YARDIE CREEK ROAD REALIGNMENT - BIOLOGICAL SURVEY

Main Roads WA

ecoscape

Revision	Author	QA Reviewer	Approved	Date
Draft Rev0	Stephen Kern Bruce Turner	 Terri Jones Senior Ecologist	 Terri Jones Senior Ecologist	31/10/2020
Final Rev0	Stephen Kern Bruce Turner	 Sonya Bateman Associate Spatial Planner	 Sonya Bateman Associate Spatial Planner	10/12/2020
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This document should be cited as 'Ecoscape (Australia) Pty Ltd (2020) *Yardie Creek Road Realignment - Biological Survey,* prepared for Main Roads WA'

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SUMMARY

Main Roads Western Australia (Main Roads) is proposing to undertake a diversion of Yardie Creek Road as part of the redevelopment of the Ningaloo Lighthouse Caravan Park. Ecoscape was commissioned by Main Roads to undertake a biological survey of an area comprising 42.73 hectares including a detailed flora and vegetation and a basic fauna survey.

The desktop assessment identified that:

- the survey area intersects three pre-European vegetation associations (662, 663, 664) that occupy between 85.24% and 99.06% of original extent at the statewide scale
- one Threatened Ecological Community was identified by the database search, occurring approximately 16 km south of the survey area
- 27 conservation-listed vascular flora species were identified by the combined database searches including one Priority 1, 12 Priority 2, ten Priority 3 and four Priority 4. There are no previous records from within the survey area, though seven of these species have been recorded from an adjacent survey area.
- a search of the DBCA Threatened and Priority Fauna database identified 71 listed species including six species with a high likelihood of occurrence were identified as potentially being within or near to the survey area
- five fauna habitats were recorded in previous surveys in an area adjacent to the survey area.

The field surveys identified:

- 170 vascular flora species including:
  - seven Priority Flora: *Daviesia pleurophylla* (P2), *Tinospora esiangkara* (P2), *Corchorus congener* (P3), *Eremophila forrestii* subsp. *capensis* (P3), *Grevillea calcicola* (P3), *Stackhousia umbellata* (P3), *Brachychiton obtusilobus* (P4).
  - one of potential taxonomic interest (*Alyogyne pinoniana*) and two of potential other significance (*Olax aurantia* as a disjunct population and *Owenia reticulata* as a range extension)
  - six introduced flora, none of which have any specific significance
- seven vegetation types from two broad landform types. None of the vegetation types have any formal conservation significance. However, the **BaTg** and **CzTg** vegetation types are potentially of local or regional significance.
- vegetation condition ranged from Degraded to Excellent
- 20 vertebrate fauna species, none of which are conservation-listed. The species recorded are typical for the habitats they were found in and are well represented in the region.
- Significant fauna species considered to potentially occur were identified as follows:
  - Osprey (*Pandion cristatus*) – EPBC status MI; BC status MI; occasional visitor
  - Crested Tern (*Sterna bergii*) – EPBC status MI; BC status MI; occasional visitor
  - Cape Range Slider (*Lerista allochira*) – DBCA status P3; resident
  - Cape Range Stone Gecko (*Diplodactylus capensis*) - DBCA status P2; resident
  - Ningaloo Worm-lizard (*Aprasia rostrata*) - DBCA status P3; resident
- three fauna habitat types from within the survey area from 16 habitat assessment points including:
  - dunes (includes dune crests and swales)
  - hummock grasslands
  - sheltered gullies and minor caves
- none of the habitat types are confined to the survey area and all occur commonly in areas adjacent to the survey area

- at a regional basis, the dunes habitat type is the most restricted in extent. Fauna species, particularly reptiles, are likely to require the sandy soils of this habitat, however, none of the species likely to occur are dependent on this habitat type within the survey area
- no fauna species inhabiting or likely to inhabit the survey area is dependent on the survey area.

1 INTRODUCTION

1.1 BACKGROUND

Main Roads Western Australia (Main Roads) is proposing to undertake a diversion of Yardie Creek Road as part of the redevelopment of the Ningaloo Lighthouse Caravan Park. In 2018 Ecoscape surveyed approximately half of the project area, as detailed in the Ningaloo Lighthouse Development Environmental Surveys report.

Ecoscape was commissioned by Main Roads to undertake a biological survey to delineate key flora, fauna, soil, and surface water values (wetlands) and potential sensitivity to impact for the project. A detailed flora and vegetation and a basic fauna survey were conducted to achieve these objectives. The outcomes of the survey and information supplied in the biological survey report will be used to inform the environmental assessment and approvals process. The results of the biological survey may also assist in the preparation of Environmental Impact Assessment documentation.

1.2 SURVEY AREA

The survey area, located approximately 13 km north of Exmouth, is within the Shire of Exmouth and consists of three polygons that comprise a total of 42.73 hectares (ha), adjacent to an area previously surveyed (Ecoscape 2018). The survey area location is shown in **Figure 1**.

Figure 1: Survey area location

1.3 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Western Australian *Animal Welfare Act 2002*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- Department of Sustainability Environment Water Population and Communities (DSEWPaC 2011a) *Survey guidelines for Australia's threatened mammals*
- DSEWPaC (2011b) *Survey guidelines for Australia's threatened reptiles*
- DEWHA (2010a) *Survey guidelines for Australia's threatened bats*
- DEWHA (2010b) *Survey guidelines for Australia's threatened birds*
- Threatened Species Scientific Committee (TSSC 2005) *Commonwealth Listing Advice on Northern Quoll (Dasyurus hallucatus)*
- Commonwealth of Australia (2016) *EPBC Act referral guidelines for the endangered Northern Quoll Dasyurus hallucatus*

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2020a) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2016) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2020b) *Statement of Environmental Principles, Factors and Objectives*.

1.3.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities and heritage areas listed under the Act. Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 13** in **Appendix One**. Threatened Ecological Communities are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

1.3.2 WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

1.3.3 WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 14** in **Appendix One**; these categories align with those of the EPBC Act.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as specially protected species in the BC Act.

The most recent flora and fauna listings were published in the *Government Gazette* on 11 September 2018 (Government of Western Australia 2018a).

1.4 FLORA

1.4.1 THREATENED AND PRIORITY FLORA

Conservation significant flora species are those that are listed as TF (Threatened Flora) and (within Western Australia) as PF (Priority Flora). TF species are listed as Threatened by the Western Australian DBCA and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 13** in **Appendix One** for conservation status category descriptions).

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are seven categories covering Western Australian-listed TF and PF species which are outlined in **Table 14** in **Appendix One**. PF for Western Australia are regularly reviewed by the DBCA whenever new

information becomes available, with species status altered or removed from the list when data indicates that they no longer meet the requirements outlined in **Table 14**.

1.4.2 OTHER SIGNIFICANT FLORA

According to the Flora and Vegetation Technical Guidance (EPA 2016), other than being listed as Threatened or Priority Flora a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- of relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

1.4.3 INTRODUCED FLORA

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2020) and are designated with an asterisk (*) in this document.

1.4.3.1 Weeds of National Significance

At a national level there are 36 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2020). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

1.4.3.2 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

1.5 ECOLOGICAL COMMUNITIES

1.5.1 EPBC-LISTED THREATENED ECOLOGICAL COMMUNITIES

Ecological communities are naturally occurring biological assemblages associated with a particular type of habitat (DBCA 2020). At Commonwealth level, Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. Ecological communities are categorised as Critically Endangered, Endangered and Vulnerable as described in **Table 13** in **Appendix One**.

