

CABLE BEACH FORESHORE MASTER PLAN ENVIRONMENTAL INVESTIGATION REPORT

PREPARED FOR:

SHIRE OF BROOME



MAY 2019

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CABLE BEACH MASTER PLAN ENVIRONMENTAL INVESTIGATION REPORT

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EXECUTIVE SUMMARY

Cable Beach, located on the western edge of the town of Broome, is one of Australia's most iconic beaches, with a globally significant reputation and an average of 268,800 annual visitors. Located approximately 2,000 km north of Perth, Cable Beach is a major tourist attraction with various beach activities available including camel rides, sunset viewing, dining and snorkelling.

Following the recommendations of the Cable Beach Development Strategy, the Shire of Broome (SoB) has developed a conceptual master plan for the Cable Beach foreshore area, the Cable Beach Foreshore Master Plan (CBFMP) 'the project', which was adopted by the SoB Council in September 2017. The CBFMP provides a coherent vision to transform the public realm at Cable Beach to a public precinct that reinforces this iconic beach as one of the world's best. The CBFMP supports the objectives of the Cable Beach Development Strategy and builds on the recommendations of the adopted Broome Townsite Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) (Baird 2017). The value of Cable Beach and associated tourism infrastructure to Broome's economy and community were recognised in CHRMAP, concluding that a 'Protect' option should be adopted for the main tourist hub of Cable Beach. Through the project SoB is seeking to build a detailed understanding of the environmental and cultural values of the Cable Beach foreshore area, to inform the adaptation option of 'protect' for the Cable Beach foreshore and guide the detailed design and future implementation of the CBFMP.

On the basis of the CBFMP and the works likely to be undertaken, the following environmental factors (as defined by the Environmental Protection Authority) are likely to require an initial assessment: Coastal Processes, Marine Fauna, Flora and Vegetation and Social Surrounds. Coastal processes and Marine Fauna are deemed to represent a low risk to the approval of the project. Based on a potential loss of 0.37 ha of the Threatened Ecological Community (TEC) 'Monsoon vine thickets', Flora and Vegetation was deemed a moderate risk to the approval of the project. Based on consideration of the level of public interest in the project, and the known Aboriginal heritage and cultural values in the area, Social Surrounds was deemed a low/moderate risk to the approval of the project. Due to the likely direct loss of the Commonwealth-listed TEC 'Monsoon vine thickets', referral to the Department of the Environment and Energy is recommended and it is considered likely that the project would be deemed a 'Controlled Action', with formal assessment required.

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1. INTRODUCTION

1.1 BACKGROUND

Cable Beach, located on the western edge of the town of Broome (Figure 1), is one of Australia's most iconic beaches, with a globally significant reputation and an average of 268,800 annual visitors (Shire of Broome (SoB) 2018a). Located approximately 2,000 km north of Perth, Cable Beach is a major tourist attraction with various beach activities available including camel rides, sunset viewing, dining and snorkelling.

Following the recommendations of the Cable Beach Development Strategy, the Shire of Broome (SoB) has developed a conceptual master plan for the Cable Beach foreshore area, the Cable Beach Foreshore Master Plan (CBFMP) 'the project', which was adopted by the SoB Council in September 2017. The CBFMP provides a coherent vision to transform the public realm at Cable Beach to a public precinct that reinforces this iconic beach as one of the world's best. The CBFMP supports the objectives of the Cable Beach Development Strategy and builds on the recommendations of the adopted Broome Townsite Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) (Baird 2017).

The CHRMAP noted that under projected climate change and sea level rise scenarios, coastal hazard as a result of storm surge inundation and the erosion of the shoreline are forecast to increase for the coastal areas of Broome. For Cable Beach an extreme level of risk was identified for all planning periods as the foreshore reserve area and the Surf Club are almost certain to be impacted by coastal erosion in the coming decades. The value of Cable Beach and associated tourism infrastructure to Broome's economy and community were recognised in CHRMAP, concluding that a 'Protect' option¹ should be adopted for the main tourist hub of Cable Beach. Mitigation of the coastal erosion threat could be achieved through a coastal protection structure, with options including seawalls, revetments, groynes or offshore reefs (Baird 2017). Through the community workshops the most suitable option was determined to be a buried seawall, which has been incorporated into the CBFMP.

Through the project SoB is seeking to build a detailed understanding of the environmental and cultural values of the Cable Beach foreshore area, to inform the adaptation option of 'protect' for the Cable Beach foreshore and guide the detailed design and future implementation of the CBFMP.

Environmental and cultural heritage investigations were undertaken alongside other feasibility studies, including geotechnical investigations, to inform the detailed design of the foreshore redevelopment. The CBFMP is intended to help revitalise the Cable Beach area and includes the following proposed features (Plate 1):

- 'The Arrival' including improvements to pedestrian and vehicular movements into the precinct.
- The 'Consolidated Car park' that improves parking amenity and pedestrian movement to the beach.
- 'Cable Beach Plaza', a new urban public space that will be the heart of the Cable Beach precinct.
- The new "Cable Beach Park" that incorporates the existing amphitheatre area and old car park area.
- New 'Commercial Opportunity' space that capitalises on the underutilised elevated lawn area overlooking the world's best sunset.
- 'The Promenade' that links the site north to south and provides for universal access to the beach and enables comfortable viewing of the beach environment.
- A new "Trail Head Park".

A 'Development Envelope', encompassing the likely extent of any works associated with the CBFMP, has been developed and is presented in Figure 1.

¹ The WAPC adaptation hierarchy includes; Avoid, Managed Retreat, Accommodate, and Protect. The 'Protect' option applies where 'sufficient justification can be provided for not avoiding the use or development of land that is at risk from coastal hazards, and accommodation measures alone cannot adequately address the risks from coastal hazards, then coastal protection works may be proposed where there is a need to preserve the foreshore reserve, public access and public safety, property and infrastructure that is not expendable' (WAPC 2014).

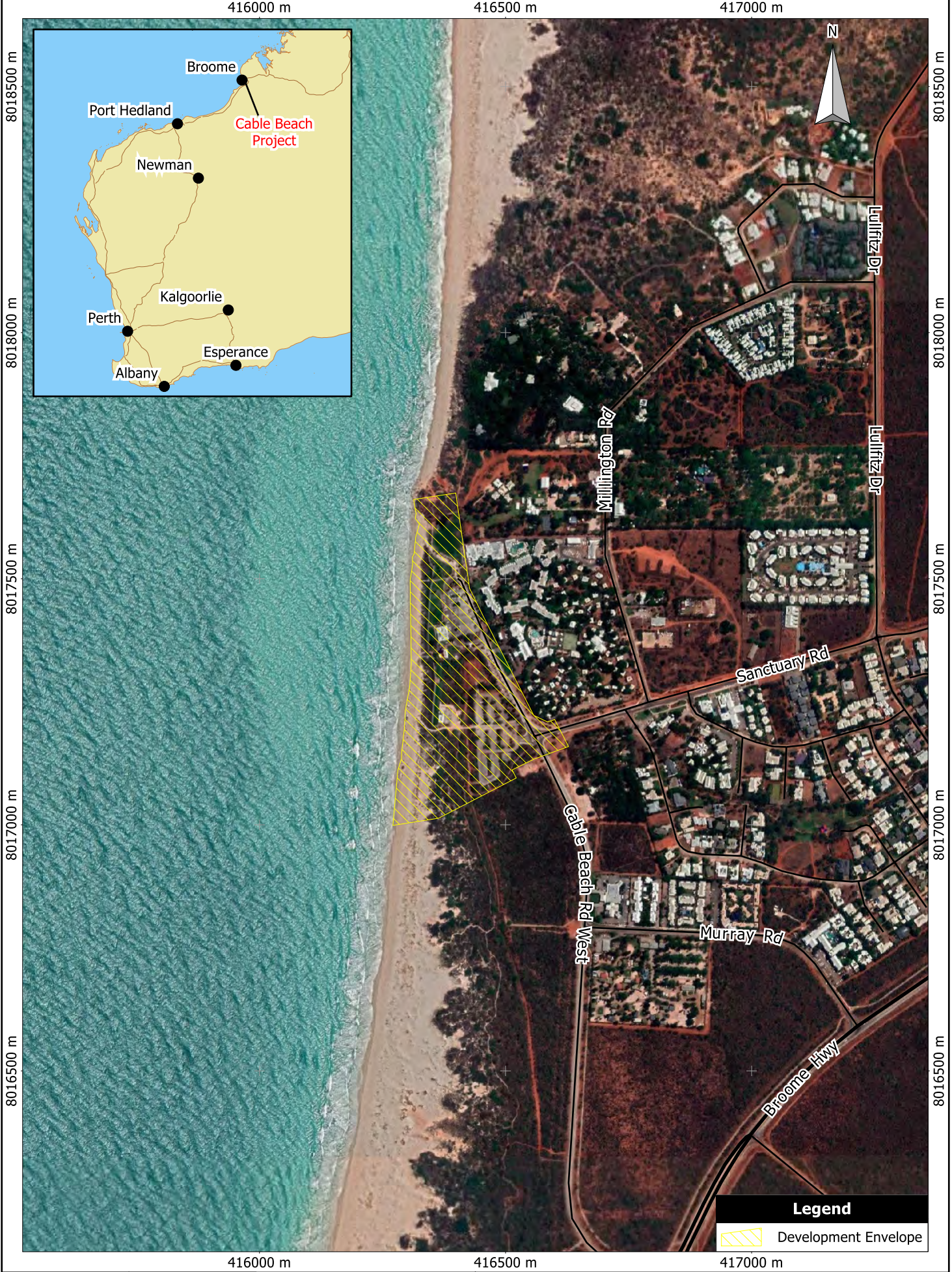




Plate 1: Conceptual Representation of Features Proposed Under the Cable Beach Foreshore Master Plan

1.2 OBJECTIVE OF THE ENVIRONMENTAL INVESTIGATION REPORT

The objective of the Environmental Investigation Report (this document) is to provide a summary of the environmental values of the Cable Beach foreshore area.

A separate Cultural Heritage Investigation Report has been prepared, concurrently, to provide a summary of the indigenous and cultural significance of the Cable Beach foreshore area.

1.3 SCOPE OF WORK

The scope of works included the completion of:

- A comprehensive literature review and desktop analysis of the site and surrounds, taking into consideration ecological designations (at a State and Federal level), previous planning reports, surveys, business cases, engineering reports and drawings, plans and proposed development strategies for the area.
- An on-site flora and vegetation survey of environmental values, having regard to the Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual (EPA 2018) and technical guidance from the West Australian Environmental Protection Authority (EPA).
- An Environmental Investigation Report including:
 - Findings from the survey and desktop review (e.g. any Priority or Threatened flora and fauna) (presented in Section 3).

- A preliminary assessment of potential impacts from the proposed development, identifying potential mitigation measures and design requirements (presented in Section 5).
- Risk analysis of the outcomes from the survey for proceeding with implementation of the CBFMP (presented in Section 5).
- An overview of approvals likely to be required to implement the CBFMP (such as referrals under the *Environmental Protection Act 1986* (EP Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or a clearing permit under the EP Act) (presented in Section 5).
- Recommendations to implement the CBFMP (presented in Section 5).

2. DATA SOURCES

A list of data sources used in the assessment is provided in Table 1. These include Geographic Information System (GIS) databases and search results from State and Commonwealth government databases.

Table 1: Data Sources

Component	Attribute	Data Source	Search Date
Land Tenure and Current Land Use	Land Use	Shire of Broome Local Planning Scheme maps	24 January 2019
	Local Government Authority (LGA)	DMIRS: TENGRAPH Online System	
	Roads	Department of Transport	
Climate	Climate	Bureau of Meteorology (BoM): Climate Data Online	18 January 2019
Landforms, Geology and Soils	Geology	DMIRS: Geological Survey of Western Australia Maps	21 January 2019
	Soils and Landscape Systems	CSIRO: Australian Soil Resource Information System (ASRIS)	18 January 2019
	Acid Sulfate Soils		
	Contaminated Sites	Department of Water and Environment Regulation (DWER): Contaminated Sites Database	18 January 2019
Hydrology and Hydrogeology	RIWI Surface Water Areas	Department of Water and Environmental Regulation (DWER): Database	18 January 2019
	Public Drinking Surface Water Source Areas		
	RIWI Groundwater Areas		
	Catchments and Sub-Catchments	Hydrographic Catchments - Subcatchments (DWER 2018a)	
	Groundwater Sub-Areas	RIWI Act, Groundwater Subareas (DWER 2018b)	
	Public Drinking Groundwater Source Areas	Public Drinking Water Source Areas (DWER 2019)	
	Groundwater Level and Salinity	BoM: Australian Groundwater Explorer	
Flora and Vegetation	Threatened and Priority flora and fauna species	NatureMap	13 February 2019
	Threatened flora and fauna species and ecological communities	EPBC Act Protected Matters Report	13 February 2019
Fauna	Protected Fauna	<ul style="list-style-type: none"> Department of the Environment and Energy (DoEE): EPBC Act Protected Matters Search Tool DoEE: Species Profile and Threats Database Department of Biodiversity Conservation and Attractions (DBCA): Priority/Threatened Fauna Database Search 	31 January 2018
	Introduced Fauna	DoEE: EPBC Act Protected Matters Search Tool	31 January 2018

Component	Attribute	Data Source	Search Date
Protected Ecological Communities	Threatened Ecological Communities	DoEE: EPBC Act Protected Matters Database	13 February 2019
Aerial Imagery	Vegetation	Sentinel Hub EO Browser	18 January 2019

3. EXISTING ENVIRONMENT

3.1 LAND TENURE AND LAND USE

The project is located within the Shire of Broome and is situated on Crown Land on Lot 2789, Cable Beach Road, Cable Beach (SoB 2018b). The project is situated wholly within a Public Purposes Local Scheme Reserve for Recreation and Parking, as included in the Shire of Broome Local Planning Scheme No. 6 (SoB 2018b). A Landscape Protection Area intersects the southern portion of the development envelope and extends to the south. As outlined in Section 5.2.7 of the Local Planning Scheme No. 6, no earthworks or construction activities can be carried out within a Landscape Protection Area without the prior approval of the local government (SoB 2018b).

The project is also located within a 'Dog Strictly Prohibited Area' and a bush fire prone area (SoB 2018b). The development envelope is surrounded by various different planning `scheme zones, with coastal reserve areas bordering the development envelope boundary to the north and south, a Parks, Recreation and Drainage reserve located to the south and tourist zoning for the remainder of the adjacent area (SoB 2018b).

3.2 CLIMATE

The project is located in the south west Kimberley and the climate can be described as tropical, defined by a wet season and dry season. The wet season typically occurs from November through to April, with the remainder of the year experiencing minimal rainfall and being referred to as the dry season (Figure 2).

Broome Airport is the closest weather station to the development envelope. The mean maximum summer temperatures range from 32.9°C to 33.9°C, with the mean minimum winter temperatures ranging between 13.7°C and 15.2°C (Figure 2).

The average annual rainfall for Broome is 628.1 mm (BOM 2019). Precipitation occurs predominantly during the summer wet season, with December to March experiencing the greatest number of rain days (BOM 2019). The lowest recorded annual rainfall was 132 mm, with the highest recorded at 1,598.4 mm in 2018 (BOM 2019). The mean rainfall during the wet season ranges from 9 mm to 191.5 mm, while the period from May to October experiences rainfall ranging from 1.4 mm to 26.9 mm (Figure 2).

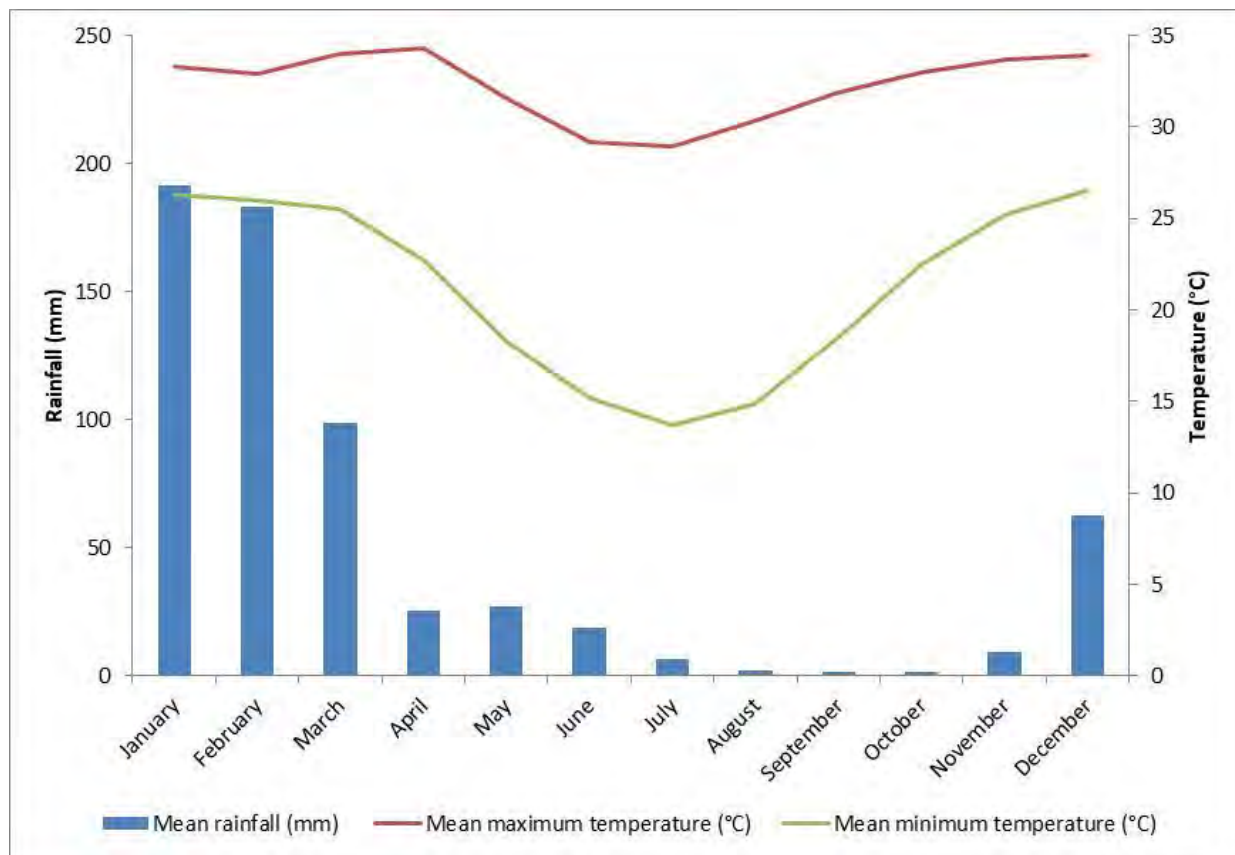


Figure 2: Climate Information for Broome (BOM 2019)

3.3 LANDFORMS, GEOLOGY AND SOILS

3.3.1 Regional Geology

The project is located in the Jurgurra Terrace within the Broome Platform Sub-Basin of the Canning Basin (DMIRS 2019a). The Canning Basin is the largest sedimentary basin in Western Australia, spanning an area of 430,000 km² onshore and 165,000 km² offshore (Paul *et al.* 2013). The primary lithology of the Canning Basin is Palaeozoic sedimentary rocks comprising sandstone, lesser sandstone and conglomerates (DMIRS 2019a). The region surrounding the project contains Broome, Mowla and Melligo Sandstones, which are described as fine- to coarse-grained sandstone, minor mudstone and conglomerate (Hocking 2015).

3.3.2 Local Geology

The primary lithology of the development envelope is Broome Sandstone, which consists of weakly cemented, fine- to coarse-grained quartzose sandstone, with minor beds of siltstone and claystone, thin coal seams, and minor pebble conglomerate (Rockwater 2014).

3.3.3 Soils and Landform Systems

The Australian Soil Resource Information System identified the soil unit 335Ye (Yeeda System) occurring within the development envelope. The soil units 3335Cr_2 and 335Cr_1 also occur in the Broome region (CSIRO 1991). These units are described in Table 2.

Table 2: Soil and Landform Units of the Study Area

Unit	Description
Yeeda System (335Ye)	Red sandplains supporting pindan vegetation with dense acacia shrubs, scattered bloodwood and grey box trees and curly spinifex and ribbon grass. Main soil type is red deep sand (82%), with red sandy earth (7%) and yellow deep sand (7%) also occurring.
Carpentaria Low Subsystem - low capacity (335Cr_2)	Bare coastal mudflats, minor sandy margins and seaward margins, little vegetation except for mangrove fringing thickets. Main soils are tidal soil (70%), sandy duplexes supergroup (15%), calcareous loamy earth (10%) and yellow deep sand (5%).
Carpentaria High Subsystem - high capacity (335Cr_1)	Sandy surfaced coastal plains supporting rice grass and saltwater couch. Main soil types are sandy duplexes supergroup (60%), tidal soil (20%), yellow deep sand (10%) and calcareous loamy sand (10%).

3.3.3.1 Acid Sulfate Soils

The Australian Soil Resource Information System (CSIRO 2012) results show that no acid sulfate soil (ASS) information exists for the development envelope. Soils to the east of the development envelope are identified as having an extremely low probability of ASS occurrence.

3.3.3.2 Contaminated Sites

A search of DWERs Contaminated Sites Database did not identify any known contamination in the development envelope (DWER 2018c). Ten registered contaminated sites occur within a 10 km radius of the development envelope with the closest being 4 km from the development envelope, related to hydrocarbon contamination of groundwater and soil.

3.4 COASTAL PROCESSES

The main processes that influence or control the shoreline around Cable Beach include (EPA, 1987):

- Shoreline erosion and littoral transport of sediment by wave action away from Gantheaume Point (i.e. northwards along Cable Beach).
- Inland aeolian (wind-driven) transport of fine sands.

A number of investigations have been completed for the Broome Coastal Vulnerability Study (Cardno 2015) as summarised below.

3.4.1 Storm Tide and Coastal Inundation Assessment

The Broome Coastal Vulnerability Study undertaken by Cardno (2015) recorded water levels from the Broome tide gauge. Extreme Value Analyses (EVA)² were then conducted to determine appropriate water level design criteria for future infrastructure developments in Broome.

Design water level criteria calculated by Cardno (2015) indicated that compared to a 1 year Average Recurrence Interval (ARI) event, a 10 year ARI event will cause a 0.22 m rise in sea level, a 50 year ARI event will cause a 0.32 m rise in sea level and a 100 year ARI event will cause a 0.35 m rise in sea level.

² Used to reliably estimate design conditions that have an ARI two to three times greater than the record length of the measured data

The Broome Coastal Vulnerability Study (Cardno 2015) identified that the likely effects of climate change would be an increase in the mean sea level and changes to the cyclonic frequency and intensity as shown in Table 3.

Table 3: Projected Climate Change Effects for Broome

Planning Horizon	2040	2070	2110
Sea Level Rise			
Predicted Increase (m)	0.15	0.4	0.9
Cyclonic Wind Speed Increase			
Predicted Increase (%)	3	6	10

The Broome Coastal Vulnerability Study (Cardno 2015) indicated that the majority of extreme water level events occur between March and April, a time when there are co-incident large tides.

The design water levels were revised to take into account the sea level rise predictions (Table 3) to inform future development (Table 4).

Table 4: Comparison of Design Water Level Criteria

ARI (years)	Current Day Scenario (m)	Climate Change Scenarios (m)		
		2040	2070	2110
10	5.26	5.41	5.66	6.12
50	5.36	5.51	5.76	6.19
100	5.39	5.57	5.86	6.39

3.4.2 Shoreline Stability Assessment

The Cable Beach area consists of sand dunes with high crests (in excess of 16 m AHD) with little development close to the shoreline except for the immediate area around the Cable Beach Resort, where lowering of the dunes has occurred.

A shoreline stability assessment (Cardno 2015) included the Cable Beach area and involved an analysis of aerial imagery from 1965 to 2012. For this assessment Cable Beach was split into three sections:

- Cable Beach (North) extending north of the car park adjacent to Cable Beach Resort.
- Cable Beach (Central) encompassing the developed area adjacent to the beach, in proximity to Cable Beach Resort.
- Cable Beach South extending southwards to the edge of the cliffs at the northern edge of Gantheaume Point.

For Cable Beach (North) the assessment indicated zero net shoreline movement. Erosion was identified along small sections of beach while several areas exhibited a trend of accretion.

For Cable Beach (Central) (Figure 3), and Cable Beach (South), an average shoreline erosion of 0.2 m/year was identified. One section was observed to have up to 0.35 m/year erosion, however this was due to vehicle use, uncontrolled drainage, and removal of vegetation (Cardno 2015).

The re-colonisation of coastal vegetation following impacts from Cyclone Rosita (April 2000) has resulted in a gradual accretion of sand at Cable Beach (North) and Cable Beach (South). Cable Beach Central has not shown

the same re-colonisation of vegetation of sand accretion, potentially due to the presence of a rocky outcrop, development and significant beach use within the area (Cardno 2015).

Table 5 outlines the shoreline reserve allowance recommendations for development at Cable Beach for the 2040, 2070 and 2110 planning horizons.



Figure 3: Historical Shoreline Change at Cable Beach (Central) (from Cardno 2015)

Table 5: Shoreline Reserve Allowance (Cardno 2015)

Planning Horizon	Total (m)
Cable Beach North	
2040	94
2070	131
2110	197
Cable Beach Central	
2040	63
2070	100
2110	166
Cable Beach South	
2040	68
2070	99
2110	157

3.4.3 Coastal Hazard Risk Management and Adaptation Plan

A Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) was prepared to provide strategic guidance on coordinated, integrated and sustainable management of coastal areas identified as being at risk of coastal erosion and inundation in current and future planning periods (Baird 2017).

The level of risk identified for the Cable Beach shoreline was extreme for all planning periods, as it is almost certain to be impacted by coastal erosion in the coming decades. The main access point and focus of tourist activity for Cable Beach, includes Zanders Café, the Cable Beach Club Resort, the Surf Club and significant Shire infrastructure including car parks, roads and beach access. The current and future risk from coastal erosion to this area, as assessed through the CHRMAP process (Baird 2017), is as follows:

- The current risk posed from a 1 in 100-year storm impacting the coast is significant, with this type of event potentially resulting in approximately 30 m of the coastal dune being lost, with shoreline erosion back to the point of Zanders Café and the Surf Club. Shire infrastructure including beach access, coastal pathways, foreshore reserve and landscaping would all be severely impacted or lost under such an event.
- For the 2040 planning period, with the inclusion of the sea level rise and the historical rate of shoreline recession, the coastal processes allowance line moves a further 30 m landward. Under this scenario the potential for shoreline erosion is landward of Zanders Café and the Surf Club, and the present foreshore public open space areas.
- For the 2070 planning period, the coastal processes allowance line extends across most of the main carpark and is within the northwest boundary of the Cable Beach Club Resort.
- For 2110 the coastal processes line is 66 m further landward predominantly due to sea level rise allowance. Under this scenario the potential for shoreline erosion encompasses the majority of the present day foreshore area, and extends to the main entrance of Cable Beach Club Resort.

The present location of the Surf Club is in the likely zone of coastal erosion in the 2040 planning period. It is planned to rebuild the surf club in coming years. Zanders Café is situated within the likely erosion hazard zone and is rated in the extreme risk category for 2040.

A suite of options for Cable Beach (Central) were identified in the adaptation strategy (Baird 2017), including:

- Structural Options:
 - Access to the coast (stairs, ramps, pathways) are exposed to an identified erosion and inundation risk hazard and these types of structures will always be at risk of erosion and inundation in an extreme cyclonic event. The structural integrity of structures currently located in the coastal erosion zone should be verified on a periodic basis, with recommendations regarding further repair or maintenance for their continued safe use consistent with a 'managed retreat' approach.
 - Structures in the foreshore area that do not require coastal connection (e.g. toilets and BBQs etc.) should be sited relative to their expected design life and consider the projected coastal erosion hazard across that time.
- Coastal Protection of Foreshore:
 - Mitigation of the coastal erosion threat to the assets at the upper foreshore (Surf Club, Zanders, Shire structures including carparks and amphitheatre) could be achieved through coastal protection structures. These could take the form of seawalls, revetments, groynes or offshore reefs all of which would offer some form of protection to the coast and ensure that the present location of the upper foreshore at the top of the dune is maintained. The most suitable option for an engineering solution was determined to be a buried seawall.
- Soft Options:
 - Sand nourishment was undertaken by Shire in July 2000 for the dune in front of Zanders and the beach area in front between the two main access stairs either side of this section of the coast, a distance of approximately 160 m. Based on Shire records, a contractor was engaged to use scrapers and bulldozers to move approximately 15,000 m³ of sand from the southern end of the beach below the high water mark into the eroded area to re-establish the profile of the beach and dune. In the event of a future similar large erosion impact of the foreshore area, this nourishment approach would mitigate the extreme risk identified for the beach area, as well as guard against a further storm impact noting that more than one extreme storm may impact the beach area in a cyclone season.
 - Increasing the natural resilience of the coastal dune through planting and dune rehabilitation is an effective strategy already underway at the location, with the intention of providing good vegetation cover across the dune face. The vegetation stabilises the sand on the dune from wind-blown transport, and also offers greater resilience to the dune face under wave attack in extreme events.

3.5 HYDROLOGY

The study area lies within the Cape Leveque Coast Catchment within the basin of the same name (21,377 km²) of the Timor Sea Division (DWER 2016). Surface water flows are managed via the formal drainage network within the Broome Township area (Cardno 2015).

The coastal vulnerability assessment completed by Cardno (2015) undertook two assessments, one for the Dampier Creek subcatchment and one for the Broome Township area. Results from the modelling indicated that:

- Catchment flooding associated with the local drainage network is the dominant flood mechanism for Broome Township with inundation from ocean flooding events rare.
- Where no formal drainage exists (e.g. industrial estate), flood waters are stored in local depressions.

It was also identified that a large area of low-lying land at Cable Beach, approximately 1 km south of the development envelope and adjacent to Cable Beach Road West and Gubinge Road, is subject to ponding of surface water. This is likely due to the low infiltration rates exhibited by the Pindan Sands in the area (Cardno 2015).

3.6 HYDROGEOLOGY

3.6.1 Hydrogeological Setting

The Broome Sandstone Aquifer is the major unconfined to semi-confined aquifer underlying the development envelope and is the primary groundwater resource in the West Kimberley, supplying groundwater for irrigation, stock and domestic use (Paul *et al.* 2013, Rockwater 2014). The Broome Sandstone Aquifer covers an area of over 30,000 km² with an average saturated thickness of about 150 m (Paul *et al.* 2013). It is a layered aquifer comprising coarse sandstone and conglomerate, and is around 250 m thick beneath Broome (Rockwater 2014).

3.6.2 Groundwater Quality

Groundwater within the Broome Sandstone is recharged by direct rainfall infiltration, with fresh to slightly brackish groundwater overlying a saltwater wedge (Rockwater 2014). The groundwater total dissolved solids (TDS) values range from 500 to 1,500 mg/L (Rockwater 2014).

3.7 FLORA AND VEGETATION

3.7.1 Desktop Assessment

3.7.1.1 Regional Context

The project lies within the Pindanland subregion (DAL02) of the Dampierland (DAL) IBRA region (Graham 2001). The Dampierland bioregion is characterised by extensive plains, ranges and spectacular gorges with the Pindanland subregion comprising sandplains of the Dampier Peninsular and western part of Dampierland, including the hinterland of the Eighty Mile Beach. It is a fine-textured sand sheet with subdued dunes and includes the paleodelta of the Fitzroy River (Focused Vision 2019, Appendix 3).

3.7.1.2 Vegetation Communities

The project is located on the Dampier Peninsula and the vegetation has been broadly characterised by Beard (1990) as 'Shrublands, pindan, *Acacia tumida* shrubland with grey box and cabbage gum medium woodland over ribbon grass and curly spinifex' (Focused Vision 2019).

3.7.1.3 Threatened and Priority Ecological Communities

Database searches identified two ecological communities as likely to be present within the development envelope:

- 'Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula' (Monsoon vine thickets) is a Threatened Ecological Community (TEC) that occurs within the development envelope. It is categorised as Endangered under the EPBC Act and Vulnerable under the WA Biodiversity Conservation Act 2016 (BC Act).
- The buffer for a State-listed Priority Ecological Community (PEC), 'Corymbia paractia dominated community on dunes', also intersects the development envelope (Focused Vision 2019).

The Monsoon vine thickets represent the southern-most occurrence of rainforest (dry monsoon rainforests) in Western Australia and provide refuge habitat for many plants and animals at the southern-most limit of their Australasian range. These vine thickets are confined to coastal dunes (and in some cases other unconsolidated Holocene coastal landforms) and have been shown to be distinct from other types of rainforest in the Kimberley Region (Focused Vision 2019).

Corymbia paractia is endemic to the Kimberley region of Western Australia and restricted to the Broome Peninsula and immediate vicinity. It is mainly confined to a relatively narrow coastal zone, where beach dunes merge into pindan soils, with some patches occurring across the Dampier Peninsula (Focused Vision 2019).

3.7.1.4 Significant Flora Species

Database searches of NatureMap, the EPBC Protected Matters Search Tool and the DBCA database identified 19 significant flora species as potentially occurring in the development envelope and within a 50 km buffer of the development envelope (Table 6). Only one Threatened species, *Seringia exastia*, was recorded and is classified as Critically Endangered under both the EPBC Act and the WA BC Act. However, the closest recorded location is over 1.5 km from the development envelope. *Corymbia paractia* (a Priority species) has been recorded adjacent to the development envelope (Appendix 3).

Table 6: Threatened and Priority Flora within or adjacent to the development envelope (Focused Vision 2019)

Species	Cons. Status		Description	Preferred Habitat	Likelihood of Occurrence
	BC Act	EPBC Act			
<i>Seringia exastia</i>	CR	CR	Erect, compact, multi-stemmed shrub that can grow to 0.9 m high. Flowers purple, April to December	Pindan (red soil) heathland - occur on almost flat land and associated vegetation includes Feathertop Spinifex (<i>Triodia schinzii</i>) and scattered trees, under 7 m in height, of Soap Wattle (<i>Acacia coleii</i>), Bloodwood (<i>Eucalyptus dampieri</i>)	Likely to occur
<i>Corymbia paractia</i>	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 and red pindan soils	Likely to occur
<i>Jacquemontia</i> sp. Broome (AA Mitchell 3028)	P1	-		<i>Acacia eriopoda</i> in disturbed pindan woodland	May occur
<i>Thespidium basiflorum</i>	P1	-	Densely tufted, multi-stemmed perennial, herb, to 0.2 m high. Fl. green, May to Aug.	Occurs in sandy soils, creek beds	Unlikely to occur
<i>Gomphrena pusilla</i>	P2	-	Slender branching annual, herb, to 0.2 m high. Fl. white, Mar to Apr or Jun.	On fine beach sands behind foredunes or on limestone	May occur
<i>Acacia monticola</i> x <i>tumida</i> var. <i>kulpam</i>	P3	-	Low-domed (semi-prostrate), spreading shrubs	On coastal cliffs and red sand/loam/rocky gullies	May occur
<i>Aphyllodium glossocarpum</i>	P3		Spreading or erect shrub, to 1.2 m high. Fl. pink-purple, Apr to Oct.	Occurs in sand verging onto cleared areas and open grassland fringes. Pindan soils	May occur
<i>Bonamia oblongifolia</i>	P3		Perennial, herb or shrub. Fl. blue, Feb.	Sandy or gravelly soils	May occur
<i>Glycine pindanica</i>	P3	-	Prostrate or scrambling perennial, herb or climber. Fl. pink/blue-purple, Feb to Mar or Jun.	Pindan soils	May occur

Species	Cons. Status		Description	Preferred Habitat	Likelihood of Occurrence
	BC Act	EPBC Act			
<i>Goodenia byrnesii</i>	P3	-	Prostrate to decumbent herb, stems to 30 cm. Fl. yellow, Jan to Feb.	Sand. Edge of creek	Unlikely to occur
<i>Lophostemon grandiflorus</i> subsp. <i>grandiflorus</i>	P3		Tree, 4-8 m high. Fl. cream-white, apparently Jan to Dec.	Occurs in damp habitats (swamps, seepages)	Unlikely to occur
<i>Nicotiana heterantha</i>	P3		Decumbent, short-lived annual or perennial, herb, to 0.5 m high, forming low, spreading colonies. Fl. white-cream, Mar to Jun or Sep.	Black clay. Seasonally wet flats.	Unlikely to occur
<i>Polymeria</i> sp. Broome (KF Kenneally 9759)	P3	-	Prostrate herb 10 cm high x 30 cm wide, trailing herb with greyish green leaves and mauve flowers.	Red, pindan soils	May occur
<i>Seringia katatona</i>	P3	-	Erect, compact, multi-stemmed shrub, to 1 m high, grey leaved. Fl. purple, Mar to Aug.	Desert dunes in pindan, ranges, disturbed areas on red sands	Likely to occur
<i>Stylidium pindanicum</i>	P3	-	Annual herb to about. 0.3 m high. Leaves slender, numerous, held in a terminal rosette. Fl. pink or mauve, May to Aug.	Restricted to seasonally damp areas over pindan sands (Barrett <i>et al.</i> 2015)	Unlikely to occur
<i>Tephrosia andrewii</i>	P3	-	Ascending, multi-stemmed shrub, to 0.8 m high. Fl. orange, Apr or Oct.	In dry sand Pindan soils, on hill sides and road verges	Unlikely to occur
<i>Terminalia kumpaja</i>	P3	-	Large tree	Pindan, sandy soils	May occur
<i>Tetragonia coronata</i>	P3	-	Decumbent annual, herb. Fl. yellow, Jul.	Occurs on calcrete outcrops, red clay loamy soil, in the shade of larger shrubs	Unlikely to occur
<i>Pittosporum moluccanum</i>	P4	-		White sand. Sand dunes	May occur

CR – Critically Endangered, P1, P2, P3 and P4 – Priority species,

3.7.1.5 Weeds

Within the Shire of Broome, 45 Declared Pest plants are listed under Section 22(2) of the *Biosecurity and Agriculture Management 2007* (BAM Act). Of these species, the following six have the highest level of control category applied (C2; Eradication) (Focused Vision 2019):

- *Chondrilla juncea* (skeleton weed).
- *Pistia stratiotes* (water lettuce).
- *Prosopis glandulosa* x *Prosopis velutina* (mesquite).
- *Ulex europaeus* (gorse).
- *Xanthium spinosum* (thorny burweed).
- *Xanthium strumarium* (sheepbur).

3.7.2 Field Survey

A reconnaissance flora and vegetation field assessment of the CBFMP area was completed on 7 March 2019. The key findings and conclusions were as follows (Focussed Vision 2019, Appendix 3):

- A total of 20 flora taxa, from 19 genera and 14 families were recorded during the reconnaissance survey, including 15 (80%) native species and five (20%) introduced (weed) species.
- No Threatened flora protected under the BC Act or under the EPBC Act were recorded and no Priority flora were recorded.
- The 'Corymbia paractia dominated community on dunes' Priority 1 community was not recorded within the development envelope.
- No recorded species exhibited an extension beyond their current documented range, in accordance with records of the Western Australian Herbarium (DBCA 2018a), besides *Casuarina obesa*, which is not naturally occurring and likely to have been planted. This occurrence is not considered a range-extension.
- Three intact vegetation units and two disturbed/planted areas were described and mapped.
- The vegetation of the study area ranges in condition from 'Very Good' to 'Completely Degraded', with most of the vegetation found to be in 'Degraded' condition.
- The regional vegetation/vegetation association of the study area, vegetation association 750 (Beard 1990), is represented by 99.56% of its pre-European extent and therefore the vegetation of the area is not significant due to poor regional representation.
- It is considered that the monsoon vine thicket TEC is represented within the MVT vegetation unit, based on positive results in comparison to the key characteristics, and this occurrence of the TEC is considered to meet condition thresholds.
- The patch of monsoon vine thicket TEC mapped within the area totals 0.37 ha.

3.8 FAUNA

A desktop search of the *EPBC Act* Protected Matters Search Tool (PMST) (DoEE 2019) was conducted for the development envelope, and a 10 km buffer, to identify Threatened and Migratory species potentially present within the development envelope. The search identified 31 threatened species and 65 migratory species as potentially occurring within the development envelope (Appendix 1). The species identified, with some marine species excluded as they are not considered likely to be impacted by the project, are listed in Table 7.

A search of the DBCA Threatened/Priority Fauna database (DBCA 2019) was also undertaken to determine the recorded presence of conservation significant fauna species (Appendix 2). The results identified 93 species which

have potential to occur in the development envelope and surrounds, comprising 75 birds, 1 fish, 9 mammals and 8 reptile species. These species are detailed in Table 7.

Table 7: Conservation Significant Fauna Potentially Occurring

Common Name	Scientific Name	Conservation Status		
		BC Act	DBCA Listing	EPBC Listing
Birds				
Arctic Jaeger, Arctic Skua	<i>Stercorarius parasiticus</i>	IA		MI
Asian Dowitcher	<i>Limnodromus semipalmatus</i>	IA		MI
Australian Little Bittern	<i>Ixobrychus dubius</i>		P4	
Barking Owl (southwest subpop.)	<i>Ninox connivens connivens</i>		P3	
Barn Swallow	<i>Hirundo rustica</i>	IA		MI
Bar-tailed Godwit	<i>Limosa lapponica</i>	IA		MI
Bar-tailed Godwit (Northern Siberian)	<i>Limosa lapponica menzbieri</i>	VU		CR
Black Bittern (Southwest subpop.)	<i>Ixobrychus flavicollis australis</i> (southwest subpop.)		P2	
Black-Naped Tern	<i>Sterna sumatrana</i>	IA		MI
Black-tailed Godwit	<i>Limosa limosa</i>	IA		MI
Bridled Tern	<i>Onychoprion anaethetus</i>	IA		MI
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	IA		MI
Brown Booby	<i>Sula leucogaster</i>	IA		MI
Bulwer's Petrel	<i>Bulweria bulwerii</i>	IA		MI
Caspian Tern	<i>Hydroprogne caspia</i>	IA		MI
Common Greenshank, Greenshank	<i>Tringa nebularia</i>	IA		MI
Common Noddy	<i>Anous stolidus</i>	IA		MI
Common Redshank, Redshank	<i>Tringa totanus</i>	IA		MI
Common Sandpiper	<i>Actitis hypoleucos</i>	IA		MI
Common Tern	<i>Sterna hirundo</i>	IA		MI
Crested Tern	<i>Thalasseus bergii</i>	IA		MI
Curlew Sandpiper	<i>Calidris ferruginea</i>	VU		CR, MI
Eastern Curlew, Far Eastern Curlew	<i>Numenius madagascariensis</i>	VU		CR, MI
Fork-tailed Swift	<i>Apus pacificus</i>	IA		MI
Glossy Ibis	<i>Plegadis falcinellus</i>	IA		MI
Gouldian Finch	<i>Erythrura gouldiae</i>		P4	EN
Great Frigatebird	<i>Fregata minor</i>	IA		MI
Great Knot	<i>Calidris tenuirostris</i>	VU		CR, MI
Greater Sand Plover	<i>Charadrius leschenaultii</i>	VU		VU, MI

Common Name	Scientific Name	Conservation Status		
		BC Act	DBCA Listing	EPBC Listing
Grey Falcon	<i>Falco hypoleucos</i>	VU		
Grey Plover	<i>Pluvialis squatarola</i>	IA		MI
Grey-tailed Tattler	<i>Tringa brevipes</i>	IA		MI
Gull-billed Tern	<i>Gelochelidon nilotica</i>	IA		MI
Hutton's Shearwater	<i>Puffinus huttoni</i>	EN		
Lesser Frigatebird	<i>Fregata ariel</i>	IA		MI
Lesser Sand Plover	<i>Charadrius mongolus</i>	EN		EN, MI
Letter-winged Kite	<i>Elanus scriptus</i>		P4	
Little Curlew, Little Whimbrel	<i>Numenius minutus</i>	IA		MI
Little Ringed Plover	<i>Charadrius dubius</i>	IA		MI
Little Tern	<i>Sternula albigrons</i>	IA		MI
Long-toed Stint	<i>Calidris subminuta</i>	IA		MI
Marsh Sandpiper, Little Greenshank	<i>Tringa stagnatilis</i>	IA		MI
Masked Owl (Northern)	<i>Tyto novaehollandiae kimberli</i>		P1	VU
Masked Owl (Southwest)	<i>Tyto novaehollandiae novaehollandiae</i>		P3	
Oriental Cuckoo	<i>Cuculus optatus</i>	IA		MI
Oriental Plover	<i>Charadrius veredus</i>	IA		MI
Oriental Pratincole	<i>Glareola maldivarum</i>	IA		MI
Osprey	<i>Pandion cristatus</i>	IA		MI
Pacific Golden Plover	<i>Pluvialis fulva</i>	IA		MI
Pectoral Sandpiper	<i>Calidris melanotos</i>	IA		MI
Peregrine Falcon	<i>Falco peregrinus</i>	OS		
Pin-tailed Snipe	<i>Gallinago stenura</i>	IA		MI
Princess Parrot	<i>Polytelis alexandrae</i>		P4	VU
Red Knot	<i>Calidris canutus</i>	EN		EN, MI
Red-necked Stint	<i>Calidris ruficollis</i>	IA		MI
Roseate Tern	<i>Sterna dougallii</i>	IA		MI
Ruddy Turnstone	<i>Arenaria interpres</i>	IA		MI
Ruff, Reeve	<i>Philomachus pugnax</i>	IA		MI
Sanderling	<i>Calidris alba</i>	IA		MI
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	IA		MI
Short-tailed Shearwater	<i>Ardenna tenuirostris</i>	IA		MI
Streaked Shearwater	<i>Calonectris leucomelas</i>	IA		MI
Swinhoe's Snipe	<i>Gallinago megala</i>	IA		MI
Terek Sandpiper	<i>Xenus cinereus</i>	IA		MI
Wedge-tailed Shearwater	<i>Ardenna pacifica</i>	IA		MI

Common Name	Scientific Name	Conservation Status		
		BC Act	DBCA Listing	EPBC Listing
Whimbrel	<i>Numenius phaeopus</i>	IA		MI
White-winged Black Tern, White-winged Tern	<i>Chlidonias leucopterus</i>	IA		MI
Wilson's Storm-petrel	<i>Oceanites oceanicus</i>	IA		
Wood Sandpiper	<i>Tringa glareola</i>	IA		MI
Yellow Wagtail	<i>Motacilla flava</i>	IA		MI
Mammals				
Australian Snubfin Dolphin	<i>Orcaella heinsohni</i>		P4	MI
Bilby, Dalgyte, Ninu	<i>Macrotis lagotis</i>	V		VU
Dugong	<i>Dugong dugon</i>	OS		MI
Humpback Whale	<i>Megaptera novaeangliae</i>	CD		VU, MI
Northern Brushtail Possum (Kimberley)	<i>Trichosurus vulpecula arnhemensis</i> (Kimberley)	VU		
Northern Quoll	<i>Dasyurus hallucatus</i>	EN		EN
North-western Free-tailed Bat	<i>Mormopterus cobourgiensis</i>		P1	
Scaly-tailed Possum	<i>Wyulda squamicaudata</i>		P4	
Water-rat, Rakali	<i>Hydromys chrysogaster</i>		P4	
Reptiles				
Northwestern Coastal Ctenotus	<i>Ctenotus angusticeps</i>		P3	VU
Dampierland Burrowing Snake	<i>Simoselaps minimus</i>		P2	
Dampierland Plain Slider	<i>Lerista separanda</i>		P2	
Dampierland Plain Slider, Skink	<i>Lerista separanda</i>		P2	
Flatback Turtle	<i>Natator depressus</i>	VU		VU
Green Turtle	<i>Chelonia mydas</i>	VU		VU
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	VU		VU
Short-nosed Seasnake	<i>Aipysurus apraefrontalis</i>	CR		CR
Fish				
Green Sawfish	<i>Pristis zijsron</i>	VU		VU, MI

CR – Critically Endangered, EN – Endangered, VU – Vulnerable, MI – Migratory, CD – Conservation dependent fauna

OS – Other specially protected fauna, P1, P2, P3 and P4 – Priority species

IA – Migratory birds protected under an international agreement

Records from the DBCA database search for the development envelope and immediate surrounds are displayed in Figure 4. The following species have been recorded from within the development envelope:

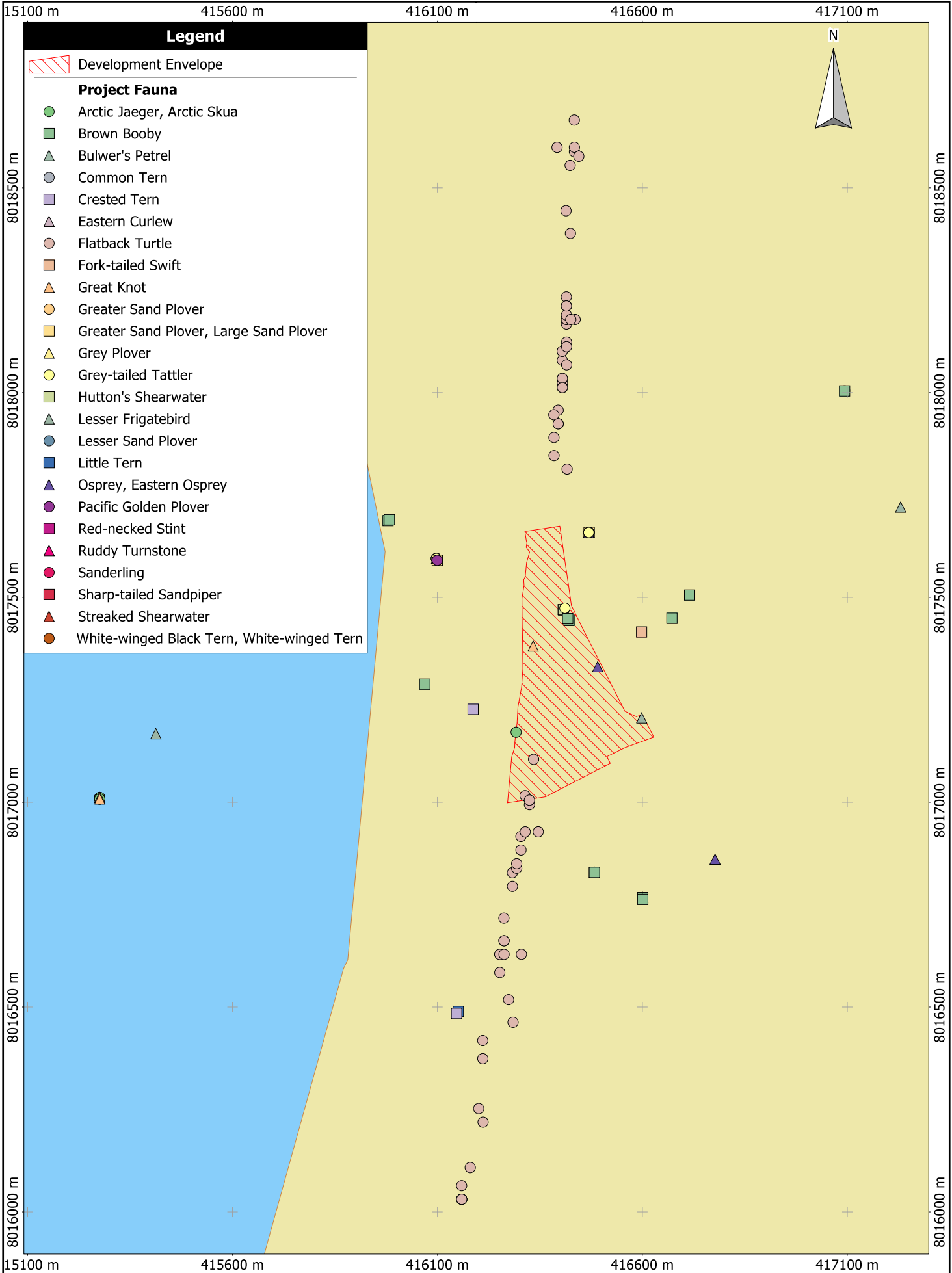
- Lesser frigatebird.
- Osprey.
- Brown booby.
- Bulwer's petrel.

- Sanderling.
- Red-necked stint.
- Great knot.
- Streaked shearwater.
- Greater sand plover.
- Grey plover.
- Hutton's shearwater.
- Arctic skua.
- Grey-tailed tattler.
- Flatback turtle.

Including a 1 km buffer around the development envelope, 24 bird species and one reptile (Flatback turtle) were returned from the database search, including seven Threatened species:

- Eastern curlew (*Numenius madagascariensis*).
- Flatback turtle (*Natator depressus*).
- Great knot (*Calidris tenuirostris*).
- Greater sand plover (*Charadrius leschenaultii*).
- Hutton's shearwater (*Puffinus huttoni*).
- Lesser sand plover (*Charadrius mongolus*).
- Red knot (*Calidris canutus*).

The Cable Beach Volunteer Turtle Monitoring Program, organised by DBCA and involving annual monitoring along Cable Beach, was established in 2013. During the 2018-2019 nesting season a total of 87 Flatback turtle nests and three Green turtle nests were recorded (Appendix 7). Seven nests had been directly impacted (by goanna, crab, dog, and high water levels) but the largest source of disturbance recorded was vehicle traffic.



4. ENVIRONMENTAL APPROVALS

4.1 ENVIRONMENT PROTECTION ACT 1986 (EP ACT)

The Western Australian EP Act is the primary legislation governing environmental protection and impact assessment in the State. Projects with potential to significantly impact on the environment, or of sufficient public interest, are assessed under Part IV of the EP Act.

The processes used in Western Australia for assessment and regulation of environmental aspects of proposals depends upon a number of factors, chiefly related to the complexity of the project, the sensitivity of the environment in which the proposal would take place, and the actual or perceived level of environment risk associated with the proposal. In cases where the EPA considers that a proposal may have a significant impact, and especially in cases where the potential impacts are not readily assessed and/or managed under other statutory frameworks, the EPA may decide to formally assess a proposal.

4.1.1 Pre-referral

The EPA encourages proponents to request a pre-referral meeting with DWER to discuss the proposal, including:

- Potential impacts, including on Matters of National Environmental Significance.
- Possible preliminary key environmental factors.
- Stakeholder consultation.
- Proposed management measures.
- Potential assessment pathways for the proposal, including possible level of assessment requirements, if the EPA is likely to assess the proposal.

4.1.2 Referral

The EPA requires that a referral is submitted in writing on the EPA s38 Referral Form (see Instructions and Form: EPA s38 Referral). The form is used for significant proposals, strategic proposals, proposals of a prescribed class and proposals under an assessed scheme. The form includes instructions for completing the referral form. The referral form has the following sections:

- Referrer information.
- Part A: Proponent and proposal description (including key proposal characteristics).
- Part B: Environmental impacts.
- Part C: Other approvals and regulation (including request that the proposal be assessed under the Bilateral Agreement or as an accredited assessment).

The public are invited to comment on whether or not the EPA should assess the proposal, and if so, the level of assessment (see below). The EPA uses the relevant information obtained from public comments to gauge the level of public interest about the likely effect of the proposal, if implemented, on the environment. If the proposal may impact on Matters of National Environmental Significance (i.e. a potential Controlled Action), the EPA may request that the Commonwealth Department of the Environment and Energy (DoEE) provide advice on the adequacy of referral documentation, in parallel with the public comment period.

4.1.3 Level of Assessment

In deciding the level of assessment requirements, the EPA considers information including, but not limited to the following:

- Information and level of detail provided in the referral (and any supplementary reports with the referral), including: – the proposal – potential impacts – proposed management measures – evidence of effective stakeholder consultation.
- Information obtained from any requests for further information and/or the EPA's own investigations and inquiries.
- The number and complexity of preliminary key environmental factors relevant to the proposal.
- Whether it is a common type of proposal where there is an established condition-setting framework for that type of proposal.
- The level of public interest about the likely effect of the proposal, if implemented, on the environment.

When considering significance of the potential impacts, the EPA may have regard to various matters, including the following:

- Values, sensitivity and quality of the environment which is likely to be impacted.
- Extent (intensity, duration, magnitude and geographic footprint) of the likely impacts.
- Consequence of the likely impacts (or change).
- Resilience of the environment to cope with the impacts or change.
- Cumulative impacts with other existing or foreseeable activities, developments and land uses.
- Connections and interactions between parts of the environment to inform a holistic view of impacts to the whole environment.
- Level of confidence in the prediction of impacts and the success of proposed mitigation.

If referred, the EPA will determine the level of assessment required for the proposal which include:

- Not assessed – proposal not significant (i.e. does not pose the risk of a significant impact on the environment).
- Referral information - where the EPA determines that it has enough information to assess the proposal from the referral information.
- Environmental Review – no public review – where the EPA determines that an environmental review is required, but the report on the environmental review (Environmental Review Document) will not be made public.
- Public environmental review (PER) – where the EPA determines that an environmental review is required and the Environmental Review Document is to be made available for public review.

4.2 **ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)**

Commonwealth approval is required if Matters of National Environmental Significance (MNES), as defined in the EPBC Act, are at risk of a significant impact. MNES of potential relevance to the project include listed Threatened and Migratory species (Flatback turtle, migratory birds) and a TEC (Monsoon vine thickets). DoEE is responsible for administering the EPBC Act.

A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted and upon the intensity, duration, magnitude and geographic extent of the impacts.

The DoE (2013) advised that an action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community.
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.
- Adversely affect habitat critical to the survival of an ecological community.
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
 - Assisting invasive species, that are harmful to the listed ecological community, to become established,
 - Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.
- Interfere with the recovery of an ecological community.

A person who proposes to take an action that will have, or is likely to have, a significant impact on a MNES must refer that action for a decision on whether assessment and approval is required under the EPBC Act. In the event that a significant impact to a MNES is considered unlikely, a decision can be made not to refer the project. In this case it is recommended that a 'self-assessment' be completed, documenting the decision process and justifying the decision not to refer. Submission of a Referral to DoEE using the prescribed form is required for formal determination of whether a project is a Controlled Action (i.e. requires formal assessment) or not.

MBS Environmental's experience is that it is better for the proponent to submit a referral to DoEE early to provide certainty and to enable State and Federal Government processes to be aligned.

5. PRELIMINARY ASSESSMENT OF POTENTIAL IMPACTS

5.1 STATE ASSESSMENT

The Western Australian EP Act is the primary legislation governing environmental protection and impact assessment in the State. Projects with potential to significantly impact on the environment, or which have generated a high degree of public interest, are likely to be formally assessed under Part IV of the EP Act.

Environmental factors are those parts of the environment that may be impacted by an aspect of a proposal or scheme. They provide a systematic approach to organising environmental information for the purpose of environmental impact assessment and a structure for the assessment report. The EPA has 13 environmental factors, organised into five themes: Sea, Land, Water, Air and People.

The CHRMAP noted that under projected climate change and sea level rise scenarios, coastal hazard as a result of storm surge inundation and the erosion of the shoreline are forecast to increase for the coastal areas of Broome. For Cable Beach an extreme level of risk was identified for all planning periods as the foreshore reserve area and the Surf Club are almost certain to be impacted by coastal erosion in the coming decades. The value of Cable Beach and associated tourism infrastructure to Broome's economy and community were recognised in CHRMAP, concluding that a 'Protect' option should be adopted for the main tourist hub of Cable Beach. Mitigation of the coastal erosion threat could be achieved through a coastal protection structure, with options including seawalls, revetments, groynes or offshore reefs (Baird 2017). Through the community workshops the most suitable option was determined to be a buried seawall, which has been incorporated into the CBFMP.

On the basis of the conceptual master plan for the Cable Beach foreshore area (the CBFMP) and the works likely to be undertaken, including the installation of a buried seawall, and the EPA's 'Statement of Environmental Principles, Factors and Objectives' guidance, the following preliminary key environmental factors (those requiring an initial assessment) are considered relevant to the project:

- Coastal Processes.
- Marine Fauna.
- Flora and Vegetation.
- Social Surrounds.

These factors are further discussed, in relation to the project, in Section 5.1.2.

5.1.1 Relevant Policy and Guidance

A summary of the policy and guidance relevant to the environmental factors and the environmental assessment of the project is presented in Table 8. A draft pre-referral form is presented in Table 9.

Table 8: Relevant State Policy and Guidance Documents relevant to the assessment of Proposals under the EP Act

General
Statement of Environmental Principles, Factors and Objectives (EPA 2018)
Instructions on how to prepare and Environmental Review Document (EPA 2018)
Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (DSEWPAC 2012)
WA Environmental Offsets Policy (Government of Western Australia 2011)
WA Environmental Offsets Guidelines (Government of Western Australia 2014)
Coastal Processes
Environmental Factor Guideline – Coastal Processes (EPA 2016)
State Planning Policy No. 2.6 – State Coastal Planning Policy (WA Planning Commission 2006)
Sea Level Change in Western Australia – Application of Coastal Planning (Department of Transport 2010)
Marine Fauna
Environmental Factor Guideline – Marine Fauna (EPA 2016)
Environmental Assessment Guideline (No. 5) for Protecting Marine Turtles from Light Impacts (EPA 2010)
Flora and vegetation
Environmental Factor Guideline – Flora and Vegetation (EPA 2016)
Technical Guidance – Flora and vegetation surveys for environmental impact assessment (EPA 2016)
Social Surrounds
Environmental Factor Guideline – Social Surroundings (EPA 2016)
Aboriginal Heritage Due Diligence Guidelines (DAA & DPC 2013)
Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design (Western Australian Planning Commission 2007)

Table 9: Draft Pre-referral Form

Factor	Surveys and investigations	Potential Impact	Mitigation
Coastal Processes	<ul style="list-style-type: none"> Desktop assessment Field measurements Modelling to inform appropriate coastal setbacks 	<ul style="list-style-type: none"> Impact to sediment transport leading to seabed, beach or dune erosion 	<ul style="list-style-type: none"> Appropriate design of seawall Appropriate design and siting of infrastructure in relation to coastal hazards
Marine Fauna	<ul style="list-style-type: none"> Desktop assessment DBCA turtle monitoring 	<ul style="list-style-type: none"> Loss or degradation of marine fauna habitat (e.g. breeding and or foraging habitat) due to construction activities Behavioural responses of marine fauna due to noise or light spill 	<ul style="list-style-type: none"> Appropriate lighting design (construction and operations) No construction activities creating ground vibration adjacent to turtle nesting area
Flora and Vegetation	<ul style="list-style-type: none"> Desktop assessment Field reconnaissance survey 	<ul style="list-style-type: none"> Direct loss of native vegetation and significant flora species (including TEC Monsoon vine thickets, the PEC '<i>Corymbia paractia</i> dominated community on dunes' and the Priority species <i>Corymbia paractia</i>) during clearing for onshore infrastructure Indirect loss or degradation of native vegetation and significant flora species and communities due to dust emissions, the introduction or spread of weeds or altered surface water flows 	<ul style="list-style-type: none"> Minimise direct loss of native vegetation Appropriate construction management to avoid/minimise indirect impacts to native vegetation Appropriate drainage design Hygiene measures to be adopted during construction to minimise risk of introduction or spread of weeds
Social Surrounds	<ul style="list-style-type: none"> Desktop assessment Site walkover Heritage survey Public consultation 	<ul style="list-style-type: none"> Disturbance to Aboriginal heritage places Temporary impacts to the social values (e.g. aesthetics or active use) of the development envelope Constraints on access and traditional cultural activities Changes to surface water flow patterns and/or coastal processes which may impact Aboriginal heritage places 	<ul style="list-style-type: none"> Consultation with Yawuru and Department of Planning, Lands and Heritage (refer Cultural Heritage Investigation Report) Design of infrastructure to avoid impacts to heritage places where possible Section 18 <i>Aboriginal Heritage Act 1972</i> process

5.1.2 Preliminary Key Environmental Factors

5.1.2.1 Coastal Processes

EPA Objective: To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.

The EPA will want it demonstrated that current coastal processes (erosion and accretion patterns) are understood and that the project has been designed to take account of these processes, future sea level rise and storm intensity predictions and the guidance presented within State Planning Policy No. 2.6 – State Coastal Planning Policy (WA Planning Commission 2006). This can readily be demonstrated through the completion of the CHRMAP process (Baird 2017), which concluding that a 'Protect' option (buried seawall preferred) should be adopted for the main tourist hub of Cable Beach.

With the correct design of the proposed seawall and appropriate setback of buildings, it is considered likely that the EPA Objective would be met. Coastal processes is deemed to represent a low risk to the approval of the project.

5.1.2.2 Marine Fauna

EPA Objective: To protect marine fauna so that biological diversity and ecological integrity are maintained.

The EPA will want it demonstrated that current usage of the area by marine fauna (including nesting Flatback turtles and Green turtles and feeding or roosting migratory birds) is understood and that the project has been designed and will be implemented to take account of this usage. This will include the strict management of artificial lighting and noise during the construction phase, especially if this overlaps with the turtle nesting season, and the appropriate design of operations phase lighting to minimise the risk of impact to turtles and migratory birds.

With the correct design and implementation of the project, it is considered likely that the EPA Objective would be met. Marine fauna is deemed to represent a low risk to the approval of the project.

5.1.2.3 Flora and Vegetation

EPA Objective: To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

The EPA will expect the detailed characterisation of any native vegetation to be removed as a result of the project and will look at the ways in which this loss has been minimised or will be offset. Impacts to the TEC Monsoon vine thickets (listed as Vulnerable under the BC Act) are likely to be the focus of the assessment.

Based on the findings of the reconnaissance survey, a loss of 0.37 ha of the TEC may occur. It is recommended that, where possible, clearing of any intact native vegetation, including that within vegetation units FD, HD and particularly MVT, which is considered to be a representation of the monsoon vine thicket TEC, be avoided or minimised.

