlenae subsp. *occidentalis*				0.01			0.1		
Menispermaceae	*Tinospora smilacina*	0.5	0.1	1	1	10	20	30	1	
Myrtaceae	*Corymbia paractia*									Y
Moraceae	*Ficus aculeata* var. *indecora*	0.1	0.5	30	0.1			5	1	
Nyctaginaceae	*Boerhavia gardneri*	0.1	0.1	1	2	1	0.1	0.1		
Oleaceae	*Jasminum didymum* subsp *lineare*			0.1				0.1		
Passifloraceae	**Passiflora foetida* var. *hispida*							0.1		
Phyllanthaceae	*Flueggea virosa* subsp. *melanthesoides*	0.1								
Poaceae	**Cenchrus ciliaris*						1			
	**Cenchrus echinatus*									Y
	**Cenchrus biflorus*	20			5		3	0.1	5	
	**Cenchrus setiger*				0.2					
	Aristida holathera var holathera	0.5			0.1		5		0.1	
	Panicum decompositum	0.1	20		30	20	20	0.1	20	
	Sorghum stipoideum								0.01	
	Spinifex longifolius		0.1	30	50	5	1	30	20	

Kimberley Marine Support Base - Biological Survey
Appendix D - Flora species by site matrix

Family	Taxon	1	2	3	5	6	7	8	9	Opportunistic records
	Triodia microstachya			20				1		
	Eragrostis eriopoda									Y
Proteaceae	*Hakea macrocarpa*							0.1		
Solanaceae	*Seringia extasia*									Y
	Solanum cunninghamii							0.1		
Zygophyllaceae	**Tribulus terrestris*		0.1				0.1			

APPENDIX E: FLORA SPECIES ACCUMULATION CURVE

The Species Accumulation Curves calculated from the data collected in the Detailed Survey show the observed number of species (Sobs) to be equal to the expected number of species (UGE) (Figure 1).

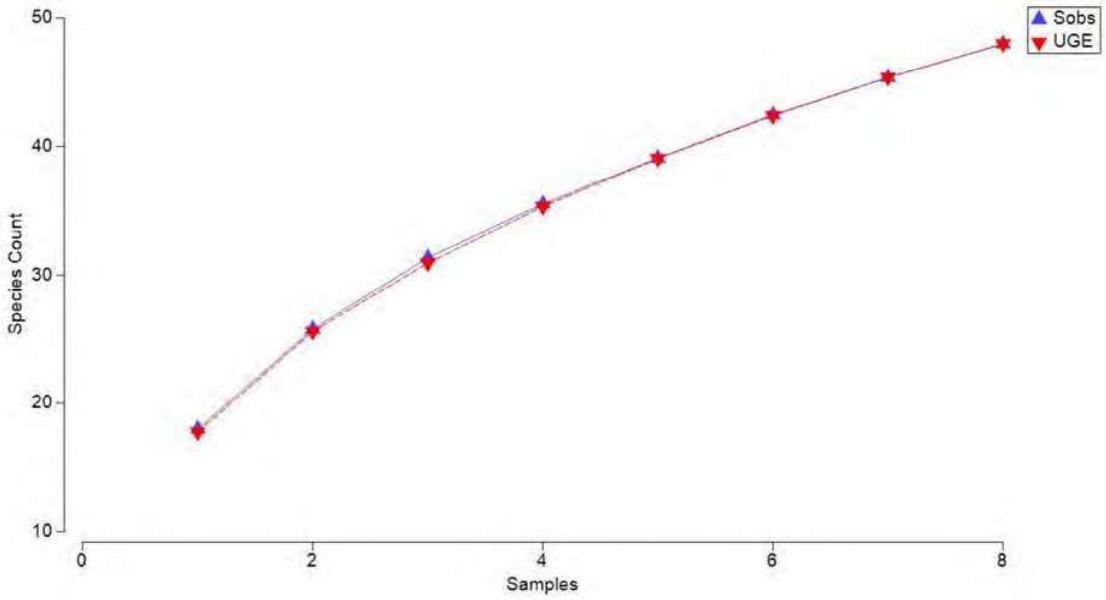

Figure 1. Flora species accumulation curve for the Kimberly Marine Support Base Detailed Survey. Sobs is the observed species diversity from 8 detailed quadrat surveys. UGE is the derived expected species diversity calculated using the Primer 7 statistics package using the method published in Ugland et al (2003).

References:

Ugland K, Gray JS, Ellingsen K (2003) *Journal of Animal Ecology* 72: 888-897.