1.5.2 WESTERN AUSTRALIAN THREATENED ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act. TECs are categorised much like those of the EPBC Act, shown in **Table 15** in **Appendix One**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June in June 2018 (DBCA 2018).

1.5.3 WESTERN AUSTRALIAN PRIORITY ECOLOGICAL COMMUNITIES

DBCA maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 28 July 2020 (Species and Communities Programs, DBCA 2020).

1.5.4 OTHER SIGNIFICANT VEGETATION

According to the Flora and Vegetation Technical Guidance (EPA 2016), other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

1.6 FAUNA

1.6.1 EPBC-LISTED THREATENED FAUNA

At a Commonwealth level, Threatened Fauna are protected under the EPBC Act, which lists species and ecological communities that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild (detailed in **Table 13** in **Appendix One**).

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (DotEE 2020):

> *Migratory species are the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.*

Species listed by the following international agreements are currently protected under the EPBC Act:

- *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)
- *China-Australia Migratory Bird Agreement* (CAMBA)
- *Japan-Australia Migratory Bird Agreement* (JAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement* (ROKAMBA).

1.6.2 WESTERN AUSTRALIAN BC ACT-LISTED FAUNA

Threatened fauna that meet the categories listed within the BC Act are protected and require authorisation by the Minister to take or disturb. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act.

Fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. These are known as Specially Protected Species in the BC Act.

The categories covering State-listed threatened fauna species are outlined in **Table 14** in **Appendix One**.

1.6.3 WESTERN AUSTRALIAN PRIORITY FAUNA

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 14** in **Appendix One**.

1.7 ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas around Western Australia identified as being of environmental significance, within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs) and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

1.8 CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018b).

2 EXISTING ENVIRONMENT (DESKTOP ASSESSMENT)

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

The climate of the survey area is arid, semi-desert to subtropical with variable summer and winter rainfall. Cyclonic activity can be significant, and cyclonic systems may affect the coast and hinterland annually (Kendrick & Mau 2002).

According to the Köppen-Geiger climate classification, the survey areas have a hot arid desert (Class BWh) (Peel, Finlayson & McMahon 2007). This classification is considered to represent a desert climate where annual rainfall is generally less than 200 mm or the region loses more water via evapotranspiration than it receives as rain, generally a result of hot, sunny weather without significant cloud. The mean average temperature exceeds 18°C, and summer temperatures are frequently over 40°C.

The closest Bureau of Meteorology (BoM) station with long term records for rainfall is Exmouth Town (BoM 2020b station no. 5051, operating since 1968) located approximately 15 km south of the survey area. The mean annual rainfall is 283.3 mm with 84.44% falling from late summer to late winter (February to July).

The closest BoM station with long term records for temperature is Learmonth Airport (BoM 2020b station no. 5007, operating since 1975) located approximately 50 km south-east of the survey area. January is the hottest month with a mean maximum temperature of 38°C and minimum of 23.1°C. July is the coldest month with a mean maximum of 24.4°C and minimum of 11.4°C.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the year of the field survey.

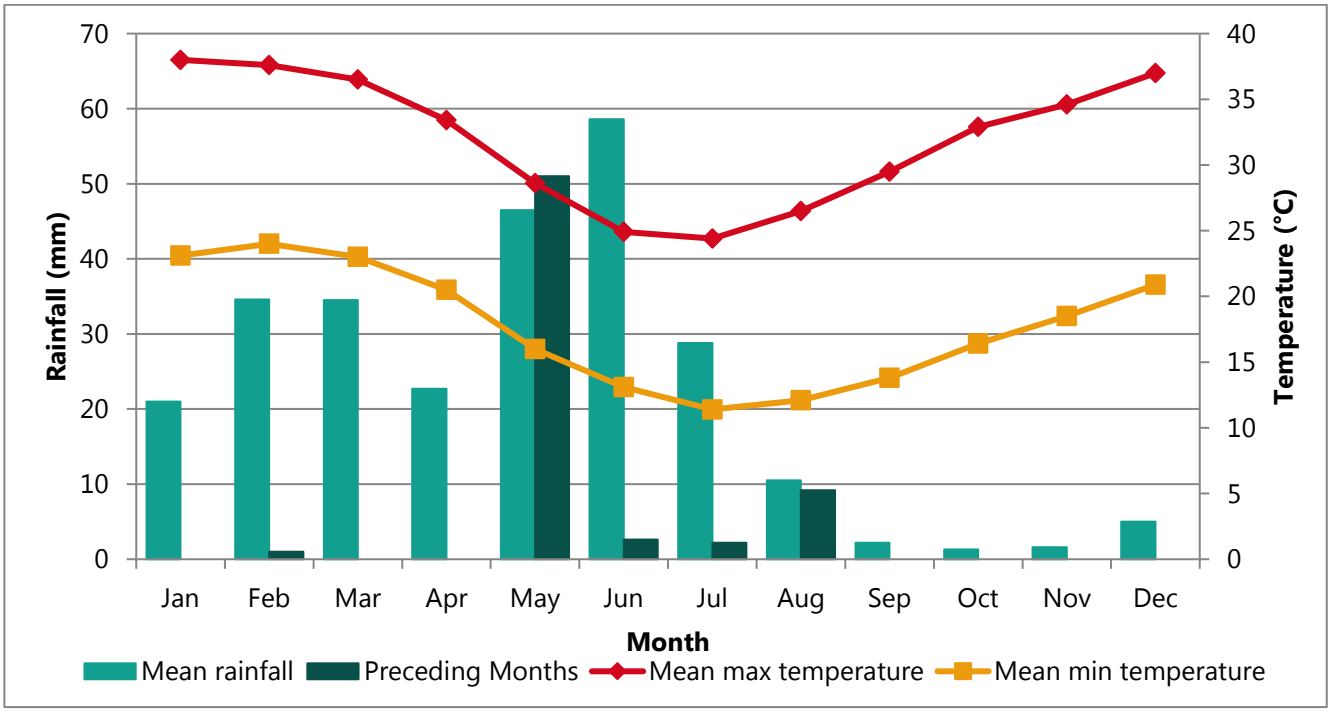

Figure 2: Rainfall and temperature data for the survey area

2.1.2 LAND SYSTEMS

According to Department of Primary Industries and Rural Development (DPIRD 2020) soil landscape mapping, the survey area is only intersected by the Learmonth system (204Le), described as: sandy outwash plains marginal to the Cape Range, supporting mainly soft spinifex hummock grasslands with scattered acacia shrubs.