There is a risk that impacts on the TEC Monsoon vine thickets could result in the EPA Objective not being met. Flora and vegetation is deemed to represent a moderate risk to the approval of the project.

5.1.2.4 Social Surrounds

EPA Objective: To protect social surroundings from significant harm.

The EPA will seek evidence that the community has been thoroughly consulted on the CBFMP and that, where possible, the feedback has been taken into account in the final design of the project. It is understood that the CBFMP has been published for public review. This factor includes the consideration of potential impacts to:

- Aboriginal heritage and culture.
- Natural and historical heritage.
- Amenity.
- Economics.

With appropriate consultation and project design, it is considered likely that the EPA Objective would be met. Social surrounds is deemed to represent a low/moderate risk to the approval of the project.

5.1.3 Summary

Following the recommendations of the Cable Beach Development Strategy, the SoB has developed a conceptual master plan for the Cable Beach foreshore area, the CBFMP which was adopted by the SoB Council in September 2017. The CBFMP supports the objectives of the Cable Beach Development Strategy and incorporates coastal protection measures as described in the CHRMAP process (Baird 2017).

The CHRMAP noted that under projected climate change and sea level rise scenarios, coastal hazard as a result of storm surge inundation and the erosion of the shoreline are forecast to increase for the coastal areas of Broome. For Cable Beach an extreme level of risk was identified for all planning periods as the foreshore reserve area, Zanders Café and the Surf Club are almost certain to be impacted by coastal erosion in the coming decades. The value of Cable Beach and associated tourism infrastructure to Broome's economy and community were recognised in CHRMAP, concluding that a 'Protect' option should be adopted for the main tourist hub of Cable Beach. Mitigation of the coastal erosion threat could be achieved through a coastal protection structure, with options including seawalls, revetments, groynes or offshore reefs (Baird 2017). Through the community workshops the most suitable option was determined to be a buried seawall, which has been incorporated into the CBFMP. Without the implementation of the CBFMP it is likely that significant impacts to the coastline and coastal infrastructure would occur. The demonstration of this risk will support the State assessment of the project.

Due to the public interest in the project, as demonstrated through the numerous submissions on the CBFMP, and the inclusion of Environs Kimberley and the Yawuru as key stakeholders, it is likely that the outcome of referral of the project under the EP Act would be a Public Environmental Review. This opinion is informed by several recent decisions made by the EPA Chairman (Tom Hatton).

A PER level of assessment, which entails the preparation of a thorough and robust assessment of potential environmental impacts and the development of appropriate management measures, and includes several public review opportunities, is the most thorough. A PER could potentially be avoided in the event that all key stakeholders support the project and this is demonstrated at the referral stage (refer Section 4.1.2).

It is recommended that the final design and layout of proposed infrastructure be completed with a view to addressing, where possible, stakeholder comments and minimising the loss of the TEC Monsoon vine thickets. If the latter is not possible offsets, such as provisions for the better protection and management of other patches of the TEC, are likely to be required under the State approvals process.

5.2 COMMONWEALTH ASSESSMENT

5.2.1 Listed Threatened and Migratory Species

An assessment of potential impacts to listed Threatened and Migratory species, including the Flatback turtle, Green turtle and several migratory bird species, would be required. However, significant impacts are considered unlikely given appropriate project design and implementation.

5.2.2 Listed Threatened Ecological Communities

Potential impacts to the TEC Monsoon vine thickets would require a detailed assessment.

The approved Conservation Advice for this TEC is provided in Appendix 3. Monsoon vine thickets occurs as discontinuous patches of dense vegetation. The patches are usually located within the swales on the leeward side of the coastal Holocene dune systems. Outliers may occur on different substrates where other factors, such as moisture availability, support the ecological community. In the absence of fire, the ecological community can often form a continuous link with adjacent fire-prone communities (Appendix 3). Monsoon vine thickets are considered a rainforest subset ranging from semi-deciduous vine thickets to closed semi-deciduous vine forest. The ecological community provides an important habitat for a number of plant species. For example, the vine *Parsonsia kimberleyensis* is at the southern-most limit of its range within the ecological community along with *Glycosmis* sp. and the deciduous shrub *Croton habrophyllus*. The small tree, *Vitex glabrata* (bush currant) is only known to occur on the Dampier Peninsula in the ecological community (Appendix 3). In July 2017, an isolated 4,300 m² patch of the TEC was reported at Cable Beach (Appendix 5).

A preliminary assessment, completed following the reconnaissance survey (March 2019), indicated that:

- An area of vegetation within the proposed Development Envelope (Figure 1) met the key diagnostic criteria for the TEC (Canopy Layer: 50% or more of the total cover of the canopy comprises perennial native species; Understorey: 50% or more of the total vegetation cover in the ground and mid layers comprises perennial native species).
- An area of Monsoon vine thicket in 'Very Good' condition was recorded across 0.32 ha.
- An area of Monsoon vine thicket in 'Degraded to Completely Degraded' condition was recorded across 0.065 ha.

The interim recovery plan (Appendix 6) objective is to 'conserve the ecological and conservation values of the Monsoon vine thicket community' by:

- Ensuring the permanent protection and conservation of self-sustaining representative areas of key occurrences identified in this plan.
- Attaining conservation management of self-sustaining representative key areas of each of the identified vine thicket clusters.
- Minimising the loss and maximising the conservation of all remaining occurrences as far as possible, including recovering degraded occurrences where it is cost effective and practical to do so.

Any losses of Monsoon vine thicket within the Development Envelope could potentially be offset by one or more of the following measures (as identified as 'criteria for success' in the interim recovery plan):

- Increasing the number of key self-sustaining areas of the vine thicket community that are managed for conservation and/or with conservation included in their purpose (including Indigenous Protected Areas, and reserves that are jointly managed between the Conservation and Parks Commission and the Aboriginal Native Title Holder in accordance with the *Conservation and Land Management Act 1984* (CALM Act)).
- Increasing the number of identified vine thicket cluster groups for which representative areas have conservation management in place.
- Increasing the number of occurrences of the vine thicket community for which formal strategies are in place to minimise loss and maximise conservation (such as formal weed or fire management strategies in place and being implemented).

5.2.3 Summary

Following the recommendations of the Cable Beach Development Strategy, the SoB has developed a conceptual master plan for the Cable Beach foreshore area, the CBFMP which was adopted by the SoB Council in

September 2017. The CBFMP supports the objectives of the Cable Beach Development Strategy and incorporates coastal protection measures as described in the CHRMAP process (Baird 2017).

The CHRMAP noted that under projected climate change and sea level rise scenarios, coastal hazard as a result of storm surge inundation and the erosion of the shoreline are forecast to increase for the coastal areas of Broome. Mitigation of the coastal erosion threat could be achieved through a coastal protection structure, with options including seawalls, revetments, groynes or offshore reefs (Baird 2017). Through the community workshops the most suitable option was determined to be a buried seawall, which has been incorporated into the CBFMP. Without the implementation of the CBFMP it is likely that significant impacts to the coastline and coastal infrastructure would occur. The demonstration of this risk will support the Commonwealth assessment of the project.

Due to the likely direct loss of the Monsoon vine thicket TEC, referral to the DoEE is recommended. It is considered likely that the project would be deemed a 'Controlled Action', with formal assessment required. This could readily be achieved through a PER document if this is required under the State process.

It is recommended that the final design and layout of proposed infrastructure be completed with a view to addressing, where possible, stakeholder comments and minimising the loss of the TEC Monsoon vine thickets. If the latter is not possible offsets, such as provisions for the better protection and management of other patches of the TEC, are likely to be required under the Commonwealth approvals process. A formal assessment would provide a mechanism for the development and approval of environmental offsets for the loss of the TEC.

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APPENDICES

APPENDIX 1: PROTECTED MATTERS SEARCHES (10KM BUFFER AND 50KM BUFFER)



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: 31/01/19 11:42:30

[Summary](#)

[Details](#)

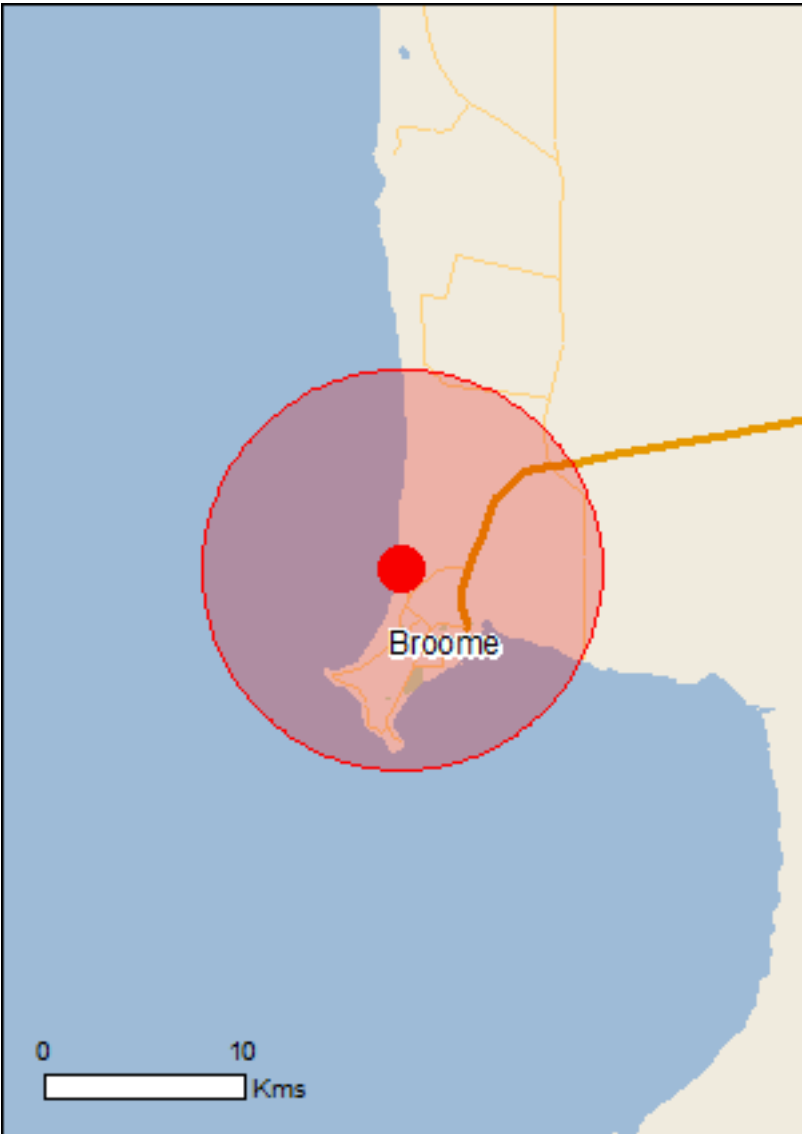
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

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[Buffer: 10.0Km](#)



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:	31
Listed Migratory Species:	65

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:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	None
Invasive Species:	12
Nationally Important Wetlands:	1
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 10km of Ramsar

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, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely 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	Species or species habitat 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
Ctenotus angusticeps Northwestern Coastal Ctenotus, Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area

Name	Status	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
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

Name	Threatened	Type of Presence
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 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
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	Species or species habitat 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 within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species

Name	Threatened	Type of Presence
Hirundo rustica Barn Swallow [662]		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 may 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]	Endangered	Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Critically Endangered
Calidris melanotos Pectoral Sandpiper [858]	Critically Endangered	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]		Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]	Vulnerable	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Endangered
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 within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur

Name	Threatened	Type of Presence
Limosa lapponica Bar-tailed Godwit [844]	Critically Endangered	within area 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]		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]
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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]
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* 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
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Anous stolidus Common Noddy [825]		Species or species habitat likely to occur
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Name	Threatened	Type of Presence
		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
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species

Name	Threatened	Type of Presence
Gallinago megala Swinhoe's Snipe [864]		habitat known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting likely 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]	Critically Endangered	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 may 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]		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]	Endangered*	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]		Species or species habitat likely 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 spirostris 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 micronotus 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]	Endangered	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]		Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]		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
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		area 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	Species or species habitat 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
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

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Broome Wildlife Centre	WA
Unnamed WA51105	WA
Unnamed WA51162	WA
Unnamed WA51497	WA
Unnamed WA51617	WA
Unnamed WA52354	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		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur 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
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species

Name	Status	Type of Presence
		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
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

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

-17.93079 122.21065

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.



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: 31/01/19 11:29:32

[Summary](#)

[Details](#)

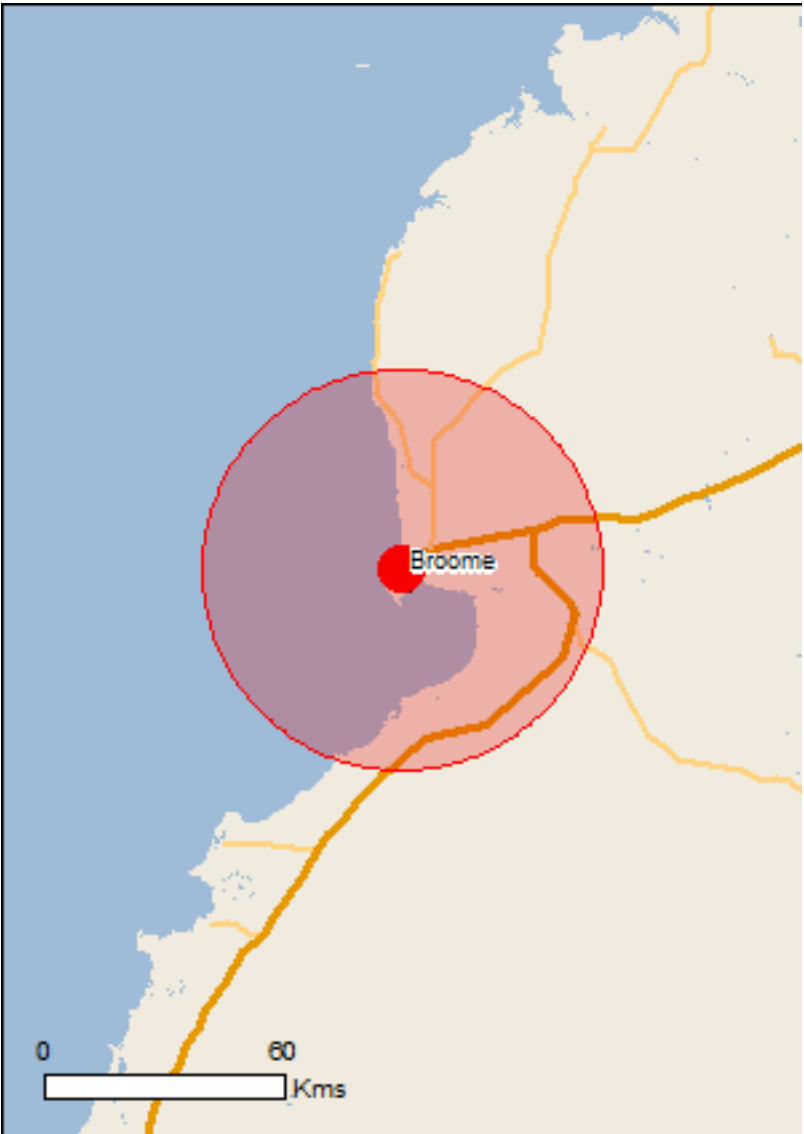
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

[Buffer: 50.0Km](#)



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:	32
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:	106
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:	9
Regional Forest Agreements:	None
Invasive Species:	20
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
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat 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, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely 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	Species or species habitat 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
Ctenotus angusticeps Northwestern Coastal Ctenotus, Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
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
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

Name	Threatened	Type of Presence
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	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	Species or species habitat 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

Name	Threatened	Type of Presence
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		within area 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 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

Name	Threatened	Type of Presence
Gallinago stenura Pin-tailed Snipe [841]	Critically Endangered	within area
Glareola maldivarum Oriental Pratincole [840]		Roosting likely 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
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]		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
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

Name	Threatened	Type of Presence
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
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

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]	Critically Endangered	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]		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]	Endangered	Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]		Species or species habitat may 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
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely 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,		Species or species

Name	Threatened	Type of Presence
Network Pipefish [66200]		habitat may occur within area
Cosmocampus banneri		
Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus		
Banded Pipefish, Ringed Pipefish [66210]		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
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 angustus		
Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		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

Name	Threatened	Type of Presence
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		area 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 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

Name	Threatened	Type of Presence
		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 area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]		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]	Endangered	Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]		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	Species or species

Name	Status	Type of Presence
Orcaella brevirostris Irrawaddy Dolphin [45]		habitat known to occur within area 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	

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

Name	Status	Type of Presence
<div><div>Sturnus vulgaris</div><div>Common Starling [389]</div></div>		Species or species habitat likely to occur within area
Frogs		
<div><div>Rhinella marina</div><div>Cane Toad [83218]</div></div>		Species or species habitat may occur within area
Mammals		
<div><div>Camelus dromedarius</div><div>Dromedary, Camel [7]</div></div>		Species or species habitat likely to occur within area
<div><div>Canis lupus familiaris</div><div>Domestic Dog [82654]</div></div>		Species or species habitat likely to occur within area
<div><div>Equus asinus</div><div>Donkey, Ass [4]</div></div>		Species or species habitat likely to occur within area
<div><div>Equus caballus</div><div>Horse [5]</div></div>		Species or species habitat likely to occur within area
<div><div>Felis catus</div><div>Cat, House Cat, Domestic Cat [19]</div></div>		Species or species habitat likely to occur within area
<div><div>Mus musculus</div><div>House Mouse [120]</div></div>		Species or species habitat likely to occur within area
<div><div>Oryctolagus cuniculus</div><div>Rabbit, European Rabbit [128]</div></div>		Species or species habitat likely to occur within area
<div><div>Rattus rattus</div><div>Black Rat, Ship Rat [84]</div></div>		Species or species habitat likely to occur within area
<div><div>Sus scrofa</div><div>Pig [6]</div></div>		Species or species habitat likely to occur within area
<div><div>Vulpes vulpes</div><div>Red Fox, Fox [18]</div></div>		Species or species habitat likely to occur within area
Plants		
<div><div>Cenchrus ciliaris</div><div>Buffel-grass, Black Buffel-grass [20213]</div></div>		Species or species habitat likely to occur within area
<div><div>Dolichandra unguis-cati</div><div>Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]</div></div>		Species or species habitat likely to occur within area
<div><div>Jatropha gossypifolia</div><div>Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]</div></div>		Species or species habitat likely to occur within area
<div><div>Parkinsonia aculeata</div><div>Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]</div></div>		Species or species habitat likely to occur within area
<div><div>Prosopis spp.</div><div>Mesquite, Algaroba [68407]</div></div>		Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
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

-17.93083 122.21063

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

APPENDIX 2: DBCA NATUREMAP SEARCH RESULTS

[illegible]

[illegible]

Sala kucugaster	Brown Booby	SRD	A	2106/1981	Signling	1	RIOBUCK	ROEBUCK	122-2213	-17-913	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2913	-17-913	122-2913	-17-913	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	2708/1981	Signling	1	RIOBUCK	ROEBUCK	122-2213	-17-913	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2913	-17-913	122-2913	-17-913	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1209/1999	Signling	1	MANNV	MANNV	122-2217	-18-026	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2217	-18-026	122-2217	-18-026	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1906/1999	Signling	1	MANNV	MANNV	122-2217	-18-026	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2217	-18-026	122-2217	-18-026	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1909/1999	Signling	1	CABLE BEACH	Gartneaux Point	122-1983	-17-973	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1983	-17-973	122-1983	-17-973	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	4007/1999	Signling	1	CABLE BEACH	Cable Beach & Little Drive, Broom	122-2246	-17-982	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2246	-17-982	122-2246	-17-982	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	2106/1999	Signling	1	WATERBANK	Coconut Hills Beach	122-2207	-17-892	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2207	-17-892	122-2207	-17-892	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	2208/1999	Signling	1	WATERBANK	Coconut Hills Beach	122-2207	-17-892	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2207	-17-892	122-2207	-17-892	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	3070/1999	Signling	1	WATERBANK	Coconut Hills Beach	122-2207	-17-892	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2207	-17-892	122-2207	-17-892	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1111/1999	Signling	1	MANNV	Cable Beach, Broom	122-2283	-18-021	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2283	-18-021	122-2283	-18-021	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1312/1999	Signling	1	MANNV	Cable Beach, Broom	122-1446	-17-919	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1446	-17-919	122-1446	-17-919	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1312/1999	Signling	1	MANNV	Cable Beach, Broom	122-1446	-17-919	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1446	-17-919	122-1446	-17-919	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1912/1999	Signling	1	MANNV	Cable Beach, Broom	122-1446	-17-919	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1446	-17-919	122-1446	-17-919	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1912/1999	Signling	1	MANNV	Cable Beach, Broom	122-1446	-17-919	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1446	-17-919	122-1446	-17-919	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	701/2000	Signling	1	MANNV	Cape Gartneaux	122-1203	-18-033	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1203	-18-033	122-1203	-18-033	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	801/2000	Signling	1	MANNV	Cape Gartneaux	122-1203	-18-033	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1203	-18-033	122-1203	-18-033	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1601/2000	Signling	1	MANNV	Cape Gartneaux	122-1203	-18-033	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1203	-18-033	122-1203	-18-033	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	750/2000	Signling	1	MANNV	Coconut Hills Beach	122-2207	-17-892	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2207	-17-892	122-2207	-17-892	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	2607/2000	Signling	1	CABLE BEACH	Cable Beach, Broom	122-2132	-17-924	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-2132	-17-924	122-2132	-17-924	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	1408/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	198/2000	Signling	1	BROOM	Broom	122-223	-17-914	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-223	-17-914	122-223	-17-914	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	700/2000	Signling	1	BROOM	Gartneaux Point	122-1983	-17-973	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1983	-17-973	122-1983	-17-973	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	200/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV	Broom Point	122-1216	-18-036	29754	Subside	Sala	kucugaster	Armenia	Pont	1	1	122-1216	-18-036	122-1216	-18-036	0	0	0	0	0	0	0
Sala kucugaster	Brown Booby	SRD	A	260/2000	Signling	1	MANNV																						

[illegible]

[illegible]

[illegible]

[illegible]

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[illegible]

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[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	30/10/2000	Unknown	1	MNYRR	Kimberley, BloomPort	122-1985	-17-9021	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-1985	-17-9021	122-1985	-17-9021	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	1/03/2001	Unknown	1	DUGUN	Broome, Cable Beach	122-2154	-17-9401	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-2154	-17-9401	122-2154	-17-9401	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	4/05/2000	Unknown	1	BALNGURR	Broome, Broome North	122-2322	-17-9217	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-2322	-17-9217	122-2322	-17-9217	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	7/05/2000	Unknown	1	BALNGURR	Broome, Broome North	122-2338	-17-9238	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-2338	-17-9238	122-2338	-17-9238	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	6/05/2000	Unknown	1	BALNGURR	Broome, Broome North	122-2339	-17-9234	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-2339	-17-9234	122-2339	-17-9234	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	6/05/2000	Unknown	1	BALNGURR	Broome, Broome North	122-234	-17-9232	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-234	-17-9232	122-234	-17-9232	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	10/05/2000	Unknown	1	BALNGURR	Broome, Broome North	122-2343	-17-9233	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-2343	-17-9233	122-2343	-17-9233	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	8/05/2000	Unknown	1	BALNGURR	Broome, Broome North	122-2343	-17-9223	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-2343	-17-9223	122-2343	-17-9223	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	16/05/2011	Deat	2	Broome		122-244249	-17-901868	0				Animalia	Point	1	1	122-244249	-17-901867	122-2404	-17-9602	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	30/11/1999	Unknown	1			122-233333	-17-8867	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-233333	-17-866817	122-2333	-17-8667	0	0	0	0	0	0	0	0
Tachoursa vespula antennata	Kimbe Northern Brutaal Possum (Kimberley)	MAMMAL	VU	30/11/1999	Unknown	1		WHARF (BROOME)	122-23686	-17-97	24107	Phalangidae	Tachoursa vespula	antennata	Animalia	Point	1	1	122-23686	-17-97	122-2386	-17-97	0	0	0	0	0	0	0	0
Daynesia hollandsi	Northern Quail	MAMMAL	EN	27/03/2011	Day sighting	1	Dugun		122-238946	-17-932764	0				Animalia	Point	1	1	122-23896	-17-93207	122-236	-17-9637	0	0	0	0	0	0	0	0
Momophaps coluargus	Northwestern Free-tailed Bat	MAMMAL	P1	16/03/2011	Unknown	1	DUGUN	Broome, Cable Beach	122-2173	-17-944	0	Molossidae	Momophaps coluargus		Animalia	Point	1	1	122-2173	-17-944	122-2173	-17-944	0	0	0	0	0	0	0	0
Momophaps coluargus	Northwestern Free-tailed Bat	MAMMAL	P1	26/03/2011	Unknown	1	WATERBANK	Broome, Madagap	122-2705	-17-8802	0	Molossidae	Momophaps coluargus		Animalia	Point	1	1	122-2705	-17-8802	122-2705	-17-8802	0	0	0	0	0	0	0	0
Wyllodia squamulata	Sooty-tailed Possum	MAMMAL	P4	16/10/1991	Caught on Is	1	Broome		122-191301	-17-978908	0				Animalia	Point	1	1	122-191301	-17-97941	122-1913	-17-9794	0	0	0	0	0	0	0	0
Hydromys thomomys	Flat-tail Rat	MAMMAL	P4	10/12/1971	Caught on Is	1	Broome		122-231209	-17-99881795	0				Animalia	Point	1	1	122-231201	-17-99931	122-2316	-17-9995	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Caught on Is	1	Roadcut		122-260733	-17-9382429	0				Animalia	Point	1	1	122-260733	-17-939234	122-2607	-17-9392	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Caught on Is	1	Roadcut		122-2607465	-17-93801479	0				Animalia	Point	1	1	122-260747	-17-938017	122-2607	-17-938	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Caught on Is	1	Roadcut		122-2607507	-17-93107265	0				Animalia	Point	1	1	122-260904	-17-931071	122-2607	-17-9310	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Caught on Is	1	Roadcut		122-2617264	-17-93808805	0				Animalia	Point	1	1	122-261726	-17-93808	122-2617	-17-9307	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-263468	-17-9347187	0				Animalia	Point	1	1	122-26346	-17-93472	122-2633	-17-9347	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	2	Roadcut		122-262279	-17-9348401	0				Animalia	Point	1	1	122-262279	-17-93484	122-2633	-17-9348	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-26899	-17-9385643	0				Animalia	Point	1	1	122-26898	-17-93856	122-2689	-17-9386	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-268612	-17-9384238	0				Animalia	Point	1	1	122-26861	-17-93842	122-2687	-17-9382	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-262287	-17-93281189	0				Animalia	Point	1	1	122-262763	-17-93212	122-268	-17-932	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-263464	-17-9321373	0				Animalia	Point	1	1	122-26346	-17-932137	122-2625	-17-9321	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-263438	-17-932844	0				Animalia	Point	1	1	122-26344	-17-93243	122-2624	-17-9324	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-262287	-17-9350428	0				Animalia	Point	1	1	122-26228	-17-935042	122-261	-17-9325	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-262194	-17-935705	0				Animalia	Point	1	1	122-26219	-17-93570	122-2622	-17-9327	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-933101	122-2616	-17-9331	0	0	0	0	0	0	0	0
Chnus angustipops	Alie Island Ctenoda, Northwestern Coast	REPTILE	P3	7/04/2017	Sighting	1	Roadcut		122-261983	-17-9331094	0				Animalia	Point	1	1	122-26198	-17-9										

APPENDIX 3: FLORA AND VEGETATION RECONNAISSANCE SURVEY REPORT (FOCUSSED VISION 2019)



FLORA AND VEGETATION ASSESSMENT
CABLE BEACH FORESHORE ADAPTATION PROJECT
MBS ENVIRONMENTAL, FOR THE SHIRE OF BROOME

APRIL 2019

F  **USED**
VISION
consulting

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EXECUTIVE SUMMARY

The Shire of Broome has developed the Cable Beach Foreshore Master Plan (CBFMP) which addresses conceptual design and was adopted by the Shire of Broome Council in September 2017. As part of studies to inform the detailed design, MBS Environmental (MBS) was engaged by the Shire of Broome to undertake environmental and heritage assessments. Focused Vision Consulting Pty Ltd (FVC) was in-turn commissioned by MBS to undertake the flora and vegetation assessment component of the work. This report presents the findings of this assessment.

The study area occupies 3.30 hectares (ha) and is located at the Cable Beach foreshore, west of Cable Beach Road.

FVC undertook a desktop assessment followed by a reconnaissance flora and vegetation field assessment which was completed on 7 March 2019 by Principal Ecologist, Kellie Bauer-Simpson.

The key findings, conclusions and recommendations arising from the flora and vegetation assessment within the study area are as follows:

- A total of 20 flora taxa, from 19 genera and 14 families were recorded during the reconnaissance survey, including 15 (80%) native species and five (20%) introduced (weed) species.
- None of the weed species recorded are listed as Declared Pest plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), nor are any listed as Weeds of National Significance (WoNS).
- No Threatened flora protected under the BC Act or under the EPBC Act were recorded and no Priority flora were recorded.
- No recorded species exhibited an extension beyond their current documented range, in accordance with records of the Western Australian Herbarium (DBCA 2018a), besides *Casuarina obesa*, which is not naturally occurring and likely to have been planted. This occurrence is not considered a range-extension.
- Three intact vegetation units and two disturbed/planted areas were described and mapped from four relevés and various observation points throughout the study area.
- The vegetation of the study area ranges in condition from 'Very Good' to 'Completely Degraded', with most of the vegetation found to be in 'Degraded' condition.
- The regional vegetation/vegetation association of the study area, vegetation association 750 (Beard 1990), is represented by 99.56% of its pre-European extent and therefore, the vegetation of the study is not significant due to poor regional representation.
- It is considered that the monsoon vine thicket TEC is represented within the MVT vegetation unit within the study area, based on positive results in comparison to the key characteristics; and this occurrence of the TEC is also considered to meet condition thresholds.
- The patch of monsoon vine thicket TEC mapped within the study area totals 0.37 ha and this patch is considered to be confirmed to within the study area.
- The timing of the survey (early March, following the majority of the wet season) was considered suitable for a flora and vegetation assessment, although the preceding February and December recorded significantly lower than average rainfall and therefore, the flowering season in the region (March to

June) has the potential to be poorer than usual. However, this is not expected to have influenced the characterisation of the monsoon vine thicket TEC within the study area.

Based on the findings of the study, the following recommendations are provided for consideration:

- Although it is understood that clearing is proposed as part of the Master Plan, where possible, or where native vegetation is to be retained, it is recommended that clearing of vegetation is minimised, including within vegetation units FD, HD and particularly MVT, which is considered to be a representation of the monsoon vine thicket TEC.
- Whilst the existing conditions within the study area and on the Cable Beach Foreshore do not provide a 50 m buffer, as preferred by the Conservation Advice (DSEWPaC 2013), it is recommended that future redevelopment aim to avoid or minimise further encroachment on the TEC vegetation from that which is currently in existence, which would be in accordance with exemptions for continuing use.
- It is recommended that management plans be prepared and implemented for both the design and construction phases of the redevelopment, as well as the ongoing operational and maintenance phases, including, but not limited to:
 - Limiting clearing or other direct or indirect impacts on native vegetation, where possible
 - Management measures that address the key threats to the monsoon vine thicket TEC, including:
 - an appropriate fire management plan that addresses risk management and rapid response
 - an appropriate weed management plan that addresses active control and avoidance of continued weed invasion into sensitive areas
 - appropriate drainage design with ongoing maintenance, to ensure that hydrological regimes are not altered
 - measures to ensure access to sensitive areas and subsequent impacts are excluded (e.g. signage and fencing, if appropriate).

1. INTRODUCTION

1.1 BACKGROUND

The Shire of Broome has developed a conceptual master plan for Cable Beach Foreshore area, the Cable Beach Foreshore Master Plan (CBFMP), which was adopted by the Shire of Broome Council in September 2017.

As part of the Environmental and Cultural Heritage Investigations to inform the detailed design of the foreshore redevelopment, Focused Vision Consulting Pty Ltd (FVC) was commissioned by MBS Environmental (MBS) to undertake the flora and vegetation assessment component of the work. This report presents the findings of the flora and vegetation assessment conducted within the study area.

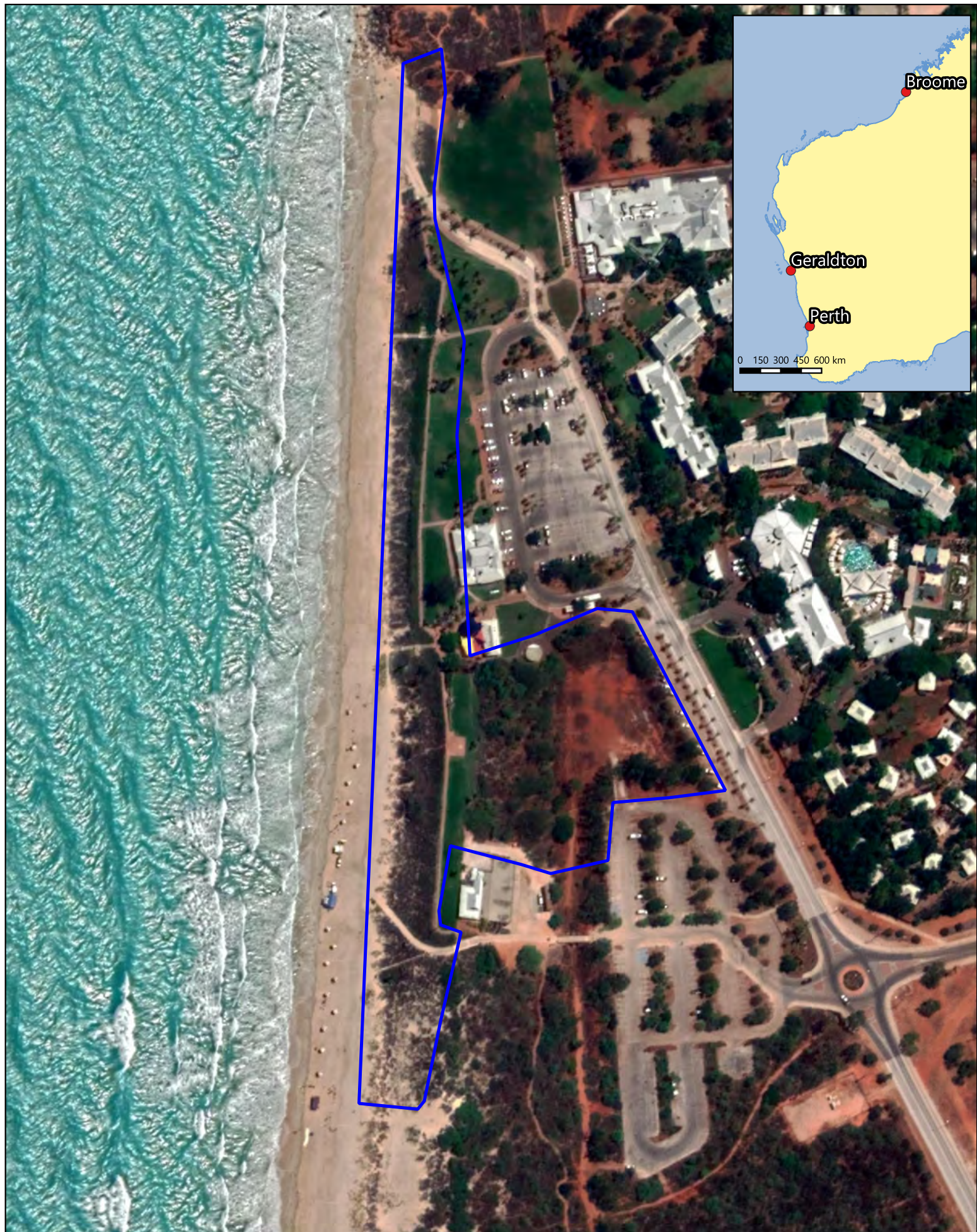
1.2 LOCATION

The 3.30 hectare (ha) study area is located at the Cable Beach foreshore, west of Cable Beach Road, within the Shire of Broome, as shown in **Figure 1**.

1.3 SCOPE OF WORK

The full scope of work required to be fulfilled is as follows:

- undertake a desktop flora and vegetation assessment of the study area
- undertake a reconnaissance field flora and vegetation assessment of the study area
- provide a report that documents the findings of the above, and that could contribute to the broader Environmental Assessment Report for the project.



2. EXISTING ENVIRONMENT

2.1 CLIMATE

The study area lies within the Kimberley Region of Western Australia. This region has a tropical climate with hot and humid summers and warm winters. There are two distinct seasons: the 'wet' usually from December to March and the 'dry' for the remainder of the year (Bureau of Meteorology 2019). Tropical cyclones can be experienced during the months from November to April, but are most common in January and February (Bureau of Meteorology 2019).

Broome Airport (Site Number 003003) is one of the Bureau of Meteorology (BoM) meteorological recording stations which has been recording since 1939 and has recorded an average annual rainfall of 628.1 mm (BoM 2019). The annual mean maximum temperature ranges from 28.9°C in winter to 34.0°C in summer (BoM 2019) (Figure 2).



Figure 2 - Climate Data for Broome Airport (003003)

2.2 IBRA REGION

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Commonwealth of Australia 2013). The study area lies within the Dampierland (DAL) IBRA region and, at a finer scale, within the Pindanland subregion (DAL02) (Graham 2001).

The Dampierland bioregion is characterised by extensive plains, ranges and spectacular gorges. The Pindanland subregion comprises of sandplains of the Dampier Peninsular and western part of Dampierland, including the hinterland of the Eighty Mile Beach. It is a fine-textured sand sheet with subdued dunes and includes the paleodelta of the Fitzroy River. The vegetation is described as pindan. This is the coastal, semi-arid, north-western margin of the Canning Basin (Graham 2001).

2.3 GEOLOGY AND SOILS

The study area is situated on a flat to gently undulating plain of the Dampier Peninsula. The Dampier Peninsula is underlain by the ancient (Precambrian) rocks of the Canning Basin. The geology of the study area comprises "red sand, fine to medium, minor silt; Aeolian" (Geological Survey of Western Australia, 1982).

The principal soil-type of the Dampier Peninsula is the pindan, which developed during the Quaternary period on desert dune sandstone. The soils of the area are red earthy sands, which are of wind-blown origin (Kenneally *et al.* 1996).

Within the Broome area, the pindan is often overlain by a layer of more recent, coarser and unconsolidated sand, which assists in water penetration, plant establishment and growth (Kenneally *et al.* 1996).

2.4 VEGETATION

The study area is located on the Dampier Peninsula and the vegetation has been broadly characterised by Beard (1990). The Beard vegetation associations supported by the study area and the remaining extent across a range of contexts are presented in **Table 1** and spatially in **Figure 3**.

Table 1 - Pre-European Vegetation of the Study Area (Beard 1990, DBCA 2019a)

Veg. Association No.	Broad Vegetation Description	Extent Context	Pre-European Extent (ha)	Current Extent (ha)	% Pre-European Extent Remaining	% Current Extent Protected (IUCN I–IV)
750	Shrublands, pindan, <i>Acacia tumida</i> shrubland with grey box and cabbage gum medium woodland over ribbon grass and curly spinifex	Western Australia	1,231,155.50	1,225,687.52	99.56	2.70

One of the objectives of the Environmental Protection Authority (EPA) in terms of vegetation protection is maintaining at least 30% of each vegetation complex. The following key criteria are applied to vegetation protection from clearing (EPA 2000):

- the 'threshold level' below which species loss appears to accelerate exponentially within an ecosystem level, is regarded as being at a level of 30% (of the pre-European, i.e. pre-1750 extent of the vegetation type)
- a level of 10% of the original extent of a vegetation community is regarded as being a level representing Endangered
- clearing which would increase the threat level to a vegetation community should be avoided.

All of the documented (Beard 1990) remaining vegetation extents applicable to the study area are above the 30% minimum threshold level (**Table 1**) and therefore meet the EPA objective of retention for the purpose of biodiversity conservation.

2.5 WETLANDS

There are no wetlands listed under the Directory of Important Wetlands in Australia relevant to the study area. The closest wetland listed is located approximately 3 km to the east of the study area. The closest Ramsar Wetland, a section of Roebuck Bay, is located approximately 11 km south-east of the study area (DoEE 2019).



Legend



Study Area



Shrublands, pindan; *Acacia tumida* shrubland with grey box & cabbage gum medium woodland over ribbon grass & curly spinifex

0 25 50 75 100 m

GDA 94 / MGA Zone 50

**Figure 3 - Pre-European
Vegetation**



3. METHODOLOGY

The assessment for flora and vegetation was carried out in accordance with:

- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*
- EPA (2016a) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment
- Department of Environmental Regulation (2014) -*A Guide to the Exemptions and Regulations for Clearing Native Vegetation under Part V of the Environmental Protection Act 1986.*

3.1 DESKTOP ASSESSMENT

Results of searches of the Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Flora and Ecological Communities databases were compiled for the desktop assessment (DBCA 2019b, 2019c, 2019d). Other available information was also sourced through searches of NatureMap and the Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool (PMST), for Matters of National Environmental Significance (MNES), listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) associated with the site.

The suite of information gathered from the desktop assessment was used to generate potential species lists tailored to the study area, with a focus on Threatened and Priority flora and ecological communities and assisted in determining species and areas of the study site to particularly focus on during the field assessment.

A review of the following publicly available information included:

- DBCA NatureMap Species Report (**Appendix A**), providing:
 - flora species listed as rare (Threatened (T)) or likely to become extinct
 - flora species protected under international agreements (IA)
 - flora species listed as Priority 1 to 5 (P1, P2, P3, P4, P5)
 - other non-conservation taxa recorded or known to the area.
- EPBC Act PMST results for the study area (**Appendix B**), providing results relevant to:
 - the following MNES:
 - World Heritage Properties
 - National Heritage Places
 - Wetlands of International Importance
 - Great Barrier Reef Marine Park
 - Commonwealth Marine Areas
 - Listed Threatened Ecological Communities
 - Listed Threatened Species (flora and fauna)
 - Listed Migratory Species.
 - the following other matters protected by the EPBC Act:
 - Commonwealth Land
 - Commonwealth Heritage Places
 - Listed Marine Species
 - Whales and other Cetaceans
 - Critical Habitats
 - Commonwealth Reserves (Terrestrial)
 - Commonwealth Reserves (Marine).
- spatial data sourced from DBCA for:
 - Threatened and Priority flora, across the study area
 - Threatened and Priority Ecological Communities, across the study area.

- relevant technical reports:
 - ecologia (2012a) Sheffield Resources Ltd. Thunderbird Dampier Peninsula Project. Level 1 Flora and Fauna Assessment. November 2012.
 - ecologia (2012b) Woodside Energy Ltd. James Price Point: Light Industrial Area, Workers' Accommodation Camp, Southern Pipeline. Vegetation and Flora Survey. October 2012.
 - GHD (2009) LandCorp Broome North: Southern Portion (Area A) Preliminary Environmental Impact Assessment and Biological Survey. September 2009.
 - Black, S. J., Willing T., and Dureau, D. M. (2010) A comprehensive survey of the flora, extent and condition of vine thickets on coastal sand dunes of Dampier Peninsula, West Kimberley, 2000-2002. Prepared for the Broome Botanical Society. Final Report September 2010.
 - Reynolds, S., Beames, L., Willing, T., and Parker, C. (2018) Distribution, ecology and cultural importance of Gunurru or Cable Beach Ghost Gum *Corymbia paractia* in the Broome Area, Western Australia. Environs Kimberley, Broome.
 - AECOM (2017) Flora, Vegetation and Fauna Assessment, Broome Asparagus Farm. July 2017.
 - Phoenix Environmental Services (2017) Flora and vegetation survey and terrestrial fauna survey for Shamrock Station Irrigation Project. Prepared for Argyle Cattle Company Pty Ltd. August 2017.

3.2 FIELD SURVEY

The field assessment was carried out by Principal Ecologist, Kellie Bauer-Simpson, on 7 March 2019, which comprised a single-phase reconnaissance flora and vegetation assessment, in accordance with the Environmental Protection Authority (EPA) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a).

Field data was collected predominantly on electronic tablet equipped with the mobile mapping software Mappt™, which contains customised electronic data forms. The mobile mapping software allows in-field spatial determination of boundaries for vegetation communities, condition areas and habitats, as well as the collection of spatial point data where individual species or other observations or photographs are captured.

Field data was collected from four non-permanent flora and vegetation assessment relevés (detailed data collection points), in accordance with EPA guidance for a reconnaissance survey. Data collected was representative of the diversity of floristic values of the study area. Observations were recorded and opportunistic data collection was also carried out continuously whilst traversing the study area.

The following information was collected at each relevé:

- observer
- date
- GPS location (MGA94)
- representative photograph
- soil type and colour
- topography
- vegetation condition/degradation/disturbances (e.g. grazing, weed invasion, fire)
- flora species observed, including average height and projected foliage cover of dominant species within each stratum

- vegetation community, described in accordance with Level 5 of the National Vegetation Information System (NVIS)
- vegetation condition, assessed against the currently accepted scale; an adaptation of the Keighery (1994) and Trudgen (1988) condition scales.

Prior to the field survey, the locations of all Priority flora retrieved from the various database searches and literature reviews was collated. A proportion of the field assessment time was dedicated to selected targeted searches for relevant flora, in suitable habitats. Conservation significant flora were also opportunistically surveyed throughout the assessment of the study area.

If observed, the location of each potentially significant taxon collected was to be recorded using a GPS-enabled tablet and the local abundance, landform and associated flora species noted. Representative photographs were also to be taken.

Flora specimens were collected, pressed, dried and fumigated in accordance with the protocols of the Western Australian Herbarium, for later identification. Flora identifications were undertaken by botanical taxonomist, Sharnya Thomson-Yates, who specialises in arid-region flora. Taxonomy and nomenclature followed current protocols of the WA Herbarium.

The flora and vegetation data collected from the combination of relevés and continuous opportunistic observations contributed to the flora inventory for the study and was utilised to digitise mapping boundaries for the range of vegetation units present within the study area, as well as the varying vegetation condition. This mapping was refined following return from the field, using GIS mapping software, based on initial mapping prepared in the field, within the Mappt™ software. Only areas supporting native vegetation were surveyed in detail, with only broad mapping applied to areas of kept gardens, lawns and planted tree groves. Areas of completely cleared roads and tracks and the beach were not mapped. The mapped areas comprise 2.54 ha of the 3.30 ha study area.

4. RESULTS

4.1 DESKTOP ASSESSMENT

The DBCA database searches, NatureMap Species Report, the MNES Report and literature review returned results for the potential presence of conservation-significant flora and ecological communities within the study area. These results are presented in the following sections.

4.1.1 Threatened and Priority Flora

The DBCA database search, NatureMap Species Report and the MNES Report conducted for the study area returned results for ten species of Threatened and Priority flora previously recorded within or in proximity to the study area (**Table 2**). The DBCA database search only returned results for Priority flora species previously recorded within a 50 km buffer of the study area (**Figure 4**).

The 19 previously recorded significant flora comprises of one Commonwealth and State-listed Threatened flora species, three Priority 1, one Priority 2, thirteen Priority 3 and one Priority 4 species. Of these, it was determined that three species are likely to occur, nine may occur and seven are considered unlikely to occur in the study area (**Table 2**). Interrogation of the databases indicates that no species of conservation significance have been previously recorded within the study area.

4.1.2 Introduced Flora

The Shire of Broome has 45 Declared Pest plants listed under Section 22(2) of the *Biosecurity and Agriculture Management 2007* (BAM Act), the following six of which have the highest level of control category applied (C2; Eradication):

- **Chondrilla juncea* (skeleton weed)
- **Pistia stratiotes* (water lettuce)
- **Prosopis glandulosa x Prosopis velutina* (mesquite)
- **Ulex europaeus* (gorse)
- **Xanthium spinosum* (thorny burweed)
- **Xanthium strumarium* (sheepbur).

Table 2 - Threatened and Priority Flora with the Potential to Occur Within the Study Area

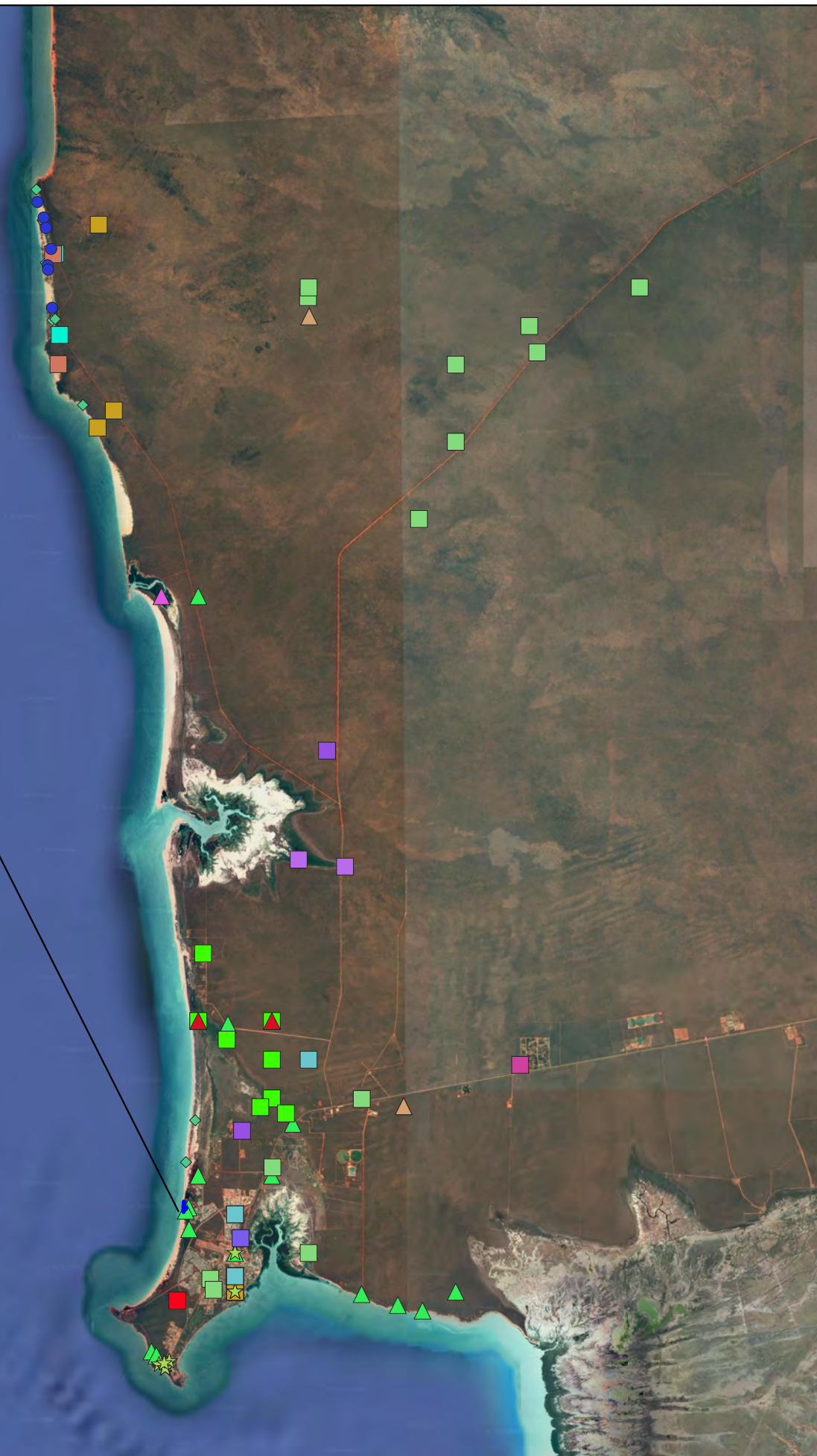
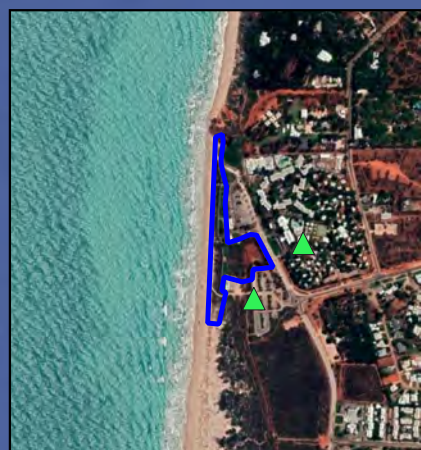
Species	WA Cons. Status	EPBC Cons. Status	Description	Preferred Habitat	Likelihood of Occurrence	Source
<i>Seringia exastia</i>	Threatened-Critically Endangered	Critically Endangered	Erect, compact, multi-stemmed shrub that can grow to 0.9 m high. Flowers purple, April to December.	Pindan (red soil) heathland - occur on almost flat land and associated vegetation includes Feathertop Spinifex (<i>Triodia schinzi</i>) and scattered trees, under 7 m in height, of Soap Wattle (<i>Acacia coleii</i>), Bloodwood (<i>Eucalyptus dampieri</i>).	Likely to occur - species habitat likely to occur within study area and species is documented as occurring in similar landforms within 4 km of the study area.	EPBC
<i>Corymbia paractia</i>	Priority 1	-	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.	Likely to occur - species habitat likely to occur within study area and species previously recorded within the study area.	DBCA
<i>Jacquemontia</i> sp. Broome (AA Mitchell 3028)	Priority 1	-		<i>Acacia eriopoda</i> in disturbed pindan woodland.	May occur - species habitat may occur within study area; documented records not within 10 km.	DBCA
<i>Thespidium basiflorum</i>	Priority 1	-	Densely tufted, multi-stemmed perennial, herb, to 0.2 m high. Fl. green, May to Aug.	Occurs in sandy soils, creek beds.	Unlikely to occur - the species has been recorded within the study area proximity, but no creeks or drainage areas are supported.	DBCA
<i>Gomphrena pusilla</i>	Priority 2	-	Slender branching annual, herb, to 0.2 m high. Fl. white, Mar to Apr or Jun.	On fine beach sands behind foredunes or on limestone.	May occur - species habitat occurs within the study area, but nearest known records are over 30 km away.	DBCA
<i>Acacia monticola</i> x <i>tumida</i> var. <i>kulparn</i>	Priority 3	-	Low-domed (semi-prostrate), spreading shrubs.	On coastal cliffs and red sand/loam/rocky gullies.	May occur - the species has been recorded within 5 km of the study area, but coastal cliffs or gullies are not present.	DBCA
<i>Aphyllodium glossocarpum</i>	Priority 3		Spreading or erect shrub, to 1.2 m high. Fl. pink-purple, Apr to Oct.	Occurs in sand verging onto cleared areas and open grassland fringes. Pindan soils.	May occur - species habitat may occur within the study area and species has been recorded within 5 km.	DBCA

Species	WA Cons. Status	EPBC Cons. Status	Description	Preferred Habitat	Likelihood of Occurrence	Source
<i>Bonamia oblongifolia</i>	Priority 3		Perennial, herb or shrub. Fl. blue, Feb.	Sandy or gravelly soils.	May occur - species habitat may occur within study area, although nearest record is 44 km away.	DBCA
<i>Glycine pindanica</i>	Priority 3	-	Prostrate or scrambling perennial, herb or climber. Fl. pink/blue-purple, Feb to Mar or Jun.	Pindan soils.	May occur - species habitat may occur within study area and nearest record is within 4 km.	DBCA
<i>Goodenia byrnesii</i>	Priority 3	-	Prostrate to decumbent herb, stems to 30 cm. Fl. yellow, Jan to Feb.	Sand. Edge of creek.	Unlikely to occur – the species has been recorded within 5 km of the study area, but no creeks or drainage areas are supported.	DBCA
<i>Lophostemon grandiflorus</i> subsp. <i>grandiflorus</i>	Priority 3	-	Tree, 4-8 m high. Fl. cream-white, apparently Jan to Dec.	Occurs in damp habitats (swamps, seepages).	Unlikely to occur – nearest record is almost 48 km to the north and suitable habitat is unlikely to be supported.	DBCA
<i>Nicotiana heterantha</i>	Priority 3	-	Decumbent, short-lived annual or perennial, herb, to 0.5 m high, forming low, spreading colonies. Fl. white-cream, Mar to Jun or Sep.	Black clay. Seasonally wet flats.	Unlikely to occur – nearest record is within 7 km although suitable habitat is unlikely to be supported.	DBCA
<i>Polymeria</i> sp. Broome (KF Kenneally 9759)	Priority 3	-	Prostrate herb 10 cm high x 30 cm wide, trailing herb with greyish green leaves and mauve flowers.	Red, pindan soils.	May occur - species habitat may occur within study area although nearest record is almost 50 km to the north.	DBCA
<i>Seringia katatona</i>	Priority 3	-	Erect, compact, multi-stemmed shrub, to 1 m high, grey leaved. Fl. purple, Mar to Aug.	Desert dunes in pindan, ranges, disturbed areas on red sands.	Likely to occur - species habitat likely to occur within study area and species is documented within 4 km of the study area.	DBCA

Species	WA Cons. Status	EPBC Cons. Status	Description	Preferred Habitat	Likelihood of Occurrence	Source
<i>Stylidium pindanicum</i>	Priority 3	-	Annual herb to about 0.3 m high. Leaves slender, numerous, held in a terminal rosette. Fl. pink or mauve, May to Aug.	Restricted to seasonally damp areas over pindan sands (Barrett <i>et al.</i> 2015).	Unlikely to occur – nearest record is 18 km away and suitable habitat is unlikely to be supported.	DBCA
<i>Tephrosia andrewii</i>	Priority 3	-	Ascending, multi-stemmed shrub, to 0.8 m high. Fl. orange, Apr or Oct.	In dry sand Pindan soils, on hill sides and road verges.	Unlikely to occur – nearest record is 50 km away and suitable habitat is unlikely to be supported.	DBCA
<i>Terminalia kumpaja</i>	Priority 3	-	Large tree.	Pindan, sandy soils.	May occur - species habitat may occur within study area and nearest record is within 3 km.	DBCA
<i>Tetragonia coronata</i>	Priority 3	-	Decumbent annual, herb. Fl. yellow, Jul.	Occurs on calcrete outcrops, red clay loamy soil, in the shade of larger shrubs.	Unlikely to occur – nearest record is 18 km away although suitable habitat is unlikely to be supported.	DBCA
<i>Pittosporum moluccanum</i>	Priority 4	-		White sand. Sand dunes.	May occur - species habitat likely to occur within study area although nearest record is 50 km to the north.	DBCA

Legend

- Study Area
- ★ *Seringia exastia*
- ▲ *Aphyllodium parvifolium*
- ▲ *Corymbia paractia*
- ▲ *Jacquemontia* sp. Broome (A.A. Mitchell 3028)
- ▲ *Thespidium basiflorum*
- ◆ *Gomphrena pusilla*
- *Acacia monticola* x *tumida* var. *kulparn*
- *Aphyllodium glossocarpum*
- *Bonamia oblongifolia*
- *Glycine pindanica*
- *Goodenia byrnesii*
- *Lophostemon grandiflorus* subsp. *grandiflorus*
- *Nicotiana heterantha*
- *Polymeria* sp. Broome (K.F. Kenneally 9759)
- *Seringia katatona*
- *Stylidium pindanicum*
- *Tephrosia andrewii*
- *Terminalia kumpaja*
- *Tetragonia coronata*
- *Pittosporum moluccanum*



0 2.5 5 7.5 10 km

GDA 94 / MGA Zone 50



**Figure 4 - Threatened
Priority Flora**

4.1.3 Threatened and Priority Ecological Communities

A review of DBCA's Threatened and Priority Ecological Communities (TEC and PEC) database and the EPBC Protected Matters Search Tool identified two Ecological Communities: '*Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula*' (monsoon vine thicket TEC) and '*Corymbia paractia* dominated community on dunes' or their buffers intersecting with the study area (DBCA 2019b) (**Figure 5**), with both significant ecological communities considered likely to be supported by the study area.

The monsoon vine thicket TEC is both a Commonwealth-listed TEC categorised as 'Endangered' and a State-listed TEC categorised as 'Vulnerable', and it represents the southern-most occurrence of rainforest (dry monsoon rainforests) in Western Australia, providing refuge habitat for many plants and animals at the southern-most limit of their Australasian range. These vine thickets are confined to coastal dunes (and in some cases other unconsolidated Holocene coastal landforms) and have been shown to be distinct from other types of rainforest in the Kimberley region (Black *et al.* 2010).

The *Corymbia paractia* ecological community is a Priority 1, State-listed PEC. *Corymbia paractia* is endemic to the Kimberley region of Western Australia and is restricted to the Broome Peninsula and immediate vicinity. It is mainly confined to a relatively narrow coastal zone, where beach dunes merge into pindan soils, with some patches occurring across the Peninsula (Reynolds *et al.* 2018).



0 2.5 5 7.5 10 km

GDA 94 / MGA Zone 50

Figure 5 - Threatened and Priority Ecological Communities



4.2 FIELD ASSESSMENT

4.2.1 Flora

Within areas of native remnant vegetation (excluding kept gardens and planted areas), 20 flora taxa, from 19 genera and 14 families were recorded during the reconnaissance field survey. The predominant families were Fabaceae (six taxa) and Poaceae (two taxa). The total includes 15 (80%) native species and five (20%) introduced (weed) species. One of the recorded native species, *Casuarina obesa*, is non-endemic, naturally occurring in the south-west of the State and likely to have been planted to provide shade on Cable Beach. None of the weed species recorded are listed as Declared Pest plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), nor are any listed as Weeds of National Significance (WoNS). The full list of vascular flora species recorded within each relevé is presented in **Appendix C** and individual site data is presented in **Appendix D**.

No recorded species exhibited an extension beyond their current documented range, in accordance with records of the Western Australian Herbarium (DBCA 2018a), besides *Casuarina obesa*, which is not naturally occurring and likely to have been planted. This occurrence is not considered a range-extension.

No species listed as Threatened flora under the WC Act or the EPBC Act were recorded. Furthermore, no species listed as Priority flora were recorded.

The timing of the survey (early March, following the majority of the wet season) was considered suitable for a flora and vegetation assessment, although the month preceding the survey (February 2019) was considerably drier than usual, recording only 25.0 mm of rain compared to the mean for that month of 181.0 mm. December of 2018 was also significantly dry, with only 12.2 mm of a mean of 62.7 mm being recorded. The region experiences the majority of seasonal rainfall between December and March, with January and February typically recording 69% of the fall volumes of these four months. Therefore, with only 14% of the average rainfall for February falling during 2019, and only 19% of the average rainfall for December falling during 2018, two months prior, the flowering season in the region (March to June) has the potential to be poorer than usual.

4.2.2 Vegetation

Three intact vegetation units and two disturbed/planted areas were described and mapped from four relevés and various observation points throughout the study area, as described in **Table 3** and presented spatially in **Figure 6**. The individual site data for each of the recorded relevés is presented in **Appendix D**.

Table 3 - Summary of Recorded Vegetation Units

Unit Code	Vegetation Unit Description	Representative Relevé (R)
Mapped Intact Native Vegetation Units		
MVT	Monsoon Vine Thicket Thicket of <i>Gyocarpus americanus</i> , <i>Grewia breviflora</i> and # <i>Delonix regia</i> , with various creeping vines, predominantly <i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i> .	R01
FD	Foredune Dense Hummock Grassland of <i>Spinifex longifolius</i> and * <i>Cenchrus ciliaris</i> with <i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i> .	R03
HD	Higher Dune Dense Hummock Grassland of <i>Spinifex longifolius</i> and * <i>Cenchrus ciliaris</i> with Dwarf Scrub D of <i>Trichodesma zeylanicum</i> and <i>Crotalaria medicaginea</i> var. <i>neglecta</i> , with creeping vines, predominantly <i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i> and <i>Canavalia rosea</i> .	R04
Planted and disturbed areas		
PR	Planted/Regrowth Previously cleared areas comprising weeds and disturbed regrowth, dominated by <i>Senna occidentalis</i> and <i>Cenchrus ciliaris</i> , with occasional planted (likely non-endemic) trees, including <i>Corymbia</i> sp..	R02
KG	Kept Gardens and Planted Trees Previously cleared areas comprising kept gardens, lawns and planted groves of trees within built areas, including <i>Senna</i> spp., <i>Acacia</i> spp. and <i>Corymbia</i> spp., <i>Plumeria</i> sp. (Frangipani) and various palms.	NA Not surveyed with relevés, study site or flora inventory due to non-native character



0 25 50 75 100 m

GDA 94 / MGA Zone 50



Figure 6 - Vegetation Units

Legend

- | | | |
|--|--|---|
|  Study Area |  HD |  MVT |
|  FD |  KG |  PR |



The area occupied by each of the vegetation units and other mapped areas within the study area is summarised in **Table 4**.

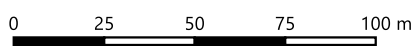
Table 4 – Areas of Mapped Vegetation

Unit Code	Vegetation Unit Name	Area (ha)	% of Study Area
Mapped Intact Native Vegetation Units			
MVT	Monsoon Vine Thicket	0.37	14.57
FD	Foredune	1.12	44.09
HD	Higher Dune	0.04	1.57
Planted and disturbed areas			
PR	Planted/Regrowth	0.58	22.83
KG	Kept Gardens and Planted Trees	0.43	16.93
Total		2.54	100.00

The vegetation of the study area ranges in condition from 'Very Good' to 'Completely Degraded', with most of the vegetation found to be in 'Degraded' condition. The areas of varying vegetation condition are summarised in **Table 5**, with the spatial extent of these presented in **Figure 7**.