2.1.3 GEOLOGY

The survey area is associated with the Onslow map sheet (SF50-05) of the 1: 250 000 Geological Map of Western Australia (Department of Primary Industries and Rural Development (DPIRD) 2019a). A summary of the six geological units intersected by the survey area and respective extents is presented in **Table 1.**

Table 1: Geological units that intersect the survey area (DPIRD 2019a)

Mapping unit	Description	Extent (ha)	%
Qbj	Jurrabi member: coralgal reef deposits, minor calcarenite and calcirudite; shallow marine and minor eolian	5.50	12.87
Qbt	Tantbiddi Member: calcarenites and calcirudites, coralgal reef deposits; shallow marine and minor eolian	12.44	29.12
Qe	Longitudinal and network dunes and residual sand plains – reddish-brown to yellowish quartz sand	9.93	23.24
Qs	Beaches and coastal dunes – light grey, unconsolidated and poorly consolidated quartzose calcarenite	0.44	1.04
Tp	Pilgramunna formation: quartzose cross-bedded calcarenite and coralgal limestone; shallow marine	7.00	16.38
Tv	Vlaming sandstone: well-sorted, medium-grained, cross-bedded quartzose calcarenite with calcrete soils, eolian	7.41	17.35

2.1.4 WETLANDS AND DRAINAGE

The survey area falls within the Yannarie River region and does not intersect any wetlands or drainage lines. The nearest hydrological feature is the Cape Range Subterranean Waterways, located approximately 2.5 km to the east of the survey area. This feature is scattered throughout the Northwest Cape and consists of waterways, sinkholes, general groundwater and artificial wells with the main ecological feature being entirely endemic stygofauna (Australian Government & Department of Agriculture 2010).

2.1.5 GROUNDWATER DEPENDENT ECOSYSTEMS

The Groundwater Dependent Ecosystems Atlas (Australian Government & BoM 2020) indicates that the survey area does not intersect any areas with potential for GDEs to occur.

2.1.6 ENVIRONMENTALLY SENSITIVE AREAS

The survey area is included in an ESA. This ESA relates a Register of National Estate (RNE) area. RNE is no longer current, instead the survey area now falls within a National Heritage Place (The Ningaloo Coast) protected under the EPCB Act.

2.1.7 CONSERVATION LANDS

The survey area narrowly intersects a portion of Jurabi Coastal Park along the western boundary and is in close proximity to Ningaloo Marine Park. Other nearby conservation areas include Cape Range national Park, located approximately 17 km to the southwest of the survey area and Bundegi Coastal Park, located approximately 5.5 km to the southeast.

2.1.8 LAND USE HISTORY

Most of the survey area is uncleared, though it lies near popular tourism infrastructure (short-term accommodation), Vlamingh Lighthouse and frequently used access roads. It does not overlay any pastoral leases, but it is likely that vegetation has been grazed by domestic and feral animals since European settlement in the early 1900s. However, the town of Exmouth itself was not established until 1967 when the United States of America constructed the Naval Communication Station.

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Department of Agriculture Water and the Environment 2020).

The survey area is located in the Carnarvon IBRA region in the Cape Range subregion (CAR1), described as (Department of Parks and Wildlife 2013):

> *The Carnarvon bioregion is composed of quaternary alluvial, aeolian and marine sediments overlaying Cretaceous strata. A mosaic of saline alluvial plains with samphire and saltbush low shrublands, Bowgada low woodland on sandy ridges and plains, Snakewood scrubs on clay flats, and tree to shrub steppe over hummock grasslands on and between red sand dune fields. Limestone strata with Acacia stuartii or A. bivenosa shrubland outcrop in the north, where extensive tidal flats in sheltered embayments support mangal.*
>
> *Cape Range and Giralia dunefields form the northern part of Carnarvon Basin. Rugged tertiary limestone ranges and extensive areas of red aeolian dunefield, Quaternary coastal beach dunes and mud flats. Acacia shrublands over Triodia on limestone (Acacia sturtii or Acacia bivenosa) and red dunefields, Triodia hummock grasslands with sparse Eucalyptus trees and shrubs on the Cape Range. Extensive hummock grasslands (Triodia) on the Cape Range and eastern dune-fields. Tidal mudflats of sheltered embayments of Exmouth Gulf support extensive mangroves. Beach dunes with Spinifex communities. An extensive mosaic of saline alluvial plains with samphire and saltbush low shrublands along the eastern hinterland of Exmouth Gulf. Islands of the Muiron, Barrow, Lowendal and Montebello groups are limestone-based. Climate is arid, semi-desert to subtropical climate, with variable summer and winter rainfall. Cyclonic activity can be significant, and cyclonic systems may affect the coast and hinterland annually. Subregional area for CAR1 is 2, 547, 911 ha.*

2.2.2 PRE-EUROPEAN VEGETATION

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia at a scale of 1:250 000 in the south-west and at a scale of 1:1 000 000 in less developed areas.

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps have since been developed in digital form by Shepherd, Beeston & Hopkins (2002) and updated by DPIRD (2019b). Extents are updated every two years by DBCA (2019a). This mapping indicates that the survey area intersects three pre-European vegetation units:

- Association 662: described as hummock grasslands with scattered low trees over dwarf shrubs or mixed short grass and spinifex mixed species. *Triodia* spp.
- Association 663: described as hummock grasslands with scattered low shrubs or mallee. *Triodia* spp., *Acacia* spp., *Grevillea* spp., *Eucalyptus* spp.
- Association 664: described as hummock grasslands with sparse Eucalyptus e.g. bloodwoods and snappy gum. *Triodia* spp., *Corymbia dichromophloia, C. opaca, Eucalyptus leucphoia.*

The pre-European vegetation associations identified from the survey area (DPIRD 2019b) and their pre-European and current extents are listed in **Table 2** (DBCA 2019a) and shown on **Map 1**.

Table 2: Pre-European vegetation association representation (DBCA 2019a)

Region	Vegetation association	Original extent (ha)	Current extent (ha)	% remaining
Western Australia	662	284795.92	282125.59	99.06
	663	30474.41	25976.66	85.24
	664	83774.94	82154.14	98.07
IBRA biogeographic region (Carnarvon)	662	282709.68	281679.33	99.64
	663	29068.26	25866.32	88.98
	664	8379.62	82154.14	98.11
IBRA biogeographic sub-region (Cape Range sub-region)	662	282709.68	281679.33	99.64
	663	29068.26	25866.32	88.98
	664	83739.62	82154.14	98.11
LGA (Shire of Exmouth)	662	194410.67	193595.74	99.58
	663	30474.41	25976.66	85.24
	664	83774.94	82154.14	98.07

2.2.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The Protected Matters Search Tool (PMST) search (Australian Government & Department of Agriculture Water and the Environment 2020, search reference PMST_CNMPNO) using a 20 km buffer around a point approximating the centre of the survey area, identified no EPBC-listed TECs or suitable habitat for such to occur.

The DBCA database search (data supplied by Main Roads) identified one TEC within the search area buffer, the Critically Endangered *Camerons Cave Troglobitic Community* (located approximately 16 km south of the survey area). **Map 2** shows the locations of this TEC identified by the DBCA database search.

2.2.4 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified no EPBC-listed TF that is known to occur or likely within the 20 km search buffer area.

The DBCA database searches (35-0820FL) was conducted using a 60 km buffer around the supplied shapefiles. The results incorporate the TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium.

The combined database searches identified the species listed in **Table 19** in **Appendix Two**, consisting of one P1, 12 P2, 10 P3 and four P4 flora. **Map 2** shows the locations of conservation-listed flora identified by the DBCA database searches.

A survey from the area directly adjacent (Ecoscape 2018) identified seven PF taxa including *Daviesia pleurophylla* (P2), *Tinospora esiangkara* (P2), *Corchorus ?congener* (P3), *Eremophila forrestii* subsp. *capensis* (P3), *Grevillea calcicola* (P3), *Stackhousia umbellata* (P3) and *Brachychiton obtusilobus* (P4). All of these taxa were identified by the DBCA database searches.