Table 5 – Areas of Varying Vegetation Condition

Condition Code	Condition	Area (ha)	% of Study Area
VG	Very Good	0.31	12.20
G	Good	0.01	0.39
D	Degraded	0.74	29.13
D-CD	Degraded to Completely Degraded	0.94	37.01
CD	Completely Degraded	0.54	21.26
Total		2.54	100.00



GDA 94 / MGA Zone 50



Legend

- | | | |
|------------|------|----|
| Study Area | D-CD | G |
| CD | D | VG |



Figure 7 - Vegetation Condition

5. DISCUSSION

5.1 FLORA

A total of 20 flora species were recorded during the survey which includes 15 (80%) native species and five (20%) introduced (weed) species. The broad area consists of relatively large areas of kept lawns and gardens, and planted tree groves including palms, Frangpani and other endemic shrubs and trees. These planted and garden areas were not assessed as part of the flora inventory.

The low floral diversity can be attributed to a range of factors, such as the small size of the study area, as well as the highly modified nature of the majority of the site and the ongoing disturbances and pressures of an area subject to intensive use for general recreation. The timing of the field survey, in early March, following a relatively dry wet-season (particularly for December 2018 and February 2019), is likely to have had some effect on the diversity of species recorded.

No species were recorded outside their known range based on distributions from the WA Herbarium records. *Casuarina obesa*, which is not naturally occurring, is likely to have been planted on Cable Beach to provide shade. This species is endemic to the south-west of Western Australia, although not considered to be exhibiting a range-extension in the study area.

Several other non-endemic plant taxa also occur, particularly within the kept gardens, Frangpani and a species of *Corymbia*, which was not able to be identified due to a lack of fruiting material. One introduced species, **Delonix regia*, recorded within the MVT vegetation unit, is likely to have invaded this native remnant vegetation from nearby kept gardens, as this cultivated species is widely used for its attractive red flowers.

None of the introduced (weed) species recorded are listed as WoNS or as Declared Pest plants under the BAM Act.

5.2 VEGETATION

5.2.1 Vegetation Units

Three intact vegetation units and two disturbed/planted areas were described and mapped within the study area. The three vegetation units that represent native remnant vegetation are described as follows:

- **Monsoon Vine Thicket**
Thicket of *Gyrocarpus americanus*, *Grewia breviflora* and **Delonix regia*, with various creeping vines, predominantly *Ipomoea pes-caprae* subsp. *brasiliensis*.
- **Foredune**
Dense Hummock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with *Ipomoea pes-caprae* subsp. *brasiliensis*.
- **Higher Dune**
Dense Hummock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with Dwarf Scrub D of *Trichodesma zeylanicum* and *Crotalaria medicaginea* var. *neglecta*, with creeping vines, predominantly *Ipomoea pes-caprae* subsp. *brasiliensis* and *Canavalia rosea*.

The other mapped areas consist of disturbed/planted areas and kept lawns and gardens, which were not formally described as part of the flora and vegetation assessment, although their spatial extent has been mapped. Such areas support little, if any ecological value.

5.2.2 Vegetation Condition

Overall, the vegetation of the study area ranges in condition from 'Very Good' to 'Completely Degraded' (where no remaining native vegetation occurs, including within cleared infrastructure footprints, and in areas consisting of only kept lawns and gardens).

Of the three intact vegetation units recorded and mapped, MVT was found to support vegetation in mostly 'Very Good' condition, with small areas in 'Good' and in 'Degraded to Completely Degraded' condition. The disturbed area appears to have resulted from an isolated previous disturbance such as clearing, as evident in **Plate 1**.



Plate 1 – An area within the MVT vegetation unit in 'Degraded to Completely Degraded' condition

The 'Very Good' condition of the area of MVT has likely retained its condition due to its impenetrable and inhospitable nature to users of the area, who would be unlikely to venture into the dense vegetation. Some weed invasion is evident, however, which includes that of garden cultivars which are likely to have established from seed stock from nearby kept gardens.

The FD vegetation unit supports vegetation in mostly 'Degraded' condition, but with some area in 'Degraded to Completely Degraded' condition. The third intact vegetation unit, HD, was observed to be in 'Degraded' condition. These areas are likely to be more degraded due to better accessibility by recreational users of the area, and to their more exposed position, in comparison to the area of vegetation unit MVT.

5.2.3 Vegetation Representation

The objective of the EPA in relation to flora and vegetation is; *To protect flora and vegetation so that biological diversity and ecological integrity are maintained* (EPA 2016b). This objective is documented in the EPA Environmental Factor Guideline - Flora and Vegetation (EPA 2016b), which has superseded a number of documents including Position Statement No. 2 (EPA 2000). With a lack of quantifiable retention targets outlined in the new factor guideline, the 30% threshold/retention target as documented in Position Statement 2 remains a useful guideline for determining whether or not adequate proportions of native vegetation are being conserved. Position Statement No. 2 (EPA 2000) outlined criteria aimed to help reverse the long-term decline in the quality and extent of Western Australia's native vegetation cover.

The criteria are as follows:

- the "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-clearing extent of the vegetation type
- a level of 10% of the original extent is regarded as being a level representing "endangered"
- clearing which would put the threat level into the class below 10% should be avoided
- from a biodiversity perspective, stream reserves should generally be in the order of at least 200 m wide.

The status of remaining vegetation can be delineated into five different classes:

- *Presumed extinct* - probably no longer present in the bioregion
- *Endangered* - <10% of pre-European extent remains*
- *Vulnerable* - 10-30% of pre-European extent exists*
- *Depleted* - >30% and up to 50% of pre-European extent exists*
- *Least concern* - >50% pre-European extent exists and has been subject to little or no degradation over a majority of this area.

* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status.

The study area is considered to be in an unconstrained region, and as such, the minimum retention target of 30% of the original vegetation extent is considered appropriate. The Beard (1990) vegetation association of the study area, vegetation association 750, is represented by 99.56% of its pre-European extent in the region (**Table 1**). Therefore, the vegetation of the study is not significant due to poor regional representation.

5.2.4 Significant Ecological Communities

5.2.4.1 *Corymbia paractia* community

Even though the '*Corymbia paractia* dominated community on dunes' community was reported in the desktop assessment to have its buffer intersecting with the study area, this significant ecological community was not recorded within the study area during the field assessment. Therefore, it can be confirmed that the Priority 1, State-listed PEC does not occur in the study area.

5.2.4.2 *Monsoon Vine Thicket* TEC

Characterisation and Diagnosis

The monsoon vine thicket TEC, a Commonwealth and State-listed TEC, is described in its Interim Recovery Plan (DBCA 2018b) as a very distinctive type of rainforest, confined to the Peninsula between Broome and Derby, along with the coastal dune formations on which it occurs. The TEC occurs as semi-deciduous vine thickets on leeward slopes and swales of coastal sand dunes on the Dampier Peninsula, and is likely to be an indicator 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 vine thickets occur as discrete areas of dense vegetation and can occur as a stand of a

few trees or as larger patches. The 90 known occurrences of the TEC vary in size from about 0.3 ha up to 507 ha, with a mean size of about 33 ha (DBCA 2018b). They can occur as clumps or narrow linear stands (Black *et al.* 2010).

The Commonwealth Conservation Advice (DSEWPac 2013) lists the key diagnostic characteristics of the TEC as follows:

- Distribution occurs within the Dampierland bioregion – mostly in the Pindanland subregion DL2 (IBRA4).
- The ecological community is mainly restricted to the deep white or grey calcareous sands of the coastal Holocene dunes of the Dampier Peninsula.
- The ecological community mainly occurs within the swales and on the leeward side of the coastal dunes and occasionally on the crests of these dunes and other coastal landforms such as: beach fronts, sand-spit headlands and storm ridges with intertidal flats (Black *et al.* 2010).
- Outliers may occur on different substrates within the DL2 subregion, e.g. on pindan soil the ecological community may establish following dispersal of key species by frugivores and where these patches are buffered from moisture loss and fire.
- The overstorey (canopy) typically shows the following features:
 - The overstorey typically ranges from three to nine metres tall and may consist of trees, tall shrubs and/or climbers/vines.
 - The tree canopy composition is variable but the most common species are typically one or more of the taxa *Bauhinia cunninghamii* (jigal, joomoo), *Celtis philippensis* (goolnji), *Diospyros humilis* (ebony wood), *Exocarpos latifolius* (jarnba, mistletoe tree), *Grewia breviflora* (goolmi, currant/coffee fruit), *Mallotus nesophilus* (yellow ball flower), *Mimusops elengi* (joongoon, mamajen), *Sersalisia sericea* (mangarr), *Terminalia ferdinandiana* (gabiny, gubinge, kabiny) and *Terminalia petiolaris* (blackberry tree, marool, narwulu).
- The understorey shows the following features:
 - Shrub and small tree species when present include: *Breynia cernua*, *Bridelia tomentosa*, *Caesalpinia major* (goolyi), *Croton habrophyllus* (ankoolmarr), *Dodonaea platyptera*, snowball bush and *Santalum lanceolatum*.
 - The ground layer is generally sparse to absent but may contain a variety of herbaceous species depending on seasonal conditions, site characteristics and canopy density.
 - Native grass species are uncommon but may occur on the edges of vine thicket patches or in open groves. When present they typically include annual species (**Appendix E**) such as *Perotis rara* (comet grass) and *Setaria apiculata* (pigeon grass).
- Vines and creepers are often, but not always, present in the overstorey and/or understorey and when present include the following: crab's eye bean, *Adenia heterophylla* subsp. *australis*, *Capparis lasiantha* (ngoorla, bush caper), *Jacquemontia paniculata*, *Jasminum didymum*, *Tinospora smilacina* (oondal, snake vine) and *Tylophora cinerascens* (oyster-catcher bill).
- The following genera/species often present in other rainforest/vine thicket types in northern Australia, are typically absent or uncommon in the ecological community: *Albizia lebbek*, *Bombax ceiba*, *Cryptocarya cunninghamii*, *Elaeodendron melanocarpum*, *Ganophyllum falcatum*, *Vitex acuminata* and *Ziziphus quadrilocularis*. The understorey of other northern vine thicket patches also contains shrub species that are absent from the ecological community, such as those from the genera *Alectryon*, *Denhamia*, *Micromelum*, *Murraya*, *Strychnos*, *Trema* and *Wrightia*.

Based on the information above, it is considered that the monsoon vine thicket TEC is represented within the MVT vegetation unit within the study area. The geographical location, landform and soils in this location, in reference to the key characteristics listed supports that the MVT vegetation represents the TEC. Although many

of the typical species listed in the Conservation Advice (DSEWPaC 2013) were not recorded within the MVT vegetation unit (besides *Grewia breviflora*, dominant in the canopy), the full species list (**Appendix E**) reveals that nine of the 12 species recorded within the MVT vegetation unit within the study area are known to be supported by the monsoon vine thicket TEC. The Conservation Advice also confirms that the list of plant species present in the ecological community is indicative rather than comprehensive and that patches may not include all species on the lists or may include other species not listed (DSEWPaC 2013).

Condition Thresholds

Further to characterisation, there are also condition thresholds that apply to areas of nationally-significant ecological communities, in order for them to be considered representative of the respective TEC. In the case of the monsoon vine thickets TEC, the following condition thresholds apply (DSEWPaC 2013):

- 50% or more of the total cover of the canopy comprises perennial native species
- 50% or more of the total vegetation cover in the ground and mid layers comprises perennial native species.

These condition thresholds are considered to be met within the patch of vegetation unit MVT mapped within the study area.

TEC Patch

The size of the patch of monsoon vine thicket TEC mapped within the study area (area of vegetation unit MVT) is 0.37 ha. This patch is not considered to extend outside the area mapped within the study area, as no surrounding vine thicket vegetation in a continuous occurrence (separated only by minor interruptions) exists in the immediate vicinity.

Buffers

To assist in the preservation of the patch, it is recommended that where possible, a buffer zone of at least 50 m be maintained from the outer edge of the patch. The purpose of the buffer zone is to protect and manage the patch and to help avoid potential significant impacts to the ecological community. Changes in land-use within the buffer zone must not have a significant impact on the ecological community, but there are exemptions for continuing use (DSEWPaC 2013).

Threats to the TEC

The key threats to the ecological community are summarised below (DSEWPaC 2013):

- Inappropriate fire regimes. Fires are severely impacting the ecological community causing changes in species composition and patches to contract over time.
- Invasive species. Feral animals browse and damage native vegetation plus eat native or displace fauna. Weed species are replacing native species, changing vegetation structure and altering fire regimes causing patches to decline over time.
- Clearance and disturbance. This can further fragment or degrade remaining patches, increasing the risk of patches becoming more isolated and vulnerable to local extinction.
- Altered hydrology. Developments can impact on local microclimates, groundwater access and surface runoff changing hydrological input for vegetation.
- Climate change. Trends suggest that increased frequency and severity of weather events are likely to adversely affect the hydrological and fire regimes operating on the ecological community.

6. CONCLUSION AND RECOMMENDATIONS

The key findings, conclusions and recommendations arising from the flora and vegetation assessment within the study area are as follows:

- A total of 20 flora taxa, from 19 genera and 14 families were recorded during the reconnaissance survey, including 15 (80%) native species and five (20%) introduced (weed) species.
- None of the weed species recorded are listed as Declared Pest plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), nor are any listed as Weeds of National Significance (WoNS).
- No Threatened flora protected under the BC Act or under the EPBC Act were recorded and no Priority flora were recorded.
- No recorded species exhibited an extension beyond their current documented range, in accordance with records of the Western Australian Herbarium (DBCA 2018a), besides *Casuarina obesa*, which is not naturally occurring, likely to have been planted. This occurrence is not considered a range-extension.
- Three intact vegetation units and two disturbed/planted areas were described and mapped from four relevés and various observation points throughout the study area.
- The vegetation of the study area ranges in condition from 'Very Good' to 'Completely Degraded', with most of the vegetation found to be in 'Degraded' condition.
- The regional vegetation/vegetation association of the study area, vegetation association 750 (Beard 1990), is represented by 99.56% of its pre-European extent and therefore, the vegetation of the study is not significant due to poor regional representation.
- It is considered that the monsoon vine thicket TEC is represented within the MVT vegetation unit within the study area, based on positive results in comparison to the key characteristics; and this occurrence of the TEC is also considered to meet condition thresholds.
- The patch of monsoon vine thicket TEC mapped within the study area totals 0.37 ha and this patch is considered to be confirmed to within the study area.
- The timing of the survey (early March, following the majority of the wet season) was considered suitable for a flora and vegetation assessment, although the preceding February and December recorded significantly lower than average rainfall and therefore, the flowering season in the region (March to June) has the potential to be poorer than usual. However, this is not expected to have influenced the characterisation of the monsoon vine thicket TEC within the study area.

Based on the findings of the study, the following recommendations are provided for consideration:

- Although it is understood that clearing is proposed as part of the Master Plan, where possible, or where native vegetation is to be retained, it is recommended that clearing of vegetation is minimised, including within vegetation units FD, HD and particularly MVT, which is considered to be a representation of the monsoon vine thicket TEC.
- Whilst the existing conditions within the study area and on the Cable Beach Foreshore do not provide a 50 m buffer, as preferred by the Conservation Advice (DSEWPaC 2013), it is recommended that future redevelopment aim to avoid or minimise further encroachment on the TEC vegetation from that which is currently in existence, which would be in accordance with exemptions for continuing use.

- It is recommended that management plans be prepared and implemented for both the design and construction phases of the redevelopment, as well as the ongoing operational and maintenance phases, including, but not limited to:
 - Limiting clearing or other direct or indirect impacts on native vegetation, where possible
 - Management measures that address the key threats to the monsoon vine thicket TEC, including:
 - an appropriate fire management plan that addresses risk management and rapid response
 - an appropriate weed management plan that addresses active control and avoidance of continued weed invasion into sensitive areas
 - appropriate drainage design with ongoing maintenance, to ensure that hydrological regimes are not altered
 - measures to ensure access to sensitive areas and subsequent impacts are excluded (e.g. signage and fencing, if appropriate).

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Appendix A - DBCA Naturemap Search Report

NatureMap Species Report

Created By Guest user on 13/02/2019

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 122° 12' 24" E, 17° 56' 00" S
Buffer 5km
Group By Kingdom

Kingdom	Species	Records
Animalia	613	12085
Chromista	5	6
Fungi	10	18
Plantae	412	1091
Protozoa	1	1
TOTAL	1041	13201

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Animalia				
1.	? ?			
2.	<i>Abudefduf bengalensis</i>			
3.	<i>Abudefduf</i> sp.			
4.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
5.	<i>Acanthopagrus latus</i>			
6.	<i>Acanthopagrus palmaris</i>			
7.	<i>Acanthurus dussumieri</i>			
8.	<i>Acanthurus grammoptilus</i>			
9.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
10.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
11.	24283 <i>Accipiter fasciatus</i> subsp. <i>didimus</i> (Brown Goshawk)			
12.	<i>Acentrogobius viridipunctatus</i>			
13.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
14.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
15.	25544 <i>Aegotheles cristatus</i> (Australian Owllet-nightjar)			
16.	25350 <i>Aipysurus apraefrontalis</i> (Short-nosed Seasnake)		T	
17.	25355 <i>Aipysurus laevis</i> (Olive Seasnake)			
18.	42369 <i>Aipysurus mosaicus</i> (Mosaic Seasnake)			
19.	25357 <i>Aipysurus tenuis</i> (Brown-lined Seasnake)			
20.	<i>Alectis indica</i>			
21.	42372 <i>Amalosia rhombifer</i> (Zigzag velvet gecko)			
22.	<i>Amblyomma moreliae</i>			
23.	<i>Amniataba caudavittata</i>			
24.	30831 <i>Amphibolurus gilberti</i> (Ta-ta, Gilbert's Dragon)			
25.	<i>Amphiprion rubrocinctus</i>			
26.	24310 <i>Anas castanea</i> (Chestnut Teal)			
27.	24312 <i>Anas gracilis</i> (Grey Teal)			
28.	<i>Anas platyrhynchos</i> subsp. <i>domesticus</i>			
29.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
30.	<i>Anguilla bicolor</i>			
31.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
32.	44632 <i>Anilius diversus</i>			
33.	25634 <i>Anous stolidus</i> (Common Noddy)		IA	
34.	24505 <i>Anous stolidus</i> subsp. <i>pileatus</i> (Common Noddy)		IA	
35.	24317 <i>Anseranas semipalmata</i> (Magpie Goose, Pied Goose)			
36.	25241 <i>Antaresia stimsoni</i> subsp. <i>stimsoni</i> (Stimson's Python)			
37.	24600 <i>Anthus cervinus</i> (Red-throated Pipit)			
38.	<i>Apogon cookii</i>			
39.	<i>Apogon pallidofasciatus</i>			
40.	<i>Apogon rueppellii</i>			
41.	<i>Apogon</i> sp.			
42.	24719 <i>Aprosmictus erythropterus</i> (Red-winged Parrot)			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
43.	25554	<i>Apus pacificus</i> (Fork-tailed Swift, Pacific Swift)		IA	
44.	24334	<i>Apus pacificus</i> subsp. <i>pacificus</i> (Fork-tailed Swift, Pacific Swift)		IA	
45.	24285	<i>Aquila audax</i> (Wedge-tailed Eagle)			
46.	24337	<i>Ardea garzetta</i> subsp. <i>nigripes</i> (Little Egret)			
47.	25558	<i>Ardea ibis</i> (Cattle Egret)			
48.	25559	<i>Ardea intermedia</i> (Intermediate Egret)			
49.	41324	<i>Ardea modesta</i> (great egret, white egret)			
50.	24340	<i>Ardea novaehollandiae</i> (White-faced Heron)			
51.	24341	<i>Ardea pacifica</i> (White-necked Heron)			
52.	24343	<i>Ardea sacra</i> subsp. <i>sacra</i> (Eastern Reef Egret, Eastern Reef Heron)			
53.	41328	<i>Ardenna tenuirostris</i> (Short-tailed Shearwater)		IA	
54.	24610	<i>Ardeotis australis</i> (Australian Bustard)			
55.	25736	<i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
56.	24778	<i>Arenaria interpres</i> subsp. <i>interpres</i> (Ruddy Turnstone)		IA	
57.		<i>Arius</i> sp.			
58.		<i>Arothron hispidus</i>			
59.		<i>Arothron manilensis</i>			
60.		<i>Arrhamphus sclerolepis</i>			
61.	25566	<i>Artamus cinereus</i> (Black-faced Woodswallow)			
62.	25567	<i>Artamus leucorhynchus</i> (White-breasted Woodswallow)			
63.	24356	<i>Artamus personatus</i> (Masked Woodswallow)			
64.		<i>Arthrorhaddus paucispinus</i>			
65.	25320	<i>Aspidites melanocephalus</i> (Black-headed Python)			
66.		<i>Atherinomorus endrachtensis</i>			
67.		<i>Austracantha minax</i>			
68.	24318	<i>Aythya australis</i> (Hardhead)			
69.		<i>Backobourkia collina</i>			
70.		<i>Bathygobius fuscus</i>			
71.		<i>Batrachomoeus dahl</i>			
72.		<i>Batrachomoeus occidentalis</i>			
73.		<i>Blennodesmus scapularis</i>			
74.		<i>Brachysomophis cirrocheilos</i>			
75.	25334	<i>Brachyurophis roperi</i> (Northern Shovel-nosed Snake)			
76.	24685	<i>Bulweria bulwerii</i> (Bulwer's Petrel)		IA	
77.	24359	<i>Burhinus grallarius</i> (Bush Stone-curlew)			
78.	47897	<i>Butorides striata</i> (Striated Heron, Mangrove Heron)			
79.	25713	<i>Cacatua galerita</i> (Sulphur-crested Cockatoo)			
80.	24726	<i>Cacatua roseicapilla</i> subsp. <i>roseicapilla</i> (Galah)			
81.	25716	<i>Cacatua sanguinea</i> (Little Corella)			
82.	24728	<i>Cacatua sanguinea</i> subsp. <i>sanguinea</i> (Little Corella)			
83.	42307	<i>Cacomantis pallidus</i> (Pallid Cuckoo)			
84.	25599	<i>Cacomantis variolosus</i> (Brush Cuckoo)			
85.	24779	<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
86.	24780	<i>Calidris alba</i> (Sanderling)		IA	
87.	25738	<i>Calidris canutus</i> (Red Knot, knot)		IA	
88.	24783	<i>Calidris canutus</i> subsp. <i>rogersi</i> (Red Knot (north-eastern Siberia))		T	
89.	24784	<i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
90.	24786	<i>Calidris melanotos</i> (Pectoral Sandpiper)		IA	
91.	24788	<i>Calidris ruficollis</i> (Red-necked Stint)		IA	
92.	24789	<i>Calidris subminuta</i> (Long-toed Stint)		IA	
93.	24790	<i>Calidris tenuirostris</i> (Great Knot)		T	
94.	24686	<i>Calonectris leucomelas</i> (Streaked Shearwater)		IA	
95.	25717	<i>Calyptrorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
96.		<i>Caranx bucculentus</i>			
97.		<i>Caranx ignobilis</i>			
98.		<i>Caranx sexfasciatus</i>			
99.		<i>Caranx</i> sp.			
100.	25015	<i>Carlia munda</i> (Shaded-litter Rainbow Skink)			
101.	25016	<i>Carlia rufilatus</i> (Red-sided Rainbow Skink)			
102.		<i>Centriscus scutatus</i>			
103.		<i>Centrogenys vaigiensis</i>			
104.	25600	<i>Centropus phasianinus</i> (Pheasant Coucal)			
105.	30884	<i>Centropus phasianinus</i> subsp. <i>phasianinus</i> (Pheasant Coucal)			
106.		<i>Cephalopholis boenak</i>			
107.	24188	<i>Chalinolobus nigrogriseus</i> (Hoary Wattled Bat)			
108.		<i>Chanos chanos</i>			
109.	25574	<i>Charadrius dubius</i> (Little Ringed Plover)		IA	
110.	25575	<i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
111.	24372	<i>Charadrius leschenaultii</i> subsp. <i>leschenaultii</i> (Greater Sand Plover (Mongolian))		T	
112.	25576	<i>Charadrius mongolus</i> (Lesser Sand Plover)		T	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
113.	24375 <i>Charadrius mongolus</i> subsp. <i>mongolus</i> (Lesser Sand Plover)		T	
114.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
115.	24378 <i>Charadrius veredus</i> (Oriental Plover)		IA	
116.	<i>Chelmon marginalis</i>			
117.	<i>Chelmon muelleri</i>			
118.	25336 <i>Chelonia mydas</i> (Green Turtle)		T	
119.	<i>Chelonodon patoca</i>			
120.	<i>Chiloscyllium punctatum</i>			
121.	<i>Chirocentrus dorab</i>			
122.	24863 <i>Chlamydosaurus kingii</i> (Frill-necked Lizard)			
123.	41332 <i>Chlidonias leucopterus</i> (White-winged Black Tern, white-winged tern)		IA	
124.	<i>Choerodon cyanodus</i>			
125.	<i>Choerodon</i> sp.			
126.	<i>Chroicocephalus novaehollandiae</i>			
127.	<i>Chromileptes altivelis</i>			
128.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
129.	24433 <i>Chrysococcyx minutillus</i> subsp. <i>minutillus</i> (Little Bronze Cuckoo)			
130.	24434 <i>Chrysococcyx osculans</i> (Black-eared Cuckoo)			
131.	24288 <i>Circus approximans</i> (Swamp Harrier)			
132.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
133.	24565 <i>Cissomela pectoralis</i> (Banded Honeyeater)			
134.	25756 <i>Cisticola exilis</i> (Golden-headed Cisticola)			
135.	24835 <i>Cisticola exilis</i> subsp. <i>exilis</i> (Golden-headed Cisticola)			
136.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
137.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
138.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
139.	<i>Conger cinereus</i>			
140.	<i>Congrogadus subducens</i>			
141.	24566 <i>Conopophila rufogularis</i> (Rufous-throated Honeyeater)			
142.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
143.	25569 <i>Coracina papuensis</i> (White-bellied Cuckoo-shrike, Little Cuckoo-shrike)			
144.	24416 <i>Corvus bennetti</i> (Little Crow)			
145.	25593 <i>Corvus orru</i> (Torresian Crow)			
146.	24418 <i>Corvus orru</i> subsp. <i>ceciliae</i> (Western Crow)			
147.	<i>Cosmophasis baehrae</i>			
148.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
149.	25701 <i>Coturnix ypsilophora</i> (Brown Quail)			
150.	24672 <i>Coturnix ypsilophora</i> subsp. <i>cervina</i> (Brown Quail)			
151.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
152.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
153.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
154.	42383 <i>Cryptoblepharus metallicus</i>			
155.	30890 <i>Cryptoblepharus ruber</i>			
156.	30891 <i>Cryptoblepharus tythos</i>			
157.	24876 <i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)			
158.	24882 <i>Ctenophorus nuchalis</i> (Central Netted Dragon)			
159.	25048 <i>Ctenotus inornatus</i>			
160.	25073 <i>Ctenotus saxatilis</i> (Rock Ctenotus)			
161.	47919 <i>Cuculus optatus</i> (Oriental Cuckoo)		IA	
162.	25371 <i>Cyclorana australis</i> (Giant Frog)			
163.	25374 <i>Cyclorana longipes</i> (Long-footed Frog)			
164.	<i>Cyclosa camelodes</i>			
165.	24322 <i>Cygnus atratus</i> (Black Swan)			
166.	<i>Cymbacephalus nematophthalmus</i>			
167.	<i>Cynoglossus</i> sp.			
168.	<i>Cypselurus</i> sp.			
169.	25547 <i>Dacelo leachii</i> (Blue-winged Kookaburra)			
170.	24304 <i>Dacelo leachii</i> subsp. <i>leachii</i> (Blue-winged Kookaburra)			
171.	<i>Dampierosa daruma</i>			
172.	24093 <i>Dasyurus hallucatus</i> (Northern Quoll)		T	
173.	25004 <i>Delma tinca</i>			
174.	42390 <i>Demansia angusticeps</i>			
175.	24324 <i>Dendrocygna arcuata</i> (Wandering Whistling Duck, Chestnut Whistling Duck)			
176.	24325 <i>Dendrocygna eytoni</i> (Plumed Whistling Duck)			
177.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
178.	24896 <i>Diporiphora pindan</i> (Pindan Dragon)			
179.	<i>Drepane punctata</i>			
180.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
181.	<i>Drombus</i> sp.			
182.	<i>Drombus triangularis</i>			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
183.	25584	<i>Ducula bicolor</i> (Pied Imperial Pigeon)			
184.	24084	<i>Dugong dugon</i> (Dugong)		S	
185.		<i>Echeneis naucratis</i>			
186.		<i>Egretta garzetta</i>			
187.		<i>Egretta novaehollandiae</i>			
188.		<i>Elanus axillaris</i>			
189.	24290	<i>Elanus caeruleus</i> subsp. <i>axillaris</i> (Australian Black-shouldered Kite)			
190.	24291	<i>Elanus scriptus</i> (Letter-winged Kite)		P4	
191.		<i>Elates ransonnetii</i>			
192.		<i>Eleutheronema tetradactylum</i>			
193.		<i>Elops hawaiiensis</i>			
194.	47937	<i>Elseyonis melanops</i> (Black-fronted Dotterel)			
195.	24631	<i>Emblema pictum</i> (Painted Finch)			
196.		<i>Enneapterygius gracilis</i>			
197.		<i>Enneapterygius larsonae</i>			
198.		<i>Eolophus roseicapillus</i>			
199.	25362	<i>Ephalophis greyae</i>			
200.	25578	<i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)			
201.		<i>Epinephelus areolatus</i>			
202.		<i>Epinephelus coioides</i>			
203.		<i>Epinephelus corallicola</i>			
204.		<i>Epinephelus fasciatus</i>			
205.		<i>Epinephelus homosinensis</i> (invalid)			
206.		<i>Epinephelus malabaricus</i>			
207.		<i>Epinephelus ongus</i> ?			Y
208.		<i>Epinephelus quoyanus</i>			
209.		<i>Epinephelus</i> sp.			
210.	24569	<i>Epthianura crocea</i> (Yellow Chat)			
211.	24570	<i>Epthianura tricolor</i> (Crimson Chat)			
212.	42404	<i>Eremiascincus isolepis</i>			
213.	25342	<i>Eretmochelys imbricata</i> subsp. <i>bissa</i> (Hawksbill Turtle)		T	
214.		<i>Eriophora biapicata</i>			
215.	24379	<i>Erythronyx cinctus</i> (Red-kneed Dotterel)			
216.	24632	<i>Erythrura gouldiae</i> (Gouldian Finch)		P4	
217.	47938	<i>Esacus magnirostris</i> (Beach Stone-curlew, Beach Thick-knee)			
218.	24368	<i>Eurostopodus argus</i> (Spotted Nightjar)			
219.	25591	<i>Eurystomus orientalis</i> (Dollarbird)			
220.	24415	<i>Eurystomus orientalis</i> subsp. <i>pacificus</i> (Dollarbird)			
221.		<i>Eviota queenslandica</i>			
222.	25621	<i>Falco berigora</i> (Brown Falcon)			
223.	24471	<i>Falco berigora</i> subsp. <i>berigora</i> (Brown Falcon)			
224.	25622	<i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
225.	24472	<i>Falco cenchroides</i> subsp. <i>cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
226.	24473	<i>Falco hypoleucos</i> (Grey Falcon)		T	
227.	25623	<i>Falco longipennis</i> (Australian Hobby)			
228.	24474	<i>Falco longipennis</i> subsp. <i>longipennis</i> (Australian Hobby)			
229.	25624	<i>Falco peregrinus</i> (Peregrine Falcon)		S	
230.	24041	<i>Felis catus</i> (Cat)	Y		
231.		<i>Fistularia petimba</i>			
232.	25327	<i>Fordonia leucobalia</i> (White-bellied Mangrove Snake)			
233.	24478	<i>Fregata ariel</i> (Lesser Frigatebird)		IA	
234.	24479	<i>Fregata minor</i> (great frigatebird, Greater Frigatebird)		IA	
235.	25727	<i>Fulica atra</i> (Eurasian Coot)			
236.	24792	<i>Gallinago megala</i> (Swinhoe's Snipe)		IA	
237.	24793	<i>Gallinago stenura</i> (Pin-tailed Snipe)		IA	
238.	25730	<i>Gallirallus philippensis</i> (Buff-banded Rail)			
239.	24765	<i>Gallirallus philippensis</i> subsp. <i>mellori</i> (Buff-banded Rail)			
240.	42314	<i>Gavialis virens</i> (Singing Honeyeater)			
241.	24952	<i>Gehyra australis</i>			
242.		<i>Gehyra kimberleyi</i>			
243.	24956	<i>Gehyra pilbara</i>			
244.	24959	<i>Gehyra variegata</i>			
245.	47954	<i>Gelochelidon nilotica</i> (Gull-billed Tern)		IA	
246.	24401	<i>Geopelia cuneata</i> (Diamond Dove)			
247.	24402	<i>Geopelia humeralis</i> (Bar-shouldered Dove)			
248.	25585	<i>Geopelia striata</i> (Zebra Dove)			
249.	24403	<i>Geopelia striata</i> subsp. <i>placida</i> (Peaceful Dove)			
250.	24404	<i>Geophaps plumifera</i> (Spinifex Pigeon)			
251.		<i>Gerres</i> sp.			
252.		<i>Gerres subfasciatus</i>			

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253.	25530	<i>Gerygone fusca</i> (Western Gerygone)			
254.	25531	<i>Gerygone levigaster</i> (Mangrove Gerygone)			
255.	24273	<i>Gerygone levigaster subsp. levigaster</i> (Mangrove Gerygone)			
256.	24276	<i>Gerygone tenebrosa</i> (Dusky Gerygone)			
257.	24481	<i>Glareola maldivarum</i> (Oriental Pratincole)		IA	
258.	24443	<i>Grallina cyanoleuca</i> (Magpie-lark)			
259.	24484	<i>Grus rubicunda</i> (Brolga)			
260.		<i>Gymnothorax favagineus</i>			
261.		<i>Gymnothorax pseudothyrsoides</i>			
262.		<i>Gymnothorax undulatus</i>			
263.	25627	<i>Haematopus fuliginosus</i> (Sooty Oystercatcher)			
264.	24487	<i>Haematopus longirostris</i> (Pied Oystercatcher)			
265.	24293	<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
266.	25541	<i>Haliastur indus</i> (Brahminy Kite)			
267.	24294	<i>Haliastur indus subsp. girrenera</i> (Brahminy Kite)			
268.	24295	<i>Haliastur spheonurus</i> (Whistling Kite)			
269.		<i>Halichoeres nigrescens</i>			
270.		<i>Halophryne diemensis</i>			
271.		<i>Halophryne ocellatus</i>			
272.	24296	<i>Hamirostra isura</i> (Square-tailed Kite)			
273.	24297	<i>Hamirostra melanosternon</i> (Black-breasted Buzzard)			
274.		<i>Haplogenyx kishinouyei</i>			
275.	25232	<i>Hemidactylus frenatus</i> (Asian House Gecko)	Y		
276.		<i>Hemiscyllium trispeculare</i>			
277.		<i>Herklotsichthys blackburni</i>			
278.	24961	<i>Heteronotia binoei</i> (Bynoe's Gecko)			
279.		<i>Heteropoda renibulbis</i>			
280.	47965	<i>Hieraaetus morphnoides</i> (Little Eagle)			
281.	25734	<i>Himantopus himantopus</i> (Black-winged Stilt)			
282.	24775	<i>Himantopus himantopus subsp. leucocephalus</i> (Black-winged Stilt)			
283.		<i>Himantura uarnak</i>			
284.		<i>Hippichthys gazella</i> (invalid)			Y
285.		<i>Hippichthys penicillus</i>			
286.		<i>Hippocampus angustus</i>			
287.		<i>Hippocampus</i> sp.			
288.	24491	<i>Hirundo neoxena</i> (Welcome Swallow)			
289.	25630	<i>Hirundo rustica</i> (Barn Swallow)		IA	
290.		<i>Hogna crispipes</i>			
291.	25363	<i>Hydrelaps darwiniensis</i>			
292.	44656	<i>Hydrophis major</i> (Olive-headed seasnake, greater seasnake)			
293.	43369	<i>Hydrophis peronii</i> (Spiny-headed Seasnake)			
294.	43385	<i>Hydrophis stokesii</i> (Stoke's Seasnake, Sea Snake)			
295.	48587	<i>Hydroprogne caspia</i> (Caspian Tern)		IA	
296.		<i>Ichthyoscopus spinosus</i>			
297.		<i>Isometrus maculatus</i>			Y
298.		<i>Istigobius diadema</i>			
299.		<i>Istigobius ornatus</i>			
300.		<i>Istigobius?</i> sp.			
301.		<i>Johnius amblycephalus</i>			
302.		<i>Labracinus lineatus</i>			
303.		<i>Lactoria cornuta</i>			
304.	24367	<i>Lalage tricolor</i> (White-winged Triller)			
305.	30851	<i>Larus fuscus</i> (Lesser Black-backed Gull, Baltic Gull)			Y
306.	24511	<i>Larus novaehollandiae subsp. novaehollandiae</i> (Silver Gull)			
307.		<i>Latrodectus geometricus</i>			
308.		<i>Latrodectus hasseltii</i>			
309.		<i>Leiognathus equulus</i>			
310.	25343	<i>Lepidochelys olivacea</i> (Olive Ridley Turtle, Pacific Ridley Turtle)		T	
311.		<i>Leptobrama muelleri</i>			
312.	25125	<i>Lerista bipes</i>			
313.	25138	<i>Lerista griffini</i>			
314.		<i>Lethrinus laticaudis</i>			
315.		<i>Lethrinus</i> sp.			
316.	25005	<i>Lialis burtonis</i>			
317.	25661	<i>Lichmera indistincta</i> (Brown Honeyeater)			
318.	24582	<i>Lichmera indistincta subsp. indistincta</i> (Brown Honeyeater)			
319.	25739	<i>Limicola falcinellus</i> (Broad-billed Sandpiper)		IA	
320.	24794	<i>Limicola falcinellus subsp. sibiricus</i> (Broad-billed Sandpiper)		IA	
321.	24795	<i>Limnodromus semipalmatus</i> (Asian Dowitcher)		IA	
322.	30932	<i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	

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323.	24796	<i>Limosa lapponica subsp. menzbieri</i> (Bar-tailed Godwit (northern Siberian))		T	
324.	25741	<i>Limosa limosa</i> (Black-tailed Godwit)		IA	
325.	24797	<i>Limosa limosa subsp. melanuroides</i> (Black-tailed Godwit)		IA	
326.	25380	<i>Litoria caerulea</i> (Green Tree Frog)			
327.	25391	<i>Litoria rothii</i> (Northern Laughing Tree Frog)			
328.	25392	<i>Litoria rubella</i> (Little Red Tree Frog)			
329.		<i>Liza alata</i>			
330.		<i>Liza subviridis</i>			
331.		<i>Liza vaigiensis</i>			
332.		<i>Lophiocharon trisignatus</i>			
333.		<i>Lophoictinia isura</i>			
334.	30933	<i>Lucasium stenodactylum</i>			
335.		<i>Lutjanus carponotatus</i>			
336.		<i>Lutjanus erythropterus</i>			
337.		<i>Lutjanus lemniscatus</i>			
338.		<i>Lutjanus russellii</i>			
339.		<i>Lutjanus sp.</i>			
340.	24129	<i>Macropus agilis</i> (Agile Wallaby)			
341.	24168	<i>Macrotis lagotis</i> (Bilby, Dalgite, Ninu)		T	
342.	24326	<i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
343.	25651	<i>Malurus lamberti</i> (Variegated Fairy-wren)			
344.	24544	<i>Malurus lamberti subsp. assimilis</i> (Variegated Fairy-wren)			
345.	25653	<i>Malurus melanocephalus</i> (Red-backed Fairy-wren)			
346.	24550	<i>Malurus melanocephalus subsp. cruentatus</i> (Red-backed Fairy-wren)			
347.	24583	<i>Manorina flavigula</i> (Yellow-throated Miner)			
348.		<i>Megalops cyprinoides</i>			
349.		<i>Melanotaenia sp.</i>			
350.	24585	<i>Melithreptus albugularis</i> (White-throated Honeyeater)			
351.	25665	<i>Melithreptus gularis</i> (Black-chinned Honeyeater)			
352.	24736	<i>Melopsittacus undulatus</i> (Budgerigar)			
353.	25184	<i>Menetia greyii</i>			
354.	24598	<i>Merops ornatus</i> (Rainbow Bee-eater)			
355.		<i>Microcarbo melanoleucos</i>			
356.	25693	<i>Microeca fascinans</i> (Jacky Winter)			
357.	25694	<i>Microeca flavigaster</i> (Lemon-breasted Flycatcher)			
358.	24657	<i>Microeca flavigaster subsp. tormenti</i> (Kimberley Flycatcher)			
359.		<i>Micrognathus micronotopterus</i>			
360.	25542	<i>Milvus migrans</i> (Black Kite)			
361.	24298	<i>Milvus migrans subsp. affinis</i> (Black Kite)			
362.	25545	<i>Mirafra javanica</i> (Horsfield's Bushlark, Singing Bushlark)			
363.	24302	<i>Mirafra javanica subsp. horsfieldii</i> (Horsfield's Bushlark, Singing Bushlark)			
364.		<i>Missulena occatoria</i>			
365.		<i>Mopsus mormon</i>			
366.	25194	<i>Morethia ruficauda subsp. ruficauda</i>			
367.	25195	<i>Morethia storri</i>			
368.	25671	<i>Motacilla alba</i> (White Wagtail)			
369.	25672	<i>Motacilla flava</i> (Yellow Wagtail)		IA	
370.		<i>Mugil cephalus</i>			
371.		<i>Mugil sp.</i>			
372.	24223	<i>Mus musculus</i> (House Mouse)	Y		
373.	25610	<i>Myiagra inquieta</i> (Restless Flycatcher)			
374.	24448	<i>Myiagra inquieta subsp. nana</i> (Restless Flycatcher)			
375.	25611	<i>Myiagra rubecula</i> (Leaden Flycatcher)			
376.	25612	<i>Myiagra ruficollis</i> (Broad-billed Flycatcher)			
377.	24450	<i>Myiagra ruficollis subsp. mimikae</i> (Broad-billed Flycatcher)			
378.	25666	<i>Myzomela erythrocephala</i> (Red-headed Honeyeater)			
379.	24590	<i>Myzomela erythrocephala subsp. erythrocephala</i> (Red-headed Honeyeater)			
380.		<i>Naso sp.</i>			
381.	25344	<i>Natator depressus</i> (Flatback Turtle)		T	
382.		<i>Nematalosa come</i>			
383.		<i>Nematalosa sp.</i>			
384.		<i>Nematalosa vlaminghi</i>			
385.	25684	<i>Neochmia phaeton</i> (Crimson Finch)			
386.		<i>Neoscona theisii</i>			
387.		<i>Neosilurus hyrtlui</i>			
388.		<i>Nephila edulis</i>			
389.	24327	<i>Nettapus pulchellus</i> (Green Pygmy-goose)			
390.		<i>Netuma proxima</i>			
391.		<i>Nibea microgenys</i>			Y
392.	25747	<i>Ninox connivens</i> (Barking Owl)			

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393.	24819 <i>Ninox connivens</i> subsp. <i>connivens</i> (Barking owl (southwest subpop.))		P3	
394.	25430 <i>Notaden nichollsi</i> (Desert Spadefoot)			
395.	<i>Notograptus guttatus</i>			
396.	24798 <i>Numenius madagascariensis</i> (Eastern Curlew)		T	
397.	<i>Numenius minatus</i>			Y
398.	24799 <i>Numenius minutus</i> (Little Curlew, Little Whimbrel)		IA	
399.	25742 <i>Numenius phaeopus</i> (Whimbrel)		IA	
400.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
401.	24192 <i>Nyctophilus arnhemensis</i> (Arnhem Land Long-eared Bat)			
402.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
403.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
404.	24497 <i>Oceanites oceanicus</i> (Wilson's Storm-petrel)		IA	
405.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
406.	<i>Oecobius marathaus</i>			
407.	<i>Omobranchus ferox</i>			
408.	<i>Omobranchus lineolatus</i>			
409.	<i>Omobranchus rotundiceps</i>			
410.	<i>Onuxodon margaritiferae</i>			
411.	24138 <i>Onychogalea unguifera</i> (Northern Nailtail Wallaby, Karrabul)			
412.	41347 <i>Onychoprion anaethetus</i> (Bridled Tern)		IA	
413.	<i>Ophichthus rutidoderma</i>			
414.	<i>Ophieleotris aporos</i>			
415.	<i>Opistognathus darwiniensis</i>			
416.	<i>Opistognathus inornatus</i>			
417.	<i>Opistognathus reticulatus</i>			
418.	<i>Orcaella brevirostris</i>			
419.	24060 <i>Orcaella heinsohni</i> (Australian Snubfin Dolphin)		P4	
420.	<i>Orectolobus wardi</i>			
421.	24608 <i>Oriolus sagittatus</i> (Olive-backed Oriole)			
422.	<i>Oxyeleotris</i> sp.			
423.	24620 <i>Pachycephala lanioides</i> (White-breasted Whistler)			
424.	25678 <i>Pachycephala melanura</i> (Mangrove Golden Whistler)			
425.	24621 <i>Pachycephala melanura</i> subsp. <i>melanura</i> (Mangrove Golden Whistler)			
426.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
427.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
428.	<i>Pantolabus radiatus</i>			
429.	<i>Parablennius tasmanianus</i>			
430.	<i>Paradiplogrammus enneactis</i>			
431.	<i>Paraplagusia sinerama</i>			
432.	<i>Paraplotosus albilabris</i>			
433.	<i>Paraplotosus butleri</i>			
434.	<i>Parasclopsis</i> sp.			
435.	<i>Parascorpaena picta</i>			
436.	<i>Pardachirus pavoninus</i>			
437.	24627 <i>Pardalotus rubricatus</i> (Red-browed Pardalote)			
438.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
439.	24642 <i>Passer montanus</i> (Eurasian Tree Sparrow)	Y		
440.	24674 <i>Pavo cristatus</i> (Common Peafowl, Indian Peafowl)	Y		
441.	24649 <i>Pelecanoides urinatrix</i> subsp. <i>exsul</i> (Common Diving Petrel)			
442.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
443.	<i>Pentapodus emeryii</i>			
444.	<i>Pentapodus porosus</i>			
445.	<i>Periophthalmus argenteolineatus</i>			
446.	<i>Periophthalmus koelreuteri</i>			
447.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
448.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
449.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
450.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
451.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
452.	24411 <i>Phaps histrionica</i> (Flock Bronzewing, Flock Pigeon)			
453.	25668 <i>Philemon citreogularis</i> (Little Friarbird)			
454.	24592 <i>Philemon citreogularis</i> subsp. <i>citreogularis</i> (Little Friarbird)			
455.	<i>Philemon</i> sp.			Y
456.	24802 <i>Philomachus pugnax</i> (Ruff, reeve)		IA	
457.	<i>Pisodonophis cancrivorus</i>			
458.	24677 <i>Pitta moluccensis</i> (Blue-winged Pitta)			
459.	24101 <i>Planigale ingrami</i> (Long-tailed Planigale)			
460.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
461.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
462.	<i>Platybelone argalus</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
463.	<i>Platycephalus</i> sp.			
464.	42305 <i>Platyplectrum ornatum</i> (Ornate Burrowing Frog)			
465.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
466.	<i>Plotosus lineatus</i>			
467.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
468.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
469.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
470.	24678 <i>Podargus strigoides</i> subsp. <i>phalaenoides</i> (Tawny Frogmouth)			
471.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
472.	24643 <i>Poephila acuticauda</i> (Long-tailed Finch)			
473.	24908 <i>Pogona minor</i> subsp. <i>mitchelli</i> (Dwarf Bearded Dragon)			
474.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
475.	<i>Polydactylus macrochir</i>			Y
476.	<i>Polydactylus multiradiatus</i>			
477.	24752 <i>Polytelis alexandrae</i> (Princess Parrot)		P4	
478.	<i>Pomacentrus milleri</i>			
479.	<i>Pomadasys argenteus</i>			
480.	25706 <i>Pomatostomus temporalis</i> (Grey-crowned Babbler)			
481.	24684 <i>Pomatostomus temporalis</i> subsp. <i>rubeculus</i> (Grey-crowned Babbler)			
482.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
483.	24766 <i>Porphyrio porphyrio</i> subsp. <i>melanotus</i> (Purple Swamphen)			
484.	<i>Priolepis nuchifasciata</i>			
485.	<i>Psammoperca waigiensis</i>			
486.	25261 <i>Pseudechis australis</i> (Mulga Snake)			
487.	<i>Pseudochromis fuscus</i>			
488.	<i>Pseudochromis wilsoni</i>			
489.	<i>Pseudogobius</i> sp.			
490.	24234 <i>Pseudomys delicatulus</i> (Delicate Mouse)			
491.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
492.	<i>Pseudorhombus</i> sp.			
493.	<i>Psittuteles versicolor</i>			
494.	<i>Pterois antennata</i>			
495.	<i>Pterois</i> sp.			
496.	24172 <i>Pteropus alecto</i> (Black Flying-fox)			
497.	24173 <i>Pteropus scapulatus</i> (Little Red Flying-fox)			
498.	30946 <i>Ptilinopus regina</i> subsp. <i>ewingii</i> (Rose-crowned Fruit-dove)			
499.	25725 <i>Ptilonorhynchus nuchalis</i> (Great Bowerbird)			
500.	24758 <i>Ptilonorhynchus nuchalis</i> subsp. <i>nuchalis</i> (Great Bowerbird)			
501.	24715 <i>Puffinus huttoni</i> (Hutton's Shearwater)		T	
502.	24716 <i>Puffinus pacificus</i> (Wedge-tailed Shearwater)		IA	
503.	24772 <i>Rallina fasciata</i> (Red-legged Crane)			Y
504.	<i>Rallina fascinata</i>			Y
505.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
506.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
507.	<i>Remora remora</i>			
508.	<i>Rhina ancylostoma</i>			Y
509.	<i>Rhinobatos</i> sp.			
510.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
511.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
512.	24457 <i>Rhipidura phasiana</i> (Mangrove Grey Fantail)			
513.	25616 <i>Rhipidura rufiventris</i> (Northern Fantail)			
514.	24174 <i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tailed Bat)			
515.	<i>Salarias sexfilum</i>			
516.	<i>Salarias sexfilum?</i>			Y
517.	<i>Sargocentron rubrum</i>			
518.	<i>Scaevius milii</i>			
519.	<i>Scartelaos histophorus</i>			
520.	<i>Scolecenchelys macroptera</i>			
521.	<i>Scolopendra morsitans</i>			
522.	<i>Scolopsis</i> sp.			
523.	<i>Scomberoides commersonnianus</i>			
524.	<i>Scomberoides lysan</i>			
525.	<i>Scomberoides</i> sp.			Y
526.	<i>Scomberomorus semifasciatus</i>			
527.	<i>Scomberomorus</i> sp.			
528.	24200 <i>Scotorepens greyii</i> (Little Broad-nosed Bat)			
529.	24201 <i>Scotorepens sanborni</i> (Northern Broad-nosed Bat)			
530.	25605 <i>Scythrops novaehollandiae</i> (Channel-billed Cuckoo)			
531.	<i>Selaroides leptolepis</i>			
532.	<i>Sillago analis</i>			

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533.	<i>Sillago burrus</i>			
534.	<i>Sillago sihama</i>			
535.	<i>Sillago sihama?</i>			Y
536.	30948 <i>Smicromis brevirostris</i> (Weebill)			
537.	<i>Sphyræna putnamae</i>			Y
538.	24517 <i>Stercorarius parasiticus</i> (Arctic jaeger, Arctic Skua)		IA	
539.	24521 <i>Sterna bengalensis</i> (Lesser Crested Tern)			
540.	24522 <i>Sterna bergii</i> (Crested Tern)			
541.	25640 <i>Sterna dougallii</i> (Roseate Tern)		IA	
542.	24524 <i>Sterna dougallii</i> subsp. <i>gracilis</i> (Roseate Tern)		IA	
543.	24525 <i>Sterna fuscata</i> subsp. <i>nubilosa</i> (Sooty Tern)			
544.	25642 <i>Sterna hirundo</i> (Common Tern)		IA	
545.	24527 <i>Sterna hirundo</i> subsp. <i>longipennis</i> (Common Tern)		IA	
546.	24528 <i>Sterna hybrida</i> subsp. <i>javanica</i> (Whiskered Tern)			
547.	48593 <i>Sternula albigularis</i> (Little Tern)		IA	
548.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
549.	24482 <i>Stiltia isabella</i> (Australian Pratincole)			
550.	42348 <i>Stomiopora unicolor</i> subsp. <i>unicolor</i> (White-gaped Honeyeater)			
551.	<i>Strongylura</i> sp.			Y
552.	<i>Strongylura strongylura</i>			
553.	25517 <i>Strophurus ciliaris</i>			
554.	24924 <i>Strophurus ciliaris</i> subsp. <i>aberrans</i>			
555.	25752 <i>Sturnus vulgaris</i> (Common Starling)	Y		
556.	25754 <i>Sula leucogaster</i> (Brown Booby)		IA	
557.	24828 <i>Sula leucogaster</i> subsp. <i>plotus</i> (Brown Booby)		IA	
558.	<i>Synanceia horrida</i>			
559.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
560.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
561.	25552 <i>Tadorna radjah</i> (Radjah Shelduck)			
562.	30872 <i>Taeniopygia bichenovii</i> (Double-barred Finch)			
563.	30873 <i>Taeniopygia bichenovii</i> subsp. <i>annulosa</i> (Double-barred Finch)			
564.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
565.	30871 <i>Taeniopygia guttata</i> subsp. <i>castanotis</i> (Zebra Finch)			
566.	<i>Taeniura lymma</i>			
567.	<i>Terapon jarbua</i>			
568.	<i>Terapon puta</i>			
569.	<i>Terapon</i> sp.			
570.	<i>Terapon theraps</i>			
571.	<i>Thalasseus bengalensis</i>			
572.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
573.	<i>Thereuopoda lesueurii</i>			
574.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
575.	25202 <i>Tiliqua multifasciata</i> (Central Blue-tongue)			
576.	25520 <i>Tiliqua scincoides</i> (Eastern Blue-tongue)			
577.	25208 <i>Tiliqua scincoides</i> subsp. <i>intermedia</i>			
578.	25548 <i>Todiramphus chloris</i> (Collared Kingfisher)			
579.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
580.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
581.	24309 <i>Todiramphus sanctus</i> subsp. <i>sanctus</i> (Sacred Kingfisher)			
582.	<i>Toxotes chatareus</i>			
583.	<i>Trachinocephalus myops</i>			
584.	<i>Tragulichthys jaculiferus</i>			
585.	48141 <i>Tribonyx ventralis</i> (Black-tailed Native-hen)			
586.	<i>Trichiurus lepturus</i>			
587.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
588.	24754 <i>Trichoglossus haematodus</i> subsp. <i>rubitorquis</i> (Red-collared Lorikeet)			
589.	<i>Trichonotus setiger</i>			
590.	24157 <i>Trichosurus vulpecula</i> subsp. <i>amhemensis</i> (northern brushtail possum (Kimberley))		T	
591.	24803 <i>Tringa brevipes</i> (Grey-tailed Tattler)		P4	
592.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
593.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
594.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
595.	24851 <i>Turnix velox</i> (Little Button-quail)			
596.	24852 <i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
597.	24855 <i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i> (Masked Owl (southwest))		P3	
598.	25436 <i>Uperoleia aspera</i> (Derby Toadlet)			
599.	25446 <i>Uperoleia talpa</i> (Ratcheting Toadlet)			
600.	<i>Urodacus hoplurus</i>			
601.	<i>Urodacus koolanensis</i>			

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602.	<i>Urodacus yaschenkoi</i>			
603.	<i>Urogymnus asperimus</i>			Y
604.	<i>Valamugil cunnesius</i>			
605.	<i>Valamugil</i> sp.			Y
606.	25577 <i>Vanellus miles</i> (Masked Lapwing)			
607.	24384 <i>Vanellus miles</i> subsp. <i>miles</i> (Masked Lapwing)			
608.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
609.	25209 <i>Varanus acanthurus</i> (Spiny-tailed Monitor)			
610.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
611.	25222 <i>Varanus panoptes</i> subsp. <i>panoptes</i>			
612.	41351 <i>Xenus cinereus</i> (Terek Sandpiper)		IA	
613.	24857 <i>Zosterops luteus</i> (Yellow White-eye)			

Chromista

614.	26694 <i>Colpomenia sinuosa</i>			
615.	26775 <i>Dictyota ciliolata</i>			
616.	27245 <i>Sargassum ilicifolium</i>			
617.	27255 <i>Sargassum polycystum</i>			
618.	42785 <i>Sirophysalis trinodis</i>			

Fungi

619.	46634 <i>Anthracycystis tumefaciens</i>			
620.	45797 <i>Cintractia limitata</i>			Y
621.	<i>Deightonella torulosa</i>			
622.	41902 <i>Ganoderma steyaertanum</i>			
623.	48551 <i>Inocybe subtilior</i>			
624.	<i>Pestalotiopsis palmarum</i>			
625.	46635 <i>Sporisorium porosum</i>			
626.	45898 <i>Ustilago cynodontis</i>			
627.	45910 <i>Ustilago xerochloae</i>			
628.	45826 <i>Yelsemia lowrieana</i>			Y

Plantae

629.	16979 <i>Abrus precatorius</i> subsp. <i>precatorius</i>			
630.	16919 <i>Abutilon hannii</i>			
631.	11325 <i>Abutilon indicum</i> var. <i>australiense</i>			
632.	4901 <i>Abutilon otocarpum</i> (Desert Chinese Lantern)			
633.	16160 <i>Acacia adoxa</i> var. <i>subglabra</i>			
634.	3209 <i>Acacia ampliceps</i>			
635.	3241 <i>Acacia bivenosa</i>			
636.	13403 <i>Acacia coleii</i>			
637.	17013 <i>Acacia coleii</i> var. <i>coleii</i>			
638.	3326 <i>Acacia eriopoda</i> (Broome Pindan Wattle)			
639.	42200 <i>Acacia eriopoda</i> x <i>tumida</i> var. <i>tumida</i>			
640.	3447 <i>Acacia monticola</i> (Gawar, Lilwardi)			
641.	42183 <i>Acacia monticola</i> x <i>tumida</i> var. <i>kulparn</i>		P3	
642.	14977 <i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>			
643.	3579 <i>Acacia trachycarpa</i> (Minni Ritchi, Balgali)			
644.	20321 <i>Acacia tumida</i> var. <i>kulparn</i>			
645.	19641 <i>Acacia tumida</i> var. <i>tumida</i>			
646.	26441 <i>Acanthophora spicifera</i>			
647.	7811 <i>Acanthospermum hispidum</i> (Starburr)	Y		
648.	2645 <i>Achyranthes aspera</i> (Chaff Flower)			
649.	35868 <i>Acrocystis nana</i>			
650.	4995 <i>Adansonia gregorii</i> (Boab, Djungeri)			
651.	17422 <i>Adriana tomentosa</i> var. <i>tomentosa</i>			
652.	2646 <i>Aerva javanica</i> (Kapok Bush)	Y		
653.	13230 <i>Ageratum conyzoides</i>	Y		
654.	3609 <i>Albizia lebbek</i>			
655.	6563 <i>Alstonia linearis</i> (Bitter Bark)			
656.	2653 <i>Alternanthera pungens</i> (Khaki Weed)	Y		
657.	4907 <i>Alyogyne pinoniana</i> (Sand Hibiscus)			
658.	17574 <i>Alysicarpus ovalifolius</i>	Y		
659.	20018 <i>Amaranthus undulatus</i>			
660.	26462 <i>Amphiroa fragillissima</i>			
661.	2369 <i>Amyema benthamii</i>			
662.	13700 <i>Amyema bifurcata</i>			
663.	11874 <i>Amyema sanguinea</i> var. <i>sanguinea</i>			
664.	2386 <i>Amyema thalassia</i>			
665.	35872 <i>Anadyomene plicata</i>			
666.	40917 <i>Androcalva loxophylla</i>			
667.	11193 <i>Aristida holathera</i> var. <i>latifolia</i>			

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668.	211 <i>Aristida hygrometrica</i> (Northern Kerosene Grass)			
669.	212 <i>Aristida inaequiglumis</i> (Feathertop Threewawn)			
670.	41725 <i>Asystasia gangetica</i> subsp. <i>gangetica</i>	Y		
671.	4740 <i>Atalaya hemiglaucula</i> (Whitewood)			
672.	6828 <i>Avicennia marina</i> (White Mangrove)			
673.	17660 <i>Azadirachta indica</i>	Y		
674.	1743 <i>Batis argillicola</i>			
675.	12757 <i>Bauhinia cunninghamii</i>			
676.	5183 <i>Bergia ammannioides</i>			
677.	7866 <i>Blumea tenella</i>			
678.	2770 <i>Boerhavia coccinea</i> (Tar Vine, Wituka)			
679.	2771 <i>Boerhavia dominii</i>			
680.	2772 <i>Boerhavia gardneri</i>			
681.	2773 <i>Boerhavia paludosa</i>			
682.	<i>Boerhavia</i> sp.			
683.	26515 <i>Bostrychia tenella</i>			
684.	13361 <i>Bothriochloa pertusa</i>	Y		
685.	26516 <i>Botryocladia leptopoda</i>			
686.	13010 <i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>			
687.	4603 <i>Bridelia tomentosa</i>			
688.	5291 <i>Bruguiera exaristata</i> (Ribbed Mangrove)			
689.	750 <i>Bulbostylis barbata</i>			
690.	<i>Butea monosperma</i>			Y
691.	18073 <i>Byblis filifolia</i>			
692.	3624 <i>Caesalpinia major</i>			
693.	10972 <i>Cajanus marmoratus</i>			
694.	2871 <i>Calandrinia strophiolata</i>			
695.	44923 <i>Callisia repens</i>	Y		
696.	14925 <i>Calotropis gigantea</i>	Y		
697.	4997 <i>Camptostemon schultzei</i> (Kapok Mangrove)			
698.	3749 <i>Canavalia rosea</i> (Wild Jack Bean)			
699.	2976 <i>Capparis lasiantha</i> (Split Jack, Balqarda)			
700.	6567 <i>Carissa lanceolata</i> (Conkerberry, Mamuwiji)			
701.	2949 <i>Cassytha capillaris</i>			
702.	2950 <i>Cassytha filiformis</i> (Love Vine, Jirawan)			
703.	42620 <i>Caulerpa chemnitzia</i>			
704.	35158 <i>Caulerpa corynephora</i>			
705.	44547 <i>Caulerpa lamourouxii</i>			
706.	26576 <i>Caulerpa serrulata</i>			
707.	26577 <i>Caulerpa sertularioides</i>			
708.	26579 <i>Caulerpa taxifolia</i>			
709.	35124 <i>Caulerpa taxifolia</i> var. <i>taxifolia</i>			
710.	41565 <i>Cenchrus americanus</i> (Pearl Millet)	Y		
711.	257 <i>Cenchrus biflorus</i> (Gallon's Curse)	Y		
712.	258 <i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
713.	259 <i>Cenchrus echinatus</i> (Burrgrass)	Y		
714.	<i>Cenchrus purpurascens</i>			Y
715.	29721 <i>Cenchrus setiger</i> (Birdwood Grass)	Y		
716.	<i>Centratherum punctatum</i>			
717.	26587 <i>Centroceras clavulatum</i>			
718.	<i>Centrosema molle</i>			
719.	13680 <i>Centrosema pascurorum</i>	Y		
720.	39680 <i>Cerriops australis</i>			
721.	266 <i>Chloris barbata</i> (Purpletop Chloris)	Y		
722.	272 <i>Chloris virgata</i> (Feathertop Rhodes Grass)	Y		
723.	275 <i>Chrysopogon pallidus</i> (Ribbongrass)			
724.	48838 <i>Citrullus amarus</i>	Y		
725.	11886 <i>Cleome tetrandra</i> var. <i>tetrandra</i>			
726.	2988 <i>Cleome viscosa</i> (Tickweed, Tjinduwadhu)			
727.	13693 <i>Clerodendrum floribundum</i> var. <i>coriaceum</i>			
728.	13688 <i>Clerodendrum tomentosum</i> var. <i>mollissima</i>			
729.	13690 <i>Clerodendrum tomentosum</i> var. <i>tomentosum</i>			
730.	3769 <i>Clitoria ternatea</i>	Y		
731.	15036 <i>Coccinia grandis</i>	Y		
732.	35917 <i>Codium arabicum</i>			
733.	35857 <i>Codium dwarkense</i>			
734.	2778 <i>Codonocarpus cotinifolius</i> (Native Poplar, Kundurangu)			
735.	26686 <i>Coelarthrum opuntia</i>			
736.	7939 <i>Coryza bonariensis</i> (Flaxleaf Fleabane)	Y		
737.	12767 <i>Corchorus aestuans</i>			

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738.	25847	<i>Corchorus incanus</i> subsp. <i>incanus</i>			
739.	18414	<i>Corchorus sidoides</i> subsp. <i>vermicularis</i>			
740.	16788	<i>Corymbia bella</i>			
741.	16784	<i>Corymbia dendromerinx</i>			
742.	14650	<i>Corymbia flavescens</i>			
743.	17089	<i>Corymbia greeniana</i>			
744.	16789	<i>Corymbia paractia</i>		P1	
745.	17100	<i>Corymbia polycarpa</i>			
746.	17084	<i>Corymbia zygophylla</i>			
747.	1285	<i>Corynotheca micrantha</i> (Sand Lily)			
748.	13466	<i>Crotalaria brevis</i>			
749.	3774	<i>Crotalaria cunninghamii</i> (Green Birdflower, Bilbun)			
750.	20176	<i>Crotalaria cunninghamii</i> subsp. <i>cunninghamii</i>			
751.	20179	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>			
752.	19398	<i>Crotalaria ramosissima</i>			
753.		<i>Crotalaria</i> sp.			
754.	12683	<i>Cryptostegia madagascariensis</i>	Y		
755.	7371	<i>Cucumis melo</i> (Ulicardo Melon)			
756.	17116	<i>Cullen martinii</i>			
757.	13732	<i>Cuscuta campestris</i> (Golden dodder)	Y		
758.	31213	<i>Cuscuta chinensis</i>			
759.	13733	<i>Cuscuta victoriana</i>			
760.	6749	<i>Cyanostegia cyanocalyx</i>			
761.	19063	<i>Cyanthillium cinereum</i>	Y		
762.	128	<i>Cymodocea angustata</i>			
763.	6585	<i>Cynanchum pedunculatum</i>			
764.	46558	<i>Cynodon convergens</i>			
765.	283	<i>Cynodon dactylon</i> (Couch)	Y		
766.	777	<i>Cyperus bulbosus</i> (Bush Onion, Tjanmata)			
767.	781	<i>Cyperus compressus</i>	Y		
768.	784	<i>Cyperus conicus</i>			
769.	810	<i>Cyperus rotundus</i> (Nut Grass)	Y		
770.	812	<i>Cyperus scariosus</i>			
771.	288	<i>Dactyloctenium aegyptium</i> (Coast Button Grass)	Y		
772.	290	<i>Dactyloctenium radulans</i> (Button Grass)			
773.	41200	<i>Denhamia cunninghamii</i> (Koonkara)			
774.	7319	<i>Dentella misera</i>			
775.	3853	<i>Desmodium filiforme</i>			
776.	3857	<i>Desmodium tortuosum</i> (Florida Beggarweed)	Y		
777.	3612	<i>Dichrostachys spicata</i> (Pied Piper Bush)			
778.	26782	<i>Digenea simplex</i>			
779.	309	<i>Digitaria bicornis</i> (Finger Grass)			
780.	311	<i>Digitaria ciliaris</i> (Summer Grass)	Y		
781.	35178	<i>Digitaria radicata</i>	Y		
782.	48735	<i>Distimake aegyptius</i>	Y		
783.	48738	<i>Distimake dissectus</i> var. <i>dissectus</i>	Y		
784.	38461	<i>Dodonaea hispidula</i> var. <i>arida</i>			
785.	38462	<i>Dodonaea hispidula</i> var. <i>phylloptera</i>			
786.	48390	<i>Dolichandrone occidentalis</i>			
787.	8450	<i>Eclipta prostrata</i>	Y		
788.	6682	<i>Ehretia saligna</i> (False Cedar)			
789.	14301	<i>Ehretia saligna</i> var. <i>saligna</i>			
790.	353	<i>Eleusine indica</i> (Crowsfoot Grass)	Y		
791.		<i>Eleutheranthera ruderalis</i>			
792.	363	<i>Enneapogon pallidus</i> (Conetop Nineawn)			
793.	375	<i>Eragrostis cumingii</i> (Cuming's Love Grass)			
794.	380	<i>Eragrostis eriopoda</i> (Woollybutt Grass, Wangurnu)			
795.	381	<i>Eragrostis falcata</i> (Sickle Lovegrass)			
796.	389	<i>Eragrostis minor</i> (Smaller Stinkgrass)	Y		
797.	17610	<i>Eragrostis tenuifolia</i>	Y		
798.	412	<i>Eriachne melicacea</i>			
799.	414	<i>Eriachne obtusa</i> (Northern Wandarrie Grass)			
800.	3871	<i>Erythrina vespertilio</i> (Yulbah)			
801.	3662	<i>Erythrophleum chlorostachys</i> (Ironwood, Dyundyu)			
802.	5785	<i>Eucalyptus tectifica</i> (Darwin Box)			
803.	26827	<i>Eucheuma denticulatum</i>			
804.	35303	<i>Euphorbia australis</i> var. <i>subtomentosa</i>			
805.	4623	<i>Euphorbia coghlanii</i> (Namana)			
806.	17342	<i>Euphorbia cyathophora</i>	Y		
807.	11157	<i>Euphorbia heterophylla</i>	Y		

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808.	4629	<i>Euphorbia hirta</i> (Asthma Plant)	Y		
809.	42878	<i>Euphorbia thymifolia</i>	Y		
810.	42879	<i>Euphorbia trigonosperma</i>			
811.	11416	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>			
812.	11169	<i>Exocarpos latifolius</i> (Broad-leaved Cherry)			
813.	31578	<i>Ficus aculeata</i> var. <i>indecora</i> (Ranji)			
814.	847	<i>Fimbristylis cymosa</i>			
815.	35558	<i>Flaveria trinervia</i> (Speedy Weed)	Y		
816.	4654	<i>Flueggea virosa</i>			
817.	12013	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i> (Dogwood, Guwal)			
818.	19195	<i>Gamochaeta pensylvanica</i>	Y		
819.	7328	<i>Gardenia pyrifolia</i> (Malara)			
820.	15234	<i>Gardenia pyrifolia</i> subsp. <i>keartlandii</i>			
821.		<i>Gardenia</i> sp.			
822.	13829	<i>Glycine pindanica</i>		P3	
823.	3942	<i>Glycine tomentella</i> (Woolly Glycine)			
824.	7985	<i>Gnaphalium polycaulon</i> (Indian Cudweed)	Y		
825.	2677	<i>Gomphrena celosioides</i> (Gomphrena Weed)	Y		
826.	2682	<i>Gomphrena flaccida</i> (Gomphrena Weed)			
827.	2686	<i>Gomphrena pusilla</i>		P2	
828.	2687	<i>Gomphrena tenella</i>			
829.	7490	<i>Goodenia armitiana</i>			
830.	12514	<i>Goodenia byrnesii</i>		P3	
831.	7521	<i>Goodenia lamprosperma</i>			
832.	7545	<i>Goodenia scaevolina</i> (Ngurubi)			
833.	13163	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>			
834.	4910	<i>Gossypium australe</i> (Native Cotton)			
835.	4913	<i>Gossypium hirsutum</i> (Upland Cotton)	Y		
836.	4916	<i>Gossypium populifolium</i>			
837.	26873	<i>Gracilaria salicornia</i>			
838.	15975	<i>Grevillea pyramidalis</i> subsp. <i>pyramidalis</i>			
839.	16476	<i>Grevillea refracta</i> subsp. <i>refracta</i>			
840.	4868	<i>Grewia breviflora</i>			
841.	4872	<i>Grewia retusifolia</i> (Dog's Balls)			
842.	18374	<i>Guilleminea densa</i>	Y		
843.	13228	<i>Gymnanthera oblonga</i>			
844.	2960	<i>Gyrocarpus americanus</i> (Helicopter Tree, Bilangkamar)			
845.	13748	<i>Gyrocarpus americanus</i> subsp. <i>pachyphyllus</i>			
846.	2789	<i>Gyrostemon tepperi</i>			
847.	2129	<i>Hakea arborescens</i> (Common Hakea)			
848.	2178	<i>Hakea macrocarpa</i> (Dyaridany, Jaradinty)			
849.	26894	<i>Halimeda macroloba</i>			
850.	131	<i>Halodule uninervis</i>			
851.	164	<i>Halophila ovalis</i> (Sea Wrack)			
852.	165	<i>Halophila spinulosa</i>			
853.	37642	<i>Halymenia durvillei</i>			
854.	10882	<i>Heliotropium foliatum</i>			
855.	13126	<i>Heliotropium leptaleum</i>			
856.	443	<i>Heteropogon contortus</i> (Bunch Speargrass)			
857.	29358	<i>Hibiscus apodus</i>			
858.	29317	<i>Hibiscus austrinus</i> var. <i>austrinus</i>			
859.	4929	<i>Hibiscus geranioides</i>			
860.	4933	<i>Hibiscus leptocladus</i>			
861.	5215	<i>Hybanthus aurantiacus</i>			
862.	166	<i>Hydrilla verticillata</i> (Water Thyme)			
863.	26970	<i>Hypnea pannosa</i>			
864.	13959	<i>Hypoestes floribunda</i> var. <i>varia</i>			
865.	6572	<i>Ichnocarpus frutescens</i>			
866.	3973	<i>Indigofera colutea</i> (Sticky Indigo)			
867.	3978	<i>Indigofera hirsuta</i> (Hairy Indigo)			
868.	3980	<i>Indigofera linifolia</i>			
869.	14363	<i>Ipomoea batatas</i>	Y		
870.	6620	<i>Ipomoea cairica</i> (Coast Morning Glory)	Y		
871.	6623	<i>Ipomoea coptica</i>			
872.	6633	<i>Ipomoea muelleri</i> (Poison Morning Glory, Yumbu)			
873.	6635	<i>Ipomoea pes-caprae</i>			
874.	11312	<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>			
875.		<i>Ipomoea pes-caprae</i> subsp. <i>pes-caprae</i>			Y
876.	18295	<i>Ipomoea pes-tigridis</i>	Y		
877.	6637	<i>Ipomoea polymorpha</i>			

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878.	20003	<i>Ipomoea triloba</i>	Y		
879.	6643	<i>Jacquemontia paniculata</i>			
880.	34797	<i>Jacquemontia</i> sp. <i>Broome</i> (A.A. Mitchell 3028)		P1	
881.	12059	<i>Jasminum didymum</i> subsp. <i>lineare</i> (Desert Jasmine)			
882.	4656	<i>Jatropha gossypifolia</i> (Bellyache Bush)	Y		
883.	28342	<i>Landoltia punctata</i> (Thin Duckweed)			
884.	4054	<i>Leptosema anomalum</i>			
885.	18351	<i>Leucaena leucocephala</i> subsp. <i>leucocephala</i>	Y		
886.	37480	<i>Lobelia arnhemiaca</i>			
887.	476	<i>Lolium perenne</i> (Perennial Ryegrass)	Y		
888.	5296	<i>Lumnitzera racemosa</i> (White-flowered Black Mangrove)			
889.	2399	<i>Lysiana spathulata</i>			
890.	11809	<i>Lysiana spathulata</i> subsp. <i>spathulata</i>			
891.	4070	<i>Macroptilium atropurpureum</i> (Purple Bean)	Y		
892.	4658	<i>Mallotus nesophilus</i>			
893.	16537	<i>Marsdenia angustata</i>			
894.	6598	<i>Marsdenia viridiflora</i>			
895.	16535	<i>Marsdenia viridiflora</i> subsp. <i>tropica</i>			
896.		<i>Mecardonia procumbens</i>			Y
897.	5901	<i>Melaleuca dealbata</i> (Kambor)			
898.	5051	<i>Melhania oblongifolia</i>			
899.	12361	<i>Melicope elleryana</i>			
900.	48283	<i>Mesosphaerum suaveolens</i>	Y		
901.	31374	<i>Microstachys chamaelea</i>			
902.	2944	<i>Miliusa brahei</i>			
903.	7378	<i>Momordica balsamina</i> (Balsam Apple)	Y		
904.	6490	<i>Muellerolimon salicorniaceum</i>			
905.	1167	<i>Murdannia graminea</i> (Baniyu)			
906.	17158	<i>Myoporum montanum</i> (Native Myrtle)			
907.	2573	<i>Neobassia astrocarpa</i>			
908.	44784	<i>Ocimum americanum</i>	Y		
909.	6907	<i>Ocimum basilicum</i> (Basil)	Y		
910.	13340	<i>Oldenlandia corymbosa</i> var. <i>corymbosa</i>	Y		
911.	6651	<i>Operculina aequiseptala</i>			
912.	2362	<i>Opilia amentacea</i>			
913.	104	<i>Pandanus spiralis</i> (Screwpine, Wakirri)			
914.	503	<i>Panicum decompositum</i> (Native Millet, Kaltu-kaltu)			
915.	523	<i>Paspalidium rarum</i> (Rare Paspalidium)			
916.	533	<i>Paspalum vaginatum</i> (Salt Water Couch)			
917.	5226	<i>Passiflora foetida</i> (Stinking Passion Flower)	Y		
918.	13570	<i>Pavetta kimmerleyana</i>			
919.	33482	<i>Peltophorum pterocarpum</i>	Y		
920.	17320	<i>Peperomia pellucida</i>	Y		
921.	546	<i>Perotis rara</i> (Comet Grass)			
922.	2263	<i>Persoonia falcata</i> (Wild Pear, Gandala)			
923.	4673	<i>Phyllanthus amarus</i>	Y		
924.	17794	<i>Phyllanthus tenellus</i>	Y		
925.	13927	<i>Phyllanthus urinaria</i>			
926.		<i>Pilea microphylla</i>			
927.	1045	<i>Pistia stratiotes</i> (Water Lettuce)	Y		
928.	43944	<i>Pluchea longiseta</i>			
929.	8168	<i>Pluchea rubelliflora</i>			
930.	2898	<i>Polycarpaea corymbosa</i>			
931.	2903	<i>Polycarpaea longiflora</i>			
932.	4577	<i>Polygala tepperi</i>			
933.	6653	<i>Polymeria ambigua</i> (Morning Glory)			
934.	41644	<i>Polymeria</i> sp. <i>Broome</i> (K.F. Kenneally 9759)		P3	
935.	2881	<i>Portulaca filifolia</i>			
936.	2883	<i>Portulaca napiformis</i>			
937.	2884	<i>Portulaca oleracea</i> (Purslane, Wakati)			
938.	2886	<i>Portulaca pilosa</i> (Djanggara)	Y		
939.	6735	<i>Premna acuminata</i> (Ngalinginkal)			
940.	18207	<i>Psydrax attenuata</i> var. <i>tenella</i>			
941.	2704	<i>Ptilotus calostachyus</i> (Weeping Mulla Mulla)			
942.	2721	<i>Ptilotus exaltatus</i> (Tall Mulla Mulla)			
943.	2737	<i>Ptilotus lanatus</i>			
944.	2751	<i>Ptilotus polystachyus</i> (Prince of Wales Feather)			
945.	3061	<i>Raphanus raphanistrum</i> (Wild Radish)	Y		
946.	5295	<i>Rhizophora stylosa</i> (Spotted-leaved Red Mangrove)			
947.	4190	<i>Rhynchosia australis</i> (Rhynchosia)			

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948.	4191	<i>Rhynchosia minima</i> (Rhynchosia)			
949.	17890	<i>Ruellia tuberosa</i>	Y		
950.	30434	<i>Salsola australis</i>			
951.		<i>Santalum album</i>			
952.	2357	<i>Santalum lanceolatum</i> (Northern Sandalwood, Yarnnguli)			
953.	13173	<i>Scaevola parvifolia</i> subsp. <i>parvifolia</i>			
954.	599	<i>Schizachyrium fragile</i> (Senale Redgrass)			
955.	1027	<i>Scleria brownii</i>			
956.	27274	<i>Sebdenia flabellata</i>			
957.	12303	<i>Senna costata</i>			
958.	12307	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>			
959.	12312	<i>Senna notabilis</i>			
960.	46817	<i>Seringia exastia</i> (Fringed fire-bush)		T	
961.	46820	<i>Seringia katatona</i> (Red dune fire-bush)		P3	
962.	46821	<i>Seringia nephrosperma</i> (Free carpel fire-bush)			
963.	31172	<i>Sersalisia sericea</i> (Nangi)			
964.	4196	<i>Sesbania cannabina</i> (Sesbania Pea)			
965.	11235	<i>Sesbania simpliciuscula</i> var. <i>fitzroyensis</i>			
966.		<i>Sesbania</i> sp.			
967.	2818	<i>Sesuvium portulacastrum</i>			
968.	613	<i>Setaria verticillata</i> (Whorled Pigeon Grass)	Y		
969.	4977	<i>Sida fibulifera</i> (Silver Sida)			
970.	4979	<i>Sida hackettiana</i>			
971.	18150	<i>Sida rohlenae</i> subsp. <i>occidentalis</i>			
972.	45274	<i>Sida</i> sp. <i>Pindan</i> (B.G. Thomson 3398)			
973.	4989	<i>Sida spinosa</i> (Spiny Sida)			
974.	7000	<i>Solanum cunninghamii</i>			
975.	7001	<i>Solanum dioicum</i> (Gilu)			
976.	27281	<i>Solieria robusta</i>			
977.	10920	<i>Soliva sessilis</i> (Jo-jo, Onehunga Weed)	Y		
978.	12920	<i>Sorghum interjectum</i>			
979.	620	<i>Sorghum stipodeum</i> (Annual Sorghum)			
980.	28347	<i>Spermacoe occidentalis</i>			
981.		<i>Spermacoe</i> sp.			
982.	625	<i>Spinifex longifolius</i> (Beach Spinifex)			
983.	629	<i>Sporobolus australasicus</i> (Fairy Grass)			
984.	633	<i>Sporobolus mitchellii</i> (Ratstail Couch)			
985.	635	<i>Sporobolus virginicus</i> (Marine Couch)			
986.	8239	<i>Streptoglossa macrocephala</i>			
987.	7103	<i>Striga curviflora</i>			
988.	12353	<i>Stylosanthes hamata</i> (Verano Stylo)	Y		
989.	12354	<i>Stylosanthes scabra</i>	Y		
990.	2638	<i>Suaeda arbusculoides</i>			
991.	43203	<i>Surreya diandra</i>			
992.	3677	<i>Tamarindus indica</i> (Tamarind)	Y		
993.	33236	<i>Tecticornia halocnemoides</i> (Shrubby Samphire)			
994.	33238	<i>Tecticornia halocnemoides</i> subsp. <i>tenuis</i>			
995.	33356	<i>Tecticornia indica</i> subsp. <i>indica</i>			
996.	33357	<i>Tecticornia indica</i> subsp. <i>julacea</i>			
997.	33318	<i>Tecticornia indica</i> subsp. <i>leiostachya</i> (Samphire)			
998.	4266	<i>Tephrosia crocea</i> (Baynjood)			
999.	4272	<i>Tephrosia leptoclada</i>			
1000.	4279	<i>Tephrosia remotiflora</i>			
1001.	4280	<i>Tephrosia rosea</i> (Flinders River Poison, Bungoo'dah)			
1002.	19529	<i>Tephrosia rosea</i> var. <i>rosea</i>			
1003.	4281	<i>Tephrosia simplicifolia</i>			
1004.	5303	<i>Terminalia ferdinandiana</i> (Mador)			
1005.	45697	<i>Terminalia kumpaja</i>		P3	
1006.	5307	<i>Terminalia latipes</i>			
1007.	5309	<i>Terminalia petiolaris</i> (Masroorl)			
1008.	4992	<i>Thespesia populneoides</i> (Laba)			
1009.	2942	<i>Tinospora smilacina</i> (Snakevine, Oondala)			
1010.	27335	<i>Tolypocladia calodictyon</i>			
1011.	27336	<i>Tolypocladia glomerulata</i>			
1012.	44305	<i>Trianthema pilosum</i>			
1013.	2830	<i>Trianthema portulacastrum</i> (Giant Pigweed)	Y		
1014.	44362	<i>Trianthema triquetrum</i>			
1015.	4368	<i>Tribulopsis angustifolia</i>			
1016.	4380	<i>Tribulus occidentalis</i> (Perennial Caltrop)			
1017.	4383	<i>Tribulus terrestris</i> (Caltrop)	Y		

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1018.	6727 <i>Trichodesma zeylanicum</i> (Camel Bush, Kumbalin)			
1019.	8252 <i>Tridax procumbens</i> (Tridax, Tridax Daisy)	Y		
1020.	13131 <i>Triodia epactia</i>			
1021.	691 <i>Triodia microstachya</i>			
1022.	17873 <i>Triodia schinzii</i>			
1023.	13468 <i>Triumfetta pentandra</i>	Y		
1024.	715 <i>Urochloa mosambicensis</i> (Sabi Grass)	Y		
1025.	718 <i>Urochloa pubigera</i>			
1026.	10865 <i>Urochloa subquadriflora</i>			
1027.	7663 <i>Velleia panduriformis</i> (Cabbage Poison)			
1028.	4846 <i>Ventilago viminalis</i> (Supplejack, Barndaragu)			
1029.	48983 <i>Vincetoxicum cinerascens</i>			
1030.	5106 <i>Waltheria indica</i>			
1031.	725 <i>Whiteochloa airoides</i>			
1032.	728 <i>Whiteochloa cymbiformis</i>			
1033.	729 <i>Xerochloa barbata</i> (Rice Grass)			
1034.	730 <i>Xerochloa imberbis</i> (Rice Grass)			
1035.	732 <i>Yakirra australiensis</i>			
1036.	735 <i>Yakirra pauciflora</i>			
1037.	4847 <i>Ziziphus mauritiana</i> (Zornia)	Y		
1038.	4327 <i>Zornia chaetophora</i>			
1039.	12679 <i>Zornia muelleriana</i> subsp. <i>congesta</i>			
1040.	12680 <i>Zornia prostrata</i> var. <i>prostrata</i>			

Protozoa

1041.	39008 <i>Diachea leucopodia</i>			
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Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

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

Appendix B - EPBC Protected Matters Search Report



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: 13/02/19 23:10:42

[Summary](#)

[Details](#)

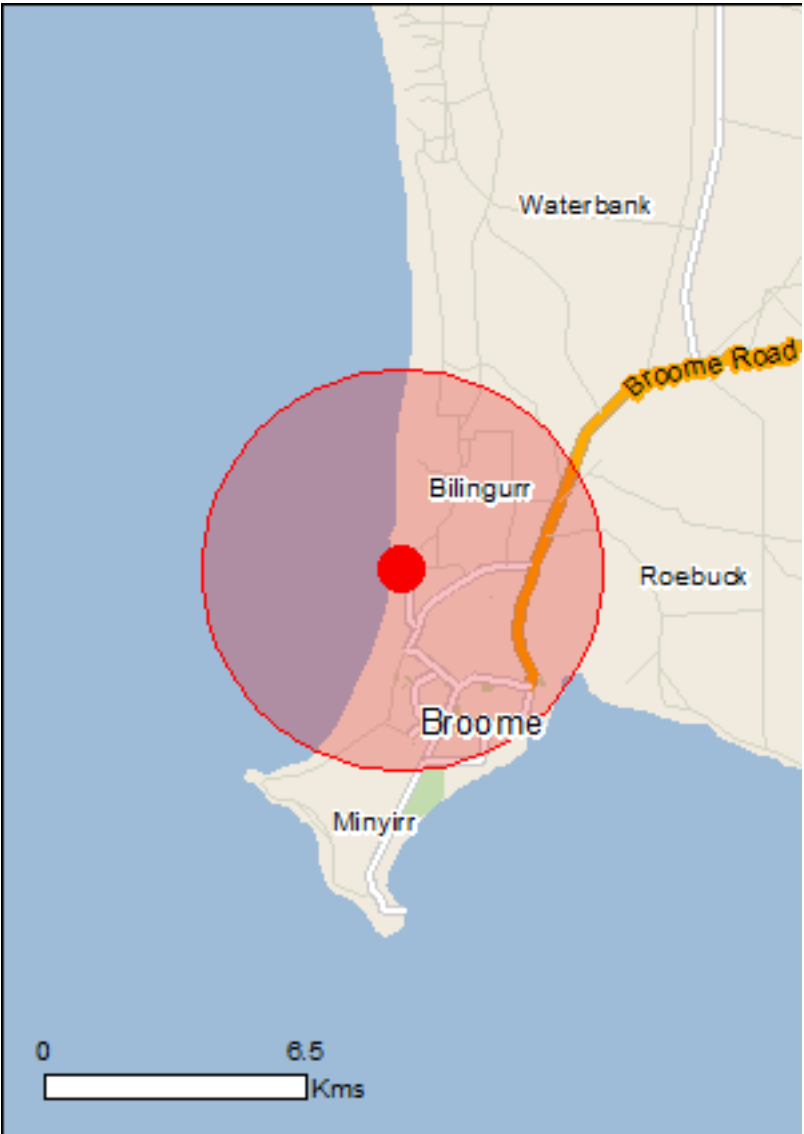
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

[Buffer: 5.0Km](#)



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:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	31
Listed Migratory Species:	65

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:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	12
Nationally Important Wetlands:	1
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 10km of Ramsar

Listed Threatened Ecological Communities	[Resource Information]
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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]
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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	Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
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, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely 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	Species or species habitat 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
Ctenotus angusticeps Northwestern Coastal Ctenotus, Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
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

Name	Status	Type of Presence
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
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

Name	Threatened	Type of Presence
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
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	Species or species habitat 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 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 may occur within area

Name	Threatened	Type of Presence
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]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Foraging, feeding or related behaviour known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Limnodromus semipalmatus Asian Dowitcher [843]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour known to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Foraging, feeding or related behaviour known to occur within area
Tringa glareola Wood Sandpiper [829]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour 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
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]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
Calonectris leucomelas Streaked Shearwater [1077]		to occur within area Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Foraging, feeding or related behaviour known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour 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
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Limnodromus semipalmatus Asian Dowitcher [843]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour 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 may 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]		Foraging, feeding or related behaviour known to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour 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
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Foraging, feeding or related behaviour known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Tringa glareola Wood Sandpiper [829]		Foraging, feeding or related behaviour 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]		Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
		to occur within area
Tringa totanus Common Redshank, Redshank [835]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour 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
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

Name	Threatened	Type of Presence
Hippocampus planifrons Flat-face Seahorse [66238]		area 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 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

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	habitat may occur within area 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 mcdowellii null [25926]		Species or species habitat may occur within 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

Name	Status	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat 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
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

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Broome Wildlife Centre	WA
Unnamed WA51162	WA
Unnamed WA51497	WA
Unnamed WA52354	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		

Name	Status	Type of Presence
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	
Canis lupus familiaris Domestic Dog [82654]	Species or species habitat likely to occur 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
Rattus rattus Black Rat, Ship Rat [84]	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

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

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

-17.93041 122.21074

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix C – Flora Species within each Recorded Relevé

*denotes introduced (weed) species #denotes non-endemic species (planted)

Family		Species	R01	R02	R03	R04
Apocynaceae		<i>Carissa lanceolata</i>	+			
Boraginaceae		<i>Trichodesma zeylanicum</i>				+
Casuarinaceae	#	<i>Casuarina obesa</i>			+	
Cleomaceae		<i>Cleome</i> sp.	+			
Convolvulaceae		<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>	+		+	+
Fabaceae		<i>Acacia ampliceps</i>	+			
Fabaceae		<i>Acacia colei</i> var. <i>colei</i>	+	+		
Fabaceae		<i>Canavalia rosea</i>				+
Fabaceae		<i>Crotalaria medicaginea</i> var. <i>neglecta</i>				+
Fabaceae	*	<i>Delonix regia</i>	+			
Fabaceae	*	<i>Senna occidentalis</i>		+		
Hernandiaceae		<i>Gyrocarpus americanus</i>	+			
Malvaceae		<i>Grewia breviflora</i>	+			
Meliaceae	*	<i>Azadirachta indica</i>	+			
Myrtaceae		<i>Corymbia</i> sp.		+		
Nyctaginaceae		<i>Boerhavia ? dominii</i>	+			
Passifloraceae	*	<i>Passiflora foetida</i> var. <i>hispida</i>	+	+		
Phyllanthaceae		<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	+			
Poaceae	*	<i>Cenchrus ciliaris</i>		+	+	+
Poaceae		<i>Spinifex longifolius</i>			+	+

Appendix D – Site Data

Site R01

Date	07/03/2019
Botanist	Kellie Bauer-Simpson
Quadrat Size	NA, relevé
NW Corner Coordinates	416381 mE 8017327 mN
Slope	Gentle
Landform	Lower slope
Soil Colour	Brown
Soil Type	Loamy sand
Litter	80%
Bare Ground	1%
Fire Age	>10years
Vegetation Condition	Very Good
Disturbances/Impacts	Some weeds
Vegetation Unit	MVT

Thicket of *Gyrocarpus americanus*, *Grewia breviflora* and [#]*Delonix regia*, with various creeping vines, predominantly *Ipomoea pes-caprae* subsp. *brasiliensis*.



Name	Height (m)	Cover (%)
<i>*Delonix regia</i>	8	3
<i>Gyrocarpus americanus</i>	7	20
<i>Grewia breviflora</i>	4	15
<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>	creeper	5
<i>Acacia ampliceps</i>		+
<i>Acacia colei</i> var. <i>colei</i>		+
<i>*Azadirachta indica</i>		+
<i>Boerhavia ? dominii</i>		+
<i>Carissa lanceolata</i>		+
<i>Cleome</i> sp.		+
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>		+
<i>*Passiflora foetida</i> var. <i>hispida</i>		+

Site R02

Date	7/03/2019
Botanist	Kellie Bauer-Simpson
Quadrat Size	NA, relevé
NW Corner Coordinates	416438 mE 8017286 mN
Slope	gentle
Landform	Lower slope
Soil Colour	Brown
Soil Type	Clayey loamy sand
Litter	25%
Bare Ground	40%
Fire Age	5-10years
Vegetation Condition	Completely Degraded
Disturbances/Impacts	Clearing and weeds
Vegetation Unit	PR

Previously cleared areas comprising weeds and disturbed regrowth, dominated by *Senna occidentalis* and *Cenchrus ciliaris*, with occasional planted (likely non-endemic) trees, including *Corymbia* sp..



Name	Height (m)	Cover (%)
<i>Corymbia</i> sp.	15	occasional
* <i>Senna occidentalis</i>	2	35
<i>Acacia coleii</i> var. <i>coleii</i>	1.5	3
* <i>Cenchrus ciliaris</i>	0.5	20
* <i>Passiflora foetida</i> var. <i>hispida</i>	creeper	4

Site R03

Date	7/03/2019
Botanist	Kellie Bauer-Simpson
Quadrat Size	NA, relevé
NW Corner Coordinates	416329 mE 8017212 mN
Slope	Steep
Landform	Lower slope
Soil Colour	Pale brown
Soil Type	sand
Litter	25%
Bare Ground	5%
Fire Age	> 10years
Vegetation Condition	Degraded
Disturbances/Impacts	Weeds
Vegetation Unit	FD

Dense Hummock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with *Ipomoea pes-caprae* subsp. *brasiliensis*.



Name	Height (m)	Cover (%)
<i>Spinifex longifolius</i>	0.6	50
* <i>Cenchrus ciliaris</i>	0.4	10
<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>	creeper	10
# <i>Casuarina obesa</i>	4	occasional

Site R04

Date	7/03/2019
Botanist	Kellie Bauer-Simpson
Quadrat Size	NA, relevé
NW Corner Coordinates	416350 mE 8017634 mN
Slope	Steep
Landform	Mid slope
Soil Colour	Orange
Soil Type	Sand
Litter	25%
Bare Ground	10%
Fire Age	>10years
Vegetation Condition	Degraded
Disturbances/Impacts	Weeds and erosion
Vegetation Unit	HD

Dense Hummock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with Dwarf Scrub D of *Trichodesma zeylanicum* and *Crotalaria medicaginea* var. *neglecta*, with creeping vines, predominantly *Ipomoea pes-caprae* subsp. *brasiliensis* and *Canavalia rosea*.



Name	Height (m)	Cover (%)
<i>Spinifex longifolius</i>	0.7	65
<i>Trichodesma zeylanicum</i>	0.6	8
* <i>Cenchrus ciliaris</i>	0.5	15
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	0.5	3
<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>	creeper	5
<i>Canavalia rosea</i>	creeper	2

Appendix E – Monsoon Vine Thicket TEC Characteristic Species List (DSEWPaC 2013)

NB: This is an indicative rather than comprehensive list of plant species present in the ecological community. Patches may not include all species on the lists or may include other species not listed. Scientific names are current as at August 2012.

Sources: Kenneally *et al.*, 1991; McKenzie *et al.*, 1991; Kenneally *et al.*, 1996; Lands, 1997; Black *et al.*, 2010; DEC, unpublished.

Scientific name	Common name
Trees	
<i>Acacia tumida</i>	wongai
<i>Atalaya hemiglauc</i>	western whitewood
<i>Atalaya variifolia</i>	wingleaf whitewood
<i>Bauhinia cunninghamii</i>	Bauhinia, jigal, joom
<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	darlab, gorrgorr, kawoorrkaworr, northern kurrajong,
<i>Canarium australianum</i>	styptic tree
<i>Celtis philippensis</i>	goonlnji
<i>Corymbia bella</i>	weeping ghost gum
<i>Corymbia flavescens</i>	apple, bastard or cabbage ghost gum
<i>Corymbia greeniana</i>	Dampier's bloodwood
<i>Corymbia opaca</i>	
<i>Corymbia polycarpa</i>	long fruited bloodwood
<i>Cupaniopsis anacardioides</i>	tuckeroo
<i>Diospyros humilis</i>	ebony wood, birimbir
<i>Diospyros maritima</i>	
<i>Ehretia saligna</i>	native willow, peachwood
<i>Erythrophleum chlorostachys</i>	ironwood
<i>Eucalyptus camaldulensis</i> subsp. <i>obtus</i>	river red gum
<i>Eucalyptus miniata</i>	woollybutt, manowan
<i>Eucalyptus tectifica</i>	Darwin box, grey box,
<i>Exocarpos latifolius</i>	mistletoe tree
<i>Ficus aculeata</i>	sandpaper fig
<i>Ficus platypoda</i>	
<i>Ficus virens</i>	banyan or strangler fig, albay
<i>Grevillea pyramidalis</i>	caustic tree, maangga
<i>Grewia breviflora</i>	currant or coffee fruit, goolmi, gullego
<i>Gyrocarpus americanus</i> subsp. <i>pachyphyllus</i>	coolaman tree, helicopter tree, stinkwood
<i>Hakea arborescens</i>	tree hakea, yellow hakea
<i>Hakea macrocarpa</i>	
<i>Lophostemon grandiflorus</i> subsp. <i>grandiflorus</i>	lardik
<i>Mallotus nesophilus</i>	badarrbadarr, yellow ball flower
<i>Melaleuca alsophila</i>	saltwater paperbark
<i>Melaleuca dealbata</i>	garnboorr
<i>Mimusops elengi</i>	joongoon, mamajen,
<i>Panadanus spiralis</i>	common screwpine, idool, jarmirdany, manbang
<i>Parinari nonda</i>	nonda
<i>Persoonia falcata</i>	gamaloon, geebung, ngarliwarny, wankirr, wild pear
<i>Pittosporum moluccanum</i>	
<i>Planchonia careya</i>	cocky apple, goolay
<i>Premna acuminata</i>	firestick tree
<i>Santalum lanceolatum</i>	tropical sandalwood
<i>Sersalisia sericea</i>	Mangarr, minyyuru
<i>Syzygium eucalyptoides</i> subsp. <i>bleeseri</i>	wild apple, iilarr
<i>Terminalia canescens</i>	wingnut tree
<i>Terminalia ferdinandiana</i>	gabiny, gubinge, kabiny, madoor
<i>Terminalia ferdinandiana</i> x <i>Terminalia petiolaris</i> (hybrid)	red gubinge

Scientific name	Common name
Trees continued	
<i>Terminalia petiolaris</i>	blackberry tree, marool, narwulu
<i>Thespesia populneoides</i>	
<i>Ventilago viminalis</i>	medicine bark, supplejack
Shrubs	
<i>Abutilon indicum</i>	Indian lantern flower
<i>Acacia bivenosa</i>	Cable Beach wattle, dune wattle
<i>Acacia coleii</i>	candelabra wattle, Cole's wattle, lirriringkirn, limarrkoodkood, noomoorrgoodoord, soap wattle
<i>Acacia eriopoda</i>	Broome pindan wattle
<i>Acacia monticola</i>	red wattle
<i>Acacia monticola</i> aff.	
<i>Acacia platycarpa</i>	ghost wattle
<i>Acacia wickhamii</i>	
<i>Adriana tomentosa</i> var. <i>hookeri</i>	
<i>Androcaloxophylla</i>	
<i>Breynia cernua</i>	
<i>Bridelia tomentosa</i>	amam
<i>Calytrix exstipulata</i>	Kimberley heath, turkey bush
<i>Carissa spinarum</i>	conkerberry
<i>Caesalpinia major</i> (also considered a climber)	Goolyi
<i>Clerodendrum floribundum</i> var. <i>ovatum</i>	
<i>Clerodendrum tomentosum</i> var. <i>mollissima</i>	
<i>Codonocarpus cotinifolius</i>	desert poplar
<i>Crotalaria cunninghamii</i>	green birdflower, minmin, oorlgoo, parrot pea
<i>Croton habrophyllus</i>	
<i>Cullen martinii</i>	
<i>Cyperus bulbosus</i>	bush onion, niarlboon, niyalboon, yarrinyarri
<i>Diospyros rugosula</i>	
<i>Dodonaea hispidula</i>	
<i>Dodonaea platyptera</i>	broad-winged hop bush
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	goorralgar, goowal, snowball bush
<i>Glycosmis</i> sp.	
<i>Gossypium australe</i>	
<i>Grevillea refracta</i>	silverleaf grevillea
<i>Grewia retusifolia</i>	dog's balls, dysentery bush, turkey bush
<i>Gyrostemon tepperi</i>	
<i>Helicteres rhynchocarpa</i>	
<i>Hibiscus apodus</i>	yellow hibiscus
<i>Hibiscus</i> sp.	
<i>Hypoestes floribunda</i> var. <i>varia</i>	musk-scented plant
<i>Keraudrenia exastia</i>	fringed keraudrenia
<i>Luvunga monophylla</i>	
<i>Myoporum montanum</i>	boobialla, gawar, native myrtle
<i>Pavetta kimberleyana</i>	
<i>Phyllanthus reticulatus</i>	
<i>Plumbago zeylanica</i>	
<i>Psydrax pendulina</i>	
<i>Senna costata</i>	ram's horns
<i>Sida hackettiana</i>	golden rod
<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	
<i>Solanum cunninghamii</i>	bunug, langgoorr, nankoorr
<i>Tephrosia rosea</i>	Flinders River poison
<i>Triumfetta</i> sp.	
<i>Trophis scandens</i>	

Scientific name	Common name
Climbers/Vines	
<i>Abrus precatorius</i>	Crab's eye bean
<i>Adenia heterophylla</i> subsp. <i>australis</i>	
<i>Asparagus racemosus</i>	asparagus fern
<i>Canavalia rosea</i>	Jack bean, beach bean
<i>Capparis jacobsonii</i> aff.	
<i>Capparis lasiantha</i>	bush caper
<i>Capparis sepiaria</i>	
<i>Cassytha filiformis</i>	jirrawany, koodikoodi, wagalwagal
<i>Cucumis maderaspatanus</i>	
<i>Cynanchum carnosum</i>	
<i>Flagellaria indica</i>	lawyer vine, supplejack
<i>Gymnanthera oblonga</i>	harpoon bud
<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>	beach morning glory
<i>Jacquemontia paniculata</i>	
<i>Jasminum didymum</i>	
<i>Operculina aequiseipala</i>	
<i>Opilia amentacea</i>	
<i>Parsonsia kimberleyensis</i>	
<i>Sarcostemma</i> sp.	
<i>Sarcostemma viminalis</i>	caustic vine, milkbush
<i>Secamone timoriensis</i>	
<i>Tinospora smilacina</i>	snake vine
<i>Tylophora cinerascens</i>	oyster-catcher bill
<i>Tylophora flexuosa</i>	
<i>Vigna vexillata</i> var. <i>angustifolia</i>	wild cowpea
Hemiparasites (mistletoes)	
<i>Amyema benthamii</i>	
<i>Amyema bifurcata</i>	
<i>Amyema sanguinea</i> var. <i>sanguinea</i>	Christmas mistletoe
<i>Cassytha capillaris</i> (also considered a climber)	
<i>Cassytha filiformis</i> (also considered a climber)	
<i>Dendrophthoe acacioides</i> subsp. <i>acacioides</i>	
<i>Lysiana spathulata</i> subsp. <i>spathulata</i>	
<i>Santalum lanceolatum</i> (also considered a tree)	
Epiphytes	
<i>Cymbidium canaliculatum</i>	tree orchid
Herbs	
<i>Abutilon</i> sp.	
<i>Achyranthes aspera</i>	chaff flower
<i>Amaranthus</i> sp.	
<i>Amaranthus undulatus</i> (formerly <i>A. pallidiflorus</i>)	
<i>Boerhavia dominii</i>	tarvine
<i>Boerhavia</i> sp.	
<i>Cleome viscosa</i>	mustard bush, spider flower, tick weed, wild caia
<i>Crotalaria crispata</i>	walkabout
<i>Crotalaria medicaginea</i>	rattlepods
<i>Cucumis maderaspatanus</i> (formerly <i>Mukia maderaspatana</i>)	Madras sea pumpkin, bristly Bryony
<i>Euphorbia alsiniflora</i>	
<i>Gomphrena pusilla</i>	
<i>Heliotropium</i> sp.	
<i>Indigofera linifolia</i>	
<i>Portulaca oleracea</i>	common purslane, purslane

Scientific name	Common name
Herbs continued	
<i>Polycarpaea</i> sp.	
<i>Polymeria distigma</i>	
<i>Ptilotus lanatus</i> var. <i>lanatus</i>	
<i>Ptilotus nobilis</i> subsp. <i>nobilis</i>	pink mulla mulla
<i>Ptilotus polystachyus</i>	green mulla mulla, seedyhead
<i>Sida</i> sp.	
<i>Spermacoce auriculata</i>	
<i>Tacca leontopetaloides</i>	
<i>Tephrosia rosea</i>	Flinders River poison
<i>Trianthema portulacastrum</i>	giant pigweed
<i>Trichodesma zeylanicum</i>	camel bush
Graminoids (grasses and grass-like plants)	
<i>Bulbostylis barbata</i>	watergrass
<i>Cenchrus biflorus</i> (N.B. This species is a bulbous perennial with annual leaves)	Gallon's curse
<i>Cenchrus elymoides</i>	
<i>Chrysopogon pallidus</i>	ribbon grass
<i>Cymbopogon</i> sp.	
<i>Cyperus bulbosus</i>	
<i>Cyperus nervulosus</i>	
<i>Enneapogon pallidus</i>	conetop nineawn
<i>Eragrostis cumingii</i>	Cumings love grass
<i>Eriachne semiciliata</i>	
<i>Fimbristylis</i> sp.	
<i>Heteropogon contortus</i>	black or bunch speargrass
<i>Perotis rara</i>	comet grass
<i>Setaria apiculata</i>	pigeon grass
<i>Spinifex longifolius</i>	beach spinifex
<i>Triodia bitextura</i>	
<i>Triodia microstachya</i>	
<i>Triodia</i> sp.	
<i>Whiteochloa airoides</i>	creeping panic

APPENDIX 4: MONSOON VINE THICKET CONSERVATION ADVICE

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
Approved Conservation Advice for the
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula

1. The Threatened Species Scientific Committee (the Committee) was established under the EPBC Act and has obligations to present advice to the Minister for Sustainability, Environment, Water, Population and Communities (the Minister) in relation to the listing and conservation of threatened ecological communities, including under sections 189, 194N and 266B of the EPBC Act.
2. The Committee provided its advice on the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community to the Minister as a draft of this approved conservation advice. In 2013, the Minister accepted the Committee's advice, adopting it as the approved conservation advice.
3. The Minister amended the list of threatened ecological communities under section 184 of the EPBC Act to include the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community in the endangered category. It is noted that the ecological community is also listed as the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula on the Western Australian list of threatened ecological communities endorsed by the Western Australia Minister for the Environment.
4. The nomination and a draft description for this ecological community were made available for expert and public comment for a minimum of 30 business days. The Committee and Minister had regard to all public and expert comment that was relevant to the consideration of the ecological community.
5. This approved conservation advice has been developed based on the best available information at the time it was approved; this includes scientific literature, advice from consultations, existing plans, records or management prescriptions for this ecological community.

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Description

Name of the ecological community

This advice follows the assessment of information provided by a public nomination to list the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula as a threatened ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The name reflects that this vegetation type is mainly confined to dunes and other Holocene¹ coastal landforms of the Dampier Peninsula and heavily dependent on wet (monsoon) season rainfall.

Most common names used in this document have been obtained from available flora and fauna reference sources. However, it is recognised that Indigenous people of the Dampier Peninsula have particular names for plant and animal species and these have also been used for certain species.

Location and physical environment

The Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community (hereafter referred to as the Dampier Monsoon Vine Thickets or the ecological community) represents certain occurrences of monsoon vine thickets in the southwest Kimberley region of Western Australia (within the Dampierland bioregion). The ecological community is predominantly restricted to the coastlines of the Dampier Peninsula from Broome in the south to One Arm Point in the north and on the northeastern coast of the Peninsula from One Arm Point to Goodenough Bay. The ecological community represents the most southern occurrences of rainforest type vegetation in Western Australia. The extent of the ecological community corresponds to country (the traditional lands) of the Bardi Jawi, Djabera Djabera, Goolarabaloo, Jabirr Jabirr, Nyul Nyul and Yawuru Indigenous people and the ecological community is of cultural significance.

The Dampier Monsoon Vine Thickets occurs in the south-west Kimberley region of Western Australia. The distribution of the ecological community lies within the Dampierland bioregion (subregion DL2–Pindanland) (Interim Biogeographic Regionalisation for Australia — IBRA V7). The ecological community wholly occurs in the Kimberley subregion of the Rangelands Natural Resource Management region.

The Dampier Peninsula is bounded by the Indian Ocean on the west coast, King Sound on the east coast and the Great Sandy Desert to the south. The Dampier Peninsula has a low gradient, which gradually rises to a maximum elevation of 247m above sea level (asl) at approximately 60 km northeast of Broome. Due to the low elevation, seasonal runoff tends to form sheets, with water pooling in areas behind the coastal dune system.

The upper soil profiles of the Dampier Peninsula are predominantly comprised of extensive red pindan² sandplains of mixed river-deposited and wind-blown sediments, which formed during the Quaternary³ period on desert dune sandstone. The uniform clayish sands, ranging from red to yellow-grey, form extensive undulating plains with little or no surface drainage. In some areas, such as near Broome, the pindan soil is overlain by more geologically recent unconsolidated sand.

¹ The Holocene epoch started approximately 12 000 years BP (before present day) following the last glacial period.

² Pindan refers to the geology and vegetation that forms the transitional zone between the wetter monsoon forests of the north Kimberley and the Great Sandy Desert to the southeast, exhibiting a mix of monsoonal and arid species.

³ The Quaternary period commenced approximately 2.6 million years BP. It includes the Holocene epoch and the preceding Pleistocene epoch.

The interior plains of the Dampier Peninsula are dominated by pindan, a woodland of mainly eucalypts and a varying middle layer of acacias (Kenneally et al., 1991; Barrett, pers. comm., 2012). Coastal areas also contain samphire flats, mangroves, paperbark thickets and monsoon vine thickets (Kenneally et al., 1991).

The coastal dune environment, being largely of sand, has minimal soil development and is susceptible to erosion from various sources including rising tides, strong winds and cyclonic activity. Tides of the Dampier Peninsula range up to 11 m and are a major factor affecting the coastal environment where the ecological community occurs.

The Dampier Monsoon Vine Thickets is particularly associated with Holocene sand dunes and other coastal geological formations (Black et al., 2010). The Holocene sand dunes are typically stable, however, a few are active and encroach inland (Kenneally et al., 1996). The Holocene sand dunes typically have deep white (but may range through to pink) or grey calcareous coastal sands, often containing marine shells. Most patches of the ecological community occupy the leeward slopes and swales and sometimes the exposed crests. Some patches may extend landward onto the red-soil pindan plains.

Climate

The Dampier Peninsula is located between the Great Sandy Desert to the south and the monsoonal tropics to the north. It has a tropical climate with distinct wet and dry seasons and varies between hot, and very dry, to hot, and very wet.

The ecological community's area of occupation is closely associated with the Holocene dunes on the Dampier Peninsula coast with the southern-most limit of patches occurring close to the 600 mm isohyet near Broome. The arid limit of rainforest is generally restricted by this precipitation gradient (Webb and Tracey, 1981; Russell-Smith, 1991; Bowman, 2000). Patches may occur on similar sandy substrates, such as pindan, if sufficient moisture is present.

Although the wet season commences in October, the majority of annual rainfall on the Dampier Peninsula typically occurs from December to March. Annual median rainfall for the Peninsula occurs from up to 718 mm per year in the north (Cape Leveque) to 532 mm per year in the south (Broome) with yearly variation ranging from 20% to 40%. The dry season commences in April.

Daytime temperatures are consistently high throughout the year. However, there is variation between wet and dry seasons (Table 1). During the early dry season, cooler overnight temperatures occur. Heavy fogs can occur along the Dampier Peninsula coast during the dry season, especially in the southern range of the ecological community (Kenneally et al., 1991; BOM, 2011).

Table 1: Temperature variation for the Dampier Peninsula (BOM, 2012).

Location	Season	Min Av. temp range °C	Max av. temp range °C
Broome (South)	Dry	15–18	30–33
	Wet	24–27	33–36
Cygnet Bay (North)	Dry	18–21	33–36
	Wet	24–27	33–36

Indigenous people of the region recognise six seasonal differences throughout the year that are associated with marine and terrestrial resources (Kenneally et al., 1996). The seasons for three Indigenous groups are shown in Table 2, some of which overlap:

Table 2: Indigenous seasons for the Dampier Peninsula (McKenzie et al., 1991; Kenneally et al., 1996; Goolarabooloo, 2011; Yawuru, 2011).

	January	February	March	April	May	June	July	August	September	October	November	December
Group												
Yawuru	Man-gala The WET. Strong northwest winds. Plants grow fast. Ngaliwany (<i>Persoonia falcata</i>) and gabiny (<i>Terminalia ferdinandiana</i>) fruiting. Reef fish are fat. Turtles lay eggs. Barn swallows and swifts flying, insects abundant, snakes and lizards are out			Marrul Changing season. Little wind or rain, Humidity drops. Large tides, reef fish & shellfish are skinny Lizards are fat. Lots of mayi (bushfruit). Tadpoles become frogs; Puddles dry up.		Wirralb-uru Cooling Season. SE winds start. Lizards hibernate.	Barrgana Cold Season. Strong dry SE winds and dust storms. Whales start arriving. Walga-walga (bluenose salmon) gurlban (mullet) and nganarr (dugong) are fat. Jiribuga (echidna), langgurr (possum) and barrjarniny (agile wallaby) are fat. Lizards hibernate. Ngamagarr (little corella) eggs hatch. Jigal tree flowering, sweet nectar.		Wirlburu Warming up season. Westerly winds start. Birds feed on yarrinyarri (<i>Cyperus bulbosus</i>). Lizards (skinny) emerge from hibernation. Acacia bear seedpods.	Laja Hot time. Build up to wet season. Birndany (stingray) reef fish & shellfish are fat. Turtles are mating. Yaminyarri; gubiny and gunurru (<i>Corymbia flavescens</i>) flower. Seeds & pods are collected for drying & roasting. Ngaliwany fruiting.		Man-gala
Goolarabooloo	Mankala Storms. Plants growth is rapid. Yarrinyarri (<i>Cyperus bulbosus</i>) shoots. Gubinge (<i>Terminalia ferdinandiana</i>) fruiting. Insects are abundant. Pools are full of tadpoles. Nimanburr (flying fox) in large groups. Snakes are everywhere; lizards are too skinny to hunt.			Marul Weather hot and humidity high. Rains stop soon. Lizards are fat. Carpet snake have their young. Tadpoles become frogs. Birds feed on minmin nectar (<i>Crotalaria cunninghamii</i>).		Wirralburu SE winds start. Waterholes drying up. Yarrinyarri are dug up and eaten. Sandpaper fig (<i>Ficus</i> spp.) fruit abundant. Reef fish are skinny. Lizards still fat and start to dig their holes.	Barrgana Cold time. Whales are migrating north. Southeast winds blow strongly and sometimes occasional light rain. Small duststorms. Lizards hibernate. Yarrinyarri are plentiful, conkerberry (<i>Carissa spinarum</i>) fruiting, jigal trees (<i>Bauhinia cunninghamii</i>) are flowering.		Wilburu The weather starts to warm. Low spring tides good for reef walking to get bream, sea perch and snapper. Shellfish are fat and mangrove crabs.	Larja Hot time, the air is humid, building up to the wet. Moonga (native honey) available in jigal. Gubinge and gumamu (<i>Santalum lanceolatum</i>) in flower. Stingrays are fat. Reef fish and shell fish are fat Mating time for turtles.		Mankala

	January	February	March	April	May	June	July	August	September	October	November	December
Group												
Bardi	Mankal Wet season. Strong winds and storms from the ocean. Little fruit except gamooloon (<i>Persoonia falcata</i>).	Ngalandany Season of no fruit. High temperature and humidity, little wind.	Iralboo King tides, ideal for reefing. Much available fruit including iidool (<i>Pandanus spiralis</i>). Goannas, caterpillars, grasshoppers & kangaroos are fat. When the biilarl (<i>Corymbia greeniana</i>) flower, dugong hunting season begins. Southeast winds begin towards April.			Barrgana Cold season. Southeast winds blow. Gaamba (nuts) of iidool are red and indicate it is dugong hunting season. Many fish are fat. Not good tides for reefing. Many resources available including honey, snakes, wallaby, lizards and fruits including joongoon (<i>Mimusops elengi</i>).		Jalalay Short warming up season. Dugong season ends. Low spring tides good for reefing. Garnboor (<i>Melaleuca dealbata</i>) flowers indicate the stingrays are fat.		Lalin Build up to the wet, hot and humid. "Married turtle time" and turtle hunting season. Iilarr (<i>Syzygium eucalyptoides</i>) available. Winds shift from westerly to strong northwest bringing the rain.		Mankal

Vegetation

The Dampier Monsoon Vine Thickets occurs as discontinuous patches of dense vegetation and contains approximately 23% of vascular plant species that occur on the Dampier Peninsula (Black et al., 2010). The degree of the ecological community's fragmentation reflects the natural distribution and influences from the surrounding environment. The patches are usually located within the swales on the leeward side of the coastal Holocene dune systems. Patches tend to be larger with increasing dune size (Kenneally et al., 1996; Harding et al., 2009). Outliers may occur on different substrates where other factors, such as moisture availability, support the ecological community (Black et al., 2010; Tim Willing pers. comm., 2011). In the absence of fire, the ecological community can often form a continuous link with adjacent fire-prone communities (Russell Barrett, pers. comm., 2012).

Dampier Monsoon Vine Thickets are considered a rainforest subset ranging from semi-deciduous vine thickets to closed semi-deciduous vine forest. The ecological community contains deciduous, semi-deciduous and evergreen perennial flora species. Patches in the higher rainfall zone (e.g. Cape Borda and Cape Leveque) tend to be the most species rich and can extend onto pindan soils, particularly in the lee of dunes. These patches tend to have a much more dense canopy and be characterised by co-dominant evergreen tree species in the overstorey. The ground layer is often sparse or absent. Patches of the ecological community in the lower rainfall zone, as well as those generally situated on low dunes and other exposed locations, are mostly depauperate in evergreen trees and have a more open canopy and shrubby structure.

The ecological community provides an important habitat for a number of plant species. For example, the vine *Parsonsia kimberleyensis* is at the southern-most limit of its range within the ecological community along with *Glycosmis* sp. and the deciduous shrub *Croton habrophyllus* (Kenneally et al., 1996). The small tree, *Vitex glabrata* (bush currant) is only known to occur on the Dampier Peninsula in the ecological community (Black et al., 2010).

The Dampier Monsoon Vine Thickets shares species with some adjacent ecological communities that it intergrades with. For example, *Acacia* spp. are common in the ecological community and the adjacent pindan. The related transition zones also provide habitat for restricted species such as the Kimberley endemic shrub *Helicteres rhynchocarpa*. In addition the southern-most range of the shrub *Trophis scandens* corresponds with habitat adjacent to the Dampier Monsoon Vine Thickets (Black et al., 2010).

The Dampier Monsoon Vine Thickets has an abundance of fruiting plants and these are dependent on the movement of frugivorous animals between patches for seed dispersal, maintaining essential plant species migration and gene flow. Tree and shrub species that are dependent on this type of dispersal include *Diospyros humilis* (ebony wood), *Exocarpos latifolius* (mistletoe tree), *Ficus virens* (banyan fig), *Flueggea virosa* subsp. *melanthesoides* (snowball bush), *Mallotus nesophilus* (yellow ball flower), *Mimusops elengi* (mamajen), *Sersalisia sericea* (formerly *Pouteria sericea*) (mangarr) and *Terminalia petiolaris* (marool/nawulu or blackberry tree) (Kenneally et al., 1996).

Canopy layer (overstorey) – trees and vines

The canopy of the ecological community is typically dominated by a mix of several tree or tall shrub species which, depending on the landscape position and microclimate, may be deciduous, semi-deciduous or evergreen (Appendix B, Table B1). A patch can be occasionally dominated by a single tree species such as ebony wood or *Celtis philippensis* (goolnji).

The canopy height of the ecological community typically ranges from three metres in exposed beach and headland positions, up to nine metres where large sand dunes provide more sheltered valleys on the swale or lee side. Emergent tree species may extend beyond the canopy.

Typical overstorey trees include: goolnji, ebony wood, mamajen, mangarr, *Terminalia ferdinandiana* (gabiny/gubinge/kabiny) and blackberry tree/marool/ nawulu. The species composition of the tree canopy can be variable and may also include genera such as *Acacia*, *Corymbia*, *Eucalyptus*, *Hakea* and *Melaleuca* (Black et al., 2010). Many of the individual canopy species are more widespread and have ranges that extend outside the Dampier Peninsula.

Mid layer (understorey) – medium to tall shrubs and low trees

The mid layer, when present, can contain scattered semi-deciduous fruiting shrubs and small trees. Typical plant species present in the mid layer of the Dampier Monsoon Vine Thickets include: *Breynia cernua*, *Bridelia tomentosa*, *Croton habrophyllus*, *Dodonaea platyptera* (broad-winged hop bush), *Exocarpos latifolius* (mistletoe tree), snowball bush, *Pandanus spiralis* (common screwpine), and *Santalum lanceolatum* (tropical sandalwood).

Vines

Vines/climber species can be present in all layers of the ecological community. While vines are not the dominant component of the ecological community, they typically comprise up to 25% of the native perennial plant species richness in it. Vine species mainly occur with other tree and shrub species and are often inconspicuous, particularly during the dry season when they are leafless or die back to rootstocks. Common vines/climbers include: *Abrus precatorius* (crab's eye bean), *Adenia heterophylla*, *Caesalpinia major*, *Capparis lasiantha* (bush caper), *Jacquemontia paniculata*, *Jasminum didymum*, *Tinospora smilacina* (snake vine) and *Tylophora cinerascens* (formerly *Marsdenia cinerascens*) (oyster-catcher bill).

Ground Layer

The ground layer of the Dampier Monsoon Vine Thickets is generally shaded and often with a layer of leaf litter or dark organic matter of up to six centimetres in depth on the soil surface. Where the canopy is mostly intact, the ground layer is usually very sparse. Canopy shading combined with dense leaf litter, generally prevents annual grasses from establishing. Patches with closed canopies lack native grass or fern species in their interiors. Annuals are mainly absent in closed canopy patches particularly during the dry season. Where the canopy is more open, annuals may occur during the wet season (Appendix B, Table B1).

Fauna

Compared to the adjacent open vegetation occurring over the majority of the Dampier Peninsula, the relatively dense, closed canopy of the Dampier Monsoon Vine Thickets provides a shady and humid microclimate. This relatively moist environment provides refuge for animals particularly during the dry season when fires in the landscape are more frequent (Johnstone and Burbidge, 1991; Kendrick and Rolf, 1991; Price, 2004). The abundance of fruiting plants within the ecological community also provides relatively rich food resources for many taxa. No fauna are known to be endemic to the ecological community on a national scale, but some species are endemic at a regional level and many species occur both in the ecological community and surrounding vegetation types. The following description identifies fauna that have been recorded in, and/or are known to utilise, the ecological community.

Birds recorded in the ecological community include *Aprosmictus erythropterus* (red-winged parrot), *Coracina novaehollandiae* (black-faced cuckoo-shrike), *Geopelia humeralis* (bar-shouldered dove), *Myiagra ruficollis* (broad-billed flycatcher), *Pachycephala melanura* (mangrove golden whistler), *Ptilinopus regina* (rose-crowned fruit-dove; red-crowned pigeon), *Ptilonorhynchus nuchalis* (great bowerbird), *Scythrops novaehollandiae* (channel-billed cuckoo), as well as dollar birds and honeyeaters (Johnston and Johnstone, 1983; Burbidge, 1991; Kenneally et al., 1996; Environs Kimberley, 2009; Biota Environmental Services, 2010b;

Black et al., 2010). In Western Australia, the frugivorous rose-crowned fruit-dove is at its southern most limit on the Dampier Peninsula and in this location it is restricted to the ecological community (Johnstone, 1983; Black et al., 2010).

The Dampier Monsoon Vine Thickets is characterised by a large number of bats, both micro-chiropteran (insectivorous) and mega-chiropteran (frugivorous), and frugivorous birds (McKenzie, 1991; Black et al., 2010). Many of these species are associated with fruiting plants within the ecological community. Species recorded in the ecological community include *Chalinolobus gouldii* (Gould's wattled bat), *Chalinolobus nigrogriseus* (hoary wattled bat), *Nyctophilus arnhemensis* (Arnhem long-eared bat) and *Scotorepens greyii* (little broad-nosed bat) (Biota Environmental Services, 2010). Additionally more than 15 species of bats have been recorded within vegetation adjacent to the ecological community (McKenzie, 1991). Given that bats are typically seasonal in their use of complementary (surrounding) habitats it is likely there is a seasonal reliance on the ecological community for food, particularly for frugivorous bats such as *Pteropus alecto* (black flying fox) (Kenneally et al., 1996; Palmer et al., 2000).

Other mammals recorded in the Dampier Monsoon Vine Thickets include *Macropus agilis* (agile wallaby), *Pseudomys delicatulus* (delicate mouse) and *Nyctophilus arnhemensis* (Arnhem long-eared bat) (McKenzie, 1991; Biota Environmental Services, 2010). Species such as *Hydromys chrysogaster* (water rat) and *Trichosurus vulpecula* (northern brush-tailed possum) are highly likely to utilise vine thickets for habitat and foraging. Other species that have been recorded on the Dampier Peninsula that have the potential to periodically use vine thickets for habitat or refuge include: *Canis lupus dingo* (dingo), *Macrotis lagotis* (bilby, dalgyte), *Petaurus breviceps* (sugar glider, bollanga), *Planigale maculata* (northern planigale) and *Pseudomys nanus* (western chestnut mouse).

Reptiles recorded in the ecological community include *Ctenotus inornatus*, *Eremiascincus isolepis* and *Lerista bipes*. Although these reptiles are known to occur in many other vegetation types, they are characteristic fauna species within some vine thicket patches. The endemic *Simoselaps minimus* (Dampierland burrowing snake) also occurs in the ecological community and possibly in the sandy junction between the dunes and adjacent pindan. It is likely that this species preys on skinks from the *Lerista* genus. Detailed investigation of amphibians within the ecological community has not occurred, but *Platyplectrum ornatus* (ornate burrowing frog) has been recorded within the Dampier Monsoon Vine Thickets (Biota Environmental Services, 2010).

While there has been limited assessment of the richness of all invertebrate fauna within the ecological community, invertebrates are diverse across the region (Johnstone and Burbidge, 1991; McKenzie and Dyne, 1991; Naumann et al., 1991; Solem, 1991). For example, within the Dampier Monsoon Vine Thickets, Fisher et al. (in prep) recorded approximately 70 species of ants from the following subfamilies: Myrmicinae, Dolichoderinae, Formicinae, Ponerinae, Ectatomminae, Cerapachyinae and Pseudomyrmecinae. Characteristic species include *Oecophylla smaragdina* (green tree ant). There is also a high diversity of land snails recorded from Kimberley vine thickets, such as *Eremopeas interioris* (outback awlsnail), *Gastrocopta pediculus* (syn. *G. simplex*; weakly toothed pupasnail), *Nesopupa scotti* (syn. *Pupa mooreana*; blunt golden pupasnail), *Pupisoma orcula* (oriental toothless pupasnail) and *Quistrachia leptogramma* (McKenzie et al., 1991).

A broader list of fauna species recorded or likely to occur in the Dampier Monsoon Vine Thickets is in Appendix B, Table B3.

Key diagnostic characteristics and condition thresholds

National listing focuses legal protection on remaining patches of the ecological community that are most functional, relatively natural (see ‘Description’) and in relatively good condition. Key diagnostic characteristics and condition thresholds assist in identifying a patch of the threatened ecological community and when the EPBC Act is likely to apply to the ecological community. They provide guidance for when a patch of a threatened ecological community retains sufficient conservation values to be considered as a Matter of National Environmental Significance, as defined under the EPBC Act. This means that the referral, assessment and compliance provisions of the EPBC Act are focussed on the most valuable elements of Australia’s natural environment, while heavily degraded patches will be largely excluded.

Although significantly degraded or modified patches are not protected as the ecological community listed under the EPBC Act, it is recognised that patches that do not meet the condition thresholds may still retain important natural values. Therefore, these patches should not be excluded from recovery and other management actions (also see ‘Surrounding environmental and national context’).

Plant surveys conducted during the wet season will more easily identify the ecological community. However, accessibility is likely to be restricted due to weather conditions. Therefore, the Key Diagnostic Characteristics and Condition Thresholds are designed to identify the ecological community throughout the year.