2.2.4.1 Threatened and Priority Flora Likelihood Assessment

Ecoscape conducted a likelihood assessment to identify TF and PF species that have potential to occur within the survey area. The likelihood of a species occurring is based on the following attributes, as listed on *FloraBase* (WAH 1998-2020, 2020, including specimen collection information) or in more detailed documents e.g. information from recent nearby surveys (Ecoscape 2018), incorporating an assessment of habitats likely to be present in the survey area. The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is usually associated
- species having previously been recorded from within approximately 20 km of the survey area (considered as 'nearby') taking locational accuracy into account
- time since recorded (i.e. within the previous 25 years), taking into consideration land use changes since collection.

The likelihood rating is assigned using the categories listed in **Table 3**.

Table 3: Categories for likelihood of occurrence of TF and PF

Likelihood	Category
Recorded	Species recorded within the survey area.
Possible	May occur within the survey area (but has not been recorded); broadly, 2-4 of the required attributes (but always including records from nearby) are present in the survey area.
Unlikely	Could occur but is not expected; 1-3 of the required attributes are present in the survey area but: • it is not known from nearby, or • it is known from nearby but has no other required attributes, or • it is known from nearby but has at least one well-defined attribute that does not occur in the survey area (e.g. it is associated with a specific landform or soil type that does not occur in the survey area), or • it is known from nearby but: o the record is old (>25 years), or o the locational data is highly likely to be inaccurate, or o the area has been significantly cleared at and around the location of the record and survey area and as such the habitat almost certainly no longer occurs within the survey area.

Likelihood	Category
Highly unlikely	The species characteristics include only one or none of the required attributes of soil, landform, associated vegetation and having previously been recorded nearby, or a critical element (often landform) is not within the survey area and as such it almost certainly does not occur.

The likelihood assessment is available in **Table 19** in **Appendix Two**. There are no previous records of conservation-listed flora occurring within the survey area. Six P2, seven P3 and one P4 flora taxa were identified as having a Possible likelihood of occurring based on the information available during the desktop assessment. These were considered the most likely to occur and were prioritised for field survey.

Following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.1.1.1**.

2.2.5 THREATENED AND PRIORITY FAUNA

Exclusively marine species (e.g. whales, sea turtles etc.) are not included in the Threatened and Priority Fauna lists as their habitat does not occur within with the survey area.

2.2.5.1 NatureMap

NatureMap (DBCA 2007-2020) is maintained collaboratively by the DBCA and the WAM. These records represent a combination of vouchered museum specimens and records obtained via the Fauna Survey Returns Database maintained by the DBCA.

The *NatureMap* search identified 324 vertebrate fauna species previously recorded within the applied 20 km buffer area, 61 of the 324 species are conservation listed:

- 23 mammals (19 native; 4 introduced)
- 181 birds (180 native; 1 introduced)
- 85 reptiles (85 native; 0 introduced)
- 3 amphibians (3 native; 0 introduced)
- 32 invertebrates. (32 native; 0 introduced)

NatureMap results are incorporated into **Appendix Two**.

2.2.5.2 DBCA Database Search

A search of the DBCA databases was conducted (search reference: 2020/000669 #6428) using a 20 km buffer around the supplied shapefile. 71 conservation-listed species were identified as having previously been recorded from within the search area buffer, consisting of:

- 9 mammals
- 45 birds
- 4 reptiles
- 2 fish
- 11 invertebrates.

DBCA database search results are incorporated into **Table 20** in **Appendix Two** and shown on **Map 3**.

2.2.5.3 Protected Matters Search

The Protected Matters Search Tool (PMST) was used to identify conservation significant fauna and / or fauna habitat suitable for such species to occur within 20 km of a point approximating the centre of the survey area (Australian Government & Department of Agriculture Water and the Environment 2020, search reference PMST_CNMPNO). The PMST identified:

- 3 mammals: one 'species or species habitat known to occur within area', two 'species or species habitat may occur within area'
- 11 birds: one 'breeding known to occur within area', two 'species or species habitat known to occur within area', two 'species or species habitat likely to occur within area', six 'species or species habitat may occur within area'
- 2 fish: two 'species or species habitat known to occur within area'

The PMST results are incorporated into **Table 20** in **Appendix Two**. Not all species identified by the PMST search have DBCA/Western Australian Museum (WAM) records (*NatureMap* and DBCA database searches; see below). The following were identified by the PMST search but not by the *NatureMap* and DBCA database searches:

- Red Knot (*Calidris canutus*) – EN & MI, EN (EPBC Act, BC Act)
- Curlew Sandpiper (*Calidris ferruginea*) – CR & MI, CR (EPBC Act, BC Act)
- Grey Falcon (*Falco hypoleucos*) – VU (BC Act)
- Southern Giant-Petrel (*Macronectes giganteus*) – EN & MI, MI (EPBC Act, BC Act)
- Night Parrot (*Pezoporus occidentalis*) – EN, CR (EPBC Act, BC Act)
- Soft-plumaged Petrel (*Pterodroma mollis*) – VU (EPBC Act)
- Australian Painted Snipe (*Rostratula australis*) – EN, EN (EPBC Act, BC Act)
- Australian Fairy Tern (*Sternula nereis nereis*) – VU, VU (EPBC Act, BC Act)
- Northern Quoll (*Dasyurus hallucatus*) – EN, EN (EPBC Act, BC Act)
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* (Pilbara form) – VU, VU (EPBC Act, BC Act).

2.2.5.4 Threatened and Priority Fauna Likelihood Assessment

The likelihood of occurrence of significant fauna species identified by the database and literature searches was assessed using the following criteria:

- suitability of habitat types present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours
- record certainty.

The categories of likelihood of occurrence, assessed using the above criteria, are shown in **Table 4**.

Table 4: Categories for likelihood of occurrence of conservation-listed fauna

Likelihood	Category
Recorded	Species recorded within the survey area within a reasonable timeframe (0-25 years)
High	Species recorded in close proximity to the survey area (<5 km) within the past 25 years; and suitable habitat occurs within the survey area
Medium	Species historically recorded in close proximity (<5 km) to the survey area, more than 25 years ago; and suitable habitat may exist within the survey area
Low	Species not recorded in the proximity of the survey area or rarely recorded within 10 km of the survey area; and suitable habitat unlikely to occur within the survey area
Very Low	Species not recorded by multiple surveys/databases within 20 km of the survey area and suitable habitat does not occur within the survey area, however, species or suitable habitat is listed as potentially occurring in the wider region

The likelihood of species occurring within the survey area are indicated in **Table 20** in **Appendix Two**. Five species were assessed as having a High likelihood (i.e. 'recorded' and 'high') of occurring within the survey area:

- *Charadrius mongolus* (Lesser Sand Plover)
- *Pandion cristatus* (Osprey (eastern))
- *Petrogale lateralis lateralis* (Black-footed Rock-Wallaby)
- *Sterna bergii* (Crested Tern)
- *Lerista allochira* (Cape Range Slider)

These, and their habitats formed the bases of searches during the field survey.

Following the field survey when actual survey area characteristics are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.3.3.1**.