The national ecological community is limited to patches that meet the following key diagnostic characteristics and condition thresholds:

Step 1 Key diagnostic characteristics

The key diagnostic characteristics for the Dampier Monsoon Vine Thickets are as follows:

- Distribution occurs within the Dampierland bioregion – mostly in the Pindanland subregion DL2 (IBRA⁴).
- The ecological community is mainly restricted to the deep white or grey calcareous sands of the coastal Holocene dunes of the Dampier Peninsula.
- The ecological community mainly occurs within the swales and on the leeward side of the coastal dunes and occasionally on the crests of these dunes and other coastal landforms such as: beach fronts, sand-spit headlands and storm ridges with intertidal flats (Black et al., 2010).
- Outliers may occur on different substrates within the DL2 subregion e.g. on pindan soil the ecological community may establish following dispersal of key species by frugivores and where these patches are buffered from moisture loss and fire.
- The overstorey (canopy) typically shows the following features:
 - The overstorey typically ranges from three to nine metres tall and may consist of trees, tall shrubs and/or climbers/vines.
 - The tree canopy composition is variable but the most common species are typically one or more of the taxa *Bauhinia cunninghamii* (jigal, joomoo), *Celtis philippensis* (goolnji), *Diospyros humilis* (ebony wood), *Exocarpos latifolius* (jarnba, mistletoe tree), *Grewia breviflora* (goolmi, currant/coffee fruit), *Mallotus nesophilus* (yellow ball flower), *Mimusops elengi* (joongoon, mamajen), *Sersalisia sericea* (mangarr), *Terminalia ferdinandiana* (gabiny, gubinge, kabiny) and *Terminalia petiolaris* (blackberry tree, marool, narwulu).

⁴ IBRA: Interim Biogeographic Regionalisation for Australia V7

- The understorey shows the following features:
 - Shrub and small tree species when present include: *Breynia cernua*, *Bridelia tomentosa*, *Caesalpinia major* (goolyi), *Croton habrophyllus* (ankoolmarr), *Dodonaea platyptera*, snowball bush and *Santalum lanceolatum*.
 - The ground layer is generally sparse to absent but may contain a variety of herbaceous species depending on seasonal conditions, site characteristics and canopy density.
 - Native grass species are uncommon but may occur on the edges of vine thicket patches or in open groves. When present they typically include annual species (Appendix B, Table B1) such as *Perotis rara* (comet grass) and *Setaria apiculata* (pigeon grass).
- Vines and creepers are often, but not always, present in the overstorey and/or understorey and when present include the following: crab's eye bean, *Adenia heterophylla* subsp. *australis*, *Capparis lasiantha* (ngoorla, bush caper), *Jacquemontia paniculata*, *Jasminum didymum*, *Tinospora smilacina* (oondal, snake vine) and *Tylophora cinerascens* (oyster-catcher bill).
- The following genera/species often present in other rainforest/vine thicket types in northern Australia, are typically absent or uncommon in the ecological community: *Albizia lebbbeck*, *Bombax ceiba*, *Cryptocarya cunninghamii*, *Elaeodendron melanocarpum*, *Ganophyllum falcatum*, *Vitex acuminata* and *Ziziphus quadrilocularis*. The understorey of other northern vine thicket patches also contain shrub species that are absent from the ecological community, such as those from the genera *Alectryon*, *Denhamia*, *Micromelum*, *Murraya*, *Strychnos*, *Trema* and *Wrightia*.

Step 2 Condition thresholds

The national ecological community comprises those patches that meet the key diagnostic characteristics and the following condition thresholds.

Native vegetation cover:

Canopy Layer

- 50% or more of the total cover of the canopy comprises perennial native species.

Understorey

- 50% or more of the total vegetation cover⁵ in the ground and mid layers comprises perennial native species.

Survey Considerations

Landuse history will influence the state in which a patch of the ecological community is expressed. The surrounding vegetation will also influence how important a patch of the ecological community is in the broader landscape.

Defining a Patch

A patch is defined as a discrete and continuous area of the ecological community. However, a patch may include small-scale disturbances, such as tracks or breaks, watercourses or small-scale variations in vegetation that do not significantly alter its overall functionality (functionality here refers to processes such as the movement of wildlife and pollinators, the dispersal of plant propagules, activities of seed and plant predators and many others).

Buffer zone

To assist in the preservation of the patch, it is recommended that a buffer zone be maintained from the outer edge of the patch. It is recommended that a buffer zone of at least 50 m from the

⁵ Total vegetation cover includes all vascular plants but **not** mosses, lichens, liverworts, plant litter or bare ground.

edge of the canopy cover be applied to the Dampier Monsoon Vine Thickets. The purpose of the buffer zone is to protect and manage the patch and to help avoid potential significant impacts to the ecological community. The buffer zone will help protect the patch edges and the ecological community from weed impacts and take into consideration appropriate fire management. Changes in land-use within the buffer zone must not have a significant impact on the ecological community, but there are exemptions for continuing use.

Revegetated areas

Revegetated or replanted sites are not excluded from the listed ecological community so long as the patch meets the key diagnostic characteristics and condition thresholds above.

Timing of surveys

The season of surveys is important because the ecological community can be variable in its appearance throughout the year and between years depending on hydrological inputs e.g. precipitation. Assessment should occur at a time of year where the greatest number of species is likely to be detectable. The edge of the patch can vary in appearance after a hot fire. It is important to note what kind of disturbance may have happened within a patch and when that disturbance occurred, as far as possible. Timing of surveys should also consider the detectability of flora species at different times of their life cycle, or their recovery after recent disturbances (natural or human-induced) to the ecological community.

Sampling protocols

Patches can vary in size and species makeup. The recommended sampling protocol involves developing a quick/simple map of the vegetation, landscape qualities and management history (where possible) of the site. The site should be representatively sampled for vegetation cover.

Surrounding environment and landscape context

In the context of actions that may have ‘significant impacts’ and require approval under the EPBC Act, it is important to consider the habitats that surround patches that meet the condition thresholds. The condition thresholds outlined above are the minimum level at which patches are to be considered under the EPBC Act for actions that may require approval. These thresholds do not represent the ideal state of the ecological community. Patches that are larger, more species rich and less disturbed may provide greater biodiversity value. Additionally, patches that are spatially linked, whether ecologically or by proximity, are particularly important as wildlife habitat and to the viability of those patches of the ecological community into the future.

Connectivity between remnants of the ecological community and with other native vegetation remnants is an important determinant of habitat quality at the landscape scale for native flora and fauna, as well as the overall condition of the ecological community. For flora, connectivity varies with the species in question. Generally it is important as it increases pollination and spread of propagules among individuals and populations. In addition, the diversity and abundance of fauna may depend on connectivity of a patch of the ecological community to other remnant vegetation.

In contrast, other patches that meet the condition thresholds occur in isolation and require protection or priority actions to link them with other patches. Other patches that are interconnected to similar native vegetation associations that may not, in their current state, meet the condition thresholds have additional conservation value. Therefore, the following indicators should be considered when assessing the impacts of actions or proposed actions under the EPBC Act, or when considering recovery, management and funding priorities for a particular patch:

- Evidence of recruitment of key native species or the presence of a range of age cohorts;
- Good faunal habitat as indicated by patches containing fruiting species, cover, refuge, contribution to movement corridors;
- Species richness, as shown by the variety and proportion of native flora and the diversity of fauna species present;
- Presence of listed threatened species;
- Areas of minimal weeds and feral animals, or where these can be managed easily; and/or,
- Patches that are in areas where the ecological community has been heavily degraded, or that are at the natural edge of its range, or local species assemblages that are representative of unique variants of the ecological community.

Area critical to the survival of the ecological community

Areas that meet the key diagnostic characteristics and condition thresholds plus the buffer zone are considered critical to the survival of Dampier Monsoon Vine Thickets. Additional areas such as adjoining native vegetation or areas that meet the description of the ecological community but not the condition thresholds are also considered important to the survival of the ecological community.

Individual patches and patch groups operate as an ecological network, with bird and mammal frugivore species playing key roles in connectivity (Black et al., 2010). Trees, shrubs and vines that produce copious amounts of fruit are important to the viability of the ecological community. Black et al. (2010) recommend the protection of all *Canarium australianum* (jalgir), *Ficus virens* trees (albay, banyan or strangler fig), hybrids of *Terminalia ferdinandiana* x *petiolaris* (barragool, gariling or red gubinge) and *T. petiolaris* (marool or blackberry). Woodlands, mangroves and other adjacent ecological communities are likely to play a

significant complementary role in the provision of food and habitat resources for mobile frugivores (Black et al., 2010) and thereby contribute to the maintenance of connectivity.

It is also important to consider the surrounding environment and landscape context outlined on page 14.

Geographic extent and patch distribution

While there has been no detailed modelling of the likely pre-European distribution of the ecological community, it has been estimated that the ecological community formerly occupied up to 2800 ha (Black et al., 2010; DEC, unpublished).

The current extent of the ecological community is estimated to range from 2300 to 2685 ha, based on recent vegetation surveys (Black et al., 2010; DEC, unpublished). The majority of patches (94%) are less than 100 ha in size (Table 3).

Table 3. Patch size distribution for the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community in relation to thresholds for fragmentation in Criterion 2 under the EPBC Act.

Thresholds		Size range (ha)	No. patches	% patches	Cumulative %	
Restricted	Very Restricted	< 10	28	36.4	36	94
		> 10-100	44	57.1		
		> 100	5	6.5		
		Total	77	100		

Source: analysis of known patches of the ecological community based on data from Fisher et al. (unpublished).

National context and existing protection

The Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula is listed as a vulnerable ecological community on the state's list of threatened ecological communities endorsed by the Western Australia Minister for the Environment. The state-listed ecological community corresponds with the description and known distribution of the national ecological community, although the state-listed ecological community does not specify condition thresholds. Under the Western Australian *Wildlife Conservation Act 1950*, individual species of plants and animals are also protected.

The Dampier Monsoon Vine Thickets contains habitat for at least four threatened fauna species listed under the EPBC Act (Appendix B, Table B3) and at least five threatened flora species listed under the *Wildlife Conservation Act 1950* (Appendix B, Table B2).

The National Heritage listing of West Kimberley overlaps within the northern end of the Dampier Peninsula; however, the Dampier Monsoon Vine Thicket patches are not part of the Heritage listed area.

Further details on national context including level of protection in reserves can be found at Appendix D.

Summary of threats

The key threats to the ecological community are summarised below:

- Inappropriate fire regimes. Fires are severely impacting the ecological community causing changes in species composition and patches to contract over time.
- Invasive species. Feral animals browse and damage native vegetation plus eat native or displace fauna. Weed species are replacing native species, changing vegetation structure and altering fire regimes causing patches to decline over time.
- Clearance and disturbance. This can further fragment or degrade remaining patches, increasing the risk of patches becoming more isolated and vulnerable to local extinction.
- Altered hydrology. Developments can impact on local microclimates, groundwater access and surface runoff changing hydrological input for vegetation.
- Climate change. Trends suggest that increased frequency and severity of weather events are likely to adversely affect the hydrological and fire regimes operating on the ecological community.

A detailed description of key threats is at Appendix E.

Summary of eligibility for listing against EPBC Act criteria

Criterion 1 – Decline in geographic distribution

The Assessment against criterion 1 for the Dampier Monsoon Vine Thickets is as follows:

- The ecological community occurs as naturally fragmented patches from Broome in the south-west to One Arm Point in the north to Goodenough Bay in the south-east of the Dampier Peninsula.
- The pre-European extent of the ecological community was estimated to be about 2800 ha.
- The current extent of the ecological community is estimated to be between 2300 and 2685 ha.
- The decline in extent of the ecological community is in the order of 4.1 to 18%.

The ecological community has not undergone a significant decline in its geographic distribution. Therefore, the ecological community is **not eligible** for listing in any category under this criterion.

Criterion 2 – Small geographic distribution coupled with demonstrable threat

The Assessment against criterion 2 for the Dampier Monsoon Vine Thickets is as follows:

- The extent of occurrence is estimated to be about 194 700 ha, which is generally indicative of a limited geographic distribution.
- The area of occupancy is presently estimated to be up to 2685 ha, indicative of a restricted geographic distribution.
- The majority (94%) of known patches of the ecological community are less than 100 ha in size and (36%) are less than 10 ha in size. This is also consistent with a restricted geographic distribution.
- The ecological community is subject to ongoing and demonstrable threats as identified above, and detailed in Appendix E. The threats could cause the ecological community to be lost in the medium-term future.

The ecological community has a restricted distribution, on the basis of fragmented patch size and area of occupancy, and that it is subject to a range of ongoing threats that could cause it to be lost in the medium-term future. Therefore, the ecological community has demonstrated to have met the relevant elements of Criterion 2 to make it **eligible** for listing as **vulnerable**.

Criterion 3 – Loss or decline of functionally important species

There is little information about the ecological roles and functional importance of species that are specific to the Dampier Monsoon Vine Thickets. Therefore, the ecological community is **not eligible** for listing in any category under this criterion.

Criterion 4 – Reduction in community integrity

Indicators of reduction in community integrity for the Dampier Monsoon Vine Thickets are as follows:

- The existing patches of Dampier Monsoon Vine Thickets are naturally fragmented. About 94% of the known 77 patches are less than 100 ha in size.
- Many of the plant species in the ecological community are fire sensitive and do not readily recover. Repeated uncontrolled fires are impacting many patches over short intervals with a median number of 4.5 fires per patch over the decade 2000–2010. As many of the patches have a high edge to area ratio due to their generally linear shape, edges are in decline, further reducing core areas. An increase in the frequency and intensity of fires, particularly in the late dry season can lead to a loss of plant diversity, canopy cover and

ground cover. This in turn can lead to increased invasion of the patch core by transformer weeds, such as invasive grasses and vines, which promote further fires.

- A range of weeds has the potential to smother and outcompete native plants in the ecological community. Weeds have been recorded in approximately 60% of surveyed patches. Many of the weeds in the Dampier Monsoon Vine Thickets are well established, highly invasive and can alter fire regimes to the edges and core of the ecological community.
- In addition to the impacts of altered fire regimes and weed invasion, other disturbances are acting on the ecological community. These include feral populations of domestic stock, which can reduce canopy cover, remove native regrowth and directly disrupt the effective regeneration of plant species. Predators, such as cats can impact native fauna by direct predation or competition for resources.

The effects of severe fragmentation, the small size and isolation of most remnants, the combined impacts from inappropriate fire regimes, invasive weeds and pest animals have severely reduced the community's integrity, disrupted ecological processes and consequently impaired its ability to respond to natural and anthropogenic pressures.

The reduction in integrity experienced by the ecological community is **severe** and regeneration is unlikely in the near future. Therefore, the ecological community is **eligible** for listing as **endangered** under this criterion.

Criterion 5 – Rate of continuing detrimental change

There are no quantitative data about the rate of continuing detrimental change for the Dampier Monsoon Vine Thickets over the immediate past or projected for the immediate future. Therefore, the ecological community is **not eligible** for listing in any category under this criterion.

Criterion 6 – Quantitative analysis showing probability of extinction

There are no quantitative data available to assess this ecological community under this criterion. Therefore, it is **not eligible** for listing under this criterion.

Further details about how the ecological community was judged against the EPBC Act listing criteria can be found at Appendix F.

PRIORITY RESEARCH AND CONSERVATION ACTIONS

Research priorities

Research priorities that would inform future regional and local priority actions for the Dampier Monsoon Vine Thickets include:

- Research the most effective control methods for the most damaging weed species that infest the ecological community e.g. neem (*Azadirachta indica*), buffel grass (*Cenchrus ciliaris*), horehound (*Hyptis suaveolens*), coffee bush (*Leucaena leucocephala*), hairy morning glory (*Merremia dissecta*) and wild passionfruit (*Passiflora foetida*).
- Investigate the importance of landscape scale gene flow and its implications for management of remnants, associated fauna, plant and animal interactions and longer term ecological function. This includes research into optimal distances between remnants and remnant sizes that are crucial for a range of flora and fauna movements.
- Design and implement a monitoring program or support and enhance existing programs for the ecological community and associated threatened species.
- Undertake or support and enhance existing survey programs to locate and map remnants and other occurrences of the ecological community, as well as identify key fauna species and threatened species that occur in the ecological community.
- Undertake or support research, monitoring and evaluation to determine the relative biodiversity, conservation benefits of remnants, areas of regeneration and supplementary planting.
- Assess the vulnerability of the ecological community to climate change.
- Undertake or support analysis of the hydrological needs of the ecological community including groundwater and occult precipitation.

Priority recovery and threat abatement actions

The following priority recovery and threat abatement actions should be implemented to support the recovery of the Dampier Monsoon Vine Thickets:

Habitat Loss, Disturbance and Modification

- Protect and conserve remaining areas of the ecological community. Further clearance of this endangered ecological community should be avoided.
- Maintain and reconnect wildlife corridors or linkages and ensure that areas of particularly high quality, connectivity or importance in a landscape context, are protected.
- Monitor the progress of recovery, through improved mapping, estimates of extent and condition assessments of the ecological community.
- Develop and implement appropriate, consistent and best practice adaptive management actions to maintain the biodiversity, including the threatened species, of the ecological community.
- Avoid changes to hydrology that may result in changes to the natural hydrological regime, including drainage and increase or decrease in run-off, salinity or pollution. In particular, manage any potential adverse effects on groundwater.
- Liaise with local councils and state authorities to ensure new developments, road works, maintenance activities, or other activities involving substrate or vegetation disturbance in areas where the ecological community occurs, do not adversely impact the ecological community.

- Liaise with planning authorities to ensure that planning takes the protection of the ecological community into account, with due regard to principles for long-term conservation.
- Apply buffer zones between the ecological community and development zones.

Impacts from urban and other developments

- Where appropriate, fence significant remnants in or adjacent to urban or tourist areas and limit access for vehicles, in consultation with Traditional Owners, local and state authorities.
- Support local patch management through Indigenous ranger groups, local conservation groups and regional bodies (e.g. Australian Wildlife Conservancy, Society for Kimberley Indigenous Plants and Animals, West Kimberley Nature Project, Rangelands Natural Resource Management Authority).

Invasive Species

- Target control of key weeds that threaten the ecological community using appropriate methods. Manage sites to prevent the introduction of new, or further spread of, invasive weeds.
- Discourage the planting of invasive species in developments adjacent or near to the ecological community.
- Encourage appropriate use of local native species in developments in the region through local government and industry initiatives and best practice strategies.
- Ensure chemicals, or other mechanisms used to manage weeds, do not have significant adverse, non-target impacts on the ecological community.
- Control invasive pest animals to allow natural regeneration, especially for threatened species, at known sites through coordinated landscape-scale control programs.

Trampling, Browsing or Grazing

- Exclude species such as cats, cattle, donkeys and pigs from patches of the ecological community.

Fire

- Exclude fire where appropriate. Ensure that managed fires and, where possible, wildfires do not enter buffer zones around remnants.
- Discourage the use of fire as a means to control high biomass and ecosystem transforming weeds in or near to Dampier Monsoon Vine Thicket remnants.
- Manage fires in adjacent vegetation e.g. ensure appropriate fuel load and buffer management in adjacent pindan ecological communities is undertaken, avoiding mid-late dry season, to minimise the risk of fire in the ecological community.
- Negotiate appropriate standing procedures with local fire authorities, in relation to establishing fire control lines to avoid destruction of the ecological community.

Conservation Information

- Maintain liaison with managers of land on which the ecological community occurs.
- Involve Traditional Owners/land managers/Indigenous ranger groups in, and promote community programs that assist with the conservation of the ecological community.

- In consultation with Traditional Owners, develop sustainable management guidelines and technical material to assist land managers, including measures to address inappropriate fire regimes, invasive animal management, weed management and canopy health and maintenance.
- In consultation with Traditional Owners, develop or support appropriate existing education programs, information products and signage to help the public recognise the presence and importance of the ecological community, and their responsibilities under state and local regulations and the EPBC Act.
- Raise awareness of the ecological community within State Government and regional authorities (including the Rangelands Natural Resources Management Authority), local authorities and the local community (e.g. through active conservation and Indigenous ranger groups).
- Raise awareness about the importance of large native fruiting trees, and shrubs and vines, as well as dead trees, as faunal habitat.
- Investigate opportunities for inclusion of the ecological community in any proposed reserve tenure, including Indigenous Protected Areas.

Enable Recovery of Additional Sites

- Consider priority conservation funding for patches of Dampier Monsoon Vine Thickets in consultation with local and state authorities, non-government organisations and Indigenous Ranger groups.
- Plant local indigenous vine thicket species to facilitate landscape processes and regeneration.
- Investigate options to maintain and improve connectivity, including the protection of adjoining vegetation and the replanting of key local canopy species.
- Develop seed harvesting and propagation techniques (having acquired the necessary permits and land access permission required) for Dampier Monsoon Vine Thickets species not already available from nurseries to facilitate the species diversity in revegetation sites.
- Ensure that any revegetation is undertaken in an appropriate manner.

Existing management actions/plans

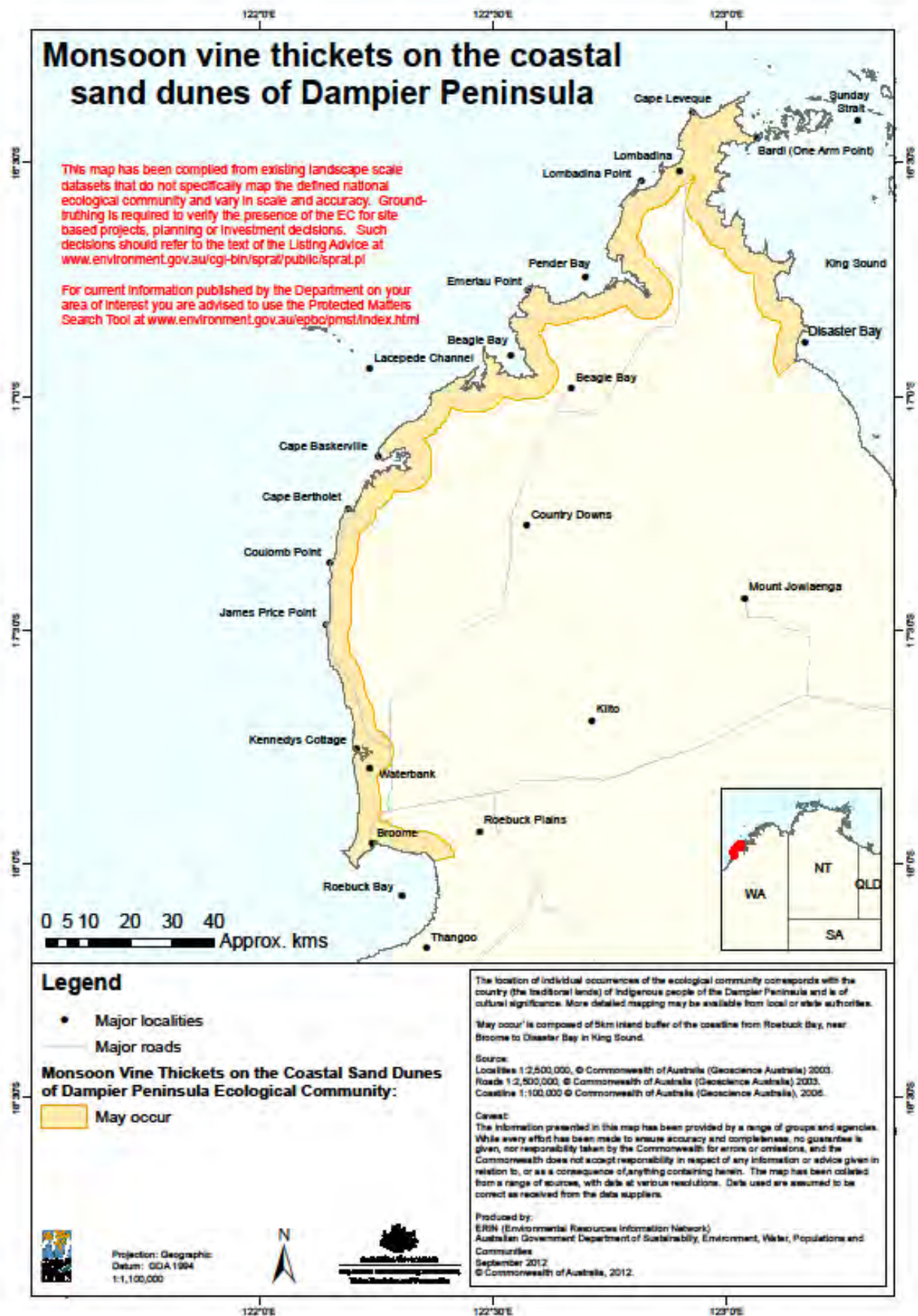
There is no approved state recovery plan for the ecological community. However, there are various local conservation groups and Indigenous ranger groups undertaking monitoring, weed control, localised fire management and restoration programs, primarily in monsoon vine thickets of the Dampierland bioregion. Some management actions are also being conducted in collaboration with the Western Australian Department of Environment and Conservation and the Shire of Broome.

Recovery plan recommendation

A recovery plan for this ecological community will be developed because consistent planning, implementation and coordination of recovery actions is required for the entire range of the ecological community which would involve state, regional and numerous local land managers.

APPENDICES

Appendix A – Distribution map



Appendix B – Species lists

Table B1. Characteristic plant species of the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community

This is an indicative rather than comprehensive list of plant species present in the ecological community. Patches may not include all species on the lists or may include other species not listed. Scientific names are current as at August 2012.

Sources: Kenneally et al., 1991; McKenzie et al., 1991; Kenneally et al., 1996; Lands, 1997; Black et al., 2010; DEC, unpublished.

Scientific name	Common name
Trees	
<i>Acacia tumida</i>	wongai
<i>Atalaya hemiglauc</i>	western whitewood
<i>Atalaya variifolia</i>	wingleaf whitewood
<i>Bauhinia cunninghamii</i>	Bauhinia, jigal, joom
<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	darlab, gorrgorr, kawoorrkaworr, northern kurrajong,
<i>Canarium australianum</i>	stypitic tree
<i>Celtis philippensis</i>	goonlnji
<i>Corymbia bella</i>	weeping ghost gum
<i>Corymbia flavescens</i>	apple, bastard or cabbage ghost gum
<i>Corymbia greeniana</i>	Dampier's bloodwood
<i>Corymbia opaca</i>	
<i>Corymbia polycarpa</i>	long fruited bloodwood
<i>Cupaniopsis anacardioides</i>	tuckeroo
<i>Diospyros humilis</i>	ebony wood, birimbir
<i>Diospyros maritima</i>	
<i>Ehretia saligna</i>	native willow, peachwood
<i>Erythrophleum chlorostachys</i>	ironwood
<i>Eucalyptus camaldulensis</i> subsp. <i>obtus</i>	river red gum
<i>Eucalyptus miniata</i>	woollybutt, manowan
<i>Eucalyptus tectifica</i>	Darwin box, grey box,
<i>Exocarpos latifolius</i>	mistletoe tree
<i>Ficus aculeata</i>	sandpaper fig
<i>Ficus platypoda</i>	
<i>Ficus virens</i>	banyan or strangler fig, albay
<i>Grevillea pyramidalis</i>	caustic tree, maangga
<i>Grewia breviflora</i>	currant or coffee fruit, goolmi, gullego
<i>Gyrocarpus americanus</i> subsp. <i>pachyphyllus</i>	coolaman tree, helicopter tree, stinkwood
<i>Hakea arborescens</i>	tree hakea, yellow hakea
<i>Hakea macrocarpa</i>	
<i>Lophostemon grandiflorus</i> subsp. <i>grandiflorus</i>	lardik

Scientific name	Common name
<i>Mallotus nesophilus</i>	badarrbadarr, yellow ball flower
<i>Melaleuca alsophila</i>	saltwater paperbark
<i>Melaleuca dealbata</i>	garnboorr
<i>Mimusops elengi</i>	joongoon, mamajen,
<i>Panadanus spiralis</i>	common screwpine, idool, jarmirdany, manbang
<i>Parinari nonda</i>	nonda
<i>Persoonia falcata</i>	gamaloon, geebung, ngarliwarny, wankirr, wild pear
<i>Pittosporum moluccanum</i>	
<i>Planchonia careya</i>	cocky apple, goolay
<i>Premna acuminata</i>	firestick tree
<i>Santalum lanceolatum</i>	tropical sandalwood
<i>Sersalisia sericea</i>	Mangarr, minyyuru
<i>Syzygium eucalyptoides</i> subsp. <i>bleeseri</i>	wild apple, iilarr
<i>Terminalia canescens</i>	wingnut tree
<i>Terminalia ferdinandiana</i>	gabiny, gubinge, kabiny, madoor
<i>Terminalia ferdinandiana</i> x <i>Terminalia petiolaris</i> (hybrid)	red gubinge
<i>Terminalia petiolaris</i>	blackberry tree, marool, narwulu
<i>Thespesia populneoides</i>	
<i>Ventilago viminalis</i>	medicine bark, supplejack
Shrubs	
<i>Abutilon indicum</i>	Indian lantern flower
<i>Acacia bivenosa</i>	Cable Beach wattle, dune wattle
<i>Acacia colei</i>	candelabra wattle, Cole's wattle, lirriringkirn, limarrkoodkood, noomoorrgoodoord, soap wattle
<i>Acacia eriopoda</i>	Broome pindan wattle
<i>Acacia monticola</i>	red wattle
<i>Acacia monticola</i> aff.	
<i>Acacia platycarpa</i>	ghost wattle
<i>Acacia wickhamii</i>	
<i>Adriana tomentosa</i> var. <i>hookeri</i>	
<i>Androcaloxophylla</i>	
<i>Breynia cernua</i>	
<i>Bridelia tomentosa</i>	amam
<i>Calytrix exstipulata</i>	Kimberley heath, turkey bush
<i>Carissa spinarum</i>	conkerberry
<i>Caesalpinia major</i> (also considered a climber)	Goolyi
<i>Clerodendrum floribundum</i> var. <i>ovatum</i>	
<i>Clerodendrum tomentosum</i> var. <i>mollissima</i>	

Scientific name	Common name
<i>Codonocarpus cotinifolius</i>	desert poplar
<i>Crotalaria cunninghamii</i>	green birdflower, minmin, oorlgoo, parrot pea
<i>Croton habrophyllus</i>	
<i>Cullen martinii</i>	
<i>Cyperus bulbosus</i>	bush onion, niarlboon, niyalboon, yarrinyarri
<i>Diospyros rugosula</i>	
<i>Dodonaea hispidula</i>	
<i>Dodonaea platyptera</i>	broad-winged hop bush
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	goorralgar, goowal, snowball bush
<i>Glycosmis</i> sp.	
<i>Gossypium australe</i>	
<i>Grevillea refracta</i>	silverleaf grevillea
<i>Grewia retusifolia</i>	dog's balls, dysentery bush, turkey bush
<i>Gyrostemon tepperi</i>	
<i>Helicteres rhynchocarpa</i>	
<i>Hibiscus apodus</i>	yellow hibiscus
<i>Hibiscus</i> sp.	
<i>Hypoestes floribunda</i> var. <i>varia</i>	musk-scented plant
<i>Keraudrenia exastia</i>	fringed keraudrenia
<i>Luvunga monophylla</i>	
<i>Myoporum montanum</i>	boobialla, gawar, native myrtle
<i>Pavetta kimberleyana</i>	
<i>Phyllanthus reticulatus</i>	
<i>Plumbago zeylanica</i>	
<i>Psydrax pendulina</i>	
<i>Senna costata</i>	ram's horns
<i>Sida hackettiana</i>	golden rod
<i>Sida rohlenae</i> subsp. <i>occidentalis</i>	
<i>Solanum cunninghamii</i>	bunug, langgoorr, nankoorr
<i>Tephrosia rosea</i>	Flinders River poison
<i>Triumfetta</i> sp.	
<i>Trophis scandens</i>	
Climbers / Vines	
<i>Abrus precatorius</i>	Crab's eye bean
<i>Adenia heterophylla</i> subsp. <i>australis</i>	
<i>Asparagus racemosus</i>	asparagus fern
<i>Canavalia rosea</i>	Jack bean, beach bean
<i>Capparis jacobsii</i> aff.	
<i>Capparis lasiantha</i>	bush caper

Scientific name	Common name
<i>Capparis sepiaria</i>	
<i>Cassytha filiformis</i>	jirrawany, koodikoodi, wagalwagal
<i>Cucumis maderaspatanus</i>	
<i>Cynanchum carnosum</i>	
<i>Flagellaria indica</i>	lawyer vine, supplejack
<i>Gymnanthera oblonga</i>	harpoon bud
<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>	beach morning glory
<i>Jacquemontia paniculata</i>	
<i>Jasminum didymum</i>	
<i>Operculina aequisejala</i>	
<i>Opilia amentacea</i>	
<i>Parsonsia kimberleyensis</i>	
<i>Sarcostemma</i> sp.	
<i>Sarcostemma viminalis</i>	caustic vine, milkbush
<i>Secamone timoriensis</i>	
<i>Tinospora smilacina</i>	snake vine
<i>Tylophora cinerascens</i>	oyster-catcher bill
<i>Tylophora flexuosa</i>	
<i>Vigna vexillata</i> var. <i>angustifolia</i>	wild cowpea
Hemiparasites (mistletoes)	
<i>Amyema benthamii</i>	
<i>Amyema bifurcata</i>	
<i>Amyema sanguinea</i> var. <i>sanguinea</i>	Christmas mistletoe
<i>Cassytha capillaris</i> (also considered a climber)	
<i>Cassytha filiformis</i> (also considered a climber)	
<i>Dendrophthoe acacioides</i> subsp. <i>acacioides</i>	
<i>Lysiana spathulata</i> subsp. <i>spathulata</i>	
<i>Santalum lanceolatum</i> (also considered a tree)	
Epiphytes	
<i>Cymbidium canaliculatum</i>	tree orchid
Herbs	
<i>Abutilon</i> sp.	
<i>Achyranthes aspera</i>	chaff flower
<i>Amaranthus</i> sp.	
<i>Amaranthus undulatus</i> (formerly <i>A. pallidiflorus</i>)	
<i>Boerhavia dominii</i>	tarvine
<i>Boerhavia</i> sp.	

Scientific name	Common name
<i>Cleome viscosa</i>	mustard bush, spider flower, tick weed, wild caia
<i>Crotalaria crispata</i>	walkabout
<i>Crotalaria medicaginea</i>	rattlepods
<i>Cucumis maderaspatanus</i> (formerly <i>Mukia maderaspatana</i>)	Madras sea pumpkin, bristly Bryony
<i>Euphorbia alsiniflora</i>	
<i>Gomphrena pusilla</i>	
<i>Heliotropium</i> sp.	
<i>Indigofera linifolia</i>	
<i>Portulaca oleracea</i>	common purslane, purslane
<i>Polycarpaea</i> sp.	
<i>Polymeria distigma</i>	
<i>Ptilotus lanatus</i> var. <i>lanatus</i>	
<i>Ptilotus nobilis</i> subsp. <i>nobilis</i>	pink mulla mulla
<i>Ptilotus polystachyus</i>	green mulla mulla, seedyhead
<i>Sida</i> sp.	
<i>Spermacoce auriculata</i>	
<i>Tacca leontopetaloides</i>	
<i>Tephrosia rosea</i>	Flinders River poison
<i>Trianthema portulacastrum</i>	giant pigweed
<i>Trichodesma zeylanicum</i>	camel bush
Graminoids (grasses and grasslike plants)	
<i>Bulbostylis barbata</i>	watergrass
<i>Cenchrus biflorus</i> (N.B. This species is a bulbous perennial with annual leaves)	Gallon's curse
<i>Cenchrus elymoides</i>	
<i>Chrysopogon pallidus</i>	ribbon grass
<i>Cymbopogon</i> sp.	
<i>Cyperus bulbosus</i>	
<i>Cyperus nervulosus</i>	
<i>Enneapogon pallidus</i>	conetop nineawn
<i>Eragrostis cumingii</i>	Cumings love grass
<i>Eriachne semiciliata</i>	
<i>Fimbristylis</i> sp.	
<i>Heteropogon contortus</i>	black or bunch speargrass
<i>Perotis rara</i>	comet grass
<i>Setaria apiculata</i>	pigeon grass
<i>Spinifex longifolius</i>	beach spinifex
<i>Triodia bitextura</i>	
<i>Triodia microstachya</i>	

Scientific name	Common name
<i>Triodia</i> sp.	
<i>Whiteochloa airoides</i>	creeping panic

Table B2. Rare plant species which occur in or adjacent to the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community

Scientific names are current as at August 2012.

Source: Black et al., 2010; Smith, 2012.

Scientific Name	Growth Form	Conservation Status	
		WA	EPBC
<i>Eriachne</i> sp. Dampier Peninsula (K.F Kenneally 5946)	grass	Priority 3	Not listed
<i>Gomphrena pusilla</i>	herb	Priority 2	Not listed
<i>Parsonsia kimberleyensis</i>	climber	Priority 1	Not listed
<i>Pittosporum moluccanum</i>	tree	Priority 4	Not listed
<i>Polymeria distigma</i>	herb	Priority 3	Not listed

Table B3. Fauna that may occur in the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community

Scientific names are current as at August 2012.

* Species thought to be no longer present in this region.

Sources: Johnstone and Burbidge, 1991; McKenzie et al., 1991; Churchill, 2008; Black et al., 2010; Biota, 2010; Wilson and Swan, 2010; Smith, 2012.

Scientific name	Common name	Conservation status	
		WA	EPBC
Mammals			
<i>Canis lupus</i>	dingo		
<i>Chalinolobus gouldii</i>	Gould's wattled bat		
<i>Chalinolobus nigrogriseus</i>	hoary wattled bat		
<i>Chaerephon jobensis</i>	northern freetail bat		
<i>Isoodon auratus</i> *	golden bandicoot	Schedule 1	Vulnerable
<i>Macroglossus minimus</i>	northern blossom bat		
<i>Macropus agilis</i>	agile wallaby		
<i>Macrotis lagotis</i>	greater bilby	Schedule 1	Vulnerable
<i>Mesembriomys macrurus</i> *	golden-backed tree-rat	Priority 4	Vulnerable
<i>Miniopterus schreibersii orianae</i>	northern bentwing bat		
<i>Mormopterus beccarii</i>	Beccari's freetail bat		
<i>Mormopterus loriae cobourgiana</i>	mangrove freetail bat		
<i>Nyctophilus arnhemensis</i>	Arnhem long-eared bat		
<i>Nyctophilus daedalus</i>	northern long-eared bat		
<i>Nyctophilus geoffroyi</i>	lesser long-eared bat		
<i>Scotorepens greyii</i>	little broad-nosed bat		
<i>Scotorepens sanborni</i>	northern broad-nosed bat		
<i>Tachyglossus aculeatus</i>	echidna		
<i>Taphozous georgianus</i>	common sheaf-tail bat (cave bat)		
<i>Trichosurus vulpecula arnhemensis</i>	northern brushtail possum		
<i>Pipistrellus westralis</i>	mangrove pipistrelle		
<i>Pteropus alecto</i>	black flying fox		
<i>Pteropus scapulatus</i>	little red flying fox		
Birds			
<i>Aprosmictus erythropterus</i>	red-winged parrot		
<i>Artamus leucorhynchus</i>	white-breasted woodswallow		
<i>Artamus minor</i>	little woodswallow		
<i>Artamus personatus</i>	masked wood-swallow		
<i>Cacatua sanguinea</i>	little corella		

Scientific name	Common name	Conservation status	
		WA	EPBC
<i>Cacomantis variolosus</i>	brush cuckoo		
<i>Calyptrorhynchus banksii</i>	red-tailed black cockatoo		
<i>Colluricincla harmonica</i>	grey shrike-thrush		
<i>Conopophila rufogularis</i>	rufous-throated honeyeater		
<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		
<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		
<i>Dicaeum hirundinaceum</i>	mistletoebird		
<i>Eolophus roseicapillus</i>	galah		
<i>Erythrura gouldiae</i>	Gouldian finch	Schedule 1	Endangered
<i>Falco peregrinus</i>	peregrine falcon	Schedule 4	
<i>Geopelia humeralis</i>	bar-shouldered dove		
<i>Geopelia striata placida</i>	peaceful dove		
<i>Gerygone olivacea</i>	white-throated gerygone, white-throated flyeater		
<i>Lichenostomus flavescens</i>	yellow-tinted honeyeater		
<i>Lichenostomus unicolor</i>	white-gaped honeyeater		
<i>Lichenostomus virescens</i>	singing honeyeater		
<i>Lichmera indistincta</i>	brown honeyeater		
<i>Malurus lamberti</i>	variegated fairy-wren		
<i>Melithreptus gularis</i>	black-chinned honeyeater		
<i>Myiagra ruficollis mimikae</i>	broad-billed flycatcher		
<i>Myzomela erythrocephala</i>	red-headed honeyeater		
<i>Pachycephala melanura melanura</i>	mangrove golden whistler		
<i>Pachycephala rufiventris</i>	rufous whistler		
<i>Philemon citreogularis</i>	little friarbird		
<i>Podargus strigoides</i>	tawny frogmouth		
<i>Pomatostomus temporalis</i>	grey-crowned babbler		
<i>Ptilinopus regina ewingii</i>	red-crowned fruit-dove		
<i>Ptilonorhynchus nuchalis</i>	great bowerbird		
<i>Rhipidura rufiventris</i>	northern fantail		
<i>Taeniopygia bichenovii</i>	double-barred finch		
<i>Todiramphus sanctus</i>	sacred kingfisher		
<i>Zosterops luteus</i>	yellow white-eye		
Reptiles			
<i>Carlia rufilatus</i>			
<i>Carlia triacantha</i>			
<i>Ctenotus inornatus</i>			
<i>Cryptoblepharus</i>	metallic snake-eyed skink		

Scientific name	Common name	Conservation status	
		WA	EPBC
<i>metallicus</i>			
<i>Cryptoblepharus pulcher</i>	elegant snake-eyed skink		
<i>Cryptoblepharus ruber</i>	tawny snake-eyed skink		
<i>Cryptoblepharus tyttos</i>	pygmy snake-eyed skink		
<i>Delma tincta</i>			
<i>Diplodactylus conspicillatus</i>	fat tailed gecko		
<i>Eremiascincus isolepis</i>			
<i>Gehyra pilbara</i>			
<i>Glaphyromorphus isolepis</i>			
<i>Heteronotia binoei</i>	Bynoe's gecko		
<i>Lerista apoda</i>			
<i>Lerista bipes</i>			
<i>Lerista greeri</i>			
<i>Lerista separanda</i>		Priority 2	
<i>Lialis burtonis</i>	Burton's snake-lizard		
<i>Notoscincus ornatus</i>			
<i>Pseudechis australis</i>	King brown snake, mulga snake		
<i>Ramphotyphlops diversus</i>			
<i>Simoselaps minimus</i>	Dampierland burrowing snake, jooroo	Priority 2	
<i>Strophurus ciliaris</i>			
<i>Tiliqua multifasciata</i>	Centralian blue-tongue		
<i>Tiliqua scincoides intermedia</i>	northern blue tongue		
<i>Ramphotyphlops diversus</i>			
<i>Varanus goudii</i>	Gould's goanna		
<i>Varanus tristis</i>	freckled monitor		
Invertebrates			
<i>Erelopeas interioris</i>	outback awlsnail		
<i>Gastrocopta mussoni</i>	desert land snail		
<i>Gastrocopta pediculus</i> (syn. <i>G. simplex</i>)	weakly toothed pupasnail		
<i>Nesopupa scotti</i> (syn. <i>Pupa mooreana</i>)	blunt golden pupasnail		
<i>Pupisoma orcula</i>	Oriental toothless pupasnail		
<i>Quistrachia leptogramma</i>	land snail		

Scientific name	Common name	Conservation status	
		WA	EPBC
Amphibians			
<i>Litoria caerulea</i>	green tree frog		
<i>Platyplectrum ornatus</i>	ornate burrowing frog		

Table B4. Weed species that may occur in the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula

Scientific names are current as at August 2012.

Source: Black et al., 2010.

Scientific Name	Common Name	Growth form
<i>Aerva javanica</i>	kapok bush	perennial herb
<i>Azadirachta indica</i>	neem tree	tree
<i>Cenchrus biflorus</i>	Gallon's curse	annual grass
<i>Cenchrus ciliaris</i>	buffel grass	perennial tussock grass
<i>Cenchrus setiger</i>	birdwood grass	perennial tussock grass
<i>Clitoria ternatea</i>	butterfly pea, Darwin pea	herbaceous perennial vine
<i>Citrullus lanatus</i>	pie melon	annual herb or climber
<i>Cryptostegia madagascariensis</i>	rubber vine*	vine, climber
<i>Hyptis suaveolens</i>	hyptis, horehound, mint weed	annual or perennial, herb
<i>Ipomoea quamoclit</i>	morning glory	climbing annual, herb
<i>Jatropha gossypifolia</i>	bellyache bush*	shrub
<i>Lantana camara</i>	lantana*	shrub or climber
<i>Leucaena leucocephala</i>	coffee bush	shrub
<i>Macroptilium atropurpureum</i>	siratro, black pea	perennial herb or climber
<i>Merremia aegyptia</i>	hairy merremia	perennial herb or climber
<i>Merremia dissecta</i>	hairy morning glory, white convolvulus creeper	vine, climber
<i>Passiflora foetida</i> var. <i>hispida</i>	wild passionfruit	woody climber
<i>Peltophorum pterocarpum</i>	yellow poinciana tree	deciduous tree
<i>Stachytarpheta cayennensis</i>	snakeweed	woody perennial herb or shrub
<i>Tribulus terrestris</i>	caltrop	prostrate annual herb
<i>Vinca major</i>	blue periwinkle, vinca	scrambling perennial herb

* Weed of National Significance

Appendix C – Detailed description of biology and ecological processes

Vegetation dynamics

There are a small number of closed canopy vegetation formations in the wet tropics of Western Australia, including: rainforests, *Melaleuca-Pandanus* stands fringing watercourses and mangroves (McKenzie, 1991). Rainforests and vine thickets in Western Australia are among the smallest and most open deciduous forests of northern Australia (McKenzie et al., 1991). They are typically patchy (Kahn and Lawrie, 1987) due to local topography, hydrology, geology, incidence of disturbance and historical distribution of rainforests within an area.

Monsoon vine thickets mainly occur as small, scattered patches along the Kimberley coastline and for a short distance inland (McKenzie et al., 1987), with very few exceeding 100 ha. Patches are usually linear and narrow, running parallel to the coastal dunes and associated swales. Surveys conducted by McKenzie et al. (1991) and Black et al. (2010) found that Dampier Monsoon Vine Thicket patch size varied greatly but the mean was 32 ha. The scattered distribution and variable size of monsoon vine thickets means the loss or degradation of a single patch can reduce species migration, leaving patches isolated and vulnerable to local extinction.

The Dampier Monsoon Vine Thickets contains many fruits, medicines and tools that are important in Indigenous culture. Many patches are also important sites for Biidin or jila (fresh water under the ground, living water) camping and ceremonial areas and law grounds (Bardi Jawi Oorany Rangers, 2012). Freshwater indicator trees associated with vine thickets include *Lophostemon grandiflorus* and *Pandanus spiralis* (Louise Beames pers. com., 2012). Important bushtucker plants in the ecological community include *Diospyros humilis* (birimbiri), *Flueggea virosa* (goorralgar, goowal), *Grewia breviflora* (goolmi, gullego), *Mimusops elengi* (joongoon, mamajen), *Planchonia careya* (goolay), *Sersalisia sericea* (mangarr, minyyuru), *Syzygium eucalyptoides* (iilarr) and *Terminalia petiolaris* (marool, narwulu) (Noury et al., 2005; Bardi Jawi Oorany Rangers, 2012).

The interactions between fauna, fire and hydrology in vegetation dynamics are discussed below.

Faunal roles and interactions

The closed canopy of the Dampier Monsoon Vine Thickets provides a shady and humid refuge for animals particularly during the dry season when fires in the landscape are more frequent (Johnstone and Burbidge, 1991; Kendrick and Rolf, 1991; Price, 2004). The abundance of fruiting plants within the ecological community also provides relatively rich food resources for many taxa.

The ecological community provides habitat for a number of mammal and bird species which act as pollinators and seed dispersers (Crome and Irvine, 1986; Price et al., 1999; Price, 2004; Neilan et al., 2006; Black et al., 2010). These animals feed on the spatially variable and seasonally complementary fruit and nectar that exist in the ecological community (Johnstone, 1983; Environs Kimberley, 2009; Black et al., 2010). This is similar to the ecology of vine thickets in the Northern Territory, where birds have been shown to track fruit resources with variations in fruit availability (Bach and Price, 1999).

Fauna such as the agile wallaby, rose-crowned fruit-dove, great bowerbird and flying foxes often travel between vine thickets as resources become available. These frugivores help connect patches of the ecological community through dispersing seeds between patches. For example, *Ficus virens* trees provide fruit at varying times of the year across the Dampier Peninsula, and its seeds are dispersed by birds, where they drop the seeds when perching on tree branches (Bardi Jawi Oorany Rangers, 2012). Black flying foxes prefer blossom, pollen (a major source of protein) and fleshy fruit depending on the season although they will also eat

tree leaves. The little red flying fox feeds predominantly on tree and shrub blossom, while the northern blossom bat mainly relies on nectar and pollen. Bats foraging on blossom and pollen become covered in pollen during feeding (Chrome and Irvine, 1986; Palmer et al., 2000; Churchill, 2008).

Fauna such as *Aprosmictus erythropterus* (red-winged parrot), *Ptilonorhynchus nuchalis* (great bowerbird), *Philemon citreogularis* (little friarbird), *Zosterops luteus* (yellow white-eye), rose-crowned fruit-dove and native bees use food and habitat resources from plants in the ecological community such as *Diospyros humilis* (ebony wood, birimbiri), *Grewia breviflora* (goolmi), *Planchonia careya* (goolay), and *Terminalia petiolaris* (marool, nawulu) (Bardi Jawi Oorany Rangers, 2012). In Western Australia, the rose-crowned fruit-dove is at its southern most limit on the Dampier Peninsula and is mainly restricted to the ecological community in this location. Male great bowerbirds use seeds from *Caesalpinia major* (goolyi) to decorate their nest, whilst small birds shelter in this shrub/vine as it is thick and prickly (Kenneally et al., 1996; Bardi Jawi Oorany Rangers, 2012). Birds also nest in plants of the ecological community (Bardi Jawi Oorany Rangers, 2012).

Monsoon rainforests, such as the ecological community, are also used opportunistically by savanna adapted mammals in order to avoid climatic extremes, predators and savanna fires (Bowman and Woinarski, 1996). *Macropus agilis* (agile wallaby) finds refuge from the heat of the day in the dense vegetation of the ecological community emerging to graze on a variety of plants such as grasses and fallen fruit.

Hydrology

Although the hydrological requirements of the ecological community have not been extensively studied, the position of the ecological community in the landscape suggests that it relies on various hydrological inputs. Indigenous people of the Kimberley often identify vine thickets and rainforest patches as areas near jila (living water/ groundwater). Flora taxa such as albay (fig), manbung (pandanus) and mutgarr (paperbark) are also closely associated with freshwater close to the surface. Many Kimberley vine thicket patches occur adjacent to or on groundwater springs or shallow aquifers such as permanent soakage sites (Kenneally et al., 1991).

The hydrology is partly influenced by the nature of the soils on the Dampier Peninsula. The pindan soils of the Dampier Peninsula form extensive undulating plains with few organised surface drainage channels, such as watercourses. Where a layer of unconsolidated sand overlies the pindan, water penetration is aided. In these locations, rainfall is usually soaked up by the pindan sandplains, recharging aquifers. However, surface water is often present after heavy rains and seasonal runoff can form sheet flow (Kenneally et al., 1996; Black et al., 2010; BOM, 2011). Concentrated water from precipitation, such as rain, congregates into the recharge zones or swales at the base of the coastal dune systems.

During the dry season, a moist, humid microclimate occurs behind the dune system. When cooler air interacts with warm moist coastal air, high humidity and heavy fogs can occur along the Dampier coast, especially at Broome (Kenneally et al., 1996). Fog and mist condensation settles on the dense and shady canopy of the Dampier Monsoon Vine Thickets. This process is known as occult precipitation and may contribute to the annual hydrological inputs for the ecological community. Studies in upland rainforest have shown occult precipitation can contribute to the groundwater store (DERM, 2007; Australian National University, 2009).

Role of fire

Prior to European colonisation, Indigenous people in northern Australia used fire as a primary landscape management tool, systematically burning parts of the landscape as soon as the fuels dried sufficiently to carry a fire (Jones, 1975; Haynes, 1985, 1991; Russell-Smith et al., 1997, 2003; Yibarbuk et al., 2001; Garde et al., 2009). Small fires that created a patchwork or mosaic were used to control the intensity of the fire and contain the area to be burnt (Kenneally et al., 1996; Russell-Smith et al., 2009c) and to prevent widespread, intense fires late in the dry season (Braithwaite and Estbergs, 1985; Haynes, 1985; Bowman and Panton, 1993). Garde et al. (2009) details substantial ethnographic evidence, including contemporary customary practice, indicating this timing.

As rainforest and vine thicket communities were prime food-gathering areas, Indigenous people would try to protect them from fires by burning away from a rainforest patch early in the dry season (Mangglamarra et al., 1991). Fires burning in the wet or early dry seasons would generally not penetrate rainforests and vine thickets as they were too moist to burn at these times. This management regime reduced fuel load and created burn breaks along walking tracks and around important resources. As a consequence, vegetation such as the ecological community could also act as refugia for many fauna species such as reptiles during fires and seasonal food scarcity (Kendrick and Rolf, 1991; Bowman and Woinarski, 1996). Low intensity, mosaic burning during the early dry season in vegetation adjacent to vine thicket patches shows little impact to the patches (Val English pers. comm., 2012)⁶. However, as the dry season progresses, plant fuels dry and the severity of fire increases (Gill et al., 1996; Russell-Smith and Edwards, 2006) combining to increase the vulnerability of vine thickets to fire damage.

Fire has had a strong influence on the localised distribution and boundary characteristics of rainforests across northern Australia (Russell-Smith and Dunlop, 1987; McKenzie and Belbin, 1991). The size and shape of persisting patches often reflects the level of protection from fire offered by surrounding landforms and vegetation (Russell-Smith and Dunlop, 1987). For example, patches of the ecological community surrounded by rock outcrops or coastal formations such as sand spits are less frequently burnt than patches of the ecological community adjacent to more flammable pindan and savanna woodlands (McKenzie, 1991).

Since European settlement, fire regimes have shifted toward extensive, relatively intense fire events in the mid-late dry season. The impacts of altered fire regimes are discussed in Appendix E.

⁶ This supports anecdotal evidence from Indigenous custodians that the vine thickets 'did not want to burn'.

Appendix D – Detailed description of national context and existing protection

Heritage

On 31 August 2011 the West Kimberley was inscribed on the National Heritage List as a Matter of National Environmental Significance protected by the EPBC Act. Natural values included the vine thickets of the northern Kimberley coast and islands and the Kimberley Plateau, and the Devonian reefs of the west Kimberley. These were identified as having outstanding heritage value to the nation for their evolutionary refugial role that has resulted in high invertebrate richness and endemism. Some patches of the ecological community on the northern end of the Dampier Peninsula overlap with the heritage listing, however, the Dampier monsoon vine thicket patches are not part of the Heritage listed area.

Relationships to State-listed ecological communities

The Monsoon vine thickets on coastal sand dunes of the Dampier Peninsula is listed as a vulnerable ecological community on the Western Australian list of threatened ecological communities endorsed by the Western Australia Minister for the Environment. While there is currently no specific legislation that provides for the listing of threatened ecological communities in Western Australia, there is an informal, non-statutory process to list them. In addition, threatened ecological communities are listed as Environmentally Sensitive Areas under regulations made under the *Environmental Protection Act 1986* that control clearance of native vegetation in Western Australia. Several species of plants and animals that occur in the ecological community are also protected under the *Western Australian Wildlife Conservation Act 1950* (see Appendix B).

The state-listed Monsoon (vine) thickets on the coastal sand dunes of Dampier Peninsula falls within the description and known distribution of the national ecological community, although the state-listed ecological community does not specify condition thresholds.

Relationships to other vegetation classifications

The ecological community corresponds, entirely or in part, to the following vegetation classifications:

National Vegetation Information System (NVIS) (V4.1):

- Major Vegetation Group (MVG) 1: Rainforest and vine thickets
- Major Vegetation Subgroup (MVS) 62: Dry rainforest or vine thickets

Webb et al. (1984):

- Dry tropical (monsoon) forests
 - i. semi-deciduous mesophyll and notophyll vine forest
 - ii. deciduous microphyll vine thicket

Kenneally et al. (1991):

- Group 6 western Kimberley Holocene sand dune patches

Differences to similar or intergrading ecological communities and adjacent vegetation communities

In addition to monsoon vine thickets, the coastal areas of the Dampier Peninsula contain a variety of vegetation communities including coastal shrublands, mangroves, paperbark thickets, saline grasslands, samphire flats, seepage areas and wetlands (Chalmers and Woods, 1987; Kenneally et al., 1996). In many areas the ecological community may intergrade with pindan woodland and low coastal shrublands.

Pindan is a type of woodland common across the Dampier Peninsula. It has a tree layer that is predominantly eucalypts and a middle layer of dense *Acacia* spp. and *Hakea* spp. Pindan also

contains grass species in the understorey, such as *Chrysopogon pallidus* (razorgrass), *Heteropogon contortus* (black speargrass), *Sarga stipoidea* (annual sorghum) and *Triodia schinzii* (feathertop spinifex) (Kenneally et al., 1996).

Closed vine forests of paperbark thickets can also occur in the leeward slopes of larger dune systems on the Dampier Peninsula and may occur adjacent to the Dampier Monsoon Vine Thickets (McKenzie and Kenneally, 1983; Kenneally et al., 1996; Black et al., 2010). These paperbark thickets may reach heights of up to 15 m, with upperstorey trees dominated by paperbark species, such as *Melaleuca cajuputi* (cadjeput) and *M. viridiflora* (broad-leaved paperbark). These thickets are associated with ephemeral swamps and groundwater. The closed vine forests are distinguished from the ecological community by the presence of persistently wet or damp ground and a distinct and well-developed tall tree canopy dominated by paperbarks.

Vine thicket patches also occur north of the Dampier Peninsula in the Northern Kimberley Bioregion, however, they are not considered to be part of the ecological community. The ecological community has a lower rainfall, different geomorphology and floristic makeup to the northern Kimberley vine thickets. The overstorey of northern Kimberley vine thickets contain tree species that are typically absent from the ecological community including *Adansonia gregorii*, *Albizia lebbek*, *Bombax ceiba*, *Cryptocarya cunninghamii*, *Elaeodendron melanocarpum*, *Ganophyllum falcatum*, *Vitex acuminata* and *Ziziphus quadrilocularis* (Kenneally et al., 1991). The understorey of these vine thicket patches also contains large shrub species from the genera *Alectryon*, *Denhamia*, *Micromelum*, *Murraya*, *Strychnos*, *Trema* and *Wrightia* that are typically absent from the ecological community.

Monsoon rainforest in northern Australia, of which Dampier Monsoon Vine Thickets are a subset, has a restricted occurrence of less than <1% of the total land area (Price et al., 1995). As noted by Bowman (2000), monsoon rainforests are wide ranging but with a fragmented distribution of usually small patches (Russell-Smith, 1991) which is characteristic of the Dampier Monsoon Vine Thickets. Many northern Australian patches also occur on coastal sand dunes. Comparison of flora species of the Dampier Monsoon Vine Thickets with patches on similar substrates, such as in the Northern Territory, indicate that there are a number of similarities. However, the diversity of species present in the ecological community is more limited than those in other northern Australia patches e.g. Northern Territory. Flora frequency analysis from available data demonstrated that there was an absence of many of the ecological community's key canopy species in northern vine thicket patches on coastal sand dunes, e.g. *Diospyros humilis*, *Grewia breviflora*, *Mallotus nesophilus* and *Terminalia petiolaris*. Also occurring within the Dampier Monsoon Vine Thickets, but absent from northern patches on coastal dunes, are more ecologically versatile species (i.e. which also occur in the drier adjacent pindan and savanna ecosystems), e.g. *Acacia colei*, *A. tumida*, *Bauhinia cunninghamii*, *Tephrosia rosea* and *Terminalia fernandiana*. The analysis indicated that the ecological community has an idiosyncratic species composition and is sufficiently distinct to be considered different to other northern monsoon rainforest types.

Level of protection in reserves

The Dampier Monsoon Vine Thickets occurs on unallocated crown lands (38%), on land managed by Indigenous people (Aboriginal Reserves – 36%), freehold land (11%) and pastoral leases (six per cent). Approximately nine per cent of the Dampier Monsoon Vine Thickets is located within the Yawuru Conservation Park (Minyirr Coastal Park) and other lands vested in the Shire of Broome. Yawuru Conservation Park is jointly vested with the Yawuru Indigenous people with the Western Australian Department of Environment and Conservation conducting day to day management.

Appendix E – Description of threats

Clearing/fragmentation/disturbance

While the ecological community is naturally fragmented due to landscape position, fire regimes, hydrological requirements and availability of suitable habitat, it functions as a network ecosystem. The scattered distribution and variable size of patches means that the degradation of a single patch can reduce species migration, leaving patches isolated and vulnerable to local extinction. Additional pressures including edge effects and altered fire regimes can further reduce opportunities for pollination and dispersal of plant propagules.

Direct impacts on the ecological community have occurred from clearance for development in areas close to the town of Broome as well as around smaller settlements further north. Patches have been cleared for vehicle access and campsites. Some may have also been cleared for pasture (Black et al., 2010). Clearing reduces the extent of the ecological community and exacerbates patch isolation, reducing connectivity between remnants. Connectivity between remnants of the ecological community and other native vegetation is an important determinant of habitat quality at the landscape scale for native flora and fauna and overall condition and persistence of the ecological community.

Incremental and ongoing disturbance⁷ of the Dampier Monsoon Vine Thickets adversely affects the structural integrity of patches of the ecological community. Disturbance can open up the canopy within a patch thereby enabling invasive flora such as exotic grasses to establish. These species can reduce the ecological community's ability to resist fire, impacting on the structural integrity of the patch, which can also enhance edge effects. If unmanaged, tourism and associated recreational uses of the Dampier Monsoon Vine Thickets may increase disturbance events.

While most of the Holocene dunes on the Dampier Peninsula are stable, shifting dunes in a number of locations has impacted Dampier Monsoon Vine Thickets. For example, near Hunter Creek, Karrakatta Bay and Thomas Bay (Djarindjin) (Harding et al., 2009; DEC pers. comm., 2012). Dunes destabilised by removal and damage of vegetation can smother the ecological community as prevailing winds shift the dune system at a greater rate.

Inappropriate fire regimes

The tropical north of Australia has been characterised by Liedloff and Cook (2007) as “perhaps the most extensive and flammable ecosystem in the world” where fire is a natural disturbance process in the tropical savannas. The regular monsoonal climate promotes rapid grass growth, followed by a period of curing in the dry season (Rangelands NRM, 2009).

Key fire regime issues confronting the Dampier Monsoon Vine Thickets relate to the contemporary frequency of very extensive, relatively non-patchy and severe late dry season wildfires (Yates et al., 2008; Edwards and Russell-Smith, 2009; Val English, pers. comm., 2012). The most vulnerable vegetative components of the Dampier Monsoon Vine Thickets to fire impacts are the patch edges. Russell-Smith and Stanton (2002) found that contemporary fire impacts on monsoon rainforests in northern and northwestern Australia indicated significant widespread damage to the margins of typically small monsoon rainforest patches. Recurring hot fires in adjacent vegetation to the Dampier Monsoon Vine Thickets may cause the patches to contract over time (Black et al., 2010) due to damage to the margins of patches.

Fire damage has been recorded in 32% (20 out of 62) of Dampier Monsoon Vine Thicket patches surveyed on the Dampier Peninsula. Nine of the patches suffered from severe fire damage extending well into the stand and included burnout trees causing/inducing retreat or contraction of the patches (Black et al., 2010). Further, late dry-season fires tend to homogenise

⁷ Disturbance includes collection of timber, removal of branches, the creation of new campsites (permanent and temporary) and development of non-traditional tracks for stock, vehicles and walking.

the vegetation structure, with mid-storey vegetation particularly at risk (Bastin and ACRIS MC, 2008). Significant fire events may have long-term impacts on the ecological community. Comparative aerial photographs (commencing from 1942) of fire-affected patches at Cape Borda in Western Australia appear to show little recovery to the larger trees and shrubs over several decades (Black et al., 2010).

Vegetation disturbances such as damage to canopy species, and ground cover and litter removal due to cattle, vehicles and the formation of tracks and campsites can exacerbate fire impacts. By opening up the canopy of the ecological community, annual and exotic grasses, such as *Cenchrus ciliaris* (buffel grass), can invade a patch leading to an increased fuel load which in turn increases fire intensity (Black et al., 2010). The distribution of exotic species in a patch also effects fire behaviour. Clumps of buffel grass near trees and shrubs can increase localised fire intensity and flame height, damaging woody species (CRC, 2008) (also see Appendix F – Criterion 4).

Fire management

Fire management by Western Australian Government agencies on the Dampier Peninsula has typically involved controlled burning early in the dry season via aerial incendiaries (Black et al., 2010) so that fires are of a lower intensity (Val English, pers. comm., 2012). Despite on-going fire management for northern Australia, there is growing recognition of the impact of contemporary fire regimes on fire-sensitive components of northern Australian flora and fauna. Monitoring suggests that fire-sensitive vegetation, such as the ecological community remain vulnerable to inappropriate contemporary fire regimes (Woinarski et al., 2005; 2010; Yates et al., 2008).

Significant efforts to address fire management challenges across northern Australia are being undertaken and include the Dampier Peninsula Fire Project (DPFP), EcoFire and the West Kimberley Nature Project. DPFP facilitates planning and implementation of a coordinated early dry season prescribed burning program in conjunction with strategic firebreaks. EcoFire aims to restore biodiversity, pastoral and cultural values by reducing the incidence of late dry season fires in the central and north Kimberley. The West Kimberley Nature Project works with Traditional Owners and Kimberley Land Council-facilitated Indigenous ranger groups to sustainably manage wildfires and control weeds to protect and conserve the Dampier Monsoon Vine Thickets and wetlands on the Dampier Peninsula (Environs Kimberley, 2011c).

Invasive species

The ecological community provides habitat for a diverse range of native animal and plant species. Although pastoral operations on the Dampier Peninsula are no longer operating, former domesticated animals are still present in the region as ferals and evidence of their impacts has been recorded in a number of patches of the ecological community.

Vertebrates

Feral cattle (*Bos* sp.) have been recorded in 39% of surveyed patches of the ecological community where they browse the understorey and break branches (Black et al., 2010) and pigs (*Sus scrofa*) graze, deposit dung, disturb the soil and damage flora. These impacts can result in a loss of structural integrity in patches of the ecological community mostly due to an opening of the canopy and introduction of seeds from invasive species. Further, where invasive species are fire tolerant, the ecological community may be more susceptible to fire damage.

Feral cats (*Felis catus*) and dogs (*Canis lupus familiaris*) can prey on native fauna that utilise the ecological community, particularly reptiles, ground dwelling mammals and birds. Bird species that forage, nest and roost on or near the ground are highly susceptible to predation by feral cats.

Cane toads are known to occur in northeastern Kimberley at Lake Argyle. While not currently detected on the Dampier Peninsula, this invasive species has the potential to displace or cause the decline of many native species within the ecological community, such as amphibians, mammals and reptiles.

Invertebrates

Introduced ant species aggressively compete with native animal species and have the potential to eliminate many native species and seriously disrupt ecological processes and alter food availability for native species. The invasive black crazy ant (*Paratrechina longicornis*) and Singapore ant (*Monomorium destructor*) have been recorded within the ecological community. These species are aggressive invaders and can reduce invertebrate species diversity and displace species such as the green tree ant (*Oecophylla smaragdina*). Invasive ants can cultivate sap-sucking insects such as scale and aphids, using the honeydew produced by these pests as a food source. They protect these insect pests from attack by natural predators, potentially leading to pest outbreaks that weaken host plants (CSIRO, 2010, 2011; Environs Kimberley, 2011b)

Weeds

Approximately 60% of the Dampier Monsoon Vine Thicket patches surveyed by Black et al. (2010) contained environmental weed species, although the degree of infestation varied with each patch. Most weed occurrences were on the edge of patches or where the canopy had been disturbed. Many of the major weed species impacting the ecological community (Appendix B, Table B3) originated from pastoral and horticultural species e.g. pie melon (*Citrullus lanatus*).

Through competition for space and resources, invasion by weeds can displace native species and reduce native plant abundance and diversity. It can also transform the vegetation structure of an ecological community. The introduced buffel grass (*Cenchrus ciliaris*) is common on the Dampier Peninsula and it occurs in approximately 30% of patches of the ecological community. Buffel grass can cause changes in fire regimes, as it is fire tolerant and can induce a 'grass-fire cycle'. The grass-fire cycle occurs when flammable invasive grasses establish and lead to an increased fire frequency and, in some cases, intensity. This causes a decline in tree and shrub cover, facilitating further grass invasion, which in turn increases the likelihood of further fires (NT Government, 2006, 2010).

The Dampier Monsoon Vine Thickets occurs adjacent to the urban areas of Broome, Lombadina-Djarindjin and One Arm Point where many invasive weeds, such as the yellow poinciana tree (*Peltophorum pterocarpum*) and neem tree (*Azadirachta indica*) are planted or have established. Disturbances to sites, feral animals, birds and macropods, are likely dispersal vectors for weed species. Minor earth works or soil disturbance such as creation or maintenance of access roads or the use of heavy machinery can lead to the germination of weeds in or near to the ecological community. For example, coffee bush (*Leucaena leucocephala*) has germinated in a number of patches near disturbed areas at James Price Point and siratro (*Macroptilium atropurpureum*) at Yawuru Conservation Park in Broome. Although not currently recorded in the ecological community, other highly invasive weeds are known to occur nearby. For example, rubber vine (*Cryptostegia madagascariensis*), a Weed of National Significance (WoNS), occurs at Lombadina-Djarindjin, while lantana (*Lantana camara*), another WoNS, is present at Beagle Bay and One Arm Point.

Introduced vines and climbers such as hairy morning glory (*Merremia dissecta*) and snakeweed (*Stachytarpheta cayennensis*) can penetrate the overstorey of the ecological community where they compete with existing native vine species and smother underlying native flora species. Other weed infestations can also act as fire paths during drought. Exotic creepers and vines such as butterfly pea (*Clitoria ternatea*) and wild passion fruit (*Passiflora foetida*) can smother

trees on rainforest boundaries that have been degraded by various impacts including fire (Russell-Smith and Bowman, 1992). When desiccated, these vines can wick fire into the canopy (Panton, 1993). Shrub species such as horehound (*Hyptis suaveolens*) have also been associated with rainforests damaged by fire.

Altered hydrology

The ecological community may be impacted by development that alters localised hydrology, microclimates and precipitation or where there is alteration to aquifer levels or quality.

Stormwater runoff from formed and sealed roads can create concentrated flows. This can lead to erosion and increased local flooding. Flora species within the ecological community that do not readily adapt to changed drainage regimes, such as the overstorey species *Gyrocarpus americanus* (helicopter tree), can decline or die from extended periods of submersion. Runoff from suburban sources is also a vector for weed invasion, increased nutrient loads and rubbish deposition.

After rain, water accumulates in the dune swale habitat of the ecological community and contributes to the recharge of aquifers. The creation of hardstand areas and use of groundwater for development will potentially alter surface flows and lower groundwater levels, reducing water availability for vegetation. Any change to hydrological inputs may affect the trees within the ecological community.

Climate Change

Climate change is now understood to pose a serious long-term threat to terrestrial, coastal and aquatic ecosystems and to have the potential to change the ecology of these environments. Not only does climate change directly threaten species that cannot adapt, it could also exacerbate existing threats, including loss of habitat, altered hydrological regimes, altered fire regimes, and invasive species. The potential large-scale impacts of climate change could influence the species composition of this ecological community through their responses to disturbance and the very nature of those disturbances.

As a consequence of greenhouse gas-induced global warming, trends suggest northern Western Australia will become warmer with more hot days and fewer cold nights (CSIRO and Bureau of Meteorology, 2007). By 2030 the annual average number of days over 35°C in Broome could grow from the current 54 to 64–119 days. A small decline in annual rainfall and a decrease in relative humidity are also expected. Trends suggest that evapotranspiration, ignition of fires due to lightning strike and frequency of severe cyclones may increase.

The modelled impacts of climate change on temperature, rainfall and the severity and frequency of extreme weather events are likely to directly affect the hydrological and fire regimes that impact on the nature and persistence of the ecological community. The Dampier Monsoon Vine Thickets will be particularly vulnerable to extended dry periods with associated desiccation of plant fuels and resultant likely increased fire risk.

Key threatening processes

The following EPBC Act listed Key Threatening Processes are considered relevant to the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ecological community:

- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs
- The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo rhinella marinus*)

Appendix F – Eligibility for listing against the EPBC Act criteria

This Appendix presents the detailed analysis relevant to the listing criteria in regard to the Dampier Monsoon Vine Thickets.

Criterion 1 - Decline in geographic distribution

The Dampier Monsoon Vine Thickets occurs as naturally fragmented patches from Broome in the southwest, to One Arm Point in the north, to Goodenough Bay in the south east of the Dampier Peninsula. It occurs in coastal to near-coastal sites that are favourable for the development of vine thicket communities.

While there has been no detailed modelling of the likely pre-European distribution of the ecological community, it has been estimated that the ecological community formerly occupied up to 2800 ha (Black et al., 2010; DEC, unpublished).

The current extent of the ecological community is estimated to range from 2300 to 2685 ha, based on recent vegetation surveys (Black et al., 2010; DEC, unpublished).

It should be noted that these estimates do not take the condition criteria prescribed earlier into account so it is likely that the extent which remains in good condition is less than these estimates. These estimates also do not take future development interests in this region into account. There is the potential for further loss of the ecological community from future development.

The known decline in extent of the ecological community is in the order of 4–18% and is likely to be <30%, even if condition and potential imminent projects are taken into account. This is well below the minimum 70% indicative threshold for the substantial decline of an ecological community.

The ecological community has not undergone a significant decline in its geographic distribution. Therefore, the ecological community is **not eligible** for listing in any category under this criterion.

Criterion 2 - Small geographic distribution coupled with demonstrable threat

This criterion aims to identify ecological communities that are geographically restricted to some extent. Three indicative measures apply: 1) extent of occurrence (i.e. the total geographic range of the ecological community); 2) area of occupancy (i.e. the area actually occupied by the ecological community within its natural range); and 3) patch size distribution, which is indicative of the degree of fragmentation. It is recognised that an ecological community with a distribution that is small, either naturally or that has become so through modification, has an inherently higher risk of extinction if it continues to be subject to ongoing threats that may cause it to be lost in the future. There are demonstrable and ongoing threats to the Dampier Monsoon Vine Thickets, as detailed in Appendix E.

Extent of occurrence

The ecological community is generally scattered across the coastal and near-coastal parts of the Dampier Peninsula. The extent of occurrence roughly equates to about 194 700 ha. An extent of occurrence that lies within the range 100 000 to <1 million ha is indicative of a limited geographic distribution.

Area of occupancy

The ecological community is estimated to occupy a total area of approximately 2300–2685 ha (Black et al., 2010; DEC, unpublished). It is likely that the extent, which remains in good condition is marginally less than these estimates. An area of occupancy within the range 1000 to <10 000 ha is indicative of a restricted geographic distribution.

Patch size distribution

Of the 77 known patches of the ecological community 28 (or 36%) are less than 10 ha in size. In addition, the majority (72 patches or 94% of the total known) are less than 100 ha in size (based on analysis of data from DEC, unpublished). This indicates the ecological community generally occurs as fragmented, small patches, which is consistent with a restricted geographic distribution. The fragmentation of the ecological community is largely natural, rather than a consequence of disturbance, and is due to the patchy nature of landscape positions suitable for the development of the Dampier Monsoon Vine Thickets.

Fragmented ecological communities are likely to be more susceptible to disturbances and adverse influences from the surrounding environment. This happens regardless of whether fragmentation arises naturally or from landscape modification and disturbance. The degree of fragmentation, in itself, is not indicative of a reduction in community integrity for the Dampier Monsoon Vine Thickets, but simply reflects the ecological community's natural distribution. However, the degree of fragmentation may influence how the ecological community responds to a threat, its resilience to a particular disturbance and, therefore, the degree to which reduction in community integrity is expressed. The relevant consideration therefore is not fragmentation but the nature of continuing degradation to these fragmented patches.

The ecological community has a restricted distribution, on the basis of its fragmented patch sizes and area of occupancy. It is subject to a range of ongoing threats, described in Appendix E, which could cause it to be further degraded or lost in the medium-term future. Therefore, the ecological community has been demonstrated to meet the relevant elements of Criterion 2 to make it **eligible** for listing as **vulnerable**.

Criterion 3 - Loss or decline of functionally important species

The closed canopy of the Dampier Monsoon Vine Thickets generally provides shelter and habitat for a range of species, both plant and animal, that require more moisture and shade than is available from more open surrounding vegetation communities. It can generally be surmised that particular species or guilds of species would have important roles for maintaining ecosystem function in the ecological community. For instance, frugivorous birds and mammals are known to be important for seed dispersal of key canopy forming trees, such as ebony wood, coffee fruit, mamajen, mangarr and wild apple (Kenneally et al., 1996). Other shrub and vine species, such as goolyi, provide important resources for small birds. However, the specific functional roles and importance of species for this ecological community are not known in detail. Furthermore, despite known threats impacting upon species within the Dampier Monsoon Vine Thickets, no data are available to show that these particular functional species are in decline. For example, none of the key canopy species are listed as threatened in their own right.

There are insufficient data available to determine the ecological roles, or the loss or decline of functionally important species within the ecological community. Therefore, the ecological community is **not eligible** for listing in any category under this criterion.

Criterion 4 - Reduction in community integrity

The Dampier Monsoon Vine Thickets is a naturally fragmented ecological community that occurs as individual patches or groups of patches within the swales and the lee of the coastal Holocene dune systems that run parallel along the coastline of the Dampier Peninsula. Individual patches and patch groups operate as an ecological network, with connectivity being maintained by dispersal vectors, particularly bird and mammal frugivorous species (Black et al., 2010). Seventy-seven patches of the ecological

community currently are known to occur. Many of these patches are linear and narrow, have a high edge to area ratio, and are small with the majority being <100 ha in size.

A number of factors potentially contribute to the degradation of the ecological community, however, altered fire regimes and invasive weeds are two factors in particular that are reducing the integrity of the ecological community. The factors do not necessarily act in isolation but may be interactive or synergistic in their cumulative impacts to the ecological community.

Reduction in integrity through altered fire regimes

The key structural elements of the Dampier Monsoon Vine Thickets include a typically closed tree canopy cover over a relatively moist understorey that confers some natural resistance to fire spreading into intact patches. This contrasts with the surrounding or nearby vegetation that is often more open, drier and flammable, for instance pindan.

Traditional fire regimes in the Kimberley region likely consisted of patchwork fires. Little is known in detail of particular fire regimes but burning patches of rainforest/vine thickets and their immediate surrounds generally appears to have been deliberately avoided. This helped to preserve vine thickets as a food resource, due to the diversity of fruit bearing trees present in the ecological community. However, fire regimes have changed from traditional Indigenous management to mostly uncontrolled annual fires ignited by natural and anthropogenic causes. In general, there are now larger and more frequent fires across the Dampier Peninsula.

The impacts of these changed fire regimes to the ecological community have been monitored at least since 1989, with detailed data from 2000 to 2010 (Fisher et al., unpublished). The data collected include the frequency and area of the Dampier Monsoon Vine Thickets affected by fire for 70 of the 77 known patches, and show that the incidence of fire in the ecological community has increased markedly in the preceding decade (Table F1).

- Only two of the 70 patches were not burnt at all in the period from 2000 to 2010 inclusive. The remainder experienced at least one fire in the patch. A few patches were burnt, to some extent, each year or almost every year. The median number of fires per patch over the decade was 4.5.
- The median total area burnt per patch was about 10 ha. Individual fires burnt a median area of 2 ha per patch.
- If it is assumed that there were minimal occasions when successive fires burnt the same parts of a patch, the total area burnt within the decade amounted to almost 1800 ha or two-thirds of the total extent of the 70 patches of the ecological community that were monitored. Even if this value overestimates the total amount burnt over the decade, the data indicate that the ecological community is impacted by fire and that fire recurs at repeated, sometimes short, intervals.

Table F1. Frequency of fires on the Monsoon Vine Thickets of the Dampier Peninsula ecological community between 2000 to 2010, inclusive (Fisher et al., unpublished) (Number of patches monitored = 70; total area of patches = 2660 ha)

A) Frequency of fires in the ecological community

Fire Frequency (years)	0	1	2	3	4	5	6	7	8	9	10	11
Number of patches	2	5	10	11	6	12	6	3	10	3	1	1
% of patches	2.9	7.1	14.3	15.7	8.6	17.1	8.6	4.3	14.3	4.3	1.4	1.4

B) Area of the ecological community burnt per year

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total *
Area burnt (ha)	84.7	348.2	94.1	77.8	80.7	243.5	22.6	202.5	159.4	431.7	51.7	1796.9
Area burnt (%)	3.2	13.1	3.5	2.9	3.0	9.2	0.8	7.6	6.0	16.2	1.9	67.6

* Assumes no substantial overlap in the area burnt by recurring fires, i.e. that the part of a patch previously burnt was not burnt again during the successive fire(s).

Many plant species that occur in the Dampier Monsoon Vine Thickets are fire sensitive and do not recover well after fire. An increase in the frequency and intensity of fires therefore can lead to a loss in the diversity of these elements of the ecological community. The impacts of fire on patches of the Dampier Monsoon Vine Thicket also include a reduction in the cover of trees, shrubs and vines and loss of accumulated ground litter. This opening of the vegetation structure and the ground layer allows invasive grasses to establish into the ecological community through burnt areas (discussed in the following section). Grasses are a minor floristic component in undisturbed patches of the Dampier Monsoon Vine Thickets.

Observations show that fire usually affects the edges of a patch more frequently than its core (Fisher et al., unpublished). This has particularly adverse affects on the Dampier Monsoon Vine Thickets because many patches are narrow and linear with large edge to area ratios. Consequently, successive fires lead to progressive degradation at the edges and greater exposure of the core of a patch to subsequent disturbances. Fisher et al. (unpublished) noted changes in the vegetation structure and increased cover of invasive grasses, particularly along the edges of a patch, following frequent fire.

The ecological community is impacted more by late dry season fires than early to mid dry season fires. Late dry season fires are likely to be more intense due to the increased dryness and flammability of the vegetation.

Reduction in integrity through weed invasion

Weed invasion is an ongoing threat that contributes to the degradation of the Dampier Monsoon Vine Thickets. The worst weeds are able to spread into relatively intact patches of native vegetation, while other species establish after some form of disturbance. Once established they adversely affect native species through direct competition or by altering ecosystem processes, such as disrupting food webs or

dispersal agents (as when natural pollinators visit weed rather than native species) or changing fire regimes (for instance the establishment of more flammable invasive grass species into a patch).

Given the broad extent of the ecological community, the number of invasive weed species threatening the ecological community is potentially large. Certain weed species are likely to have more serious adverse impacts on the ecological community than others. For example, neem (*Azadirachta indica*) and coffee bush (*Leucaena leucocephala*) displace native canopy forming trees and form impenetrable thickets. Neem is a relatively recent weed introduction (Barrett, pers. comm., 2012) that is mainly dispersed by birds that eat its fruit. *Passiflora foetida* (passion vine) is also spread by birds and bats and can invade areas that have not been subject to other disturbances. Climbers such as siratro (*Macropodium atropurpureum*), hairy morning glory (*Merremia dissecta*) and Darwin pea (*Clitoria ternatea*) are vigorous climbers that cover trees and shrubs, particularly on the edge of a patch or in other disturbed areas of the ecological community. These species have the potential to displace native vine species and to dominate the canopy of native trees species. When they desiccate, they can provide a vector for fires into the canopy of the ecological community. Shrubby weeds such as horehound (*Hyptis suaveolens*) can outcompete native species and dominate groundcover, particularly where the canopy is open such as at the edges of the ecological community.

There is evidence that the incidence of weeds in the ecological community is relatively high. Black et al (2010) recorded weeds to be present in approximately 60% of patches of the Dampier Monsoon Vine Thickets. In particular, serious weeds such as passion vine occur in about 40% of patches, buffel grass (*Cenchrus* spp.) in about 30% of patches, neem in 14% of patches, siratro in about 12% of patches and coffee bush in about 9% of patches (Louise Beames pers. com., 2012).

Weeds that were introduced as pasture species, such as buffel grass, occur in surrounding vegetation communities from which they spread into the ecological community, given appropriate disturbance or vectors. Buffel grass can penetrate the ecological community via human and animal tracks or by disturbances, such as fire (Black et al., 2010; Australian Weeds Committee, 2012). It is recognised to be highly invasive and its rapid growth can displace native species within the ecological community. Buffel grass also is tolerant of fire and can significantly increase fire fuel loads where it has established on the edge or within patches of the ecological community. This contributes to a change in the fire regime of a patch by promoting the spread of fires into the ecological community.

Degradation due to weeds can be ongoing if not appropriately managed. A number of weed identification and management programs are being conducted in the ecological community by state and local government bodies, community and NRM groups, and Indigenous ranger groups. However, these programs are not currently widespread and the effective long-term management of weeds is often resource intensive and requires considerable commitment and effort. Many of the weeds now present in the ecological community are established and likely to spread further, being highly invasive. They are contributing to a reduction in integrity of the ecological community and their impacts can be exacerbated by the changes to fire regimes noted above. The nature of the existing weed problem and the difficulties of implementing consistent management across the region, mean that weeds will continue to contribute to a reduction in integrity of the ecological community into the future.

Reduction in integrity through other disturbances, e.g. invasive pest animals

Altered fire regimes and weed invasions are key factors that are reducing the integrity of the Dampier Monsoon Vine Thickets but other disturbances also contribute. Pastoral activity formerly occurred on the Dampier Peninsula but has since declined and much of the land has been destocked. However, feral populations of domestic stock, notably cattle, donkeys and pigs occur in the region. Feral animals can damage the ecological community by removing canopy plants establishing in the understorey, opening up thickets, destroying soil structure by trampling and digging. These activities help to spread weeds into thickets and, in so doing, increase the susceptibility of patches to fire and erosion. Further, they reduce the ability of native plant species to regenerate, thereby limiting the capability of the ecological community to recover from disturbance.

Other feral animals that occur in or near to the ecological community are predators and omnivores that impact upon native fauna either by direct predation or competition for resources. For instance, black rats have been noted in vine thickets (McKenzie, 1991); feral cat tracks have been observed frequently in dune systems that occur around the Dampier Monsoon Vine Thickets; and feral dogs are often reported near outstations and tip points in the region (L. Beames, pers, comm., 2012). Introduced ant species such as the black crazy ant (*Paratrechina longicornis*) have been recorded within the ecological community and can displace species such as the green tree ant (*Oecophylla smaragdina*) (CSIRO, 2010, 2011; Environs Kimberley, 2011b).

The degree of impact on the ecological community from grazing and other activities by feral animals has not been quantified. However, there is some evidence on the incidence of feral activities within patches of the ecological community. Black et al. (2010) noted impacts due to feral cattle in 24 (or 39%) of the 62 occurrences surveyed and impacts due to feral pigs in two occurrences.

In addition to the impacts from feral animals, there also are human impacts to patches, particularly those close to larger settlements, such as Broome. Impacts include dumping of rubbish in or near to remnants, and the creation of access tracks and gaps in or at the edges and cores of remnants, including from 4WD vehicles driving off-road on dune systems.

Summary

A number of threats operate on the Dampier Monsoon Vine Thickets that adversely affect the integrity of the ecological community. There are clear adverse impacts from altered fire regimes that have lead to increased frequency and intensity of burn, but also various impacts due to weed invasion, feral animals and human activities. These impacts are exacerbated by the naturally fragmented nature and restricted distribution in the landscape of the Dampier Monsoon Vine Thickets. All these actions operate in conjunction with likely synergistic detrimental impacts. If this is ongoing, the integrity of the ecological community and its capacity for restoration from disturbance will continue to decline over time.

Based on the evidence presented above, the reduction in integrity experienced by the ecological community is severe and that indicates a severe degradation and disruption to community processes. Therefore, the ecological community is **eligible** for listing as **endangered** under this criterion.

Criterion 5 - Rate of continuing detrimental change

There are no quantitative data available to assess this ecological community under this criterion. Therefore, it is **not eligible** for listing under this criterion.

Criterion 6 - Quantitative analysis showing probability of extinction

There are no quantitative data available to assess this ecological community under this criterion. Therefore, it is **not eligible** for listing under this criterion.

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APPENDIX 5: TEC REPORTING FORM (JULY 2017)



Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

COMMUNITY: Monsoon Vine Thickets of the Dampier Peninsula		OBSERVATION DATE: 19/20/07/2017	
New occurrence <input checked="" type="checkbox"/> Site ID: _____		CONS STATUS: V (WA), E (National)	
OBSERVER/S: Johani Mamid, Jacob Smith, Eduardo Maher, Dr Malcolm Lindsay, Dr Stephen Reynolds		PHONE: 08 9192 1922	
ROLE: Country managers, ecologists		ORGANISATION: Environs Kimberley, Nyamba Buru Yawuru	
EMAIL: malcolm@environskimberley.org.au			

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):			
Broome, Cable Beach Tourist area			
north side of Broome Surfclub, near the listed MVT in Minyirr Park			
			Reserve No: _____
DISTRICT: W Kimb		LGA: Shire of Broome	
Land manager present: <input checked="" type="checkbox"/>			
DATUM: GDA94 / MGA94 <input type="checkbox"/> AGD84 / AMG84 <input type="checkbox"/> WGS84 <input type="checkbox"/> Unknown <input type="checkbox"/>		COORDINATES: (If UTM coords provided, Zone is also required) DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/> Lat / Northing: 8017289.86 Long / Easting: 416385 Zone: 51K	
METHOD USED: GPS <input type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input checked="" type="checkbox"/> No. satellites: _____ Map used: _____ Boundary polygon captured: <input type="checkbox"/> Map used: _____			
LAND TENURE:			
Nature reserve <input checked="" type="checkbox"/> Timber reserve <input type="checkbox"/> Private property <input type="checkbox"/> Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/> National park <input type="checkbox"/> State forest <input type="checkbox"/> Pastoral lease <input type="checkbox"/> MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/> Conservation park <input type="checkbox"/> Water reserve <input type="checkbox"/> UCL <input type="checkbox"/> SLK/Pole _____ to _____ Specify other: _____			

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input checked="" type="checkbox"/>		Area observed (m ²): 4300
EFFORT: Time spent surveying (minutes): 20 (x2) + 80 (x4)		No. of minutes spent / 100 m ² : 2.3

THREATS - type, and supporting information: e.g. clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents.	Cause/Agent: e.g. weed type, grazing species, recreation type	Area affected	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
• Weeds	Neem, Passiflora, Taylor Fruit, Mint weed, Coffee bush	30%	L	H	M
• Clearing	Proposed to be cleared in Broome Shire's plan for Cable Beach area	100%	N	E	S
• Weeds (individual species)	coffee bush Leucaena (3-5m)	2%			
•	buffel Cenchrus (edges)	4%			
•	Neem Azadirachta (2-4m)	6%			
•	Passiflora foetida	4%			
•	Hyptis	2%			
•	Siratro Macroptilium	1%			
•	Ziziphus mauritiana (1, edge)	<1%			

*Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme

*Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)

CONDITION OF OCCURRENCE: (Bush Forever Scale) (estimate % of area in each)

Please return form to:

communities.data@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by: _____ Date entered: _____ Database no: _____



Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

Pristine ☐ ____%Very Good ☒ 50%Degraded ☐ ____%Excellent ☒ 50%Good ☐ ____%Completely Degraded ☐ ____%**RECOMMENDED MANAGEMENT ACTIONS:** e.g. roadside markers, weed control, etc.

List patch on database

Lias with Shire to alter their development plans in the area to avoid clearing the patch

Control weeds - Neem, Passiflora, Coffee Bush are priorities

Install interpretative signage with input from Yawuru

ACTIONS IMPLEMENTED (include date):**HABITAT INFORMATION:** (Check more than one box for combinations or where necessary)**LANDFORM:**

- Crest ☐
 Hill ☐
 Ridge ☐
 Outcrop ☐
 Slope ☐
 Flat ☐
 Open depression ☐
 Drainage line ☐
 Closed depression ☐
 Wetland ☐

ROCK TYPE:

- Granite ☐
 Dolerite ☐
 Laterite ☐
 Ironstone ☐
 Limestone ☐
 Quartz ☐
 Specify other:
 none

LOOSE ROCK:

(on soil surface; e.g. gravel, quartz fields)

- 0-10% ☒
 10-30% ☐
 30-50% ☐
 50-100% ☐

SOIL TYPE:

- Sand ☒
 Sandy loam ☐
 Loam ☐
 Clay loam ☐
 Light clay ☐
 Peat ☐
 Specify other:
 pindan

SOIL COLOUR:

- Red ☒
 Brown ☐
 Yellow ☐
 White ☐
 Grey ☐
 Black ☐
 Specify other:
 white dune sand
 adjacent

DRAINAGE:

- Well drained ☒
 Seasonally
 inundated ☐
 Permanently
 inundated ☐
 Tidal ☐
 Specify other:

Specific Landform Element: (Refer to field manual for additional values)

swale behind coastal dune

CONDITION OF SOIL:
 Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐ Cracked ☐ Saline ☐ Other:
**VEGETATION
CLASSIFICATION:**

- 1.
2. overstorey Mirda and Marool with vines
3. shrubs & small trees Guwal, Breynia
4. leaf litter, some low shrubs

FIRE HISTORY:*Please return form to:***communities.data@dpaw.wa.gov.au**

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by: _____ Date entered: _____ Database no: _____



Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

Last Fire:	Season/Month:	Year:	Fire Intensity:	High <input type="checkbox"/>	Medium <input type="checkbox"/>	Low <input type="checkbox"/>	No evidence of fire <input checked="" type="checkbox"/>
Actual Occurrence Landuse:							
Adjacent Landuse:							
Associated Flora Species:							
TREES (count in brackets) Mirda Gyrocarpus americanus (52) Red Gubinge Terminalia cunn. x petiolaris (1 big)							
Marool Terminalia petiolaris (9) Grewia breviflora (8) Mallotus nesophilus (1)							
Minyjuru Sersalisea sericea (4) Brachychiton diversifolius (1)							
Sandpaper Fig Ficus aculeata (4) Clerodendrum tomentosa (5)							
Atalaya hemiglaucula (7)							
SHRUBS/small trees							
Guwal Flueggea (34) Kungkara Carissa (6)							
Bridelia tomentosa (1) Breynia cernua (24) subshrubs - Cleome viscosa, Tricho. zey., Crotalaria medic.							
Senna costata (1) Grewia retusifolia (1)							
Associated Fauna Species:							
Agile Wallaby							
Great Bowerbird (and bower)							
Grey-crowned Babbler							
Singing Honeyeater							
White-gaped Honeyeater							
Ta-Ta lizard Lophognathus							
OTHER COMMENTS:							
VINES							
Goolyi Caesalpinia major (6) Crabeye Vine Abrus prec. (6)							
Jasminum didymum (3)							
Tylophora cinerascens (16) some large							
Snakevine Tinospora smilacina (7)							
WEEDS see front page							
Acacia bivenosa, Spinifex longifolius, Ipomoea pes-caprae on adjacent dune							
ATTACHED:							
Map <input type="checkbox"/>		Mudmap <input type="checkbox"/>		Photo <input type="checkbox"/>		GIS data <input type="checkbox"/>	
						Field notes <input checked="" type="checkbox"/>	
Other:							

Please return form to:

communities.data@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by: _____ Date entered: _____ Database no: _____



Threatened and Priority Ecological Community (TEC/PEC) Occurrence Report Form

COPY SENT TO:	Regional Office <input type="checkbox"/>	District Office <input type="checkbox"/>	Other:
Submitter of record:	<u>S. Reynolds</u>	Role:	<u>Ecologist</u>
Signature:		Date submitted:	<u>20/07/2017</u>

Please return form to:

communities.data@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by: _____ Date entered: _____ Database no: _____

APPENDIX 6: INTERIM RECOVERY PLAN NO. 383 MONSOON VINE THICKETS ON THE COASTAL SAND DUNES OF THE DAMPIER PENINSULA 2018 – (DBCA 2018)

INTERIM RECOVERY PLAN NO. 383

Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula

2018 – 2023



Department of **Biodiversity,
Conservation and Attractions**

Science and Conservation Service

February 2018

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife (now Biodiversity, Conservation and Attractions) Corporate Policy Statement No. 35 (DPaW 2015a) and Corporate Guideline No. 35 (DPaW 2015b). Corporate Policy Statement No. 35 states that the department will prepare recovery plans or conservation advices that document the conservation requirements, recovery or management actions and information requirements of threatened species and ecological communities (TECs), identify threatening processes impacting threatened species or TECs, and implement programs to mitigate the threats. Interim recovery plans outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened species or ecological communities, and begin the recovery process.

While the Department of Biodiversity, Conservation and Attractions (DBCA) is committed to ensuring that threatened ecological communities are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, there is no statutory requirement to implement recovery actions identified in this plan. This plan identifies responsibilities for specific actions and largely refers to the department initiating and guiding actions. However, the implementation of recovery actions by the Department of Biodiversity, Conservation and Attractions or any other organisation will be done within the context of regional and statewide priorities and technical and resource capacity. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting the Department of Biodiversity, Conservation and Attractions, as well as the need to address other priorities.

This plan was given regional approval on 13 June 2017 and was approved by the Executive Director of Science and Conservation on 20 February 2018. This plan will operate from February 2018 to January 2023 but will remain in force until withdrawn or replaced following a review of the need for further recovery actions, and whether a revised plan needs to be prepared.

Information in this IRP was accurate at August 2017.

ACKNOWLEDGMENTS

This Interim Recovery Plan was prepared by Valerie English. Cover photograph by Valerie English.

The following people provided valuable advice and assistance in the preparation of this Interim Recovery Plan:

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CITATION

This Interim Recovery Plan should be cited as:

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SUMMARY

Name: Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula (hereafter termed 'vine thickets').

Description

The vine thickets of the Dampier Peninsula are a very distinctive type of rainforest in the Kimberley region. This type of vine thicket is confined to the Peninsula between Broome and Derby, along with the coastal dune formations on which it occurs.

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.

Vine thickets occur as discrete areas of dense vegetation and can occur as a stand of a few trees or as larger patches. The 90 known occurrences vary in size from about 0.3 ha up to 507 ha, with a mean size of about 33 ha. They can occur as clumps or narrow linear stands (Black *et al.* 2010). There are about 2,887 ha of the vine thickets currently mapped on the Department of Biodiversity, Conservation and Attractions Threatened Ecological Community (TEC) Database.

The vine thicket community contains many plants with fleshy fruits that provide important food sources for fauna such as agile wallabies, bats, bower-birds and fruit-doves. They are also an important traditional resource for Indigenous people.

DBCA Region: Kimberley

DBCA District: West Kimberley

Local Government: Shire of Broome

IBRA Subregions: Dampierland DL1 Fitzroy Trough subregion and DL2 Pindanland subregion

Current Status

Ranked as Vulnerable in Western Australia in 2001, and ranked Endangered in February 2013 under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Habitat Characteristics

This vine thicket community is largely restricted to the east and west coastlines of the Dampier Peninsula associated with Holocene and Pleistocene dune systems. Due to rainfall, frugivore distribution and fire history, occasional relictual fragments occur throughout surrounding woodlands.

The vine thicket occurrences are dependent on rainfall, hydrology and high humidity levels. Rainfall in the northern end of the Peninsula is between about 700-750mm per annum, and in the southern end of the range of the community it is about 600mm. Many occurrences are known to occur adjacent to or on groundwater springs or shallow aquifers, described as permanent soakage by Kenneally *et al.* (1991), and so some level of dependence on groundwater can be assumed. A concentration of water flow into the shallow recharge zones at the base of the dune systems is believed to support the community.

The high humidity and heavy fogs along the coast and the wet season rains also help the community to survive long dry periods. The moisture and humidity are accentuated by the dense and protective shady canopy and support the ecosystems' role as a biological refuge. The humidity is also thought to assist in protecting the community from fires.

Benefits to other species/ecological communities

One declared rare flora taxon, one Priority 2, two Priority 3, and one Priority 4 flora taxa occur in vine thicket occurrences (Biota Environmental Services 2009a). *Parsonsia kimberleyensis*, a Kimberley endemic, is only known from the vine thicket TEC (Environs Kimberley 2010). An additional TEC, three Priority 1 and two Priority 3 ecological communities also occur adjacent to or close to the vine thicket TEC near Broome. Actions such as general improvements in land management practices applied to the vine thicket TEC areas, including fire management and weed control, will assist in the conservation of nearby threatened and priority flora and communities.

A bird listed as endangered under the EPBC Act and as P4 in WA, and one Schedule 4, one Priority 2, two Priority 4 fauna, and two Commonwealth migratory fauna species have also been located in the vine thicket occurrences or similar assemblages (Biota Environmental Services 2009b). Other migratory birds are also known to seasonally utilise the vine thickets. An endemic reptile species is known from within the vine thickets TEC (Bardi Jawi Rangers, personal communication). Recovery actions implemented to improve the quality or security of the vine thicket community are likely to improve the status of all native species within the community, including the significant species noted above.

Role and interests of Indigenous people

Many vine thicket occurrences contain sites that are of Aboriginal significance and many are also managed by indigenous people (refer Appendix 1, 3). The close involvement of Indigenous people is crucial to the implementation of recovery under this plan, and this is identified in recovery actions.

Interim recovery plan objective

To conserve the ecological and conservation values of the vine thicket community, by:

- ensuring the permanent protection and conservation of self-sustaining representative areas of key occurrences identified in this plan;
- attaining conservation management of self-sustaining representative key areas of each of the identified vine thicket clusters;
- minimising the loss and maximising the conservation of all remaining occurrences as far as possible, including recovering degraded occurrences where it is cost effective and practical to do so.

Criteria for success:

- an increase in the number of key self-sustaining areas of the vine thicket community as identified in this plan that are managed for conservation and/or with conservation included in their purpose (including Indigenous Protected Areas, and reserves that are jointly managed between the Conservation and Parks Commission and the Aboriginal Native Title Holder in accordance with the *Conservation and Land Management 1984 Act* (CALM Act); or
- an increase in the number of identified vine thicket cluster groups for which representative areas have conservation management in place; or
- an increase in the number of occurrences of the vine thicket community for which formal strategies are in place to minimise loss and maximise conservation (such as formal weed or fire management strategies in place and being implemented).

Criteria for failure:

- complete loss of any identified cluster group; or

- complete loss or degradation (to degraded condition or poorer) of any key areas of the vine thicket community as identified in this plan; or
- failure to develop and implement formal strategies to manage key threats such as weed invasion, or inappropriate fire or hydrologic regimes.

Summary of Recovery Actions

Liaise with stakeholders	Design and conduct research
Complete on-ground surveys	Investigate controlled tourism, manage access
Continue to monitor	Map habitat critical to survival
Identify and implement appropriate fire regime	Develop management guidelines
Monitor and control major weeds	Monitor and manage feral and exotic animals
Report and control high threat weeds	Apply planning and impact assessment processes
Investigate hydrological processes	Consider climate change issues
Seek tenure that provides for conservation management	Report on outcomes
Protect critical habitats and species	

1. BACKGROUND

1.1 History, defining characteristics of the community, and conservation significance

The two recognised types of rainforests - tropical and temperate, both occur in Australia. Tropical rainforests occur near the equator in areas of consistently high temperatures. These are dense, damp forests on nutrient-poor soils. Tropical rainforests are generally millions of years old.

Temperate rainforests, such as the vine thickets of the Dampier Peninsula, are much younger in geological time than tropical rainforests. They are generally less than 10,000 years old (McKenzie 1991), cover a lot less area than tropical rainforests, and soils are much more nutrient-rich.

The Australian rainforests have been described as small seasonally sparse, 'raingreen' patches in gullies, scree-slopes and rugged terrain. They have the highest degree of biotic interdependence of any terrestrial community, and are still recognised as fragmentary associations derived from the original rainforest community (McKenzie 1991). McKenzie (1991) states that it is likely a variety of issues probably support the high species richness including disturbance, stability, species' reproductive biology, heterogeneity of the habitat, evolutionary time and predation pressure. The many layers within rainforests provide a suite of habitats.

Over the last million years the extent of tropical rainforests has altered continuously with variations in climate. The extent of rainforests is much greater than it was at the beginning of the Holocene – about 10,000 years ago. Australian rainforests are believed to contain species of Gondwanan and Laurasian origin (McKenzie 1991). Rainforests have continued to expand into areas previously occupied by drier associations as climate has continued to get wetter during the Holocene. Australia's dry 'monsoonal' rainforests are part of a group of this type that occur in areas with a dry season throughout Australasia. This type is characterised by presence of many vagile (mobile) cosmopolitan genera and largely deciduous tree canopy.

This vine thicket community is a type of rainforest ecosystem that occurs in discrete patches along the Dampier Peninsula in the south-western portion of the Kimberley region. These are the southernmost occurrences of rainforest (dry monsoon forest) in Western Australia. This diverse community occurs on dunal back slopes, and in swales between dunes and sometimes also on unconsolidated coastal Holocene landforms (Black *et al.* 2010). The western coastline occurrences are on the downwind (leeward, eastern) sides of quaternary slopes of coastal dunes formed in the last 2 million years - the Quaternary period. The eastern occurrences have a more varied geomorphology including a higher incidence of Pleistocene dune systems (those formed between 2 million and 10,000 years ago), headlands and rocky slopes, in addition to Holocene dunes.

Vine thickets are recorded from the western seaboard near Broome townsite in the south to the tip of the peninsula at One Arm Point in the north, however, anecdotal evidence indicates small patches may occur at Cape Villaret, about 40 km south west of Broome (L. Beames personal communication). The eastern peninsula coastline occurrences are known to extend as far south as Foul Point.

Kenneally *et al.* (1991) note that rainforest patches contribute a considerable proportion of the floristic diversity of the Kimberley Region. They recorded the vine thickets covered only 0.05% of the land area but contained 24% of the total number of flowering plant species known in the region. They also noted that a large proportion of the plant species recorded in rainforest patches did not occur outside rainforests despite suitable habitat.

Kenneally *et al.* (1991) note that many of the rainforest trees have fleshy fruits or other types that are adapted for dispersal by bats, birds, mammals, wind and water. Rainforest should therefore be able to be established in additional areas of suitable habitat, and there that the vine thicket vegetation on the Dampier Peninsula was distinct from other Kimberley rainforest should be considerable pollen transfer between patches. The inter-dependence of species may mean that component species need to migrate in unison (McKenzie 1991), and this may limit the distances that they can migrate. The vine thicket community probably occurs in its current habitats due to being afforded some protection from the elements, particularly fire, provided overall climate is appropriate.

The Kimberley Rainforests Australia survey (McKenzie *et al.* 1991) determined assemblages in the region through statistical analysis of plant species composition. The study included data from four rainforest sites on the Dampier Peninsula. These four sites were distinguished as a separate floristic group in the 18 Group level analysis of perennial plant species data. The vine thickets were termed 'Patch Group 6' and classified together on the basis of similarities of the perennial plant species. Kenneally *et al.* (1991) named the community 'Western Kimberley Holocene dune sand patches' and noted that they differed from other groups through the absence of many of the tree and large shrub species that characterised other rainforest groups in other parts of the Kimberley (eg. *Vitex acuminata*, *Ganophyllum falcatum*, *Albizia lebbbeck*, *Elaeodendron melanocarpa*, *Adansonia gregorii*, *Glycosmis* sp., *Strychnos* sp. and *Micromelum* sp.). The authors also note that although the rainforest sites as a group were generally low in annuals, they recorded 20 annuals in site 29/2 (Occurrence 3 - Vine 03, refer Appendix 3, and 6). They attributed this to increased numbers of annuals in rainforest patches with open canopies or with large glades. The vine thickets of the Dampier Peninsula were on the margins of the sites sampled by McKenzie *et al.* (1991) as well as the margin of rainforest distribution in the south western Kimberley.

Ninety occurrences of this vine thicket community have been located between Broome and One Arm Point and are recorded on the TEC database (Appendix 1). Although the original data that distinguished the vine thickets as having a unique composition was collected for McKenzie *et al.* (1991), most of the data about the location and composition of the vine thickets were gained from approximately three years' dry-season survey of the Dampier Peninsula by the then Department of Conservation and Land Management in liaison with Broome Botanical Society, Aboriginal communities, Traditional Owners, and outstation residents, between 1999 and 2002 (Black *et al.* 2010). They focussed on perennial evergreen and semi-deciduous trees, shrubs and vines, but herbs were also noted when evident.

There have been a series of additional surveys that have also contributed data about the location, status and composition of the community. The survey work has resulted in the characterisation of the vine thickets in terms of composition, threats, location and boundaries. These data are stored on the TEC database at Department of Biodiversity, Conservation and Attractions, Kensington.

Black *et al.* (2010) note that about 25% of the plant species they recorded in the vine thickets were mostly or completely confined to the community. They found that the most common plant families encountered in their surveys of the vine thickets were Fabaceae (21 species), Poaceae (14), Myrtaceae (11), Apocynaceae (seven), Malvaceae (six), with the most common genera being *Acacia* (six species), *Corymbia* (four), *Amyema* (three) and *Capparis* (three).

Black *et al.* (2010) state the following (the term patch is generally equivalent to occurrence in this plan): "Several tree and tall shrub species were common to most monsoon thickets. The trees were: Marool or blackberry tree (*Terminalia petiolaris* - 57 patches), currant or coffee fruit (*Grewia breviflora* - 56 patches), Goonj (*Celtis philippensis* - 55 patches), ebony wood (*Diospyros humilis* - 50 patches), mangarr (*Sersalisia sericea* - 48 patches), mistletoe tree (*Exocarpos latifolius* - 46 patches), mamajen (*Mimusops elengi* - 47 patches), bauhinia or jigal tree (*Bauhinia cunninghamii* - 43 patches), and

helicopter tree (*Gyrocarpus americanus* subsp. *pachyphyllus* - 43 patches). Common tall shrubs included: snowball bush (*Flueggea virosa* subsp. *melanthesoides* - 49 patches), along with *Croton habrophyllus* (44 patches) and broad-winged hop bush (*Dodonea platyptera* - 44 patches). The most common climbers were crabs eye bean (*Abrus precatorius* - 54 patches), bush caper (*Capparis lasiantha* - 45 patches), snake vine (*Tinaspora smilacina* - 44 patches), *Jasminum didymium* (42 patches), *Caesalpinia major* (37 patches), and oyster-catcher bill (*Tylophora cinerascens* - 35 patches).

While most patches were dominated by a mix of several different tree species that varied in height, a few patches were dominated by a single tree species at a uniform height, and had little to no understorey of shrubs. Any ground layer was sparse in healthy patches. Twenty three percent of the native perennial plant species present comprise generally inconspicuous vine species." Appendix 6 provides a list of plant taxa recorded in the vine thicket community, taken from the TEC database.

The trees *Ficus virens* (banyan fig) and *Syzygium eucalyptoides* subsp. *bleeseri* (wild apple) occur in a significant occurrence of vine thickets between Quandong and James Price Point. Some species also occur as localised populations in the community, including *Cupaniopsis anacardioides* at Chile Creek and *Diospyros maritima* near Emeriau Point.

The vine thickets support high species richness and this provides important habitat for fauna including the agile wallaby, rose crowned fruit-dove, flying foxes and great bowerbirds.

There are approximately 2,887 hectares in 90 occurrences of the community recorded on Biodiversity, Conservation and Attractions' TEC database. The average area of occurrences is about 33ha. There are several small additional occurrences that have been located but not yet mapped, generally due to access issues.

Of the area of the community mapped on the TEC database at the time of writing of this plan (note that some tenure categories overlap):

- About 1147 ha (~40%) occurs on Indigenous managed lands
- About 159 ha (~5%) occurs on pastoral stations (Note: some pastoral stations are also managed by Indigenous groups)
- About 1,028 ha (~36%) occurs on Unallocated Crown Lands (UCL) – unspecified land managers/usage.
- About 264 ha (~9%) occurs on land vested with the Shire of Broome; including Minyirr Coastal Park (Vine 01)
- About 302ha (~11%) occurs on private freehold land
- About 0.8ha (~0.03%) occurs on road reserves.

About 3% of the total area occurs in a reserve managed for conservation in Minyirr Coastal Park in the town of Broome. Vegetation in the Coulomb Point Nature Reserve includes a mix of vine thicket and pindan flora and is considered transitional between the two vegetation types (Black *et al.* 2005) and has therefore not been included in current mapping of the vine thicket TEC. Minyirr Coastal Park is the most degraded vine thicket occurrence and has been impacted by recreational use, off-site impacts such as hydrological change from adjacent urban developments and other impacts associated with its urban location (Black *et al.* 2005). Neither of the two reserve areas represent the true character of the Dampier Peninsula's vine thickets.

The vine thickets on the Dampier Peninsula are of great significance to Aboriginal people. The thickets contain many traditional food sources and medicine, water and significant sites. Many occurrences contain culturally sensitive law-grounds with restricted access protocols (Black *et al.* 2010) but there has not yet been a comprehensive investigation into the cultural values, protocols and traditional management for this ecosystem. Much traditional ecological knowledge about the management and

protection of vine thickets is held in a series of languages and cultural groups, including Bardi Jawi, Nyul Nyul, Djabera Djabera, Jabirr Jabirr, Goolarabooloo and Yawuru (Environs Kimberley 2009).

The vine thicket community is currently ranked Vulnerable in Western Australia and Endangered under the EPBC Act.

1.2 Biological and ecological characteristics

Flora

The main tree species include (from Black 2005; Environs Kimberley 2010): *Celtis philippinensis*, *Diospyros ferrea* var. *humilis*, *Ficus virens*, *Melaleuca cajuputi*, *Melaleuca dealbata*, *Melaleuca viridiflora*, *Mimusops elengi*, *Sersalicia sericea* and *Terminalia petiolaris*. Shrub species in the understorey include: *Croton tomentellus*, *Dodonaea platyptera*, *Exocarpos latifolius*, *Pandanus spiralis*, *Plumbago zeylanica* and *Santalum lanceolatum*. Vine species include *Abrus precatorius*, *Adenia heterophylla*, *Caesalpinia major*, *Gymnanthera nitida*, *Jacquemontia paniculata*, *Tylophora cinerascens* and *Tinospora smilacina*. *Lophostemon grandiflora* often occurs in the wettest areas behind sand dunes as part of the vine thicket stand and occurs as a forest similar to the occurrence of *Melaleuca* sp. within vine thickets. *Capparis lasiantha* is a common sprawling vine found within most vine thicket occurrences, while *Capparis sepiaria* is a regular feature in most northern vine thicket patches. Black *et al.* (2010) state that flora species in the vine thicket community comprise 23% of the species known to occur on the Dampier Peninsula.

Black *et al.* (2010) state "Flora confined to localised populations (i.e. a small number of patches) included: the climber *Secamone timoriensis* (one patch), the Kimberley endemic shrub *Helicteres rhynchocarpa* (two patches), the annual climber potato vine *Operculina aequisejala* (two patches), the small tree *Clerodendrum floribundum* var. *ovatum* (three patches), the climber *Capparis jacobsii* (four patches), the small tree *Pittosporum moluccanum* (two vine thicket patches plus one transitional patch of vegetation, and vegetation adjacent to a vine thicket), the shrub musk-scented plant *Hypoestes floribunda* var. *varia* (four patches), and the climber *Opilia amentacea* (four patches), the small tree Tuckeroo (*Cupaniopsis anacardioides* - eight patches), the shrub *Luvunga monophylla* (eight patches), and the tree wing-leaf whitewood (*Atalaya variifolia* - eight patches)."

Vine thickets provide a good food source for many fauna during the dry season, and the vegetation, with its dense canopy and large fruiting trees provides a particular refuge, habitat and nesting sites for many birds and reptiles. Species in the vine thickets that have edible fruits and berries include Mangarr (*Sersalicia sericea*), Joongoon (*Mimusops elengi*), Australian Ebony (*Diospyros ferrea*), Marool or blackberry (*Terminalia petiolaris*) and banyan fig (*Ficus virens*). These fruits are important food resources for flying foxes and rose-crowned fruit-doves that then distribute seeds to maintain the pockets of vine thickets.

Birds

Birds believed to utilise the vine thickets include rose crowned fruit-dove (*Ptilinopus regina*), and the great bower bird (*Ptilonorhynchus nuchalis*), broad-billed flycatcher, red-crowned pigeon and mangrove golden whistler (Kenneally *et al.* 1996; Johnston and Burbidge 1991; Biota Environmental Services 2010b). Dollar birds (an insectivore), honeyeaters, and channel billed cuckoos (frugivore) reportedly feed on the spatially variable and seasonally complementary fruit, nectar and habitat resources in the stands of vine thickets (Environs Kimberley 2009; D. Dureau¹ personal communication). This is similar to the ecology of vine thickets in the Northern Territory, where birds have been shown to track fruit resources with variations in fruit availability (Bach and Price 1999). Price

¹ Mr Dave Dureau: Broome Botanical Society

(2004) indicates that the conservation of frugivorous birds and of the plants whose seeds they disperse will require the protection of networks of rainforest patches. A breeding group of Gouldian finch (*Erythrura gouldiae*) was recorded in the vine thickets (Department of Water and Environmental Regulation (DWER) 2017)).

Bats

The role of birds as frugivores in vine thickets is complemented by a number of species of bats. From Northern Territory studies (Bach and Price 1999) bats also seasonally rely upon vine thicket and adjacent or neighbouring complementary habitats for year-round survival. The authors examined the diet of black flying foxes and found that it consisted of fruit from the rainforest patches in the wet season and flowers from other habitats (*Eucalyptus* savannah, *Grevillea* heath and *Melaleuca* forest) at other times of the year. The protection of alternative roosting sites and the succession of seasonal feeding sites for these frugivores is critical for maintenance of the vine thicket ecological processes, species diversity and survival of the ecosystem functionality. Bach and Price (1999) emphasised that genetic diversity was not related to rainforest patch size, but was maintained as a result of effective seed dispersal between rainforest patch networks.

At least 15 bat species were recorded by McKenzie (1991) as utilising complementary mangrove and paperbark plant communities. Bats are typically seasonal in their use of complementary habitats and a detailed investigation of the use of Dampier Peninsula monsoon vine thickets by bat species has not yet been conducted.

Mammals

There are few records of mammalian fauna in the vine thickets, however, the important role of the black flying fox (*Pteropus alecto*), as both a pollinator and seed disperser for species such as *Syzygium* spp. is noted in Palmer *et al.* (2000). McKenzie (1991) recorded agile wallaby (*Macropus agilis*) as utilising vine thicket areas. Similarly, species such as northern brush-tailed possum (*Trichosurus arnhemensis*) and water rat (*Hydromys chrysogaster*) are recorded as using the often adjacent and complementary mangrove communities and are highly likely to utilise vine thickets for habitat and available fruit and flowers.

Other species that have been recorded on the peninsula in complementary or adjacent ecosystems and have (had) the potential to periodically use/used vine thickets for habitat or refuge include sugar glider (*Petaurus breviceps* - bollanga), greater bilby (*Macrotis lagotis*), golden bandicoot (*Isodon auratus*), northern planigale (*Planigale maculata*), golden-backed tree-rat (*Mesembriomys macrurus*), western chestnut mouse (*Pseudomys nanus*) and the dingo (*Canis familiaris dingo*).

Ecological characteristics

The following characterisations of the vine thickets were noted by McKenzie *et al.* (1991) for four vine thicket occurrences ('patches') on the Dampier Peninsula:

- Average canopy height - 8.2m.
- Average perennial plant species richness - 30.7 species
- Average bird species richness - 12.75 species per patch, with a total of 24 species recorded in the four patches surveyed.
- Average total species richness (birds, snails and plants) - 48.5 species
- Six species of land snail recorded
- Soils were all Quaternary sands, dark grey, dark greyish brown, or reddish brown
- Average litter depth - 7.4cm
- Average soil pH - 7.91

- The annual mean temperature for the three northern sites was 27.4°C and for the southern site was 26.7°C
- The annual average rainfall for the three northern sites - 736mm, and for the southern site - 580mm.
- The impact of fire when surveyed in 1987-1989 was recorded as severe throughout, or severe on the edges of the patches.
- Average distance to the coast - 150m.

Black *et al.* (2010) summarizes the variation of Dampier Peninsula vine thickets as follows;

"Dendrogram classification of thickets by perennial plant species, and of perennial plant species by co-occurrence in the same thicket patches, showed some spatial associations and trends. Based on similarity of perennial plant species assemblages, coastal thickets were subdivided into four main patch groups (referred to as B, C, D and E). Vine thicket patch groups largely corresponded with the clustered patch distributions, albeit with some outliers.

Group C is the largest patch group. This group occurs at the far northern end of Dampier Peninsula above the 750 mm per annum rainfall zone, and includes the most species-rich patches. Patches in this group extend across coastal dune systems onto red pin-dan soil plains in the lee of dunes. Most were characterised by several co-dominant evergreen tree species, often at a range of heights relative to each other within the patch. Group E patches are interspersed among Group C patches in the north and most occur entirely within extensive coastal dune systems that are either very broad or very high (one patch occurs on a headland). Group E patches tended to be dominated by a single tall evergreen tree species. Group D patches occur on the mid-west coast between Cape Baskerville and Baldwin Creek. Group D patches have the narrowest range of species, comprising mainly core rainforest plants. 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."

Maintenance of key self-sustaining areas of these identified cluster groups is recommended as a focus for conservation management in this plan. In this context, self-sustaining areas are natural areas that can maintain their characteristic diversity of major functional biotic groups, productivity, and rates of biochemical cycling over the normal cycle of disturbance events that might impact the area, without the need for major management intervention (adapted from Chapin III *et al.* 1996).

Black *et al.* (2010) note that topography and soil are probably important in determining the floristic classifications of the vine thicket occurrences, with the larger dune formations towards the north of the peninsula providing suitable conditions for a greater species diversity and vegetation structure. In particular factors such as dune formation and height, and different soil types are likely determinants. They also noted that some vine thicket vegetation was recorded on rock outcrops, but that it looked quite different and grouped separately from the floristic associations of occurrences on coastal land forms.

McKenzie *et al.* (1991) surmise that differences between the species composition of the rainforest groups could be related to responses to environmental factors, such as rainfall and substrate. They note that rainforest only occurs in the drier areas in fire refugia with favourable hydrological conditions, and that none were recorded in areas where rainfall was less than 580mm. The Broome occurrence of the vine thickets occurs near this rainfall isohyet and is therefore the patch that occurred in the lowest rainfall zone of all those studied by McKenzie *et al.* (1991). McKenzie *et al.* (1991) state

that species richness correlated with rainfall and higher levels of soil phosphorus, but that richness declined with increased annual temperature range.

The vine thickets are believed to function as a network ecosystem (Environs Kimberley 2010; Black *et al.* 2010). That is, the migration of fruit-eating animals, including birds, bats and mammals, ensures dispersal of seeds and fauna and therefore helps to maintain the isolated patches of the vine thickets and their associated plant and animal communities.

Research in the Northern Territory indicates that monsoon vine thicket species re-colonize areas that remain unburnt for long periods. This reinvasion process is generally concentrated around existing savannah trees due to the deposition of seeds by roosting bats and birds (Fensham and Butler 2004) and the process has been observed in vine thickets on the Dampier Peninsula (L. Beames personal communication).

1.3 Geology and Hydrology

Red sands ('pindan soils') cover most of the Dampier Peninsula. Yellow-grey sands occur on the northern end of the Peninsula where rainfall is higher. Wind blown red sands have formed weak dunes throughout the Peninsula and may be a remnant of a more arid era when the Great Sandy Desert expanded (Kenneally *et al.* 1996). The superficial formations of the Peninsula are dominated by red pindan soils, but immature soils on sandy Pleistocene dunes, clayey tidal creek sediments and recent sandy Holocene dunes have also formed in the area. Pindan soils are of wind blown or alluvial origin and consist of red clayey sands that contain abundant iron-oxides. The 1:500,000 CSIRO soil and landform mapping indicates that the areas in which the vine thickets occur consists of "sand plain with longitudinal sand dunes, some active drainage ways – chief soils are red earthy sands", and "plains with minor sandstone residues with extensive rock outcrop, chief soils neutral red earths."

The vine thickets mainly occur on leeward slopes and swales and occasionally exposed dune crests. Many occurrences extend into the red pindan soils on the inland portions of the dunes. Landforms occupied by the vine thickets include beach fronts, sand-spit headlands, low cliffs above mangrove lined creeks, storm ridges within intertidal flats, and red soil gullies inland of coastal cliffs (Black *et al.* 2010). The soils in the Holocene dunes where the community occurs are deep coastal dunes, generally white but can be pink, with a thin humus layer.

There is typically very low relief across the Dampier Peninsula that results in sheet flooding across most of the area. Low elevation in the northern part of the Peninsula has resulted in the development of broad drainage valleys and seasonal swamps near Beagle and Pender Bays (Kenneally *et al.* 1996). The habitats of the vine thickets possess little surface drainage, are dominated by sheet runoff, and are generally a very simple environment of gently sloping surfaces, often internally draining.

Rainfall in the northern end of the Peninsula is between about 700-750mm per annum, and in the southern end of the range of the community it is about 600mm. At the far southern, more arid end of their range near Broome, the vine thickets are replaced by savanna.

Where the vine thickets occur in the southern portion of the Dampier Peninsula, site drainage is from east to west; in the northern portion groundwater flow is generally from south to north, and the eastern portion it is from west to east. There are no permanent rivers or creeks in the habitat of the vine thickets, and minor drainage lines flow after rain. After rains, water accumulates behind the first sand dune system at the coast, in the habitat of the vine thickets (Environs Kimberley 2010).

A micro-climate is created behind the dune systems, where the cooler air is thought to become trapped, interacting with the warm moist coastal breeze resulting in a higher level of precipitation from

fog and dew concentrated along the coastal strips. It is believed that the high humidity and heavy fogs along the coast, and the wet season rains, also help the community to survive the long dry periods. The moisture and humidity are accentuated by the dense and protective shady canopy and support the ecosystems' role as a biological refuge. The humidity is also thought to assist in protecting the community from fires.

The Department of Water and Environmental Regulation completed a study of groundwater dependent ecosystems on the Dampier Peninsula between Pender Bay and Waterbank in August 2017 (DWER 2017). The study showed that there were few signs that groundwater resources were being impacted by current use except in some sub-areas of the Broome groundwater area. The report states that as at 2012 increased salinity in Town Water Reserve indicated that upper limits of abstraction may have been reached.

The study included four locations within the vine thicket TEC (vine 64, vine 62a, and two sites in vine 72). The groundwater was found to be two to four metres below ground level. These water levels indicate that trees species will be accessing shallow groundwater from the regional aquifer. All occurrences in the study were found to be accessing older water from the Broome Sandstone aquifer that was forced up over the near-coastal saltwater interface, and not water derived from recent rainfall (DWER 2017).

The preliminary probability map that was developed by DWER (2017) indicates that all occurrences of the vine thicket TEC that occurred within their study area are likely to be groundwater dependent. Many vine thicket occurrences are also situated adjacent to, or on ground water springs or shallow aquifers described as permanent soakage by Kenneally *et al.* (1991) in which case they will be highly or entirely groundwater dependant. Aboriginal people culturally identify vine thickets as a place for water sites, containing jila, (living water, groundwater). Many species such as *albay* (fig), *manbung* (Pandanus) and *mutgarr* (paperbark) are closely associated with and adjacent to vine thickets and are known to indicate that fresh water is close to the surface.

1.4 Threatening processes

Clearing and Development

Rainforest vegetation in general is particularly vulnerable to disturbance. Most of the vine thicket occurrences are small or very narrow and linear and have high edge to area ratios (Black *et al.* 2010). At the time of their surveys in the early 2000s, Black *et al.* (2010) estimated about 95% of the vine thickets remained, however, clearing is a relatively new and escalating threat. Current or potential clearing of vine thicket occurrences is associated with ongoing development in Broome, the recent rapid establishment of Aboriginal outstations and ecotourism ventures, clearing for building and track construction, and recent proposals for industrial development on the coast of the peninsula.

Residential areas are expanding in Broome and the Aboriginal settlements of Beagle Bay, Lombadina-Djarindjin and One Arm Point, and vine thicket patches in their vicinity may be potentially affected by infrastructure expansion unless the issue is considered in planning processes. An additional occurrence near the town of Broome in Hidden Valley (Occurrence 8) has been subject to development plans in recent history, although it was also planned as a cultural site likely to be part of a coastal park. Environmental approvals were provided in 2015 for a Liquified Natural Gas (LNG) precinct at James Price Point (Occurrence 62).

Where tracks have been established with heavy equipment such as graders, the pindan soils erode rapidly and water tends to flow along the tracks, ultimately creating major erosion channels. Tracks established only by vehicle movement do not tend to erode in this way as the soil structure can be

maintained. A project to upgrade the 196 km Broome to Cape Leveque Road and ancillary roads to an all-weather raised gravel standard or sealed road will increase vehicle traffic, economic development and tourism pressures on the Dampier Peninsula, and this will have the potential to increase impacts to the vine thickets associated with increased runoff, erosion and visitor pressure.

The focus of environmental impact assessment should be to avoid and minimise future impacts to key occurrences of the vine thicket community such that remaining areas are self-sustaining, and to ensure that key areas of each cluster group are protected and conserved. An additional focus should be to ensure that loss of other remaining occurrences of the community is minimised and conservation is maximised.

Altered fire regimes

Local Aboriginal people have commented that healthy vine thickets did not 'want to burn' due to the cool microclimate under the closed canopy and the lack of a significant ground storey to provide fuel (Black *et al.* 2010). Aboriginal people took care to keep fire out of the vine thickets because of the valuable food resources they contain (Kenneally *et al.* 1996). Black *et al.* (2010) noted that a freehold landowner had successfully prevented late season bush fires and that these vine thickets were in exceptionally good condition.

Traditional burning practices involved lighting small fires in appropriate seasons that resulted in patchworks of new growth and maximised ecosystem diversity. These practices avoided the late dry-season bush fires that have greatly increased since European settlement. Late dry season bush fires burn hot and cover vast areas and are considered to be a key threatening process influencing the vine thickets. The frequent intense fires threaten the integrity of the vine thickets through impacting on species diversity, encouraging weed invasion and encroachment of Pindan vegetation. Recovery of the vine thicket assemblages following fire is likely to be slow as many species are fire-sensitive and much of the soil seedbank is likely to be destroyed by fire (Environs Kimberley 2010). Frequency of fire in the surrounding landscape is thought to be the most critical factor in controlling rainforest boundaries (Bowman 2000), with re-emergence of vine thicket vegetation into the surrounding woodlands only occurring where areas have been subject to much less frequent fire.

Occurrences afforded some protection from rocky outcrops, steep sided gullies, or the ocean are likely to be burnt less frequently and McKenzie *et al.* (1991) noted that rainforest patches throughout the Kimberley region are restricted to the same 'fire-proof' refugia as other tropical rainforests in Australia. Therefore, actual appropriate habitat for the vine thickets may be considerably more extensive than their current distribution indicates. In the absence of fire it is possible that occurrences may increase in size. Where hot, late season fires have occurred frequently, the vine thickets on the Dampier Peninsula have retreated from the edges and are colonised by the surrounding woodlands (T. Willing², D. Dureau personal communication). Black *et al.* (2010) state that repeated hot fires in vegetation that occurs adjacent to the vine thickets may cause occurrences to decline in size over time. As part of the West Kimberley Nature Project (WKNP), Environs Kimberley has worked with a number of on-ground groups to identify practical monitoring and assessment tools to assist with fire management applications including measurements of fire risk and impacts, and vine thicket emergence and retreat.