2.2.6 FAUNA HABITAT

The literature review has few references to fauna habitats that exist within the survey area or occur nearby, being either project area specific (Astron Environmental Services 2009) or regional broadscale assessment (Kendrick 1993). Astron (2009) referred to only three habitats however the project site was on the eastern side of the peninsula and being on sandy coastal dunes exhibits comparatively different habitat to the survey area. Ecoscape (2018) identified the following five fauna habitat types that occur adjacent to the survey area:

- Coastal dunes
- Dune crests
- Dune swales
- Rocky hills and slopes
- Sheltered gullies and minor caves.

The survey area does not have coastal dunes within the survey area boundary, the remaining types are dominated by hummock grasslands on various soils and include the red soil Pindan dunes.

2.3 LITERATURE REVIEW

The following documents have been reviewed for relevance to this project:

- Ecoscape (2018) – *Ningaloo Lighthouse Development Environmental Surveys,* a detailed flora and vegetation survey plus reconnaissance fauna survey of the area directly adjacent to the survey area. The flora and vegetation survey identified seven vegetation types and 169 vascular flora taxa including seven PF. The fauna survey identified five habitat types and 46 vertebrate fauna species including two conservation-listed.
- 360 Environmental (2017), *Australian Bundle Site. Detailed Flora and Vegetation Assessment*, detailing the investigation of a 535 ha site 35 km south of Exmouth, approximately 50 km south of the survey area. The survey identified 74 vascular flora taxa including one of conservation significance (*Corchorus congener*, P3) that was considered to be widespread within the survey area and beyond, 10 natural vegetation types and the vegetation was in Very Good to Completely Degraded condition, with Buffel Grass (**Cenchrus ciliaris*) contributing significantly to the vegetation condition.
- ENV Australia Pty Ltd (2012), *Ashburton North Strategic Industrial Area Flora and Vegetation Assessment*, detailing the investigation of a 564 ha study area located near Onslow, approximately 90 km east of the survey area and across the Exmouth Gulf. The survey identified 131 vascular flora species including one P3 species and five vegetation associations in Excellent to Completely Degraded condition.
- Meissner (2010a), *Biodiversity values of basic raw material sites within Cape Range National Park*, reported on the assessment of biodiversity values of eight existing borrow pits and two sites on UCL, including one near the survey area in red sandplain. This site was dominated by *Acacia bivenosa* and *Senna glutinosa* subsp. *pruinosa* over *Triodia epactia* and *Triodia basedowii*, with *Acanthocarpus humilis*, *Melaleuca cardiophylla* and *Acacia gregorii* on an adjacent limestone ridge. Two priority-listed flora species were recorded from the site; *Eremophila forrestii* subsp. *capensis* and *Corchorus congener*, both P3.
- Meissner (2010b), *Biodiversity values of Unallocated Crown Land on Cape Range peninsula, Western Australia*, reported on the natural values of UCL on Cape Range Peninsula including the survey area. The report notes three broad vegetation types; vegetation on limestone hills and ranges, coastal plain vegetation and vegetation of red sand dunes, the latter having no representation within the conservation estate.
- Astron Environmental Services (Services & Corporation 2009), *Exmouth Wastewater Treatment Plant Land Acquisition Flora, Vegetation and Fauna Survey*. The survey of approximately 200 ha adjacent to the town of Exmouth identified 16 vegetation types (none of conservation significance) of varying condition depending on weed density, 79 vascular flora species (two P3 species, *Corchorus congener* and *Gymnanthera cunninghamii*) and seven vertebrate fauna species.
- Ecoscape (Ltd & Ltd 2009), *Flora and vegetation survey, Market Street, Exmouth*, detailing the flora and vegetation survey of 3.5 ha within the town site of Exmouth. The survey identified a single vegetation type in Completely Degraded or Degraded condition and 35 vascular flora species.
- GHD (2008), *Passing lanes and materials pit Minilya Exmouth Road targeted flora survey*. The report documents a targeted flora survey of several small areas adjacent to the main road 10-28 km south of Exmouth. There were no significant findings during the field survey.
- Baynes & Jones (1993), *The mammals of Cape Range peninsula, north-western Australia* describes the mammal fauna of the area as it was known in 1993. Historically 49 mammal species were known from the peninsula, comprising 38 native ground mammals, five bats and six introduced species. Approximately half

of these are now extinct. The mammal fauna have their origins in the arid zone and no species were identified as being endemic to the peninsula.

- Keighery & Gibson (1993), *Biogeography and composition of the flora of the Cape Range peninsula, Western Australia*. This document details the flora of the Cape Range peninsula, and identifies 630 species of vascular plants including 12 endemic taxa and 50 taxa that are at northern end of their range; these are mostly sandplain or coastal dune species.
- Kendrick (1993), *Biogeography of the vertebrates of the Cape Range peninsula*. At the time of writing, 30 mammals, 84 reptiles, five amphibians and approximately 200 birds were known from the peninsula. The mammal, bird and reptile faunas were considered largely typical of semi-arid and arid areas, although species were often geographically isolated from the main populations. Endemism was considered to be low.
- Pringle (1987), *The biogeography of plant communities on the western coastal plain of the Exmouth Peninsula* (Honours Thesis). The author considered that the flora had origins in both the eremaean region and south west, with the southwestern species becoming isolated from their ancestral populations with some having evolved to become endemic species. These were largely associated with red aeolian sand dunes. However, overall, the flora was considered representative of widely distributed arid environments.

3 METHODS

3.1 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016). The EPA considers that a detailed survey requires:

- a comprehensive survey design, including giving consideration to the survey timing that should be conducted during the primary season of survey for the bioregion and disturbance events, and the potential requirement for supplementary surveys
- a minimum of three quadrats (in proportion to the extent of the vegetation unit), located throughout each preliminary vegetation types sampled throughout its geographic range, with additional quadrats and rescoring during supplementary surveys to clarify vegetation unit boundaries
- regional surveys if there is insufficient information available (identified during the desktop assessment) to provide local and regional context
- the survey may include a number of sampling techniques including quadrats, relevés, transects and traverses, as well as opportunistic observations
- the flora inventory should be comprised of data collected from quadrats and relevés, supplemented by opportunistic observations, systematic surveys and targeted inspections of various habitat areas
- it may be appropriate to increase survey effort in areas of unusual habitat
- sampling sites that are placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression and soil type, as well as vegetation structure, composition and condition.

Targeted searches were also conducted in areas of habitat suitable for TF and PF identified during the desktop assessment and previous surveys as having potential to occur.

The fauna and fauna habitat survey was conducted as a basic survey according to the Fauna Technical Guidance (EPA 2020a). The EPA recommends a basic survey should:

- be conducted as a low intensity survey to gather broad fauna and habitat information
- verify the adequacy of the desktop assessment
- map, describe and photograph habitats
- record opportunistic fauna observations
- identify possible future survey site locations, access and logistics
- determine if a detailed survey is required.

Targeted surveys were also conducted to gather information on significant fauna and/or habitats.

3.2 FLORA AND VEGETATION FIELD SURVEY

3.2.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016), conducted as a single phase survey.

Conservation criteria used in this assessment are included in **Table 13**, **Table 14** and **Table 15** in **Appendix One**.

Survey method details are outlined below.

3.2.1.1 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values and field observations to represent the vegetation values existing at the site. The unmarked quadrats were 30 m x 30 m in dimension, as required according to the Flora and Vegetation Technical Guidance (EPA 2016) for the Carnarvon bioregion. Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 900 m^2.