In 2010-2013, a study of fire frequency and biodiversity in the vine thickets using remote sensing data correlated with on ground measurements was coordinated by Environs Kimberley. The study indicated that about 70% of the total area of the vine thickets burnt between 2000-2010 (Fisher *et al.* 2013). They found a median of 4.5 fires per 'patch', and inter-fire intervals of 1-3 years in 71.4% of patches in 1989-2010. Sixty eight percent of all fires were found to have occurred during the late dry season.

² Mr Tim Willing: Broome Botanical Society

Remote sensing data indicated a trend of vegetation decline associated with fire, with 20% of the area of the vine thickets experiencing declining cover between 1991 and 2012 (Fisher *et al.* 2013). These figures were considered likely to be an underestimate as remote sensing data used to determine fire occurrence was found to only capture canopy fire impacts, and not smaller burns in the understorey (Fisher *et al.* 2013). These data have implications for the future ecological function of the vine thickets as the vegetation will retreat rapidly as a consequence of hot fires.

Little is known of the fire regime required to maintain species composition. An experimental approach to fire, with a general reduction in late season hot fires, in conjunction with a carefully designed monitoring regime that provides quantitative data about the effects of fire on the vine thickets is recommended in this plan.

Cattle and other disturbances, such as vehicles, exacerbate the impacts of fire as they open up the canopy. This in turn then allows annual and exotic grasses to invade, and these increase the fire risk and intensity of fire, producing a self-perpetuating threat to the vine thickets. Research also indicates that with a subsequent decrease in fire frequency the occurrences can recover and allow rainforest species to recolonise, or infiltrate into adjacent sclerophyll vegetation if there is suitable adjacent habitat (McKenzie *et al.* 1991).

Weed invasion

Weed invasion is an increasing threat to the vine thickets, and as mentioned above, is exacerbated by disturbances such as fires and grazing which in turn, can predispose areas to further weed invasion. The structure of the vine thickets is generally a dense tree canopy, providing a generally damp and shady habitat. When in good condition the community generally lacks grass cover and can include a thick layer of leaf litter and a sparse layer of medium sized fruiting shrubs. Buffel grass and other grassy weeds are penetrating the vine thickets along tracks and access points and have been spread by feral cattle, donkeys, pigs, and human access tracks. As visitation increases on the Peninsula, the threat posed by weed invasion is likely to increase. Furthermore, particular parts of Occurrence 1 in Minyirr Park near the town of Broome have increased sediment deposited from adjacent residential development, which is also implicated in serious weed invasion.

Many of the major weed species that are invading the vine thickets were historically pastoral or horticultural species that are now spreading into native bushland. Weeds have been recorded in just under 60% of vine thicket occurrences (see Appendix 4). *Passiflora foetida* var. *hispida* (passion vine) and *Cenchrus* spp. (including *Cenchrus ciliaris* - buffel grass, *C. setiger* and *C. biflorus*) were noted to be the most common weeds, with passion vine occurring in about 40% of occurrences and *Cenchrus* spp. in about 30% of occurrences. Buffel grass is a common weed on the northern Dampier Peninsula. Grassy weeds such as these dry out in the late dry season and greatly increase flammability of the vine thickets. The species regenerate rapidly, and greatly increase both the fire risk and intensity of fire, thereby increasing weed invasion. *Macroptilium atropurpureum* (siratro) is another significant and increasing weed in the vine thickets, and also contributes to the fuel load where it occurs in the community. Tree weeds, including neem trees (*Azadirachta indica*) and coffee bush (*Leucaena leucocephala*), spread from old settlements and can displace native trees and form impenetrable thickets.

The occurrence closest to Broome (Occurrence 1) has suffered major infestations of vine species that can smother tree canopies, including siratro and *Merremia aegyptia* (hairy morning glory).

Environs Kimberley (2010) states the following:

"Weeds recorded within and surrounding vine thicket vegetation on the Dampier Peninsula include the following high threat species (L. Beames personal communication):

• coffee bush	<i>Leucaena leucocephala</i>	
• buffel grass	<i>Cenchrus ciliaris</i>	
• morning glory	<i>Ipomoea quamoclit</i>	
• lantana	<i>Lantana camara</i>	WONS/Declared Weed
• white convolvulus creeper	<i>Merremia dissecta</i>	
• hairy Merremia	<i>Merremia aegyptia</i>	
• bellyache bush	<i>Jatropha gossypifolia</i>	Declared Weed
• mint weed	<i>Hyptis suaveolens</i>	
• Gallon's curse	<i>Cenchrus biflorus</i>	
• neem	<i>Azadirachta indica</i>	
• siratro	<i>Macroptilium atropurpureum</i>	
• passion vine	<i>Passiflora foetida</i>	

Cryptostegia madagascariensis (rubber vine), a significant weed, has not been found as a naturalised plant, but there is a high possibility of occurrence of this species due to localised community plantings.

Secondary weed species recorded:

• Darwin pea	<i>Clitoria ternatea</i>
• caltrop	<i>Tribulus terrestris</i>
• snakeweed	<i>Stachytarpheta cayennensis</i>
• pie melon	<i>Citrullus lanatus</i>
• vinca	<i>Vinca major</i>
• rubber tree	<i>Calotropis procera</i>
• kapok	<i>Aerva javanica</i>
• coral vine	<i>Antigonon leptopus</i> ."

Black *et al.* (2010) state that the highest priority weed to target for vine thicket conservation is the vine siratro (*Macroptilium atropurpureum*), which currently occurs at Broome (Occurrence 1), James Price Point (Occurrence 62), and in two occurrences near One Arm Point. New infestations are a higher priority than those in the already degraded occurrence close to the town of Broome.

Recommendations from Black *et al.* (2010) state that other high priority weeds are: *Clitoria ternatea* at Broome and One Arm Point; *Merremia dissecta* at Broome and Quandong Point; *Leucaena leucocephala* at James Price Point and north of Quandong Point; *Azadirachta indica*; *Cryptostegia madagascariensis* recorded in Lombadina-Djarindjin; *Hyptis suaveolens* at Broome and in and near One Arm Point; and yellow poinciana (*Peltophorum pterocarpum*) at Broome. *Macroptilium atropurpureum*, *Passiflora foetida*, *Jatropha gossypifolia*, *Azadirachta indica*, *Leucaena leucocephala*, *Clitoria ternatea*, *Hyptis suaveolens* and garden-derived rubber vine are also priorities at Lombadina, Djarindjin and One Arm Point. Black *et al.* (2010) state that *Cenchrus ciliaris*, *C. setiger*, and *C. biflorus* that occur at various locations are medium priorities for control.

Hydrological change

There is potential for groundwater abstraction to impact the vine thickets, in particular, greater abstraction of groundwater for domestic and industrial use has the potential to impact the community due to drawdown. Some developments proposed for the Peninsula involve groundwater abstraction, and have potential for saltwater intrusion, interface up-coning and subsequent impacts to groundwater dependent ecosystems. Increased infiltration and re-directed or increased runoff, from urban or industrial sites, also have the ability to impact by causing shifts in the location of available water, including occasional surface water, groundwater rise and water logging of vegetation. Groundwater contamination due to pollution events or runoff from industrial, agricultural or residential areas can also create impacts to vine thickets as a result of unacceptable water quality.

Pre-development documentation of natural flow regimes, natural water quality and determination of water and solute balances for the vine thickets will provide a baseline for assessing likely impacts and monitoring post-development change. A better understanding of the tolerances of the vine thickets to changes in hydrology, and threshold levels is also crucial for impact assessment.

The water opportunity map in DWER (2017) indicates that there is restricted opportunity for water abstraction in areas of the vine thicket TEC within the study boundary. There are likely to be extra management considerations if there are abstraction proposals in these areas.

The focus of environmental impact assessment for developments with potential to impact on the vine thicket community should be to avoid and minimise future hydrological impacts to key occurrences such that remaining areas are self-sustaining, and to ensure that representative areas of each cluster group retain natural hydrologic processes. An additional focus should be to ensure that adverse hydrological impacts to other remaining occurrences of the community are minimised.

Alterations in flow regimes or water quality can cause impacts at other sites in proximity. For example in Broome, road construction and residential developments are impacting on the hydrology of the adjacent occurrence (Occurrence 1), and Manari Road impacts on the edges of Occurrences 62 and 63. Impacts are primarily through an influx of sediment, nutrients, weed infestations, and an increase in flooding. Increasing flooding can result in changes to species composition, such as loss of helicopter trees, *Gyrocarpus americanus* (Black *et al.* 2010). *Triodia* species are also sensitive to flooding (T. Willing personal communication). More recent subdivisions, such as Januburu, have more water sensitive urban design that is intended to reduce excess nutrients and other possible pollutants in stormwater entering surrounding bushland and waterways. However, there is still a substantial amount of run-off, soil erosion and weed spread observed from the drainage system (L. Beames personal communication). Black *et al.* (2010) also note stormwater runoff redirected from roads was having a significant impact on Occurrence 62 at James Price Point at the time of their surveys.

Grazing and Feral Animals

Populations of un-managed cattle, donkeys, pigs and possibly horses that occur on the Peninsula are a major threat to the vine thickets (Environs Kimberley 2009). These animals damage canopy-forming plants, open the canopy and result in erosion and weed invasion that can subsequently result in more damaging fires. Plant species that are grazed by these animals are less likely to continue to propagate successfully. Pastoral activity has declined on the Peninsula and much of the land has been destocked in recent years. Most of the area is now Aboriginal Reserves and unallocated Crown land; however mechanical damage of plants and the soil surface by un-managed cattle is still significant in some occurrences of the vine thickets.

The impact of grazing has not been quantified through monitoring, however 'widespread and severe' cattle damage was noted in three occurrences surveyed for McKenzie *et al.* (1991) and as 'localised and severe' in one occurrence. Impacts of unmanaged cattle were recorded in 24 (39%) of the 62 occurrences surveyed in the early 2000s (Black *et al.* 2010). Occurrence 63 near Quandong Point was previously stocked with cattle, but has now been destocked.

Signs of feral pigs were noted at two occurrences by Black *et al.* (2010).

Black rats have previously been noted in vine thickets (McKenzie 1991) and have the potential to compete with native species for fruit and habitat resources.

Feral cat tracks have been observed frequently in dune systems that are part of and on the outskirts of vine thickets (L. Beames personal communication). Feral cats may have an impact on the bird, small reptile and mammal populations inhabiting vine thickets.

Wild dogs are often reported near outstations and tip points and are likely to have some impact on remaining reptile and mammal fauna inhabiting vine thickets (L. Beames personal communication).

Recreational Activities

The vine thickets are very popular shady areas for camping, and despite some work implemented by Goolarabooloo people and the Kimberley Land Council, the vine thickets on Waterbank Station (Occurrence 63 in particular) are under intense pressure from tourism, camping and fires (Environs Kimberley 2009). Many other occurrences remote from the town of Broome, such as Quandong Point and Middle Lagoon (Occurrences 63, 75), are subject to intense pressure from tourist visitation including vehicle impacts, weed invasion, clearing for camping, and increased fires.

The vine thicket community provides good shade and the occurrences are therefore a popular place for camping. Visitation and impacts associated with use of vine thickets for camping and four wheel driving such as soil compaction, fire wood collection, increased fire frequency, rubbish dumping and increased weed spread have the potential to increase. For example, James Price Point (Occurrence 62) and Quandong Point (Occurrence 63) have been popular recreational and camping sites located 60-70 km north of Broome. These sites are subject to high visitor numbers and the associated impacts of the visitation, including too frequent fire and damage by four wheel drives. The upgrade and realignment of the road from Broome to Cape Leveque is expected to increase the visitation, with an accompanying rise in tourism pressures, traffic, and infrastructure development on the Dampier Peninsula.

Increased mobility for locals and tourists is already having detrimental impacts on vine thickets close to popular fishing and camping spots. Occurrence 75 at Middle Lagoon has been part of a restoration project by Nyul Nyul Rangers with Environs Kimberley, designed to limit the extent of four wheel drive damage and vandalism on this small but significant vine thicket area.

Rubbish dumping, sometimes associated with weed invasion was noted as a threat at three occurrences of the vine thickets by Black *et al.* (2010). Soil erosion and forest product harvesting were also noted as minor threats to the community.

Climate Change

Some of the potential impacts expected as a consequence of climate change may be a threat to the vine thickets. Coastal locations may be susceptible to storm surge, cyclone damage and inundation by rising sea levels and saltwater intrusion into freshwater aquifers upon which the ecosystem is likely to have some dependency. Increase in the frequency of cyclones is predicted and this could increase flooding in the vine thickets. In addition, the tolerance of particular species to changes that may occur in association with climate change, including changes in rainfall and temperatures, is generally unknown. If biota that are significant in dispersing seeds and cross pollinating species are impacted by climate change, then this may also directly impact the vine thickets.

The naturally fragmented state of vine thickets can result in them being highly vulnerable to disturbance. Small and highly fragmented rainforest areas, such as the Dampier Peninsula vine thickets, are particularly susceptible to rapid changes or destruction in the face of threatening processes (Environs Kimberley 2010). Climate change presents a serious threat to vine thickets as it could exacerbate altered fire regimes and weed invasion (Williams 2009).

Black *et al.* (2010) state that as many vine thicket patches as possible should be reserved, managed and protected for conservation to help increase their resilience from the impacts of climate change. The continuing viability of the community will depend on maintaining the ecosystem's connectivity through species migration and the conservation of the network of occurrences and dispersal pathways. It will also be important to maintain the quality of adjacent habitat to support this connectivity. Black *et al.* (2010) note that the vine thickets will be particularly important as refuges in the face of changing climatic conditions as they will be a potential source of foundation species.

A well managed reserve system would also act as a buffer to stochastic events. The management of other threatening processes, such as increased weed invasion or fire frequency that may be exacerbated by climate change, is a crucial part of increasing resilience to this potential threat. Fire management over the wider peninsula area in particular will need to be coordinated with land managers, communities, inter-agency programs and other stakeholders to ensure that the most ecologically, spatially and seasonally appropriate regime is implemented.

The minimisation of the impact of other threats is probably the most important aspect of increasing the resilience of the vine thicket community in the face of climate change. Managing a drying climate as a threatening process in itself is, however, outside the scope of this interim recovery plan.

Dune Movement

The vine thickets can be covered by natural movement of coastal dunes through natural coastal processes. This 'natural threat' to the vine thicket occurrences can be exacerbated through destabilisation of dunes by removal or damage to vegetation. Black *et al.* (2010) recorded patch 28 (Occurrence 65) as an example of significant dune movement, and noted that some trees were buried up to the middle of their trunk in pink sand. Shifting sand dunes are also covering some areas of vine thickets near Hunter Creek (Occurrence 32) and possibly a site south west of Swan Point, Karrakatta Bay (Occurrence 38) (Harding *et al.* 2009).

1.5 Evaluation of the Plan's Performance

DBCA, in conjunction with the West Kimberley Threatened Flora and Communities Recovery Team, will evaluate the performance of this interim recovery plan. The plan will be reviewed within five years of its completion and the need for a new or updated plan will be evaluated.

1.6 Conservation status

The monsoon vine thickets on the coastal sand dunes of Dampier Peninsula were endorsed as vulnerable by the Western Australian Minister for Environment in 2001, and listed as endangered under the EPBC Act in 2013.

2.0 IRP OBJECTIVE AND CRITERIA

Objective:

To conserve the ecological and conservation values of the vine thicket community, by:

- ensuring the permanent protection and conservation of self-sustaining representative areas of key occurrences identified in this plan;
- attaining conservation management of self-sustaining representative key areas of each of the identified vine thicket clusters; and
- minimising the loss and maximising the conservation of all remaining occurrences as far as possible, including recovering degraded occurrences where it is cost effective and practical to do so.

Criteria for success:

- an increase in the number of key self-sustaining areas of the vine thicket community as identified in this plan that are managed for conservation and/or with conservation included in their purpose (including Indigenous Protected Areas, and reserves that are jointly managed between the Conservation and Parks Commission and the Aboriginal Native Title Holder in accordance with the CALM Act); or
- an increase in the number of identified vine thicket cluster groups for which representative areas have conservation management in place; or
- an increase in the number of occurrences of the vine thicket community for which formal strategies are in place to minimise loss and maximise conservation (such as formal weed or fire management strategies in place and being implemented).

Criteria for failure:

- complete loss of any identified cluster group; or
- complete loss or degradation (to degraded condition or poorer) of any key areas of the vine thicket community as identified in this plan; or
- failure to develop and implement formal strategies to manage key threats such as weed invasion, or inappropriate fire or hydrologic regimes.

2.1 Habitat critical to the survival of the community, and important occurrences

Much of the interdunal swale area behind the primary coastal dunes between Broome and Cape Leveque may be considered potential habitat for this vine thicket community. Protection from fire, and an appropriate hydrologic regime in particular, may be major determinants for the occurrence of the community in this habitat.

Although in recent geological history the community may have covered less area, and there may have been less occurrences, the importance of individual patches to the overall maintenance of the 'interacting ecosystem' as a whole is not known. It is therefore not possible to specify which occurrences might be more important than others in the continued existence of the community, and far greater detailed ecological information will be required before this might be determined.

Black *et al.* (2010) recommend the protection of all *Ficus virens* trees (banyan, albay or strangler fig), *Canarium australianum* (jalgir), *Terminalia petiolaris* (marool or blackberry), and hybrids with *T. ferdinandiana* (red gubinge, barragool or gariling) on the Dampier Peninsula, as they produce copious fruit and therefore have a strategic importance in maintaining the viability of vine thickets. It has also been suggested that conservation of *Parinari nonda* (nonda plum) is important for the same reason (D. Dureau personal communication). The maintenance of many fauna, including fruit-eating birds, bats and mammals and their implied status as dispersal agents for the seeds of many vine thicket plant species is also an important consideration.

Woodlands, mangroves and other adjacent ecological communities are likely to play a significant complementary role in the provision of food and habitat resources for mobile frugivores (Black *et al.* 2010). Species such as bats have been shown to seasonally rely upon monsoon vine thicket and adjacent or neighbouring complementary habitats for year-round survival (Bach and Price 1999). These complementary ecosystems provide alternative roosting sites and a succession of seasonal feeding sites for mobile frugivores and are believed to be critical for maintenance of monsoon vine thicket ecological processes, species diversity and survival of the ecosystem's functionality (Environs Kimberley 2010). Maintenance of vine thicket connectivity is therefore also dependent on the maintenance of the quality of complementary linking habitats.

Black *et al.* (2010) indicate that a series of occurrences are a priority for conservation as a consequence of large size, vegetation structure, significant flora, species richness, and representation of the floristic groups they identified. This is further discussed in recommended actions. Protection and conservation of key self-sustaining examples of these high priority areas of the vine thicket community are a focus for conservation management in actions recommended in this plan.

The DWER (2017) study indicated the importance of groundwater levels for maintenance of the vine thicket TEC. Groundwater quality is also likely to be important for the TEC. Further information is required in relation to hydrology in order to define critical habitat.

2.2 Benefits to other species/ecological communities

The declared rare flora taxon *Seringia exastia* occurs near a small vine thicket occurrence near the Broome Port. Four priority flora were located in the vine thickets (Occurrences 62 and 73) or allied assemblages at James Price Point. These are *Gomphrena pusilla* (priority 2), *Eriachne semiciliata* (priority 3), *Polymeria distigma* (priority 3) and *Pittosporum moluccanum* (priority 4) (Biota Environmental Services 2010a). *Pittosporum moluccanum* is only known in WA from four occurrences of the vine thickets on the Dampier Peninsula and the Maret and Berthier Islands.

Parsonsia kimberleyensis (priority 1) is only known from three occurrences of vine thickets - near Bulgin and Hunters Creek – Occurrences 31, 32, 33.

Actions such as general improvements in land management practices applied to the vine thicket TEC areas, including fire management and weed control, will assist in the conservation of nearby threatened and priority flora and communities, such as *Corymbia paractia* (priority 1) which is found in areas close to the vine thicket community.

The following occur adjacent or close to the vine thicket TEC, particularly near Broome:

- Species-rich faunal community of the intertidal mudflats of Roebuck Bay (vulnerable ranked TEC),
- Relict dune system dominated by extensive stands of Minyjuru (Mangarr) *Sersalisia sericea* (P1)
- Dwarf pindan heath of Broome Coast (P1)
- *Corymbia paractia* community on dunes (P1)
- Vegetation Association 73 (Grasslands, short bunch grass savanna, grass; salt water grassland (*Sporobolus virginicus*) (P3)
- Vegetation Association 67 (Grasslands, tall bunch grass savanna, sparse low tree; ribbon grass and paperbarks) (P3)

The greater bilby (Schedule 1), Peregrine falcon (*Falco peregrinus* – Schedule 4), Dampierland burrowing snake (*Simoselaps minimus* - priority 2), bush stone curlew (*Burhinus grallarius* - priority 4), *Lerista separandra* (priority 4 skink), rainbow bee-eater (*Merops ornatus* - Commonwealth migratory species), white-bellied sea eagle (*Haliaeetus leucogaster* – Commonwealth migratory species) occur in the vine thicket occurrences or similar assemblages at James Price Point (Biota Environmental Services 2010b). Dampierland limbless slider (*Lerista apoda*) is an endemic species for which all 31 records are from the Dampier Peninsula (Naturemap accessed 17.01.11). It is recorded as inhabiting sand dune transition zones (Wilson and Swan 2003) and the species has been observed within the vine thickets (Bardi Jawi Rangers personal communication). A breeding group of Gouldian finch (*Erythrura gouldiae*: priority 4 in WA and endangered under EPBC Act) has been recorded in a vine thicket (DWER 2017).

Actions aimed at conserving the occurrences of vine thickets that contain these taxa will also assist in helping to maintain component species.

2.3 International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that convention. The community is not listed under any specific international treaty, however, and therefore this interim recovery plan does not affect Australia's obligations under any other international agreements.

2.4 Role and interests of Aboriginal people

Many occurrences of vine thickets are on land subject to native title and managed by Aboriginal groups, so the involvement of Aboriginal people in the planning and management for the vine thickets is crucial. Many of the vine thicket areas are also located in significant law grounds.

The vine thicket community provides seasonal fruits, yams, carving timber and other valuable resources for Aboriginal people on the Dampier Peninsula. For example, *Gyrocarpus americanus* can be used to make shields and *Cassytha* species were used for fishing nets and shoes.

There are a number of Aboriginal small business operations that include harvesting of some bush fruits and medicines for use in saleable products, for example Gubinge, a species often occurring on the edge of vine thickets is harvested by a number of Aboriginal owned and operated businesses for sale in the food, nutritional and cosmetic industries. It is important that any commercial harvesting strikes a balance with allowing emerging sustainable economies to be further developed whilst also ensuring the ecosystem is not compromised by unsustainable levels of harvest.

Indigenous Protected Areas (IPAs), under the Australian federal government's IPA programme are voluntary agreements where Traditional Owners decide to enter into an agreement to manage a part or whole of their land or sea and other important cultural places and resources. Declaring an IPA on particular country, such as in vine thickets, results in that area being considered part of Australia's network of protected areas (Department of the Environment and Heritage 2006). An IPA has been established with Bardi Jawi Traditional Owners on the northern Dampier Peninsula.

3.0 RECOVERY ACTIONS

Recovery actions implemented to date

The Kimberley Rainforests Australia survey and analysis of data from 95 rainforest sites across the Kimberley included assessments of four vine thicket sites on the Dampier Peninsula (McKenzie *et al.* 1991).

Broome Botanical Society and staff from the then Department of Conservation and Land Management undertook a three year survey of the vine thickets in likely habitat on the Dampier Peninsula from 2000-2002. Environs Kimberley provided funding support for completion of the report (Black *et al.* 2010). Over 70 occurrences were described and mapped, and threats recorded including major weed infestations, clearing and inappropriate fire regimes. Data collected were entered into the Biodiversity, Conservation and Attractions corporate TEC database. A plain English version of the Black *et al.* 2010 report was later produced and distributed through the West Kimberley Nature Project (WKNP - see below) (Bellfield *et al.* 2012).

In 2007, the Northern Rangelands Steering Committee supported the WEED Project (Weed Education Eradication Delivery) coordinated by Environs Kimberley working in partnership with Department of

Biodiversity, Conservation and Attractions in implementing the 'The Dampier Peninsula Vine Thicket Project'. On-ground work in the vine thickets was undertaken by Aboriginal Ranger Groups facilitated by the Kimberley Land Council, including Bardi Jawi Rangers, the Society for Kimberley Indigenous Plants and Animals (SKIPA) and Environs Kimberley staff. The Goolarabooloo Association and Beagle Bay (now Nyul Nyul) Rangers were also involved. Weeds were surveyed in 11 occurrences. Seven occurrences were subject to follow up weed control activities including a combination of small-scale intensive weed control sites, surveys and control of isolated outbreaks, including Djoodoon, Chile Creek, Lombadina, One Arm Point School and Goornnganggoon, Kooljamon and Marrgoon. The project resulted in community-driven momentum for the protection and management of vine thickets and weed management, awareness raising, production of community information materials and propagation of native plants for restoration (Environs Kimberley 2009).

As part of the Commonwealth-funded Resource Condition Monitoring Project in 2008-2009, two monitoring protocols were developed for the vine thicket community. Both of these are available on the Biodiversity, Conservation and Attractions website. They provide information and procedures for monitoring the effectiveness of weed control work in occurrences of the vine thickets (Harding *et al.* 2009), and information and procedures for monitoring the extent of occurrences of the vine thickets (Harding 2009).

Rubibi Aboriginal Land, Heritage and Development Council commissioned a comprehensive survey and report on the environmental weeds of Minyirr Coastal Park (Black *et al.* 2010). Activities included weed removal. SKIPA, Biodiversity, Conservation and Attractions and Yawuru rangers have an ongoing program of revegetation and rehabilitation works in Minyirr Park with the vine thickets being target areas for ongoing weed control. Yawuru rangers are also upgrading walk trails to protect values including the vine thickets in the park. In addition, Nyambu Buru Yawuru (NBY - the Prescribed Body Corporate (PBC) for Yawuru) developed a green army project with SKIPA and Biodiversity, Conservation and Attractions for weed work in Minyirr Park to protect the vine thickets. Fire planning is also underway through Yawuru rangers for Minyirr Park and other reserves near Broome, to help protect the vine thickets.

Biodiversity, Conservation and Attractions staff and volunteers from Broome Botanical Society worked with Aboriginal Ranger groups and Environs Kimberley in February 2010, and September 2015 to survey a selection of the vine thickets to collect updated information about boundaries, composition, threats, and current on-ground management by Traditional Owners. Data were also collected about additional previously unknown vine thicket occurrences, and these have been added to the Biodiversity, Conservation and Attractions database. Environs Kimberley also worked with Yawuru Country Managers and Nyul Nyul rangers to collect additional survey and mapping data for previously unrecorded vine thicket occurrences.

Environs Kimberley took the lead role in a major vine thicket conservation project from 2009-2013. The WKNP, managed by Environs Kimberley and funded through Caring for our Country via Rangelands NRM WA, supported the Bardi Jawi and Nyul Nyul Rangers in developing and implementing a series of projects to conserve and manage the vine thickets. The Aboriginal Ranger groups are guided by their PBCs and facilitated by the Kimberley Land Council (KLC). The Aboriginal Rangers completed threat management, such as weed control, fire management and protection and access management in the habitat of the vine thickets. Some traditional knowledge was recorded and developed into management signs and materials and a community publication 'Plant Stories' produced. Groups consulted and supporting the WKNP and its predecessors, include Biodiversity, Conservation and Attractions, Traditional Owner groups, the KLC, and Kimberley Training Institute. The management of the vine thickets continues to form an important part of both ranger groups' workplans, including KPIs within the Bardi Jawi Indigenous Protected Area plan of management.

With additional funding through State NRM, the WKNP incorporated the Fire and Biodiversity Project. With support from the Bardi Jawi and Nyul Nyul Ranger groups, KLC, University of WA, Biodiversity, Conservation and Attractions and others, the Environs Kimberley WKNP engaged Fisher Research consultancy to identify biological indicators and design monitoring protocols to assess vine thicket health. These protocols were developed in conjunction with on-ground ranger partners and SKIPA and will be useful to groups managing vine thickets beyond the WKNP. This project component included research into the impacts of fire, fire history and vegetation cover change within the vine thicket TEC (Beames 2013).

The completed study (Fisher *et al.* 2013) determined the fire history for 70 occurrences of vine thickets. Landsat imagery was utilised to examine the relationships between fire history, including seasonality and area burnt, and vegetation canopy changes and vegetation structural measurements in the middle and edges of the vine thicket occurrences, and the adjacent pindan woodlands. The impacts of fire on the vine thickets was found to be far greater than previously estimated, having profound consequences for the ecological function, viability and cultural integrity of the entire Dampier Peninsula vine thicket ecosystem network. A plain English publication was produced to examine the findings of the WKNP with regards to the vine thickets (Environs Kimberley 2013) and two papers were produced (Fisher *et al.* 2014, Fisher *et al.* 2013).

With the endorsement of several Aboriginal groups, in 2009 Environs Kimberley's Community Weed Project Officer submitted the first nomination of a series of iterations for the vine thickets to be listed under the EPBC Act. In March 2013, the Monsoon Vine Thickets on the Dampier Peninsula was listed as Endangered under the EPBC Act.

Environs Kimberley is continuing on with the Kimberley Nature Project (KNP). This involves continuing to work with ranger groups to manage weeds, fire, feral fauna and rare fauna, in addition to managing and further documenting the vine thickets. The project brings together traditional ecological knowledge, scientific monitoring, and management of natural and cultural areas. Environs Kimberley and Biodiversity, Conservation and Attractions Yaruwu rangers also surveyed and mapped a series of new occurrences of vine thickets in 2013. The project included prioritising management works and coordinating fee-for-service burning and weeding work with other planned activities. Environs Kimberley is also working with Bardi Jawi Oorany rangers to undertake seed collection and propagation activities through their co-joined state NRM funded project (Bardi Jawi Oorany Nursery/EK Kimberley regional seedbank) as well as collaborating in seed collection, weed control and revegetation projects with this and other Dampier Peninsula groups (Nyul Nyul rangers, Nyul Nyul women rangers, Yawuru country managers, Goolarabooloo community).

Environs Kimberley is also working with SKIPA and ranger groups to develop a vine thicket plant identification resource that can be adapted for different language groups and regions.

Eleven Green Army projects that have Aboriginal groups as partners were funded in December 2015 through the Australian Government. They include activities to improve the management and protection of vine thickets. An additional project that will benefit the vine thickets was funded through the Australian Government 20 Million Trees program in December 2015. Environs Kimberley also has funding through Rangelands NRM WA to undertake work with the vine thickets that commenced November 2015, and is completing work with funds from the National Landcare Programme that has some vine thicket components.

A West Kimberley Threatened Flora and Ecological Communities Recovery Team was established in February 2016, and considers recovery activities in the vine thickets.

A hydrological study in the central portion of the range of the vine thicket TEC was completed in August 2017 (DWER 2017).

Recommended Recovery Actions

Note: The responsible agency is frequently listed as the relevant Biodiversity, Conservation and Attractions District. This refers largely to initiating and guiding actions. In general, however, the relevant departmental District, and the Recovery Team, have the primary responsibility for securing resources for recovery actions (with consideration for resourcing limits and other high priority conservation work).

An overarching principle of this plan is that for recommended actions, the highest priority areas of the vine thickets will be determined and this ranking will be used as a guide to focus conservation efforts. A secondary focus will be the conservation of other areas of the vine thicket community wherever it is possible and practical to do so.

1 Liaise with stakeholders to implement recovery

Almost all occurrences of the community are managed by authorities other than Biodiversity, Conservation and Attractions, or are privately owned. Therefore, the involvement of Aboriginal land managers, Shire of Broome, local community groups and industry in the recovery of the community is essential to the recovery process. In particular, most occurrences are on Aboriginal-managed lands (the relevant Aboriginal groups as listed in Appendix 1 are essential to recovery of the community). The West Kimberley Threatened Flora and Communities Recovery Team was established to help coordinate recovery actions for TECs and declared rare flora in the region and this provides an avenue for stakeholder liaison.

A program of community liaison and education to increase awareness of the significance and conservation management requirements of vine thickets will continue to be developed. This will also need to include information about potential legal implications for activities impacting on vine thickets. The involvement of the Recovery Team, Aboriginal rangers and natural and cultural heritage officers would be required.

The distribution of the vine thickets posters and web-based information should be continued. Signage in public areas targeting general visitors and Aboriginal people identifying the significance of the community and other biodiversity values at sites open to public access should be expanded. This includes information about fire issues, weeds, access and trampling, feral animals and dog walking. Signs on Aboriginal land should be in local languages and in English.

General publications and articles recently released include Black *et al.* (2010), McGilvray (2008), English (2010), Docherty and Williams (2009), Bellfield *et al.* (2012) and Beames (2013). A variety of websites, including those hosted by SKIPA and Environs Kimberley, also contain information about the vine thicket community. Articles and publications should continue to be developed and distributed.

To help prevent accidental destruction of the community and gain public support for its conservation, information about the community will continue to be provided by local Biodiversity, Conservation and Attractions staff to stakeholders including landholders, and managers of land containing the community. This would include information from the TEC database, and maps indicating the location of the community.

Local Biodiversity, Conservation and Attractions staff will ensure regular liaison with landowners and managers of land containing the community to ensure the TEC information is up to date.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District, Species and Communities Branch (SCB)) in consultation with land owners and managers
Cost: \$20,000 pa
Completion date: Ongoing

2 Complete on-ground surveys for occurrences

Aerial photographs should be used to identify other potential monsoon vine thicket occurrences. In addition, those potential locations identified by Broome Botanical Society in 2001 and 2002 (Black *et al.* 2010) should be investigated with more up to date mapping software and subsequent ground-truthing.

Botanical and condition survey should be completed for occurrences that remain un-surveyed. This includes occurrences in the town of One Arm Point, Tooey Creek, Weedong, Christmas Island, Broome Airport, and at Hidden Valley.

Patches of rainforest have also been recorded at Cape Villaret about 45 km south west of Broome, at Sunday Island on the far north-east Dampier Peninsula, and on Coronation Island; however, it is not known if the assemblages are similar to those in the vine thickets on the remainder of Dampier Peninsula (L. Beames, M. Lyons³ personal communication).

Black *et al.* (2010) state that their surveys of Occurrences 1, 8, 47, 48, 62 and 63 were brief. These occurrences should be subject to more detailed surveys, where this has not yet been completed.

On-ground survey data are required for Occurrences 5, 8, 11, 14, 34, 40, 41 and 42. Occurrence 90 near Tappers Inlet has been surveyed but has not been mapped.

These surveys will require close liaison with Traditional Owners, including seeking permission and ensuring that cultural access protocols are adhered to. Surveys should be conducted in both the wet and dry seasons to determine the full suite of native and weed species present.

Data collected should include that outlined on the TEC Report Form located on the web (refer <https://www.dpaw.wa.gov.au/plants-and-animals/monitoring/96-standards/140-standard-report-forms?showall=&start=2>). The condition of each occurrence should be recorded including vegetation structure in relation to tree size, number of large mature trees especially fruit bearing trees, canopy cover and health and the depth of leaf litter. Condition classes will also need to incorporate the fire history and the abundance of major weed species. These general parameters for data collection should be based on Casson *et al.* (2010), a manual specifically developed for vegetation monitoring in Western Australia.

The relative diversity of species will help to provide information about ecosystem function as species composition changes along the coast according to location, size and shape of occurrences. Composition will also be affected by species migration pathways and the condition and composition of adjacent vegetation. The level of canopy cover and leaf litter are important determinants of condition and integrity of occurrences, as the level of shading and resource availability in a healthy canopy will help prevent weed invasion. Large canopy trees are key indicators of condition and are indicative of longer intervals between hot destructive bush fires.

Condition classes should also acknowledge the cultural importance of the vine thickets and of specific sites and that work should be undertaken with Traditional Owners to identify priority areas, culturally

³ Mr Michael Lyons: Science and Conservation, Biodiversity, Conservation and Attractions

sensitive areas and ecological indicators of the vegetation health and condition (Environs Kimberley 2009).

Ideally detailed fauna surveys will be undertaken as part of the TEC surveys, however, opportunistic data should be collected and compiled wherever possible.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District, SCB) in consultation with relevant land owners and managers
Cost: \$30,000 in Year 3
Completion date: Ongoing

3 Continue to monitor, and improve extent, composition and boundary data

Harding (2009) states that the original Dampier Peninsula vine thickets boundaries were mapped using aerial photography, topographic maps and site specific surveys, and that some of the original boundaries were inaccurate when overlaid on new aerial photography. To date many of the occurrences have been manually mapped, mapped with a GPS using unknown datum, or mapped using aerial photographs. All occurrences should be remapped using current datum with a GPS to increase accuracy. Accurate GPS mapping of community boundaries has commenced and a spatial database using ArcGIS has been developed. Extent and boundary information will continue to be updated on the TEC database.

A program to monitor the condition and extent of vine thicket patches will be developed in response to current and new management regimes, with a maximum interval of five years between monitoring events. Remote sensing data can be used to determine general changes to vegetation condition. The use of these techniques was being investigated at the time of writing of this plan. The technique is likely to be able to provide a good general overview of the changes in integrity of vine thicket occurrences as a consequence of impacts, including increased fire frequency that opens up the canopy. Ideally these data will then be ground-truthed wherever possible to ensure that results acquired from remote sensing accurately reflect on-ground change in vegetation condition rank.

The boundaries of vine thickets mapped by Harding (2009) will be refined, and the expansion or contraction of the boundaries of vine thickets will be investigated over time, through further 'ground-truthing' survey work and the use of spatially rectified digital aerial photographs. This is of particular importance for vine thickets and transitional vegetation in and adjacent to the towns of Broome, One Arm Point and Lombadina-Djarindjin (Harding 2009).

Where intensive management actions are to be implemented in the community, detailed monitoring programs that will determine the effects of management actions will be established. Results will be fed into an adaptive management framework to ensure continuous improvement in knowledge, understanding and management of the vine thicket community. Occurrence 3 (Yakka country) is considered to be in excellent condition and subject to few threats and may be useful as a reference site for condition.

The highest priority sites requiring comprehensive monitoring will be determined based on those identified as key sites for conservation, those subject to major management programs, or subject to significant change caused by other factors. This ranking will be used as a guide to focus monitoring efforts. An additional secondary focus should be to ensure that basic monitoring data, such as remote sensing, is collected at least every five years for other occurrences.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District), in consultation with relevant land owners and managers

Cost: \$50,000 every fifth year
Completion date: Ongoing

4 Identify and implement an appropriate fire regime

Black *et al.* (2010) recommends that an integrated community-based fire management program should be developed for the Dampier Peninsula. The involvement of Traditional Owners and owners of freehold land in implementing any changes to fire regimes on their land is crucial. According to Black *et al.* (2010) residents of outstations should have fire units and be responsible for fire control on country.

Fisher *et al.* (2013) indicated a trend of vegetation decline associated with fire, with 20% of the area of the vine thickets area experiencing declining cover between 1991 and 2012. There is a need for research into an appropriate fire regime for the community and to determine the implications of findings for management. The inter-fire intervals of occurrences of the vine thickets will be determined from remote sensing data wherever possible, and a fire history map developed from this.

A strategic approach to fire should ideally be applied on the Dampier Peninsula with appropriate fire management sought for the vine thickets through management of fire at a landscape scale. This will involve seeking to reduce fire frequency, reduce the incidence of intense late dry-season fires, and increase application of smaller-scale cooler burns earlier in the season. As frequency of fire in the surrounding landscape is likely to be the most critical factor in controlling rainforest boundaries, fire management of the TEC will need to be part of a larger landscape scale process. Rangelands NRM is seeking to implement improved fire management across the landscape.

Access management is also an important part of fire management in the vine thickets. Unrestricted access appears to be associated with increased frequency of intense late season fires. Ways and means of reducing the frequency of intense fire, such as the practicality of restricting access to parts of areas including Quandong Point that have already suffered major decline in vegetation integrity through frequent intense fires, will be investigated. A program of information and education through signage and other means to inform visitors about the impact of fire on the environment should also be implemented.

Fire should be excluded in the short term in Occurrence 63 as the site has suffered catastrophic impacts from intense fire recently. This should be coupled with control of the prolific weed buffel grass, which is promoting the intensity and spread of the fire in this area. Fire regimes in some occurrences, for example Occurrence 3b (north of Cape Borda), appear to be entirely appropriate in maintaining plant community structure and composition, and the current fire regime in such occurrences should be maintained. The exclusion of hot fires in Occurrence 3b may be partly through its location in a protective landscape in a steep sided humid gully.

Occurrences of vine thickets that are most at risk from fire damage should be identified. Occurrences that are most accessible, such as Occurrence 1 near Broome, are likely to be most at risk of fire damage due to increased risk around urbanised areas. Severe fire damage was noted in 2010 in surveys in Occurrence 63 (Quandong Point) about 35 km north of Broome, with tree deaths and almost total replacement of understorey species with weeds.

The highest priority areas for fire management will be determined based on those occurrences identified as key sites for conservation (see actions 3.9 and 3.10), and those subject to highly inappropriate fire regimes. This ranking will be used as a guide to focus fire management efforts. An additional secondary focus should be to ensure that impacts of inappropriate fire regimes on other remaining occurrences of the community is minimised wherever it is possible and practical to do so.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District), Department of Fire and Emergency Services, land owners and managers, in consultation with all stakeholders

Cost: \$40,000 pa

Completion date: Ongoing

5 Monitor and control priority weeds; restore where necessary

Black *et al.* (2010) noted high priority vine thicket areas for weed control occur in settlements and town sites, particularly at One Arm Point, Lombadina-Djarindjin and Broome.

Aboriginal ranger groups are already implementing weed control, fire protection and management, seed collection, access management and restoration with Environs Kimberley and this should continue to be encouraged and supported. Biodiversity, Conservation and Attractions also implements similar types of on-ground management actions for locations near Broome.

Most of the weeds that pose the greatest threat to each occurrence are listed in Appendix 2. Weed populations need to be accurately mapped and appropriate herbicides or other methods of weed control determined, where this has not already been done. Control of major weeds in the community will require continued and possibly increased efforts on major weed infestations. Effort will also be required to prevent incursions of new weeds and unwanted introductions.

Tracks through many occurrences of the community facilitate weed invasion to varying extents and these sites should be priority areas for weed control. Replanting with local native species may be necessary if areas are no longer capable of regenerating following weed control. Only seed from the same occurrence should be used for rehabilitation and no seed from other areas should be introduced into occurrences. Piles of weed-contaminated soil in any occurrences should be removed and the areas replanted.

Harding *et al.* (2009) state that weed mapping and control has occurred in five occurrences of the vine thickets (Occurrences 10, 12, 41, 43 and 62). It is recommended that these occurrences should be re-monitored at one year, two years and five years after the initial weed control work, and that additional monitoring should be prior to and after any changes in land management, such as weed control or an alteration to the fire regime.

Harding *et al.* (2009) established a series of line-intercept transects where weed control work had been undertaken and in equivalent control sites. All species were recorded along the transects so that all compositional changes could also be recorded, and this proved to be an extremely accurate and quantitative method for determining compositional changes.

The highest priority areas for weed control will be determined from information about key sites for conservation of the vine thicket community (see actions 3.9 and 3.10), and priority infestations that occur in them (including Appendix 2 and section 1.4 above). This ranking will be used as a guide to focus control efforts. An additional secondary focus should be to ensure that impacts of weed invasion on other remaining occurrences of the community are minimised through weed control and restoration wherever it is possible and practical to do so.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District), land owners and managers

Cost: \$30,000 pa for weed control; rehabilitation requirements - to be determined

Completion date: Ongoing

6 Report new outbreaks of high threat weeds; prevent new incursions

Land managers, community members, tourists and other stakeholders should be informed through educational materials and workshops about how to prevent, identify and report new weed incursions.

When an incursion of a new or high threat weed is reported and confirmed, land managers should be encouraged and where possible assisted to control and eradicate the weed before it becomes an intensive or costly problem. People with appropriate skill levels will be required to advise and support the control and assessment aspect of the program.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District) in consultation with land owners and managers
Cost: \$10,000 pa
Completion date: Ongoing

7 Investigate hydrological processes; incorporate findings into planning and management

DWER (2017) provided some information about groundwater levels and dependence in four locations of the vine thicket TEC. The report also mapped all areas of the TEC within their study area as being within areas that have restricted opportunity for water development. This map should be utilised to guide environmental impact assessment for development proposals involving water abstraction near the TEC in areas covered by the DWER (2017) study.

There is evidence of hydrological change through increased inundation occurring in Occurrence 1 in the Broome townsite. An urgent effort is required to document natural flow regimes, water quality and determine water/solute balances for the vine thickets prior to development occurring within or in close proximity to occurrences. This will enable a baseline to be established and provide the ability to judge the likely severity of future impacts. A better understanding of the tolerances to change, and hydrologic thresholds for the community is also crucial.

Bores are planned to be established in areas subject to major development in the Broome townsite near vine thicket occurrences in the near future. Monitoring bores should also be placed to elucidate natural hydrologic processes in areas remote from potential impacts of development to serve as 'control' sites.

Bore data will need to be compiled and analysed over time, and may indicate the need for remedial actions, such as the creation of drainage management within Occurrence 1 adjacent to a residential area to prevent flooding of the vine thickets.

The highest priorities for hydrological investigations will be determined from areas identified as key sites for conservation of the vine thicket community and areas that are subject to current or future proposals with potential to impact hydrologic processes in the community.

The findings from hydrological investigation should be incorporated into planning and management processes such as town planning schemes. This will help ensure that housing, outstation and other developments have minimal impact on surface and groundwater levels and quality that are considered important for the health of vine thicket vegetation.

Responsibility:	Biodiversity, Conservation and Attractions (West Kimberley District), and Department of Water and Environmental Protection in consultation with land managers and owners.
Cost:	\$100,000 to establish bores, \$50,000 pa for ongoing monitoring network of bores
Completion date:	Ongoing

8 Seek tenure that provides for conservation management of representative areas of important occurrences of the vine thickets

Formal agreements that allow for greater security in conservation management include:

- Reserves with conservation included in the purpose
- Indigenous Protected Areas
- Nature conservation covenants.

Private land managed under an agreed management plan can also represent an improved level of management commitment for conservation outcomes. Management plans should be designed to include protection and active management to conserve the composition and function of the vine thickets.

Black *et al.* (2010) states that previously proposed conservation reserves should be declared and appropriate conservation management implemented.

Black *et al.* (2010) note that the proposed Borda Nature Reserve contains six occurrences of vine thickets (Occurrences 3, 6, 7, 19, 20, 48), two of which are particularly large (3, 7). The reserve was proposed in 1983. Other proposed reserves are the proposed Cygnet Bay Nature Reserve (15805 ha – encompasses eight occurrences: 2, 28, 29, 30, 39, 44, 45, 46), and the proposed Reserve for Conservation and Aboriginal Heritage (Waterbank - 92234 ha – encompassing two Occurrences 62, 63).

The recently proposed Leveque Conservation Park just north of Thomas Bay (Department of Planning and Western Australian Planning Commission (WAPC) 2015) includes up to five occurrences of the vine thickets (Occurrences 4, 5, 11, 12, 41) and the proposed Lake Louisa Conservation Park near Disaster Bay on the eastern side of the Peninsula includes an occurrence of the vine thickets (Occurrence 66).

The Bardi Jawi IPA was established in 2013 encompassing 45 occurrences in the northern portion of the Dampier Peninsula north of Pender Bay.

The following is adapted from Black *et al.* (2005, 2010). They recommend adding to the proposed conservation reserve system and/or managing vine thickets for conservation based on the following principles. The essence of these principles is supported and has been utilised in this plan:

- vine thicket patches should be protected and conserved in areas under tenure suitable for management for conservation plus a 500 m buffer zone extending into adjacent vegetation. Areas managed for conservation should extend to the low tide line to include mangroves and tidal mudflats, as much of the Dampier Peninsula's species richness comes from species dependent on these littoral areas
- critical clusters of vine thicket patches should be conserved in secure tenure to maintain connectivity
- any areas declared as nature reserves should remain available for Aboriginal usage for traditional purposes, such as ceremonial use of sacred sites.

In addition, priority areas for vine thicket conservation as discussed by Black *et al.* (2005, 2010) are:

- the cluster of ten vine thicket patches on coastal dune formations between Cape Baskerville and Baldwin Creek (Occurrences 40, 22, 21, 23, 9, 25, 24, 26, 27, 62, on Aboriginal Reserve 22615 (Beagle Bay lands), UCL and other Crown reserves. The protected area should encompass all of Baldwin Creek including its mangroves and tidal mudflats to the low tide line, Bunda Bunda Spring and the intertidal mudflats of Carnot Bay, the rock outcrops King Peaks and Carnot Peaks, and interspersed woodlands. This could be accomplished by drawing a circle of 15 km in radius around Occurrence 23;
- the cluster of four vine thicket patches from East Sandy Point to Cliff Point (Occurrences 67, 68, 69, 70) on Crown Reserve 1012 (Beagle Bay lands). A circle with a radius of about 7 km from the southern end of occurrence 70, would include Tappers Inlet in the conservation area;
- the whole of the northern end of Dampier Peninsula as this includes all the most northern vine thicket occurrences (the most species-rich) in a tight cluster along the coastline, along with a substantial area of intervening habitats including: (i) vine thickets on Lombadina Grazing Lease from just south of Chile Creek then north through Lombadina-Djarindjin to Kooljaman (Occurrences 10, 47, 71, 15, 5, 12, 11, 41 and; (ii) vine thickets on Aboriginal Reserve 20927 (One Arm Point lands) from Kooljaman (Occurrence 4) northeast to Swan Point (Occurrence 35), and south through One Arm Point (Occurrence 43) to Gallen (Occurrence 53) and Millagoon (Occurrence 59). This includes three patches on freehold land; and
- occurrence at Quandong Downs (Occurrence 63).

Key self-sustaining examples of these high priority areas of the vine thicket community are recommended as a focus for conservation management in this plan (note: Appendix 5 provides a key to patch numbers vs occurrence numbers and also states special conservation values).

Extensive Commonwealth programs operate in northern Australia, and given the listing of large areas of the West Kimberley as a National Heritage Area and the prevalence of IPAs in the vicinity of the vine thicket TEC, Commonwealth funding is crucial to achieving priority actions in this plan. The Commonwealth funds IPAs, and also provides funds for Aboriginal Ranger Programs that contribute to conserving specific occurrences of the vine thicket TEC.

Liaison with owners and managers regarding conservation management is crucial for vine thickets on freehold land in oyster and pearl license areas.

Only a few areas of the vine thicket community are owned privately. If management for conservation of vine thickets on private land seems unlikely, and areas containing occurrences of the community become available, Biodiversity, Conservation and Attractions will seek resources and negotiate to acquire occurrences and adequate buffer areas.

Responsibility:	Biodiversity, Conservation and Attractions (Land Unit, Kimberley Region) in consultation with land owners and managers
Cost:	Opportunities to be sought through potential Indigenous Land Use Agreements, offsets or covenants. Market price for acquisitions – to be determined.
Completion date:	When opportunities arise.

9 Protect critical habitats and species

In addition to areas identified in the action above, areas identified as high priority for conservation based on composition and structure according to Black *et al.* (2010) include Occurrences 2, 6, 7, 9, 10, 15, 17, 18, 22, 24, 27, 29, 32, 43, 46, 47, 50, 53, 54, 55, 56, 58, 62, 64, 65, 67, and 72.

The protection of all *Ficus virens* trees, *Canarium australianum*, *Terminalia petiolaris*, and hybrids of *T. petiolaris* and *Terminalia latipes* subsp. *psilocarpa* on the Dampier Peninsula is recommended. Wherever possible, the protection of a 250m radius around these species is also advocated by Black *et al.* (2010). These four species may be found scattered throughout the landscape where they provide alternative food sources and act as stepping-stones for fauna travelling between vine thicket occurrences. The planting of these trees in towns is also to be encouraged.

Fauna critical to survival of vine thickets also needs to be protected. Flying fox roost sites on the Dampier Peninsula should be identified and protected. Studies in the Northern Territory recommend including roosts within reserves and buffering them within a 500 m radius (Black *et al.* 2010).

Guidelines for protecting and maintaining vine thicket viability and complementary habitats in the Northern Territory as noted in Bach and Price (2005) are likely to be especially relevant to the Dampier Peninsula vine thicket ecosystem and should be further investigated and adapted for use in this area. The recommendations included: maintain all existing rainforest patches, maintain the vegetation within 500m of each patch, maintain considerable areas of all habitats that provide significant flower resources, protect all known black flying fox roost sites, never destroy a *Ficus virens* tree, manage the rainforest accordingly with respect to specific threats (feral animals, weeds or fire).

Given the unique nature of each occurrence, any occurrence regardless of size can be a significant food source and habitat for frugivores at various times of the year. It is therefore essential to conserve the existing diversity of rainforest types on the Dampier Peninsula (Harding 2009). Means of protection may include fencing, realigning or closing tracks and utilising environmental impact assessment processes to minimise impacts on important species or sites.

Responsibility:	Biodiversity, Conservation and Attractions (West Kimberley District) in consultation with land owners and managers
Cost:	To be determined
Completion date:	Ongoing

10 Design and conduct research that builds knowledge about ecosystem processes and informs management.

Research will be designed to increase understanding of the community to assist in future management decisions. Research should include:

- Investigations into the ecology of frugivorous fauna - birds, reptiles and mammals, and their role in seed dispersal in the vine thickets. Gaining an understanding of this ecological process and the complementary roles of adjacent habitats and resource provision for mobile frugivorous species will have major implications for conservation management.
- Investigating the complementary roles of vine thicket, savanna, mangroves and other habitats in the provision of resources for mobile frugivorous species on Dampier Peninsula.
- Survey for flying fox roost sites, and frugivorous bird species on Dampier Peninsula.
- Investigation of Aboriginal knowledge in relation to vine thickets. Relevant knowledge includes vine thicket values, uses, and ecology.
- Experiment with inter-fire interval and monitor effects. Fire-sensitive species may require at least twice the juvenile period between burns to sustain them and this should be investigated (Burrows *et al.* 2008). Experiments are required with dry versus wet season fires. Anecdotal evidence indicates the need to increase the inter-fire interval and ensure cool burns rather than intense late season fires. Traditional burning methods should be investigated.
- Investigating the use of drainage lines in/on cliffs, in coastal dunes where floods are occurring following development (Occurrence 1).

- Research availability of bushtucker in vine thickets and means of protecting them whilst facilitating commercialisation of particular species.
- Investigating genetic variation within and between vine thickets. The vine thicket ecosystem is likely to have compromised genetic diversity in a number of smaller patches isolated from sufficient frugivorous migration (Environs Kimberley 2010).
- There are very few data about land snails in the vine thickets, and this group should also be a focus for studies.
- Taxonomic studies of *Capparis jacobsonii* on Dampier Peninsula to determine its conservation status.
- Investigating insect damage in infected trees and understorey species.

The highest priority areas of research will be determined based on information requirements for management of areas identified as key sites for conservation of the vine thicket community, and potential risk of adverse impacts associated with lack of these data. This ranking will be used as a guide to focus research efforts. A secondary focus will be to ensure that research programs are designed to provide information to minimise adverse risk to other remaining occurrences of the community wherever possible and practical.

Support from academic and cooperative partnerships should be sought for conducting research and to incorporate findings into on-ground planning and works. Findings will be incorporated into reviews of management plans wherever applicable.

Responsibility:	Biodiversity, Conservation and Attractions (Science and Conservation, SCB, Threatened Flora Seed Centre, West Kimberley District; Botanic Gardens and Parks Authority), in consultation with land owners and managers; partnering with universities, the KLC and community groups
Cost:	\$40,000 pa
Completion date:	Ongoing

11 Investigate controlled tourism, manage recreational access and reduce potential for littering and weed spread

Black *et al.* (2010) note that most vine thickets should be protected from high rates of recreational access, especially vehicles, as the habitat is very vulnerable to disturbance.

Fencing or other barriers may be required to help prevent degradation where occurrences are being significantly grazed, are in areas with high visitation, or where the vine thickets have been exposed to increased access through development. Occurrences will be ranked by priority for the need for fencing or other means of access control such as bollards, gates and signage.

Vehicular access other than on existing tracks should be avoided in all occurrences of the vine thickets, however, the general public should have the opportunity to walk in some occurrences. Information and educational signs should be created in English and in local Aboriginal languages. Vine thicket patches, including reserved areas need to continue to be available for traditional Aboriginal purposes, such as collection of bush tucker and ceremonial use of cultural sites.

A standard and associated guideline for access track construction needs to be established and promoted to prevent further land degradation on the Dampier Peninsula and in the vine thickets in particular. Specifically, unformed access tracks should not be graded or bulldozed, rather their construction should include driving over or removal and slashing of vegetation where necessary, such that soil surfaces remain intact and tracks do not become deeply eroded. Blade-down clearing for track construction is unnecessary and is not ecologically sustainable, and unlike discrete bush tracks, detracts from the wilderness experience. Additionally, building tracks up with imported soils, gravel or

similar can cause changes to water movement and result in significant erosion with deep furrows being created.

A plan for ecologically sustainable management of tourism and recreational impacts on vine thickets and surrounding vegetation should be designed and implemented (Black 2005). Areas that are identified as high use or tourist-use areas should be subject to a number of measures to limit weed spread, irresponsible use of fire and littering. It will be important to work with land-managers and stakeholders to identify the best ways to manage these issues at alternative sites including use of effective signage, bin provision, wash-down areas, community workshops and site-adapted awareness and education material.

On Aboriginal lands the potential for tourism programs integrated with conservation management that highlight the significance of vine thickets and for guided walks with Aboriginal rangers and/or other knowledgeable local people should be investigated.

The collection of firewood is resulting in damage to vegetation in and near occurrence 72. The feasibility of providing firewood to visitors should be investigated.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District) in consultation with land owners and managers
Cost: \$10,000 pa
Completion date: Ongoing

13 Map habitat critical to survival

Although the boundary of the vine thicket occurrences have mostly been mapped, areas that are crucial to continued integrity of the community will include some complementary ecosystems and adjacent vegetation that links occurrences, such as migration pathways for fauna, and vegetation that seasonally sustains frugivores. This community is likely to have a level of groundwater dependence, so habitat critical to survival will also include groundwater catchment zones that will need to be protected to ensure maintenance of the hydrological processes in the community. These areas will need to be described and mapped.

The highest priority areas for mapping of habitat critical to survival will be determined based on areas identified as key sites for conservation of the vine thicket community and potential risk associated with lack of this information. This ranking will be used as a guide to focus mapping efforts. A secondary focus will be to ensure that habitat critical to survival is mapped wherever possible and practical to minimise adverse risk to other remaining occurrences of the community

If additional occurrences are located, then this habitat will also be determined and mapped for these locations.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District, SCB) in consultation with land owners and managers
Cost: \$30,000
Completion date: Year 3

14 Develop management guidelines

If site-based management guidelines that would help manage occurrences of the vine thicket community are not being prepared or implemented by current land managers, Biodiversity, Conservation and Attractions will seek involvement in the cooperative preparation of plans for

occurrences that include management considerations as listed in this plan. Where required, such guidelines should also include consideration of the need for sustainable tourism management, and ecologically sustainable timber harvesting from vine thickets, including monitoring and regulation, and replanting and plantation establishment as necessary.

The highest priorities for development of management guidelines will be determined based on areas identified as key sites for conservation of the vine thicket community, and areas subject to major current or future land management programs. A secondary focus will be to ensure that management guidelines are developed wherever possible and practical for other remaining occurrences of the community.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District, SCB) in consultation with land owners and managers
Cost: \$30,000 every 3rd year for plan development
Completion date: As required

15 Monitor and manage feral and exotic animals including unmanaged cattle, horses, donkeys and cats

Domestic and feral or exotic animals should be excluded from vine thickets wherever possible.

Signs of unmanaged cattle were noted in recent surveys of Occurrences 3c, 62 and 63. Cattle have the potential to cause major damage in the vine thickets. When incursions are identified, unmanaged cattle should be fenced out or, where appropriate, destroyed.

Donkeys are an additional and potentially problematic feral herbivore that exist in and around the Beagle Bay area. If monitoring indicates an increasing impact of this species within local vine thicket occurrences, the Department of Primary Industries and Regional Development should be contacted about on ground control to be undertaken with the local community. Horses have particularly been noted around Yawuru country.

Feral cats are an increasing threat to small lizards, mammals and birds that utilise vine thicket areas. Feral cat activity should be included in vine thicket site monitoring and where high levels of activity are recorded, control should be implemented. All managed sites will need to include some level of feral cat monitoring and control. Fauna monitoring should be conducted at intensive control sites to establish the impact of feral cats on the vine thicket fauna assemblage.

The highest priority areas for control of feral and exotic animals will be determined based on areas identified as key sites for conservation of the vine thicket community, from knowledge of distribution of these introduced fauna, and the level of risk they pose to the vine thicket community. This ranking will be used as a guide to focus control efforts. A secondary focus will be to ensure that programs to control feral and exotic animals are implemented wherever possible and practical to minimise adverse impacts of these fauna on other remaining occurrences of the community.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District) in consultation with land owners and managers
Cost: \$10,000 pa
Completion date: Ongoing

16 Apply planning and environmental impact assessment processes

A strategic land use planning document that covers the Peninsula seeks to ensure that all future development proposals are subject to appropriate planning procedures (Department of Planning and Western Australian Planning Commission 2015). The plan also refers to proposed Nature Reserve and Conservation Investigation Areas. The stated objective in that section of the document is: 'Without limiting the operation of relevant other legislation, facilitate conservation of cultural heritage, environmental and landscape assets of the Dampier Peninsula that are demonstrated to have local, regional, state, national or international significance'. A strategy pertinent to achieving that objective is to 'Represent the vegetation of the Peninsula in secure conservation reserves, in particular areas of known special values such as vine thickets and mound springs.' Conservation reserves are defined as nature reserves, national parks, conservation parks and marine conservation reserves under the *Conservation and Land Management Act 1984*. These reserve categories largely align with the intent of the International Union for the Conservation of Nature's category I to IV conservation reserves (protected areas established as strict nature reserves and wilderness areas, national parks, protected areas for natural monuments or features, and habitat/species management areas), and do not include IPAs.

Black *et al.* (2010) outline specific actions to undertake further investigations with regard to Coulomb Point Nature Reserve, Borda, Leveque and Cygnet Bay, and Dampier Peninsula Coastal Park proposals.

Environmental impact assessment processes should be utilised to minimise impacts to vine thicket occurrences, including consideration of secondary impacts such as hydrology, loss of patch type representation, loss of integrity of occurrences, loss of connectivity, the impacts of increased access and access tracks, and weed invasion. Primary and secondary impacts should be carefully considered in proposals for residential areas adjacent to Occurrence 1, industrial areas, outstation or ecotourism venture development or expansion, and any other planned developments.

Outcomes to be sought through impact assessment processes should be to seek to avoid and minimise impacts to occurrences of the vine thickets, and to ensure that key examples of each cluster group are protected and conserved. An additional focus should be to ensure that loss of other remaining occurrences of the community is minimised and conservation is maximised.

If funds become available for management of the vine thicket community as a condition of development impacts, they should be utilised to assist in implementing recovery actions for priority areas of the community as identified in this plan.

Responsibility:	Biodiversity, Conservation and Attractions (West Kimberley District, SCB) in consultation with land owners and managers
Cost:	\$10,000 pa
Completion date:	Ongoing

17 Consider climate change issues in management and incorporate into conservation targets and management planning

Resilience of the vine thickets in the face of climate change should be maximised through the maintenance of existing large areas of vegetation in areas that have tenure that is compatible with, and are managed for conservation, and through maintaining or increasing their connectivity. The management of other threatening processes such as increased weed invasion or fire frequency that may be exacerbated by climate change will be a crucial part of maximising resilience.

The impacts of storm surge, cyclone damage, inundation from rising sea levels and salt water incursion into freshwater aquifers should be monitored over time. The potential impacts of climate change on

biota that are significant in dispersing seeds and cross pollinating species will be part of other actions listed in this plan.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District, SCB) in consultation with land owners and managers
Cost: \$10,000 pa for additional monitoring
Completion date: Ongoing

18 Report on outcomes of management strategies and adapt recovery actions in response

Reporting should be part of annual reports for Biodiversity, Conservation and Attractions' Corporate Executive prepared by the West Kimberley Threatened Flora and Communities Recovery Team. A final report will be presented and distributed to stakeholders as part of the review of this plan. The interim recovery plan will be updated at the end of the ten year term, if deemed necessary.

Responsibility: Biodiversity, Conservation and Attractions (West Kimberley District)
Cost: \$5,000 pa
Completion date: Ongoing

Table 1: Summary of costs for each recovery action

Recovery Action	Year 1	Year 2	Year 3	Year 4	Year 5
Liaise with stakeholders	20,000	20,000	20,000	20,000	20,000
Complete on-ground surveys			30,000		
Continue to monitor		50,000			
Identify and implement appropriate fire regime	40,000	40,000	40,000	40,000	40,000
Monitor and control priority weeds	30,000	30,000	30,000	30,000	30,000
Report; control high threat weeds	10,000	10,000	10,000	10,000	10,000
Investigate hydrological processes	100,000	50,000	50,000	50,000	50,000
Seek tenure providing for conservation management of important occurrences	TBD	TBD	TBD	TBD	TBD
Protect critical habitats and species	TBD	TBD	TBD	TBD	TBD
Design and conduct research	40,000	40,000	40,000	40,000	40,000
Investigate controlled tourism, manage access	10,000	10,000	10,000	10,000	10,000
Map habitat critical to survival			30,000		
Develop management guidelines	30,000			30,000	
Monitor and manage feral and exotic animals	10,000	10,000	10,000	10,000	10,000
Apply planning and impact assessment processes	10,000	10,000	10,000	10,000	10,000
Consider climate change issues	10,000	10,000	10,000	10,000	10,000
Report on outcomes	5,000	5,000	5,000	5,000	5,000
Total	315,000	285,000	295,000	265,000	235,000

Total of all costs over five years: \$1,395,000

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APPENDIX 1 LOCATION AND SIZE OF OCCURRENCES

(from TEC database, see also location map at Appendix 4)

Occ No.	Estmd area	Details of location	Land manager	Stated land use (where known)	Native title application /determination (National Native Title Tribunal 30 September 2016)
1	76.57	Cable Beach, Broome (Minyirr Coastal Park)	Nyambu Buru Yawuru (NBY) and Shire of Broome	Conservation	Edarrbur (Rubibi, Yawuru)
			Shire of Broome		Edarrbur (Rubibi, Yawuru)
			Shire of Broome	D, P, R, BF, C**	Edarrbur (Rubibi, Yawuru)
2a	4.58	S side Cygnet Bay, NE Dampier Peninsula (29/1 in McKenzie <i>et al.</i> 1991)			Bardi Jawi
3a	5.35	N of Cape Borda, NW Dampier Peninsula (29/2 in McKenzie <i>et al.</i> 1991), 'Yakka Thickets'.			Bardi Jawi
4	15.57	~ 1 km SE of Kooljaman at Cape Leveque (29/3 in McKenzie <i>et al.</i> 1991).	The Aboriginal Affairs Planning Authority	Use and benefits Aboriginal inhabitants	Bardi Jawi
5	43.51	NW of Gregory Well	Shire of Broome	Private freehold use	Bardi Jawi
6a	53.15	N of Cape Borda, NW Dampier Peninsula			Bardi Jawi
6b		N of Cape Borda, NW Dampier Peninsula			Bardi Jawi
7a, b, c, d, e	127.70	N of Cape Borda, NW Dampier Peninsula. Northern most Cape Borda patch, just S of Gilbut Ck.			Bardi Jawi
8	52.04	Bilingurr Hidden Valley, N end Cable Beach Broome	Joint Shire of Broome and NBY	Consn and recn	darrbur (Rubibi, Yawuru)
9	12.42	Red Bluff; SW of helipad	The Aboriginal Affairs Planning Authority	AR	Binbunbur
10a, b	35.33	S of Chile Creek	DoP leasee	Private uses	Bardi Jawi
11	12.31	SSW of Cape Leveque lighthouse	DoP leasee	Private uses	Bardi Jawi
12	11.57	NW of Gregory Well	DoP leasee	Private uses	Bardi Jawi
13	9.61	Bullock Camp, E of Gallen Well, N of Cygnet Bay	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
14	7.24	NE Skeleton Point	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
15	47.99	S of Gregory Well	DoP leasee	Private uses	Bardi Jawi
				Proposed roadway	
16	3.31	SW of helipad at Red Bluff	The Aboriginal Affairs Planning Authority (Dept Indigenous	AR	Bindunbur

			Affairs)		
17	87.45	SW of One Arm Point	Private landholder	Private freehold use	Bardi Jawi
		Dampier Peninsula	DoP (lease)		Bardi Jawi
18	19.35	WSW of One Arm Point	Private landholder	Private freehold use	Bardi Jawi
		Dampier Peninsula	Private landholder	Private freehold use	Bardi Jawi
19	6.88	S of Gilbut Creek and N of VT7, Cape Borda			Bardi Jawi
20a, b	9.97	NW of Pender outstation, Cape Borda			Bardi Jawi
21	15.69	Mundud community outstation, NE of Van Tuyn Point, N of Carnot Bay	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	AR	Bindunbur
22a, b	14.12	Near Smirnoff Beach (S of Mundud Community Outstation) N of Carnot Bay	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	AR	Bindunbur
23	2.31	SW of helipad at Red Bluff between Carnot Bay and Baldwin Creek. 'Red Block'.	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	AR	Bindunbur
24a, b	6.47	ENE of helipad at Red Bluff (S of Baldwin Ck)	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	AR	Bindunbur
25	25.84	E of Red Bluff helipad to SW of Baldwin Ck	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	AR	Bindunbur
26	12.18	ENE of Helipad at Red Bluff, SW of upper Baldwin Ck	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	AR	Bindunbur
27a, b	31.23	Upper Baldwin Ck, ENE of helipad at Red Bluff	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	AR	Bindunbur
28a, b	6.74	Cunningham Point			Bardi Jawi
29a, b	16.82	S of Carlisle Head and NNW of Amatangoora Point			Bardi Jawi
30	3.53	SSW of Deepwater Point, NE Dampier Peninsula			Bardi Jawi

31	0.88	E Hunter Ck, middle occ, N Dampier Peninsula	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
32a, b	46.89	E Hunter Ck, N occ, N Dampier Peninsula	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
33a, b, c	15.17	E Hunter Ck, S occ, N Dampier Peninsula	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
vine3 4	31.66	ESE of Cape Leveque lighthouse W of upper Hunter Ck	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
		Dampier Peninsula	Ardyaloon (Dept Indigenous Affairs)		Bardi Jawi
35a, b	50.55	Immediately SW of Swan Point, Karrakatta Bay	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
36	0.31	SW of Swan Point, Karrakatta Bay, NE Dampier Peninsula	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
37	0.64	SW of Swan Point, Karrakatta Bay, NE Dampier Peninsula	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
38a, b	52.94	SW of Swan Point, Karrakatta Bay	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
		Dampier Peninsula	Private landholder	Private freehold use	Bardi Jawi
39	53.52	Willie Pt, Cygnet Bay			Bardi Jawi
40	16.36	Smirnoff beach S, N of Carnot Bay	The Aboriginal Affairs Planning Authority	AR	Bindunbur
41	43.21	N of Gnamagun Well			Bardi Jawi
42	10.90	NE of One Arm Point	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
43	161.66	One Arm Point town	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
44a, b	9.72	E point between Rumbul Bay to the S and Cygnet Bay to the N			Bardi Jawi
45	25.03	S of Willie Point (S of Lurugun)			Bardi Jawi
46a, b	62.67	SSW of Willie Point, Cygnet Bay (Lurugun)			Bardi Jawi
47	17.71	SW of Chile Creek	DoP leasee	Private use	Bardi Jawi
48	38.13	Tjarbormai Ck, E of Packer Island and Lombadina Creek			Bardi Jawi
49	14.68	Island in mudflats NW of Elephant Point, Cygnet Bay	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
50	5.30	ESE of Gallen Well. Middle on S coast of Skeleton Point Peninsula, N Cygnet Bay.	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
51	12.21	W occ on S coast of Skeleton Point Peninsula, SE of Gallen Well	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
52	8.52	S of Skeleton Point	Ardyaloon (Dept	AR	Bardi Jawi

			Indigenous Affairs)		
53	113.86	SSE of Gallen Well	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
54a, b	19.44	West of Talboys Point, Karrakatta Bay	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
55	12.89	N of Easton Point, between Karrakatta Bay and Curlew Bay	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
56	12.87	N Catamaran Bay,	Private landholder and leasee	Private use	Bardi Jawi
57	57.66	S of Catamaran Bay	Leasee	Private use	Bardi Jawi
58	31.19	Behind bay between Gallen and Brown's (Cygnet Bay) Pearl Farm	Ardyaloon (Dept Indigenous Affairs)	AR	Bardi Jawi
59a, b	38.27	Milligan/Djaradjung	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	Use and benefits Aboriginal inhabitants	Bardi Jawi
60	4.42	South west of Elephant Point	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	Use and benefits Aboriginal inhabitants	Bardi Jawi
61	8.81	W of Elephant Point	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	Use and benefits Aboriginal inhabitants	Bardi Jawi
62	507.58	Waterbank. From James Price Point to just north of Quandong Beach			Goolarabooloo
63 (vine 64)	93.44	Beach between Barred Creek and Quandong (Rurrjaman)			Goolarabooloo
64 (vine 65)	56.39	Midarlon: Dunes SE of Kooljaman at Cape Leveque	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	Use and benefits Aboriginal inhabitants	Bardi Jawi
65 (Vine 67a)	1.32	E of Cliff Point (N of Beagle Bay inlet)	The Aboriginal Affairs Planning Authority (Aboriginal Lands Trust)	Use and benefits Aboriginal inhabitants	Bindunbur
66 (vine 66)	3.46	Maddarr: SSE of Foul Point	The Aboriginal Affairs Planning Authority (Dept Indigenous Affairs)	Use and benefits Aboriginal inhabitants	Bindunbur

67 (vine 68)	15.62	E Sandy Point near mouth of Yallet Creek, N shore of Beagle Bay inlet	The Aboriginal Affairs Planning Authority (Aboriginal Lands Trust)	Use and benefits Aboriginal inhabitants	Bindunbur
68 (vine 69)	12.06	ESE of Cliff Point, N shore of Beagle Bay	The Aboriginal Affairs Planning Authority (Aboriginal Lands Trust)	Use and benefits Aboriginal inhabitants	Bindunbur
69 (vine 70)	21.90	SE of Cliff Point, N shore of Beagle Bay	The Aboriginal Affairs Planning Authority (Aboriginal Lands Trust)	Use and benefits Aboriginal inhabitants	Bindunbur
70 (vine 71)	29.35	Lombadina-Djarindjin townsite	Shire of Broome		Bardi Jawi
			Aboriginal Land Trust	AR	Bardi Jawi
71 (vine 02b)	8.42	S side of Cygnet Bay, NE Dampier Peninsula (Patch 29/1 in McKenzie <i>et al.</i> 1991)			Bardi Jawi
72 (vine 03b,c)	153.95	N of Cape Borda, NW Dampier Peninsula (patch 29/2 McKenzie <i>et al.</i> 1991)	Leasee	Pastoral	Bardi Jawi
73 (JPP nth)	0.82	Waterbank. N of James Price Point, in creekline	Shire of Broome	Public road	Goolarabooloo
74 (Mur phey Ck)	3.03	South of vine68	Aboriginal Land Trust	Use and benefits Aboriginal inhabitants	Bindunbur
75 (midd le Lago on)	11.28	Middle Lagoon, NW Dampier Peninsula	Aboriginal Land Trust	Use and benefits Aboriginal inhabitants	Bindunbur
76 (vine 67b)	10.54	E of Cliff Point (N of Beagle Bay inlet)	The Aboriginal Affairs Planning Authority (Aboriginal Lands Trust)	Use and benefits Aboriginal inhabitants	Bindunbur
77	0.79	E of Cliff Point (N of Beagle Bay inlet)	The Aboriginal Affairs	Use and benefits	Bindunbur

(vine 67c)			Planning Authority (Aboriginal Lands Trust)	Aboriginal inhabitants	
78 (BPen 01)	19.96	Kavite Rd Broome townsite.	Yawuru Native Title Holders Aboriginal Corporation (NBY), Shire of Broome and Broome Port Authority	Conservation, recreation, use and benefit of aboriginal inhabitants Harbour Purposes, House	Edarrbur (Rubibi Yawuru)
79 (BPen 02)	88.4	Port Drive Broome townsite	- Yaruwu Native Title Holders Aboriginal Corporation (NBY) Broome Port Authority, Shire of Broome	Conservation, recreation, use and benefit of aboriginal inhabitants. Conservation, culture, recreation Golf, public recreation, golf course, sewerage treatment works Quarry, pistol club, resort,	Edarrbur (Rubibi Yawuru)
80 (Perp Hd01)	31.7	North of Beagle Bay townsite (Chimney Rocks/Perpendicular Head)	Aboriginal Land Trust	Use and benefits Aboriginal inhabitants	Bindunbur
81 (Map Bch0 1)	12.5	North of Beagle Bay townsite (North Head/Mercedes Cove)	Aboriginal Land Trust	Use and benefits Aboriginal inhabitants	Bindunbur
82 (Bilun gurr0 1)	About 3.7ha? Not Mapped	South end Lullfitz Drive, Broome townsite, East side of Pleistocene dune, east of Hidden Valley	Yarawu Native Title Holders Aboriginal Corporation (Nyambu Buru Yawuru or NBY)	Use and benefits Aboriginal inhabitants	Edarrbur (Rubibi Yawuru)
83 (BroomeM VT01)	Not mapped	South of junction of Lullfitz and Fairway Drv Broome	Yawuru Native Title Holders Aboriginal Corporation	Native title exists in parts of the determination area	Edarrbur (Rubibi Yawuru)
84 (sister sYalla d)	18.1	North west of Beagle Bay community	Aboriginal Affairs Planning Authority.	Use and benefits Aboriginal inhabitants	Bindunbur
85 (Carn)	16.8	Near mouth of Carnot Bay creek, south west of Beagle Bay	Aboriginal Affairs Planning Authority	Use and benefits Aboriginal inhabitants	Bindunbur

otMV T1)					
86 (Carn otMV T2)	8.4	Near mouth of Carnot Bay creek, south west of Beagle Bay	Aboriginal Affairs Planning Authority	Use and benefits Aboriginal inhabitants	Bindunbur
87 (NN peaks)	2.1	South west of King Peaks	Aboriginal Affairs Planning Authority Shire of Broome	Use and benefits Aboriginal inhabitants Infrastructure/Pubic Use	Bindunbur
88 (Midll eLago onSW)	1.0	South of Middle Lagoon, near Neem Creek	Aboriginal Affairs Planning Authority.	Use and benefits Aboriginal inhabitants	Bindunbur
89 (Surf 01)	0.4	North of Broome townsite	Shire of Broome	Drainage, Parking, Recreation, Beach Facility, Club, Shop	Edarrbur (Rubibi Yawuru)
90 (Tapp ers01)	Not mapped	Tappers Inlet	Aboriginal Affairs Planning Authority.	Use and benefits Aboriginal inhabitants	Bindunbur

Occurrences are listed in order as they occur in the TEC database

* Department of Planning / Western Australian Planning Commission

** D=drainage, P=parking, R=recreation, BF=beach facility, C=club, AR= Aboriginal Reserve

***Unallocated Crown Land

APPENDIX 2: THREATS

Occ. #	Issues / current and future threats	Major Weeds (TEC database, Black <i>et al.</i> 2010, Environs Kimberley personal communication)	Condition, other comments (vegetation condition is based on Keighery (1994) condition scales)
1	Historical impacts of stock Weed invasion Storm water runoff and flooding Trampling Inappropriate fire regime Climate change	<i>Antigonon leptopus</i> <i>Azadirachta indica</i> <i>Aerva javanica</i> <i>Carica papaya</i> <i>Cenchrus biflorus</i> <i>Cenchrus echinatus</i> <i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Chloris virgata</i> <i>Clitoria ternatea</i> <i>Delonix regia</i> <i>Hyptis suaveolens</i> <i>Jatropha gossypifolia</i> <i>Khaya senegalensis</i> <i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Merremia aegyptia</i> <i>Merremia dissecta</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Peltophorum pterocarpum</i> <i>Stylosanthes hamata</i>	Black <i>et al.</i> (2010) described this as the most degraded patch of all. Recorded as Good condition on Keighery (1994) condition scales. Ground truthing required to clarify boundary between Occurrences 1 and 2.
2	Impacts of stock Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Azadirachta indica</i> <i>Cenchrus ciliaris</i> <i>Leucaena leucocephala</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Good, but some new incursion of weeds. Boundary mapping needs checking - landward side of the dune system.
3	Impacts of stock Inappropriate fire regime Clearing Weed invasion Climate change (Cattle tracks, lots of feral pig signs (recorded by S. Black in 2001))	<i>Cenchrus biflorus</i>	Very good
4	Impacts of stock Inappropriate fire regime Clearing Weed invasion Climate change	<i>Cenchrus ciliaris</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Naturalised within vine thicket and on the degraded western strip near the airstrip surrounding the resort:</i> <i>Azadirachta indica</i> <i>Aerva javanica</i> <i>Cenchrus echinatus</i> <i>Cenchrus ciliaris</i> <i>Clitoria ternatea</i> <i>Gossypium hirsutum</i> <i>Hyptis suaveolens</i> <i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Ocimum basiliscum</i> <i>Merremia aegyptia</i> <i>Merremia dissecta</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Good, some areas heavily impacted by fire and grass weeds.
5	-	-	
6	Impacts of stock Inappropriate fire regime Clearing	<i>Passiflora foetida</i> var. <i>hispida</i>	Excellent

	Weed invasion Climate change		
7	Innapropriate fire regime Small numbers of feral cattle Clearing Weed invasion Climate change	-	Excellent
8	Unofficial rubbish tip adjacent Development plans in recent history but planned as cultural site – most likely coastal park. Fire at wrong time greatest threat, old cattle and camel camp (mid 80s) Weed invasion Climate change Storm water runoff Trampling	<i>Azadirachta indica</i> <i>Cenchrus ciliaris</i> <i>Cenchrus biflorus</i> <i>Cenchrus setiger</i> <i>Delonix regia</i> <i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Merremia dissecta</i> <i>Physalis alkekengii</i> <i>Passiflora foetida var. hispida</i>	Excellent except degraded edge. Potentially the infestation from the Japanese garden rural properties – bird spread seeds.
9	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Cenchrus setiger</i> <i>Tribulus</i> sp. (Caltrop)	Excellent
10	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Cenchrus ciliaris</i> <i>Citrullus lanatus</i> <i>Stylosanthes hamata</i>	Excellent
11	-	-	
12	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	-	Excellent
13	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Cenchrus ciliaris</i> <i>Citrullus lanatus</i> <i>Passiflora foetida var. hispida</i>	85 % Cmplty degraded 15 % Excellent
14	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Cenchrus ciliaris</i> <i>Citrullus lanatus</i> <i>Passiflora foetida var. hispida</i>	Good to degraded
15	Inappropriate fire regimes Minor impacts of cattle Clearing Weed invasion Climate change	<i>Passiflora foetida var. hispida</i>	Excellent
16	Inappropriate fire regimes Minor impacts of cattle Clearing Weed invasion Climate change	-	Excellent
17	Clearing Weed invasion Cleared strip of vine thicket cleared to birdwood. Siratro. Innapropriate fire regime Impact of feral animals Climate change	<i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Macroptilium atropurpureum</i> <i>Passiflora foetida var. hispida</i> <i>Stylosanthes hamata</i>	10 % Cmplty degraded 90 % Excellent
18	-	<i>Cenchrus ciliaris</i> <i>Hyptis suaveolens</i> <i>Macroptilium atropurpureum</i>	

19	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	-	Excellent
20	Inappropriate fire regimes Previous impacts of cattle Weed invasion Impact of feral animals Climate change Clearing Erosion	<i>Passiflora foetida</i> var. <i>hispida</i> <i>Tribulus</i> sp. (Caltrop)	Excellent
21	Inappropriate fire regimes Previous impacts of cattle Clearing Weed invasion Climate change	-	Excellent Hopping mouse tracks noted in sand as at Cape Bouda Vine thicket is a thin strip
22	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change Rubbish	<i>Cenchrus ciliaris</i>	Excellent <i>Acyranthes aspera</i> recorded in occurrence
23	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	-	Very good
24	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	-	Excellent
25	Inappropriate fire regimes Previous impacts of cattle Clearing Weed invasion Climate change	-	Excellent
26	Inappropriate fire regimes Previous impacts of cattle Clearing Weed invasion Climate change	-	Excellent
27	Inappropriate fire regimes Previous impacts of cattle Clearing Weed invasion Climate change	-	Excellent
28	Clearing and housing construction Inappropriate fire regime Weed invasion Impact of feral animals Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Good 5 % Excellent 95 %
29	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
30	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Very good
31	Impacts of feral pigs digging up	<i>Cenchrus setiger</i>	Good 5 %

	roots of plants at edge Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Very Good 95 %
32	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	-	Excellent
33	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	<i>Cenchrus setiger</i> <i>Hyptis suaveolens</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
34	-	-	
35	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	-	Excellent
36	Sand dune encroachment Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	-	Excellent
37	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change Wind erosion	-	Excellent
38	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	-	Excellent
39	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	-	Excellent Wallaby tracks.
40	-	-	
41	-	-	
42	-	<i>Aerva javanica</i> <i>?Calotropis</i> sp. (rubber tree) <i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Clitoria ternatea</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Stylosanthes hamata</i>	
43	Clearing and urban development Inappropriate fire regimes and disturbance due to recreational activities Presumed slightly modified due to altered fire regimes Weed invasion Disturbance due to recreational	<i>Azadirachta indica</i> <i>Aerva javanica</i> <i>Cenchrus echinatus</i> <i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Clitoria ternatea</i> <i>Delonix regia</i> <i>Hyptis suaveolens</i>	Completely degraded 20 % Very Good 30 % Excellent 50 % Lawgrounds unsurveyed

	activities Storm water runoff	<i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Merremia dissecta</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Stylosanthes hamata</i> <i>Stachytarpheta</i> sp. (snake weed) On sports oval (Adjacent): <i>Cenchrus ciliaris</i> <i>Merremia dissecta</i> <i>Macroptilium atropurpureum</i> <i>Hyptis suaveolens</i> <i>Tribulus terrestris</i> <i>Senna occidentalis</i> Naturalised in town-site: <i>Antigonon leptopus</i> <i>Calotropis procera</i> <i>Delonix regia</i> <i>Ipomoea quamoclit</i> <i>Lantana camara</i> <i>Tribulus</i> sp.	
44	Inappropriate fire regimes Dumping of rubbish Abandoned building Clearing Weed invasion Impact of feral animals Climate change	<i>Cenchrus setiger</i> <i>Stylosanthes hamata</i> <i>Trianthema portulacastrum</i> <i>Tridax procumbens</i>	Very Good
45	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	-	Excellent
46	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change and changed water levels	-	Excellent
47	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	-	Excellent
48	Mostly inappropriate fire regimes Some impacts of cattle past and present Clearing Weed invasion Climate change	<i>Cenchrus setiger</i>	Very Good
49	Occurrence on dune island surrounded by intertidal mudflats, appears protected from bush fire for long time Impact of feral animals Climate change Weed invasion	<i>Senna surattensis</i> subsp. <i>sulfurea</i>	Excellent
50	Inappropriate fire regimes Past impacts of cattle Clearing Weed invasion Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
51	Inappropriate fire regimes Past impacts of cattle Clearing	<i>Cenchrus setiger</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Excellent

	Weed invasion Climate change		
52	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Very Good
53	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Cenchrus ciliaris</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Very Good
54	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Very Good
55	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	-	Excellent
56	Inappropriate fire regimes Possibly past impacts of cattle Weed invasion Vehicular damage	<i>Cenchrus setiger</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Stylosanthes hamata</i>	Very Good A rare previously unrecorded plant possibly located here - data may be available in volunteer records.
57	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Passiflora foetida</i> var. <i>hispida</i> <i>Stylosanthes hamata</i>	Excellent
58	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion	<i>Passiflora foetida</i> var. <i>hispida</i>	Very Good
59	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
60	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Azadirachta indica</i> <i>Cenchrus ciliaris</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
61	Inappropriate fire regimes and possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Azadirachta indica</i> <i>Cenchrus ciliaris</i> <i>Clitoria ternatea</i> <i>Merremia dissecta</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Senna surattensis</i> subsp. <i>sulfurea</i>	Very Good
62	Weed invasion Recreational use Inappropriate fire regimes Possibly past impacts of cattle Potential industrial development – clearing for jetty access Camping and recreation Climate change Trampling Altered hydrology due to road construction Road widening – spreading	<i>Aerva javanica</i> <i>Cenchrus echinatus</i> <i>Cenchrus setiger</i> <i>Cenchrus biflorus</i> <i>Cenchrus ciliaris</i> <i>Hyptis suaveolens</i> <i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Trianthema portulacastrum</i> <i>Tribulus</i> sp. (Caltrop)	Very Good 30 % Excellent 70 %

	mintweed and buffel grass Stray cattle		
63	Weed invasion Impacts of recreational use Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change Trampling Camping	<i>Aerva javanica</i> <i>Antigonon leptopus</i> <i>Arundo donax</i> (bamboo) <i>Azadirachta indica</i> <i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Clitoria ternatea</i> <i>Coccinia grandis</i> <i>Delonix regia</i> <i>Hyptis suaveolens</i> <i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Mangifera indica</i> (mango) <i>Merremia aegyptia</i> <i>Merremia dissecta</i> <i>Ocimum basilicum</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Stylosanthes hamata</i>	Excellent
64	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Aerva javanica</i> <i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Passiflora foetida</i> <i>Parkinsonia</i> - possible previous (controlled) infestation	Very Good
65	Inappropriate fire regime Feral cattle Weed invasion	<i>Passiflora foetida</i> var. <i>hispida</i>	Completely degraded 10 % Excellent 90 %
66	Inappropriate fire regime Clearing Weed invasion Impact of feral animals Climate change	<i>Trianthema portulacastrum</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Azadirachta indica</i>	Excellent
67	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change Outstation development Recreation	<i>Cenchrus ciliaris</i> <i>Cenchrus biflorus</i> or <i>C. echinatus</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Tribulus</i> sp. (Caltrop – large and small species)	Excellent
68	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Cenchrus ciliaris</i> <i>Cenchrus echinatus</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Tribulus</i> sp.	Excellent <i>Achyranthes aspera</i> recorded.
69	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Azadirachta indica</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Cenchrus ciliaris</i> <i>Tribulus</i> sp	Excellent
70	Inappropriate fire regimes Possibly past impacts of cattle Clearing Weed invasion Climate change	<i>Aerva javanica</i> <i>Cenchrus setiger</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
71	Inappropriate fire regimes Weed invasion Clearing Impact of feral animals Climate change Trampling Vehicle access	<i>Aerva javanica</i> <i>Azadirachta indica</i> <i>Cenchrus biflorus</i> <i>Cenchrus ciliaris</i> <i>Cenchrus echinatus</i> <i>Cenchrus setiger</i> <i>Chloris virgata</i>	Good to degraded

		<i>Clitoria ternatea</i> <i>Hibiscus sabdariffa</i> <i>Hyptis suaveolens</i> <i>Jatropha gossypifolia</i> <i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Merremia aegyptia</i> <i>Merremia dissecta</i> <i>Passiflora foetida</i> var. <i>hispida</i> <i>Stachytarpheta cayennensis</i> <i>Stylosanthes hamata</i> Naturalised in town-site: <i>Delonix regia</i> Growing in town-site: <i>Cryptostegia madagasgariensis</i>	
72	Inappropriate fire regimes Weed invasion Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
73	Inappropriate fire regime Clearing Weed invasion Climate change	<i>Passiflora foetida</i> var. <i>hispida</i>	Very good
74	Inappropriate fire regimes Weed invasion Climate change Camping Rubbish dumping	<i>Cenchrus</i> sp. <i>Passiflora foetida</i> var. <i>hispida</i>	Good
75	Recreational impacts Weed invasion Inappropriate fire regime Climate change Sand dune erosion and movement Camping, Excessive 4WD tracks Rubbish dumping Vandalism of vegetation	<i>Cenchrus ciliaris</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Good. Only occurrence of <i>Diospyros</i> <i>maritima</i> on the Dampier Peninsula
76	Inappropriate fire regime Weed invasion Past impacts of cattle	<i>Cenchrus biflorus</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Excellent
77	Inappropriate fire regime Weed invasion Climate change	<i>Cenchrus ciliaris</i>	Good
78	Land clearing, weed invasion, Inappropriate fire regime, rubbish dumping, water contamination	<i>Aerva javanica</i> <i>Azadirachta indica</i> <i>Cenchrus biflorus</i> <i>Cenchrus ciliaris</i> <i>Cenchrus setiger</i> <i>Clitoria ternatea</i> <i>Cryptostegia madagascariensis</i> <i>Hyptis suaveolens</i> <i>Jatropha gossypifolia</i> <i>Leucaena leucocephala</i> <i>Macroptilium atropurpureum</i> <i>Mangifera indica</i> <i>Merremia aegyptia</i> <i>Merremia dissecta</i> <i>Mimosa pigra</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Good (65%) Very Good (35%)
79	Land clearing, weed invasion, inappropriate fire regime, rubbish dumping, water contamination	As for Occurrence 78	Completely degraded (10%) Degraded (25%) Good (30%) Very Good (20%) Excellent (15%)
80	Weed invasion, inappropriate fire	<i>Azadirachta indica</i>	Excellent (95%)

	regime, uncontrolled 4x4 access		Good (5%)
81	Weed invasion, inappropriate fire regime, uncontrolled 4x4 access	<i>Passiflora foetida</i> var. <i>hispida</i> <i>Tribulus terrestris</i>	Excellent (80%) Good (20%)
82	Hydrological change, rubbish dumping, weed invasion	<i>Aerva javanica</i> <i>Azadirachta indica</i> <i>Cenchrus ciliaris</i> <i>Calotropis procera</i> <i>Hyptis suaveolens</i> <i>Macroptilium atropurpureum</i> <i>Meremia dissecta</i> <i>Passiflora foetida</i> var. <i>hispida</i>	Very Good to Good condition
83	Survey incomplete	Unknown	Unknown
84	Weed invasion, inappropriate fire regime	<i>Passiflora foetida</i>	Excellent (10%) Very Good (90%)
85	Weed invasion, uncontrolled 4x4 access, too frequent hot fire, rubbish dumping	<i>Cenchrus ciliaris</i>	Excellent
86	Weed invasion, uncontrolled 4x4 access, too frequent hot fire, rubbish dumping	<i>Cenchrus ciliaris</i>	Excellent
87	Weed invasion, uncontrolled 4x4 access, too frequent hot fire	<i>Cenchrus ciliaris</i> <i>Passiflora foetida</i>	Excellent
88	Weed invasion, too frequent hot fire	<i>Cenchrus ciliaris</i> <i>Passiflora foetida</i>	Excellent
89	Land clearing, weed invasion,	<i>Azadirachta indica</i> , <i>Passiflora foetida</i> , <i>Leucaena leucocephala</i>	Excellent (50%) Very Good (50%)
90	Weed invasion, inappropriate fire	<i>Passiflora foetida</i>	Pristine (80%) Excellent (20%)

APPENDIX 3: SURVEY CURRENCY AND ABORIGINAL SITES

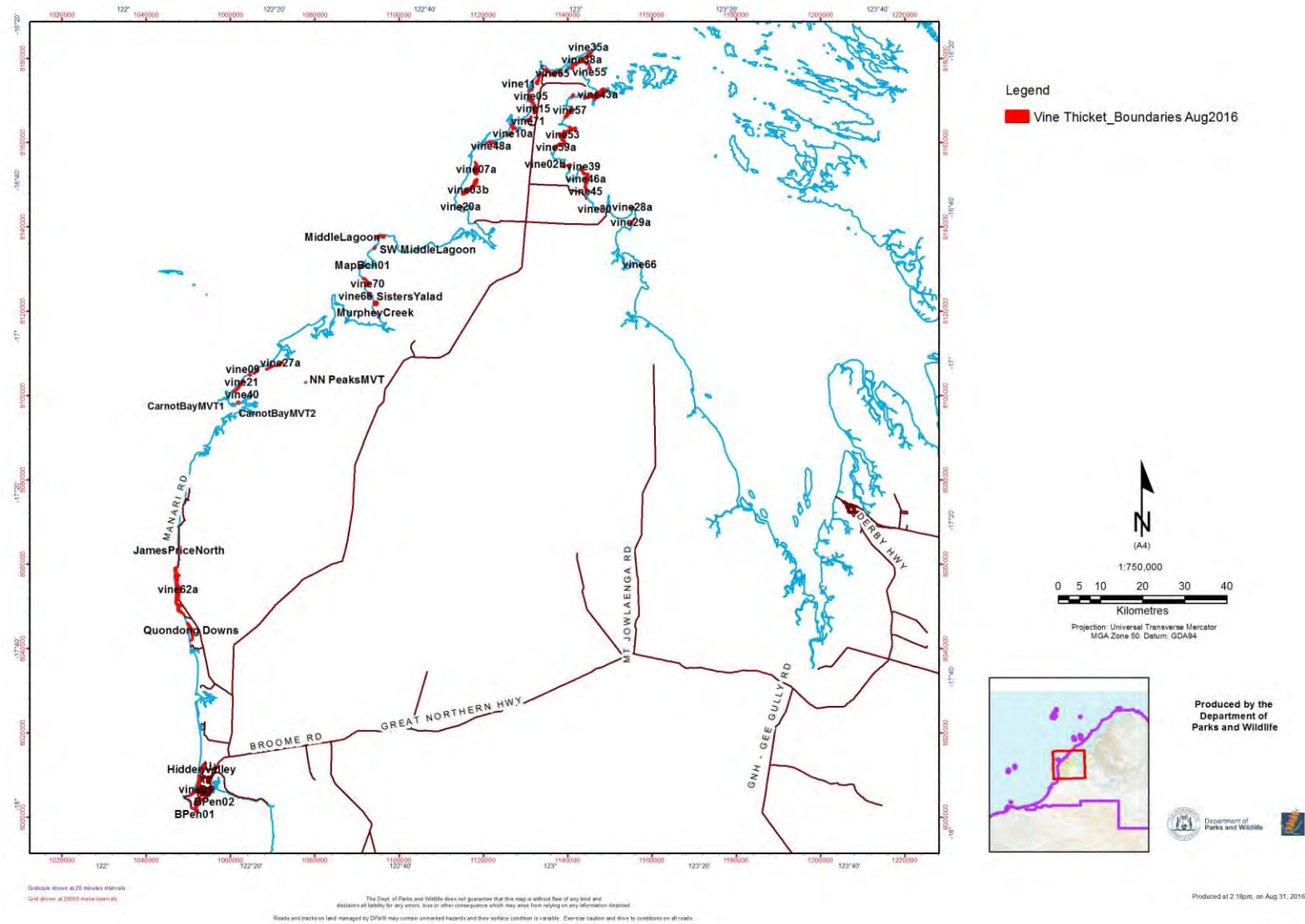
Occ. #	Date last surveyed (TEC database)	Surveys	Aboriginal significance (from Sites Register)
1	02/2010	Kimberley Rainforest Survey (site WK01) TECs Outside SW A flora and vegetation survey of part of Broome coastline, Environmental weeds of Minyirr Coastal Park, Broome	Mythological, Artefacts / Scatter / Midden
2	13/08/2002	Kimberley Rainforest Survey (site 29/1) CALM & Broome Botanical Society	None identified
3	27/08/1999	Kimberley Rainforest Survey (site 29/2) Field survey, TECs and Ecosystems projects, CALM	Artefacts/Scatter
4	01/06/1987	Kimberley Rainforest Survey (site 29/4)	Artefacts / Scatter / Midden/significant sites
5	None		Man-made structures/Artefacts, Scatter / Midden
6	24/07/2003	Conserving TECs outside SW, West Kimberley District &	
7	23/07/2001		None registered
8	16/08/2008 02/2010	Flora and vegetation survey of part of Broome coastline Viewed from ridge only	Law ground and burial ground
9	17/07/2000	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
10	14/08/2008	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project Field reconnaissance Mapped part of boundary	Unidentified site
11	None		Man-made structures/Artefacts, Scatter / Midden
12	21/07/2000	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	Unidentified site
13	21/07/2000	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	Man-made structures/Artefacts, Scatter / Midden
14	None		None identified
15	25/08/2002	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	Man-made structures/Artefacts, Scatter / Midden
16	24/10/2003	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
17	22/07/2000	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	Ceremonial / Repository / Cache / Mythological
18	?2002 Cygnets Bay		Ceremonial / Repository / Cache / Mythological / Scatter
19	09/07/2008	Monitoring reconnaissance trip	None registered
20	25/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	Adjacent to Artefacts/Scatter site
21	27/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
22	27/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
23	28/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
24	29/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
25	29/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
26	29/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered

27	29/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None registered
28	31/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	Not specified
29	31/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	Not specified
30	31/07/2001	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project	None identified
31	08/07/2008	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project Monitoring reconnaissance trip	Artefacts / Scatter / Midden
32	08/07/2008	Monitoring reconnaissance trip Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Mythological / Ceremonial / Artefacts / Scatter
33	08/07/2008	Monitoring reconnaissance trip Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Not identified
34	None		Skeletal material/Burial, Man-Made Structure, Artefacts / Scatter, Midden
35	05/08/2001	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Mythological / Man-Made Structure, Artefacts / Scatter, Midden / Ceremonial
36	3/08/2008	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Midden / Scatter / Mythological / Fish Trap
37	13/08/2008	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Midden / Scatter / Mythological / Fish Trap
38	05/08/2001	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Ceremonial / Artefacts / Scatter / Mythological
39	06/08/2001	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Fish Trap / not specified
40	None		None registered
41	None		Artefacts / Scatter / Midden
42	None		Fish Trap / Ceremonial
43	06/09/2002	Conserving TECs outside the SW	Ceremonial / Repository / Cache / Mythological
44	13/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Not specified
45	14/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Not specified
46	4/08/2008	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project Mapped boundary	Not specified
47	16/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None registered
48	16/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None registered
49	18/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Man-made structures/Artefacts, Scatter / Midden
50	18/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Man-made structures/Artefacts, Scatter / Midden
51	18/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Man-made structures/Artefacts, Scatter / Midden . Fish Trap
52	19/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None identified
53	19/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Man-made structures/Artefacts, Scatter / Midden
54	21/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Midden / Scatter / Mythological
55	21/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Fish Trap / Mythological
56	15/08/2008	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project Partial boundary and condition survey	Ceremonial / Repository / Cache / Mythological / Scatter

57	23/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Man-Made Structure / Artefacts Midden / Scatter
58	23/08/2003	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Man-Made Structure / Artefacts Midden / Scatter
59	24/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Skeletal material / Burial
60	24/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None identified
61	24/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None identified
62	02/2010	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project Biodiversity, Conservation and Attractions and Broome Botanical Society survey 2010	Mythological, Artefacts / Scatter, Midden / Scatter / Ceremonial Skeletal material/Burial / Fish Trap
63	02/09/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Mythological / Artefacts / Scatter / Midden
64	02/09/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	Mythological / scatter midden / artefacts
65	13/08/2008	Conserving TECs outside SW, West Kimberley District & Broome Botanical Society project Field reconnaissance Mapped occurrence using GPS	Skeletal material/Burial, Man-Made Structure, Artefacts / Scatter, Midden / Scatter
66	06/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None identified
67	02/2010	Briefly surveyed by Biodiversity, Conservation and Attractions, Nyul Nyul Rangers, Environs Kimberley and Broome Botanical Society 2010	Fish Trap, Artefacts / Scatter
68	02/2010	Briefly surveyed by Biodiversity, Conservation and Attractions, Nyul Nyul Rangers, Environs Kimberley and Broome Botanical Society 2010	Fish Trap
69	11/08/2002	Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None registered
70	11/08/2002	Conserving TECs outside the SW, West Kimberley District and Broome Botanical Society project	None registered
71	20/08/2002	McKenzie <i>et al</i> (1991) Kimberley Rainforest survey Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project	None registered
72	02/2010	McKenzie <i>et al.</i> (1991) -Kimberley Rainforest survey Conserving TECs outside the SW, West Kimberley District & Broome Botanical Society project Biodiversity, Conservation and Attractions and Broome Botanical Society survey	Artefacts / Scatter / Camp
73	02/2010	Biodiversity, Conservation and Attractions and Broome Botanical Society survey	Artefacts / Scatter, Midden / Scatter
74	02/2010	Biodiversity, Conservation and Attractions and Broome Botanical Society survey	Fish trap
75	02/2010	Biodiversity, Conservation and Attractions and Broome Botanical Society survey	Art, scatter, midden
76	02/2010	Conserving TECs outside the SW, West Kimberley District, Broome Botanical Society project Biodiversity, Conservation and Attractions and Broome Botanical Society survey	Fish Trap, artefacts, scatter
77	02/2010	Conserving TECs outside the SW, West Kimberley District, Broome Botanical Society project Biodiversity, Conservation and Attractions and Broome Botanical Society survey	None registered
78	26/03/2013	NBY, Environs Kimberley, SKIPA, Biodiversity, Conservation and Attractions	Artifacts/scatter, mythological, ceremonial, midden/scatter
79	26/03/2013	NBY, Environs Kimberley, SKIPA, Biodiversity, Conservation and Attractions	Artifacts/scatter, mythological, ceremonial, midden/scatter
80	11/9/2015	Nyul Nyul rangers, Environs Kimberley, Biodiversity, Conservation and Attractions	None registered
81	11/9/2015	Nyul Nyul rangers, Environs Kimberley, Biodiversity, Conservation	None registered

		and Attractions	
82	24/11/2014	Yawuru rangers, Broome Botanical Society, Environs Kimberley, Biodiversity, Conservation and Attractions	Skeletal material, burial
83	01/03/2015	Environs Kimberley, Broome Botanical Society project	Mythological
84	12/04/2016	Nyul Nyul Rangers	None registered
85	04/04/2016	Environs Kimberley, Nyul Nyul Rangers	None registered
86	04/04/2016	Environs Kimberley, Nyul Nyul Rangers	None registered
87	04/04/2016	Environs Kimberley, Nyul Nyul Rangers	None registered
88	06/04/2016	Environs Kimberley, Nyul Nyul Rangers.	None registered
89	19/07/2017	Environs Kimberley, Nyamba Buru Yawuru	Mythological
90	09/05/2017	Environs Kimberley, Nyul Nyul Rangers	None registered

APPENDIX 4: LOCATION OF OCCURRENCES



APPENDIX 5: KEY TO OCCURRENCE NAMES

Occ. # in TEC database	Site name/s in TEC database	Patch # in Black <i>et al.</i> (2010)	Patch group - Black <i>et al.</i> (2010)	Special conservation significance (Black <i>et al.</i> 2010)	Other names
Occ 1	vine01	patch 01	B		Minyirr Park
Occ 2	vine02a, b	patch 52, 61	C, B	Vine 02a is well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 3	vine03a, b, c	patch 20	D		Yakka thickets
Occ 4	vine04q	patch 69			Kooljamine
Occ 5	vine05	patch 66			
Occ 6	vine06a, b, 3a	patch 21	E	Unusual structure; high priority for conservation/ protection	
Occ 7	vine07a, b, c, d, e	patch 22	E	Large patch – high priority for conservation/ protection	
Occ 8	vine08	patch 02	B		Hidden valley
Occ 9	vine09	patch 10	D	Healthy well structured patch, significant flora species, good species rich representative of patch group D; high priority for conservation/ protection	Red Bluff
Occ 10	vine10a, b	patch 25	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	Chile Creek
Occ 11	vine11	patch 67			Gnamagun
Occ 12	vine12	patch 27	E		Gulumonon
Occ 13	vine13	patch 72			? Marrgoon/Bygunn community
Occ 14	vine14	patch 63			
Occ 15	vine15	patch 26	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 16	vine16	Not mapped by Black <i>et al.</i> 2010			
Occ 17	vine17	patch 39	C	Large patch in good condition, well structured, significant flora species in and adjacent; high priority for conservation/ protection	
Occ 18	vine18	patch 40	C	Well structured, significant flora species in and adjacent; high priority for conservation/ protection	
Occ 19	vine19	patch 64			
Occ 20	vine20a, b	patch 19	D		
Occ 21	Vine21	patch 07	D		Mundud oustation
Occ 22	vine22a, b	patch 06	D	Significant flora species, good species rich representative of patch group D; high priority for conservation/ protection	
Occ 23	vine23	patch 08	B		Red Block
Occ 24	vine24a, b	patch 11	C	Unusual composition and adjacent transitional vegetation, significant flora species; high priority for conservation/ protection	
Occ 25	vine25	patch 12	C		
Occ 26	vine26	patch 13	D		
Occ 27	vine27a, b	patch 14	D	Significant flora species; high priority for conservation/ protection	
Occ 28	vine28a, b	patch 58	B		Cunningham Point
Occ 29	vine29a, b	patch 59	B	Only well formed representative of patch group B in immediate area; high	

				priority for conservation/ protection	
Occ 30	vine30	patch 57	B		
Occ 31	vine31a, b	patch 31	C		
Occ 32	vine32a, b	patch 30	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	Hunter Creek
Occ 33	vine33a, b, c	patch 29	C		
Occ 34	vine34	patch 70			
Occ 35	vine35a, b	patch 32	C		
Occ 36	vine36	patch 33	E		
Occ 37	vine37	patch 34	E		
Occ 38	vine38a, b	patch 35	C		Karrakatta Bay
Occ 39	vine39	patch 54	C		
Occ 40	vine40	patch 09			
Occ 41	vine41	patch 68			
Occ 42	vine42	patch 38	C		
Occ 43	vine43a,b,c	patch 71	C	Large patch – high priority for conservation/ protection	One Arm Point
Occ 44	vine44a, b	patch 53	C		
Occ 45	vine45	patch 56	C		
Occ 46	vine46a, b	patch 55	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 47	vine47	patch 24	E	Representative of patch group E; possibly high priority for conservation/ protection	Byrugun scrub
Occ 48	vine48a, b	patch 23	C		Tjarbormai Ck
Occ 49	vine49	patch 48	C		
Occ 50	vine50	patch 45	E	Good representative of patch group E, significant flora species; high priority for conservation/ protection	
Occ 51	vine51	patch 46	C		
Occ 52	vine52	patch 44	C		
Occ 53	vine53	patch 47	C	Large patch, species rich; high priority for conservation/ protection	Gallen
Occ 54	vine54a, b	patch 36	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 55	vine55	patch 37	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 56	vine56	patch 41	C	Significant flora species in and adjacent; high priority for conservation/ protection	
Occ 57	vine57	patch 42	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 58	vine58	patch 43	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 59	vine59	patch 51	C		Milligoon/Djaradjung
Occ 60	vine60	patch 49	D		
Occ 61	vine61	patch 50	C		
Occ 62	vine62a, b, 63a, b, 72	patch 05, 04, 62	B	Large patch, significant flora species, species rich, good representative of patch group B; high priority for conservation/ protection	Waterbank/James Price Point
Occ 63	vine64	patch 03	B		Quandong Downs
Occ 64	vine65	patch 28	C	Well structured species rich representative of patch group C; high priority for conservation/ protection	
Occ 65	vine67a, b, c	patch 18	B	Good representative of patch group B, significant flora species, well	

				structured; high priority for conservation/ protection	
Occ 66	Vine 66	Not mapped by Black <i>et al.</i> 2010			
Occ 67	vine68	Patch 15	B	Good representative of patch group B, significant flora species, well structured; high priority for conservation/ protection	"Gubin" (Ronny Corpus' block)
Occ 68	vine69	patch 17	B		Yallert
Occ 69	Vine70	patch 16	B		
Occ 70	vine71	patch 65			Lombadina-Djarindjin
Occ 71	vine02b	patch 65			
Occ 72	vine03b, c	patch 20	D	Large patch – high priority for conservation/ protection	
Occ 73	JamesPriceNorth	Not mapped by Black <i>et al.</i> 2010			Waterbank
Occ 74	MurphyCreek	Not mapped by Black <i>et al.</i> 2010			
Occ 75	MiddleLagoon	Not mapped by Black <i>et al.</i> 2010			
Occ 76	vine67b	Not mapped as separate occurrence by Black <i>et al.</i> 2010			
Occ 77	vine 67c	Not mapped as separate occurrence by Black <i>et al.</i> 2010			
Occ 78	Bpen01	Not mapped by Black <i>et al.</i> 2010			
Occ 79	Bpen02	Not mapped by Black <i>et al.</i> 2010			
Occ 80	PerpHd01	Not mapped by Black <i>et al.</i> 2010			
Occ 81	MapBch01	Not mapped by Black <i>et al.</i> 2010			
Occ 82	Bilungurr	Not mapped by Black <i>et al.</i> 2010			
Occ 83	BroomeMVT01	Not mapped by Black <i>et al.</i> 2010			
Occ 84	SistersYallad	Not mapped by Black <i>et al.</i> 2010			
Occ 85	CarnotMVT1	Not mapped by Black <i>et al.</i> 2010			
Occ 86	CarnotMVT2	Not mapped by Black <i>et al.</i> 2010			
Occ 87	NNpeaks	Not mapped by Black <i>et al.</i> 2010			
Occ 88	MiddleLagoonSW	Not mapped by Black <i>et al.</i> 2010		Environs Kimberley, Nyul Nyul Rangers noted the substrate is sandstone. Has similar composition to other vine thicket occurrences and is surrounded by pindan.	
Occ 89	Surf01	Not mapped by Black <i>et al.</i> 2010			
Occ 90	Tappers01	Not mapped by Black <i>et al.</i> 2010			

APPENDIX 6: VASCULAR PLANTS IN OCCURRENCES

(From TEC Database April 2015)

	Taxon	Taxon
	<i>Abrus precatorius</i> (Crabs Eyes)	<i>Glycosmis</i> sp.
	<i>Abutilon andrewsianum</i>	<i>Gomphrena</i> sp.
	<i>Abutilon indicum</i> (Indian Lantern Flower)	<i>Gossypium australe</i> (Native Cotton)
	<i>Abutilon</i> sp.	<i>Grewia breviflora</i>
	<i>Acacia bivenosa</i>	<i>Grewia retusifolia</i> (Dog's Balls)
	<i>Acacia colei</i>	<i>Gymnanthera oblonga</i>
	<i>Acacia monticola</i> (Gawar)	<i>Gyrocarpus americanus</i> (Helicopter Tree)
	<i>Acacia neurocarpa</i>	<i>Gyrocarpus americanus</i> subsp. <i>pachyphyllus</i>
	<i>Acacia platycarpa</i> (Pindan Wattle)	<i>Hakea arborescens</i> (Common Hakea)
	<i>Acacia tumida</i> (Pindan Wattle)	<i>Hakea macrocarpa</i>
	<i>Acacia wickhamii</i>	<i>Hakea</i> sp.
	<i>Achyranthes aspera</i> (Chaff Flower)	<i>Helicteres rhynchocarpa</i>
	<i>Adansonia gregorii</i> (Boab)	<i>Heliotropium</i> sp.
	<i>Adenia heterophylla</i>	<i>Heteropogon contortus</i> (Bunch Speargrass)
	<i>Adenia heterophylla</i> subsp. <i>australis</i>	<i>Hibiscus austrinus</i>
	<i>Adriana tomentosa</i> (Bitter Bush)	<i>Hibiscus meraukensis</i> (Merauke Hibiscus)
*	<i>Aerva javanica</i> (Kapok Bush)	<i>Hibiscus</i> sp.
*	<i>Amaranthus hybridus</i> (Slim Amaranth)	<i>Hypoestes floribunda</i> (Bunu)
	<i>Amaranthus</i> sp.	<i>Hypoestes floribunda</i> var. <i>varia</i>
	<i>Amyema benthamii</i>	* <i>Hyptis suaveolens</i> (Hyptis)
	<i>Amyema bifurcata</i>	<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>
	<i>Amyema sanguinea</i>	<i>Ipomoea</i> sp.
	<i>Asparagus racemosus</i>	<i>Jacquemontia paniculata</i>
	<i>Atalaya hemiglaucula</i> (Whitewood)	<i>Jasminum didymum</i>
	<i>Atalaya variifolia</i> (Wingleaf Whitewood)	<i>Jasminum molle</i>
*	<i>Azadirachta indica</i>	* <i>Jatropha gossypifolia</i> (Bellyache Bush)
	<i>Bauhinia cunninghamii</i>	* <i>Leucaena leucocephala</i> (Leucaena)
	<i>Bauhinia</i> sp.	<i>Lophostemon grandiflorus</i>
	<i>Boerhavia dominii</i>	<i>Lophostemon grandiflorus</i> subsp. <i>grandiflorus</i>
	<i>Boerhavia</i> sp.	<i>Lophostemon grandiflorus</i> subsp. <i>riparius</i>
	<i>Brachychiton diversifolius</i> (Northern Kurrajong)	<i>Luvunga monophylla</i>
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	<i>Lysiana spathulata</i>
	<i>Breynia cernua</i>	<i>Lysiana spathulata</i> subsp. <i>spathulata</i>
	<i>Bridelia tomentosa</i>	* <i>Macroptilium atropurpureum</i> (Purple Bean)
	<i>Bulbostylis barbata</i>	* <i>Magnifera indica</i>
	<i>Bulbostylis</i> sp.	<i>Mallotus nesophilus</i>
	<i>Caesalpinia major</i>	<i>Melaleuca alsophila</i>
	<i>Caesalpinia</i> sp.	<i>Melaleuca dealbata</i> (Karnbor)
	<i>Calandrinia strophiolata</i>	<i>Melaleuca viridiflora</i> (Broadleaf Paperbark)
*	<i>Calotropis gigantea</i>	* <i>Merremia dissecta</i>
	<i>Calytrix exstipulata</i> (Kimberley Heather)	* <i>Merremia aegyptia</i>
	<i>Canarium australianum</i> (Jalkay)	<i>Microstachys chamaelea</i>
	<i>Canavalia rosea</i> (Wild Jack Bean)	* <i>Mimosa pigra</i>
	<i>Canavalia</i> sp.	<i>Mimusops elengi</i> (Walara)
	<i>Capparis jacobsonii</i>	<i>Mukia maderaspatana</i>
	<i>Capparis lasiantha</i> (Split Jack)	<i>Myoporum montanum</i> (Native Myrtle)
	<i>Capparis quiniflora</i>	<i>Myoporum</i> sp.
	<i>Capparis sepiaria</i>	<i>Operculina aequisejala</i>
*	<i>Carica papaya</i> (Pawpaw)	<i>Opilia amentacea</i>
	<i>Carissa lanceolata</i> (Conkerberry)	<i>Pandanus spiralis</i> (Screwpine)
	<i>Cassytha capillaris</i>	<i>Panicum decompositum</i> (Native Millet)
	<i>Cassytha filiformis</i> (Love Vine)	<i>Parinari nonda</i>
	<i>Celtis australiensis</i>	* <i>Passiflora foetida</i> (Stinking Passion Flower)
	<i>Celtis philippensis</i>	* <i>Passiflora foetida</i> var. <i>hispida</i>
	<i>Celtis</i> sp.	<i>Pavetta kimberleyana</i>
*	<i>Cenchrus biflorus</i> (Gallon's Curse)	<i>Pavetta</i> sp.
*	<i>Cenchrus ciliaris</i> (Buffel Grass)	* <i>Peltophorum pterocarpum</i> (Yellow Poinciana)

	<i>Cenchrus elymoides</i>		<i>Persoonia acuminata</i>
*	<i>Cenchrus setiger</i> (Birdwood Grass)		<i>Persoonia falcata</i> (Wild Pear)
	<i>Cenchrus</i> sp		<i>Phyllanthus reticulatus</i>
*	<i>Chloris barbata</i> (Purpletop Chloris)		<i>Physalis alkekengii</i> (Chinese lantern)
	* <i>Chloris virgata</i> (Feathertop Rhodes Grass)		<i>Pittosporum moluccanum</i>
	<i>Chrysopogon pallidus</i> (Ribbongrass)		<i>Planchonia careya</i> (Mangaloo)
	<i>Cleome viscosa</i> (Tickweed)		<i>Plumbago zeylanica</i> (Native Plumbago)
	<i>Clerodendrum floribundum</i> var. <i>ovatum</i>		<i>Polycarpaea longiflora</i>
	<i>Clerodendrum</i> sp		<i>Portulaca napiformis</i>
	<i>Clerodendrum tomentosum</i>		<i>Premna acuminata</i> (Ngalinginkal)
	<i>Clerodendrum tomentosum</i> var. <i>mollissima</i>		<i>Psoralea martinii</i>
*	<i>Clitoria ternatea</i>		<i>Psydrax pendulina</i>
	<i>Corchorus pumilio</i>		<i>Ptilotus exaltatus</i> var. <i>exaltatus</i> (Tall Mulla Mulla)
	<i>Corchorus aestuans</i>	*	<i>Pupalia lappacea</i>
	<i>Corymbia bella</i>		<i>Rulingia loxophylla</i>
	<i>Corymbia dampieri</i>		<i>Santalum lanceolatum</i> (Northern Sandalwood)
	<i>Corymbia flavesces</i>		<i>Sarcostemma</i> sp.
	<i>Corymbia paractia</i>		<i>Sarcostemma viminalis</i>
	<i>Corymbia polycarpa</i>		<i>Sebastiania chamaelea</i>
	<i>Crotalaria crispata</i> (Kimberley Horse Poison)		<i>Secamone elliptica</i>
	<i>Crotalaria cunninghamii</i> (Green Birdflower)		<i>Senna costata</i>
	<i>Crotalaria</i> sp	*	<i>Senna occidentalis</i>
	<i>Croton habrophyllus</i>		<i>Senna surattensis</i> subsp. <i>sulfurea</i>
	* <i>Cryptostegia madagascariensis</i>		<i>Sersalisia sericea</i> (Nangi)
	<i>Cullen martinii</i>		<i>Setaria apiculata</i> (Pigeon Grass)
	<i>Cupaniopsis anacardioides</i> (Tuckeroo)		<i>Setaria</i> sp.
	<i>Cymbidium canaliculatum</i>		<i>Sida hackettiana</i>
	<i>Cymbopogon ambiguus</i> (Scentgrass)		<i>Sida rohlenae</i> subsp. <i>occidentalis</i>
	<i>Cymbopogon procerus</i> (Lemon Grass)		<i>Sida</i> sp.
	<i>Cymbopogon</i> sp. (lemon scented grass)		<i>Solanum cunninghamii</i>
	<i>Cynanchum carnosum</i>		<i>Sorghum</i> sp.
	<i>Cyperus bulbosus</i> (Bush Onion)		<i>Spermacoce auriculata</i>
	<i>Cyperus conicus</i>		<i>Spinifex longifolius</i> (Beach Spinifex)
	<i>Cyperus</i> sp.		<i>Stackhousia</i> sp.
	<i>Dendrophthoe acacioides</i> subsp. <i>acacioides</i>	*	<i>Stylosanthes hamata</i> (Verano Stylo)
	<i>Digitaria bicornis</i> (Finger Grass)		<i>Syzygium eucalyptoides</i>
	<i>Dioscorea bulbifera</i> (Ganmanggu)		<i>Syzygium eucalyptoides</i> subsp. <i>bleeseri</i>
	<i>Diospyros ferrea</i> (Australian Ebony)		<i>Tacca leontopetaloides</i> (Gandungai)
	<i>Diospyros humilis</i>		<i>Tephromela</i> sp
	<i>Diospyros maritima</i>		<i>Tephrosia rosea</i> (Flinders River Poison)
	<i>Diospyros rugosula</i>		<i>Terminalia canescens</i> (Joolal)
	<i>Dodonaea lanceolata</i> (Pirrungu)		<i>Terminalia ferdinandiana</i> (Mador)
	<i>Dodonaea platyptera</i>		<i>Terminalia latipes</i>
	<i>Ehretia saligna</i> (False Cedar)		<i>Terminalia petioaris</i> x <i>ferdinandiana</i>
	<i>Enneapogon pallidus</i> (Conetop Nineawn)		<i>Terminalia petiolaris</i> (Masroorl)
	<i>Enneapogon</i> sp		<i>Thespesia populneoides</i> (Laba)
	<i>Enneapogon</i> sp.		<i>Tinospora smilacina</i> (Snakevine)
	<i>Enteropogon dolichostachyus</i>	*	<i>Trianthema portulacastrum</i> (Giant Pigweed)
	<i>Eragrostis</i> sp.	*	<i>Tribulus terrestris</i> (Caltrop)
	<i>Erythroxylum ellipticum</i>		<i>Trichodesma zeylanicum</i> (Camel Bush)
	<i>Eucalyptus bella</i> ms	*	<i>Tridax procumbens</i> (Tridax)
	<i>Eucalyptus camaldulensis</i> var. <i>obtusa</i> (Blunt-budded River Red Gum)		<i>Triodia bitextura</i>
	<i>Eucalyptus tectifera</i> (Darwin Box)		<i>Triodia microstachya</i>
*	<i>Euphorbia hirta</i> (Asthma Plant)		<i>Triodia pungens</i> (Soft Spinifex)
	<i>Exocarpos latifolius</i> (Broad-leaved Cherry)		<i>Triodia schinzii</i>
	<i>Ficus aculeata</i>		<i>Triodia</i> sp.
	<i>Ficus opposita</i> (Sandpaper Fig)		<i>Triumfetta</i> sp.
	<i>Ficus platypoda</i> (Native Fig)		<i>Tylophora cinerascens</i>
	<i>Ficus virens</i> (Albany)		<i>Tylophora flexuosa</i>
	<i>Fimbristylis</i> sp.		<i>Ventilago viminalis</i> (Supplejack)
	<i>Fioria vitifolia</i>		<i>Vernonia cinerea</i> (Vernonia)

<i>Flagellaria indica</i> (Gadji)	<i>Vigna vexillata</i> var. <i>angustifolia</i>
<i>Flueggea virosa</i>	<i>Waltheria indica</i>
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	<i>Whiteochloa airoides</i>
<i>Gardenia pyriformis</i>	<i>Wrightia saligna</i>
<i>Glycosmis</i> sp.	<i>Zornia</i> sp.

Total = 246 species

* = Introduced

APPENDIX 7: STATUS OF FLORA TAXA

(Smith 2017)

Priority species

Species that maybe threatened or near threatened but are data deficient, have not yet been adequately surveyed to be listed under the Schedules of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice, 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 flora or fauna.

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, variety or forma).

1: Priority One: 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 Two: 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 Three: 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 Four: 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 do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

5: Priority Five: Conservation Dependent species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX 7: VOLUNTEER TURTLE MONITORING PROGRAM INFORMATION



Department of Biodiversity,
Conservation and Attractions



**PARKS AND
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Cable Beach Volunteer Turtle Monitoring Program Overview 2018-2019

Volunteer statistics

- Volunteers registered: 71
- Kilometres walked: 1800km
- Monitoring days completed: 120 days

Demographic

- 69 Australian volunteers
- 2 international tourists

Staff involved

Organisers: Jesse Murdoch and Sarah Mullineux

Indigenous rangers involved: Yawuru Rangers- Jason Richardson, Luke Puertollano, Anthony Richardson, Jasmyn Cook, Jason Fong, Preston Manado

Turtle statistics

Nesting activity

- **Total number of turtle nests recorded: 90 (signs installed on all nests)**
- Flatback turtle nests (*natator-depressus*): 87*
- Green turtle (*chelonina-mydas*) nests: 3*

False crawls

- **Total number of false crawls: 43- all flatback turtles***

Hatched nests

- **Total number of hatched nests: 36**
- Green turtle nests, hatched: 2*
- Flatback turtle nests, hatched: 34*

*Please note that green turtle nests may have been misidentified as flatback turtle nests. Further track identification training may be required next season for volunteers.

Predation

- Total- 7 nests directly predated (goanna, crab, dog, tide)
- Total- 116 predator forms (predator tracks within 5 metres of the nest)
- Largest disturbance recorded- vehicles



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Education and communication activities

Facebook

Subjects covered: Cable Beach Turtle monitoring training promotion, Turtle Watchers Code of Conduct, foraging turtles, Cable Beach turtle nesting-signage, ramp closures, monitoring, hatchling season

- Posts completed: 9
- Reaches: 75,051 people
- Engagement: 9,280 people

Radio interview

Subjects covered: turtle nesting period on Cable Beach, how to view nesting turtles (Turtle Watchers Code of Conduct), signage, ramp closures.

- ABC Kimberley- Kevin Smith and Sarah Mullineux

Promotion

- Training promotional flyer displayed on Facebook and around town (noticeboards)
- Cable Beach Volunteer Turtle Monitoring Program promoted during events: Kyle Andrews, WA Marine Debris Beach Clean-up- Tangaroa Blue

Brochure distribution

- Kimberley turtle brochure distributed to Broome Caravan Parks and Visitor Centres

Training

- Volunteers- a theory and practical nesting training session (October)
- A theory hatchling training session (November)
- Yawuru Rangers practical training session (October)

School Engagement

- Halls Creek School children taken on monitoring walk to teach them about the program and turtles

Community Awareness

Large increase in community awareness surrounding nesting turtles on Cable Beach. This was seen through a variety of observations.

- Large amount of people on the beach in the morning looking at the marked turtle nests for hatchling activity. Observed by turtle monitoring volunteers during their monitoring sessions.
- All volunteers supported beach closures during nesting season; volunteers approached vehicles that were on the beach during closure times

Table 1: Cable Beach Volunteer Turtle Monitoring Program Statistics 2013-2019

Year/season	Number of turtle nests **			Total (combination of all species)	Number of false crawls (combination of all species)	Sector with the most nests	Predation /prints near nest (5m)	Number of hatched nests	Number of volunteers involved
	Flatback turtle	Green turtle	Unknown						
2013-2014	9	1	3	13	8	2	No data	No data	40
2014-2015	No individual data recorded	No individual data recorded	No individual data recorded	41 (unsure what species)	27	No data	13- predated nests	16	67
2015-2016	No individual data recorded	No individual data recorded	No individual data recorded	22 (unsure what species)	12	No data	No data	16	38
2016-2017	No individual data recorded	No individual data recorded	No individual data recorded	69 (unsure what species)	14	No data	65%	18	60
2017-2018	35	3	10	48	10	2	11- predated nests, 92 disturbanc es	7	52
2018-2019	87	3	0	90	43	2	7- predated nests, 116 disturbanc es	36	71

**Please note that this data has been captured differently each year, largely by volunteers. The 'no individual data recorded' descriptions represent areas where individual, species data was not recorded due to the different data capturing methods. The use of the tablet devices and ODK collect App has created more comprehensive data, as outlined in the years from 2017-2019.