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner
- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat
- broad soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

At least three quadrats per vegetation type were recorded for the detailed survey where there was sufficient extent. All quadrat locations are displayed on **Map 4**.

3.2.1.2 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat. Due to the relatively small extent of the survey area, the entire area was extensively searched on foot at 50 m intervals or less.

The locations of all targeted taxa collected were recorded using a handheld GPS (accuracy of 3-5 m) with the following data recorded:

- observer, date and time
- reproductive status and other features such as health of plants, percentage flowering and fruiting
- local abundance/population size and/or population boundary, including outside the development envelopes where possible
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

3.2.1.3 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

3.2.1.4 Vegetation Description and Classification

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at

Level V (NVIS Technical Working Group & DotEE 2017) (**Table 16** and **Table 17** in **Appendix One**). Up to three species per stratum from each stratum (upper, mid and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the most dominant/characteristic species of each stratum, e.g. **AsTe** refers to ***A****cacia* ***s****clerosperma* subsp. *sclerosperma* and *A. bivenosa* mid open shrubland over ***T****riodia* ***e****pactia* and *Acacia gregorii* low hummock grassland/shrubland.

Vegetation mapping was conducted in the field by mapping units of similar vegetation (known as vegetation types) and hand drawing boundaries onto printed aerial imagery for later digitisation.

3.2.1.5 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Eremaean Botanical Province (EPA 2016) (**Table 18** in **Appendix One**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

3.2.1.6 Field Survey Timing

The field survey was conducted over five days (50 hours) during 17-21 August 2020 which is outside of the optimal period for a primary survey within the bioregion according to the Flora and Vegetation Technical Guidance (EPA 2016).

3.2.2 STATISTICAL ANALYSIS

3.2.2.1 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey effort and habitat known to occur in the survey area, and updated the desktop likelihood assessment.

3.2.2.2 Floristic Analysis

PATN© software (Belbin & Collins 2006) was used to undertake statistical analysis to generate floristic groups using the data collected from the quadrats and relevés, in order to better understand local significance of floristic units. PATN analysis has been used for several local floristic analyses including Gibson *et al.* (1994) for the Swan Coastal Plain.

PATN is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes) and classifies the objects into groups and condenses the information and displays the patterns in the data graphically. It offers a choice of data transformations prior to multivariate analysis.

Floristic groups, identified using a dendrogram output of the analysis, are used as a tool to inform vegetation type groups at various levels and scales.

The analysis used the Bray Curtis similarity coefficient for rows (species) and columns (sites) as this provides a good estimation of association for ecological applications (Belbin & Collins 2006). For this analysis we used a simple square root transformation of cover values for each species.

Interpretation of these purely floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units, however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

3.2.2.3 Adequacy of Sampling

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software Species Diversity and Richness IV (Pisces Conservation Ltd 2010) using five random selections of sample order, using quadrat data only.

3.3 FAUNA FIELD SURVEY

3.3.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Fauna Technical Guidance (EPA 2020a), conducted as a basic level survey.

Conservation criteria used in this assessment are included in **Table 13** and **Table 14** in **Appendix One**.

Survey method details are outlined below.

3.3.1.1 Fauna Survey

The basic fauna survey incorporated a number of survey techniques as per the Terrestrial Fauna Technical Guidance (EPA 2020a) including habitat assessment, active searches (day and night time), raking of spoil heaps and leaf litter, searches for secondary evidence such as scats and tracks and use of trail cameras for the detection of fauna, as well as opportunistic searches.

Terrestrial vertebrate fauna were the main targets of the field survey. Survey techniques included:

- opportunistic bird observations while moving through the survey area
- turning of surface debris (rocks, logs, vegetation spoil heaps) that reptiles and mammals may shelter beneath
- raking of litter beds using a three pronged cultivator rake to locate fossorial reptile species
- tree hollow inspection to detect arboreal fauna
- spotlight surveys to detect nocturnal species
- two motion cameras (Reconyx HC500) per habitat type baited with fish oil to capture evidence of cryptic and nocturnal fauna species not easily observed directly
- Songmeter acoustic recorders fitted with both acoustic and ultrasonic microphones to sample for birds and bats.

Fauna species were identified opportunistically based on sightings, calls, remains, diggings and other signs. Potential habitats for conservation significant species were identified and evaluated and their likelihood of occurrence assessed.

Based on the desktop assessment, the following significant species were considered to have a High likelihood of occurring in the survey area and they, and habitat suitable to support them, were targeted during the field survey:

- *Aprasia rostrata*, Ningaloo Worm-lizard
- *Charadrius mongolus,* Lesser Sand Plover

- *Diplodactylus capensis*, Cape Range Stone Gecko
- *Lerista allochira*, Cape Range Slider
- *Petrogale lateralis*, Black-footed Rock-Wallaby.

3.3.1.2 Fauna Habitat Assessment

The fauna habitats present within the survey areas were identified and mapped. Fauna habitats were described as an area which is distinguishable from its surrounding area by its landform, vegetation and fauna assemblage occupying the area. In addition, its likelihood to harbour specialised fauna species which are not found in adjacent areas was taken into consideration.

The following information was used to identify and map all fauna habitats within the survey area:

- previous fauna habitat mapping
- land systems
- vegetation type and condition mapping
- aerial imagery
- landforms
- soil characteristic
- fauna assemblage information.

The composition and characteristics of each fauna habitat type was recorded, including noting suitability for various fauna suites or conservation-listed species. Habitat types were delineated in the field and digitised upon return from the field survey.

3.3.1.3 Field Survey Timing

The survey was conducted over four days (40 hours) during 18-21 August 2020. The season was not optimal for survey, which according to the EPA (2020a) *Fauna Technical Guidance* is in spring (September to November) to ensure sampling during peak activity of reptiles, amphibians and birds. Survey timing for these fauna groups is dependent on warm temperatures and/or rainfall events, mammal activity is not dependent on weather and is therefore not constrained.

Despite the suboptimal season of survey according to the *Technical Guidance*, daytime temperatures were in the 25-28° range and where observed, reptiles were moving rapidly and therefore not torpid.

3.3.2 DATA MANAGEMENT

Data gathered through the desktop review, field survey habitat assessments and observations was collated to provide locations of significant fauna species records and maps of fauna habitat types. Fauna habitat quality is assessed at each sampling point to provide an overall habitat quality of the survey area as this may vary across habitats of different type.

3.3.3 DATA ANALYSIS

This task includes the time required to collate and review all images captured by trail cameras that were deployed within the habitats of the survey area. Species detected by trail camera were included in the overall species inventory for the survey.

4 FIELD SURVEY RESULTS

4.1 FLORA AND VEGETATION SURVEY

The flora and vegetation survey was conducted by Stephen Kern (Principal Botanist, Flora Collecting Permit FB62000001; Threatened Flora Collecting Permit TFL 74-1920) during 17-21 August 2020.

4.1.1 FLORA

4.1.1.1 Flora Inventory

Twenty-two floristic quadrats were recorded from within the survey area.

A total of 170 vascular flora were recorded from 112 genera and 51 families from the quadrats, opportunistic observations and searches for conservation-listed flora. Of these, six were introduced (3.53%) and three (1.76%) could not be identified to species level due to insufficient diagnostic reproductive material.

The most commonly represented families were Fabaceae (26 taxa), Poaceae (18, including two introduced), Malvaceae (14), Amaranthaceae (8, including one introduced) and Chenopodiaceae (8). The most commonly represented genera were *Acacia* (9 taxa), *Ptilotus* (6), *Scaevola*, *Senna* and *Triodia* (5 each).

The number of species per quadrat ranged from 10 in quadrat YR2010 to 34 in quadrats YR2004 and YR2022, with an average species diversity per quadrat of 22.27. The most commonly recorded species were *Solanum lasiophyllum* recorded from 18 quadrats, *Nicotiana occidentalis* subsp. *occidentalis* (13 quadrats), *Acacia bivenosa*, *Acacia coriacea* subsp. *coriacea*, *Acacia gregorii*, *Melaleuca cardiophylla* and *Triodia angusta* (12 quadrats each).

The combined flora inventory is presented in **Table 21** in **Appendix Three**. Quadrat data is presented in **Appendix Four**.

4.1.1.2 Conservation-listed Flora

Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed Threatened Flora were recorded during the field survey.

Priority Flora

Seven Priority-listed flora were recorded during the field survey:

- *Daviesia pleurophylla* (P2)
- *Tinospora esiangkara* (P2)
- *Corchorus congener* (P3)
- *Eremophila forrestii* subsp. *capensis* (P3)
- *Grevillea calcicola* (P3)
- *Stackhousia umbellata* (P3)
- *Brachychiton obtusilobus* (P4).

Locations of PF are indicated on **Map 4** and described in more detail in **Table 5**.

Table 5: TF and PF recorded during the field survey

***Daviesia pleurophylla* (P2)**	
Description: *Daviesia pleurophylla* is a divaricately branched, broom-like shrub with spinescent branches to 3 m high; yellow flowers with red/orange centres (WAH 2020). 	**Habitat:** Typically recorded from the red Pindan sand dune (WAH 2020) corresponding with the **BaTg** vegetation type within the survey area. **Location:** All except one record from the linear sand dune near the eastern end of the survey area. One outlier record from the centre of the survey area **Survey results**: 17 plants in total from within the survey area plus at least 94 plants recorded from adjacent areas outside the survey area. **Populations:** Plants recorded represent a single population **Known records and distribution**: According to *NatureMap* (DBCA 2007-2020) there are seven records of this species from the Carnarvon bioregion, with an overall distribution of approximately 70 km (north-south) by 30 km (east-west).
***Tinospora esiangkara* (P2)**	
Description: *Tinospora esiangkara* is a climber to 2 m high (WAH 2020). 	**Habitat:** Occurs primarily on limestone outcrops and ridges and also on red clay (WAH 2020). Within the survey area, it was recorded from the **FbTa**, **GvTe** and **McTw** vegetation types **Location:** Scattered plants recorded throughout the western half of the survey area **Survey results**: 37 plants recorded within the survey area and an additional 10 plants recorded in adjacent areas. **Populations:** All plants represent a single population **Known records and distribution**: According to *NatureMap* (DBCA 2007-2020) there are nine records of this species from the Carnarvon bioregion, but it also occurs in the Northern Territory and Queensland (Atlas of Living Australia 2020).

***Corchorus congener* (P3)**	
Description: *Corchorus congener* is a spreading shrub to 0.6 m high with yellow flowers (WAH 2020)**.** 	**Habitat:** Occurs on sand and sand over limestone (WAH 2020). Within the survey area plants were recorded from the **AsTe**, **CzTg** and **McTw** vegetation types **Location:** all plants were recorded from the eastern end of the survey area **Survey results**: 13 plants recorded within the survey area plus an additional 2 plants recorded in adjacent areas **Populations:** All plants represent a single population **Known records and distribution**: According to *NatureMap* (DBCA 2007-2020) there are 142 records of this species from the Carnarvon and Pilbara bioregions, with an overall distribution of approximately 240 km (north-south) by 426 km (east-west), largely within close proximity to the coast.
***Eremophila forrestii* subsp. *capensis* (P3)**	
Description: *Eremophila forrestii* subsp. *capensis* is an erect shrub to 2 m high with felted grey green to yellowish green leaves and pink, green cream or yellow flowers (WAH 2020). 	**Habitat:** Typically occurs on exposed limestone (WAH 2020). Within the survey area this taxon was recorded from the **BaTg**, **FbTa**, **GvTe** and **McTw** vegetation types **Location:** scattered throughout much of the survey area **Survey results**: 68 plants recorded within the survey area plus an additional 19 plants recorded in adjacent areas **Populations:** All plants represent a single population **Known records and distribution**: According to *NatureMap* (DBCA 2007-2020) there are eight records of this species from the Carnarvon bioregion, with an overall distribution of approximately 50 km (north-south) by 24 km (east-west).

***Grevillea calcicola* (P3)**	
Description: *Grevillea calcicola* is a straggly tree or shrub to 4 m high with cream-white flowers (WAH 2020). 	**Habitat:** Typically occurs on limestone hilltops (WAH 2020). Within the survey area it was recorded from the **FbTa**, **GcTa** and **McTw** vegetation types **Location:** scattered records from the western half of the survey area **Survey results**: 14 plants recorded within the survey area **Populations:** All plants represent a single population **Known records and distribution**: According to *NatureMap* (DBCA 2007-2020) there are 15 records of this species from the Carnarvon bioregions, with an overall distribution of approximately 68 km (north-south) by 24 km (east-west).
***Stackhousia umbellata* (P3)**	
Description: *Stackhousia umbellata* is a leafless, spreading perennial herb to 0.5 m high with yellow flowers (WAH 2020). 	**Habitat:** Occurs in sandy soils on limestone (WAH 2020). Within the survey area it was recorded from the **GvTe** and **McTw** vegetation types. **Location:** all plants recorded from the central portion of the survey area **Survey results**: 61 plants recorded within the survey area plus an additional 38 plants recorded from adjacent areas. **Populations:** All plants represent a single population **Known records and distribution**: According to *NatureMap* (DBCA 2007-2020) there are 19 records of this species. All except one come from the Carnarvon bioregion, with an overall distribution of approximately 105 km (north-south) and 37 km (east-west).

***Brachychiton obtusilobus* (P4)**	
Description: ***Brachychiton obtusilobus*** is a small tree 3.5-6 m high when mature, with cream flowers and large star-shaped fruit (WAH 2020). 	**Habitat:** Occurs on limestone ranges, in gorges and occasionally sandplains **(WAH 2020)**. Within the survey area it was recorded from the **FbTa**, **GcTa**, **GvTe** and **McTw** vegetation types. **Location:** scattered plants from the western half of the survey area **Survey results**: 10 plants recorded within the survey area plus an additional 10 plants from adjacent areas **Populations:** All plants represent a single population **Known records and distribution**: According to *NatureMap* (DBCA 2007-2020) there are 13 records of this species from the Carnarvon bioregion, with an overall distribution of approximately 60 km (north-south) and 23 km (east-west).

4.1.1.3 Other Significant Flora

According to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016), the following taxa may be considered to be significant:

- *Olax aurantia*; part of a known disjunct population, separated from the main southwest distribution by approximately 500 km
- *Owenia reticulata*; range extension of over 100 km according to the distribution illustrated on *NatureMap* (DBCA 2007-2020).

4.1.1.4 Flora of Taxonomic Interest

One taxon, previously documented by Ecoscape (2018), was considered as potentially of taxonomic interest, *Alyogyne pinoniana*, exhibited only slightly lobed leaves, whereas most specimens of this taxon housed in the Western Australian Herbarium exhibited more deeply divided, crenulate-margined leaves. One specimen in the Herbarium, also from Cape Range (J. English 204), was considered to match the specimens collected during this survey suggesting there may be variation within the species confined to the local area.

4.1.1.5 Introduced Flora

Six introduced flora species (weeds) were recorded during the field survey, representing 3.53% of the overall flora inventory. Buffel Grass (**Cenchrus ciliaris*) was the most commonly recorded introduced species occurring in 10 of 22 quadrats and was a significant contributor to vegetation condition assessment. None of the other weeds recorded were present within more than one quadrat.

None of the introduced flora have any specific significance i.e. none are Declared Pest plants or WoNS species.

4.1.2 VEGETATION

4.1.2.1 Vegetation Types

Seven vegetation types were recorded from within the survey area (**Table 6**, **Map 4**) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.1.2.2**) and subsequent desktop review.

The vegetation types within the survey area, grouped broadly based on landform types, were:

- sand dunes and plains: **AsTe**, **BaTg** and **CzTg**
- limestone hills (and associated gullies): **FbTa**, **GcTa**, **GvTe** and **McTw**.

Table 6: Vegetation types

Bold indicates the quadrat represented in the photograph

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Sandplain	**AsTe**	*Acacia sclerosperma* subsp. *sclerosperma* and *A. bivenosa* mid open shrubland over *Triodia epactia* and *Acacia gregorii* low hummock grassland/shrubland	YR2001 YR2002 YR2003 YR2010 YR2020 **YR2021**		*Acacia coriacea* subsp. *coriacea* **Cenchrus ciliaris* *Heliotropium glanduliferum* *Indigofera boviperda* subsp. *boviperda* *Maireana lanosa* *Melaleuca cardiophylla* *Nicotiana occidentalis* subsp. *occidentalis* *Rhagodia eremaea* *Scaevola cunninghamii* *Solanum lasiophyllum* *Thysanotus exfimbriatus* *Wurmbea odorata*	10.69 ha 25.01%
Red sand dunes	**BaTg**	*Banksia ashbyi* subsp. *boreoscaia*, *Grevillea stenobotrya* and *Acacia coriacea* subsp. *coriacea* mid open shrubland over *Triodia glabra* low hummock grassland	YR2004 **YR2005**		*Alyogyne pinoniana* *Calytrix truncatifolia* *Cenchrus ciliaris* *Daviesia pleurophylla* *Euphorbia coghlanii* *Indigofera boviperda* subsp. *boviperda* *Jasminum* sp. Exmouth (G. Marsh 77) *Nicotiana occidentalis* subsp. *occidentalis* *Polymeria ambigua* *Rhodanthe condensata* *Scaevola sericophylla* *Solanum lasiophyllum* *Trianthema pilosum* *Trichodesma zeylanicum*	1.23 ha 2.89%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Sandplains	**CzTg**	*Corymbia zygophylla* and *Banksia ashbyi* subsp. *boreoscaia* mid open mallee shrubland over *Triodia glabra* low hummock grassland	YR2008 **YR2011**		*Acacia coriacea* subsp. *coriacea* *Acacia gregorii* *Grevillea stenobotrya* *Heliotropium glanduliferum* *Indigofera boviperda* subsp. *boviperda* *Jasminum* sp. Exmouth (G. Marsh 77) *Scaevola sericophylla*	3.30 ha 7.73%
Limestone foothills	**FbTa**	*Ficus brachypoda* and *Grevillea variifolia* subsp. *variifolia* mid sparse shrubland over *Triodia angusta* low hummock grassland	YR2016 **YR2019** YR2022		*Acacia arida* *Acacia bivenosa* *Acacia coriacea* subsp. *coriacea* *Acacia pyrifolia* var. *pyrifolia* **Cenchrus ciliaris* *Corchorus crozophorifolius* *Cynanchum viminale* subsp. *australe* *Eremophila forrestii* subsp. *capensis* *Exocarpos aphyllus* *Indigofera monophylla* *Jasminum* sp. Exmouth (G. Marsh 77) *Melaleuca cardiophylla* *Melhania oblongifolia* *Nicotiana occidentalis* subsp. *occidentalis* *Ptilotus obovatus* *Senna artemisioides* subsp. *oligophylla* *Solanum lasiophyllum*	7.59 ha 17.75%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Rocky limestone gullies	**GcTa**	*Grevillea calcicola*, *Acacia coriacea* subsp. *coriacea* and *Ficus brachypoda* tall open shrubland over *Triodia angusta* low open hummock grassland	**YR2018**		*Acacia tetragonophylla* *Alectryon oleifolius* *Bidens subalternans* **Cenchrus ciliaris* *Dipteracanthus australasicus* subsp. *australasicus* *Ipomoea costata* *Melhania oblongifolia* *Plumbago zeylanica* *Ptilotus obovatus* *Tinospora esiangkara*	0.51 ha 1.20%
Limestone hills	**GvTe**	*Grevillea variifolia* subsp. *variifolia* and *Acacia bivenosa* mid open shrubland over *Triodia epactia* and *T. angusta* low hummock grassland	YR2015 **YR2017**		*Acacia tetragonophylla* *Cucumis variabilis* *Cynanchum viminale* subsp. *australe* *Diplopeltis eriocarpa* *Eremophila forrestii* subsp. *capensis* *Erodium cygnorum* *Gossypium robinsonii* *Hannafordia quadrivalvis* subsp. *recurva* *Melaleuca cardiophylla* *Nicotiana occidentalis* subsp. *occidentalis* *Ptilotus obovatus* *Scaevola spinescens* *Senna artemisioides* subsp. *oligophylla* *Solanum lasiophyllum* *Tribulus suberosus* *Trichodesma zeylanicum*	3.88 ha 9.08%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Limestone hills	**McTw**	*Melaleuca cardiophylla* and *Hakea stenophylla* subsp. *stenophylla* mid open shrubland over *Triodia wiseana, T. angusta* and *Hibbertia capensis* low hummock grassland/shrubland	YR2006 YR2007 YR2009 YR2012 YR2013 **YR2014**		*Acacia bivenosa* *Acacia gregorii* *Acacia tetragonophylla* *Acanthocarpus humilis* *Alyogyne pinoniana* *Dampiera incana var. incana* *Diplopeltis eriocarpa* *Eremophila forrestii* subsp. *capensis* *Exocarpos aphyllus* *Grevillea variifolia* subsp. *variifolia* *Hannafordia quadrivalvis* subsp. *recurva* *Leptosema macrocarpum* *Nicotiana occidentalis* subsp. *occidentalis* *Solanum lasiophyllum* *Stackhousia umbellata*	13.78 ha 32.23%
		Not native vegetation (cleared)			1.76 ha	4.11%
		TOTAL EXTENT			**42.73 ha**	**100%**

4.1.2.2 Vegetation Significance

TECs and PECs

No vegetation recorded from the survey area was assessed as being representative of any currently described TEC or PEC.

4.1.2.3 Other Significant Vegetation

No vegetation having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) were recorded during the field survey.

Groundwater Dependent Ecosystems

None of the vegetation types are considered to represent GDE's.

4.1.2.4 Floristic Analysis

The floristic analysis dendrogram (**Figure 3**) indicates that the vegetation types defined are also clear floristic units.

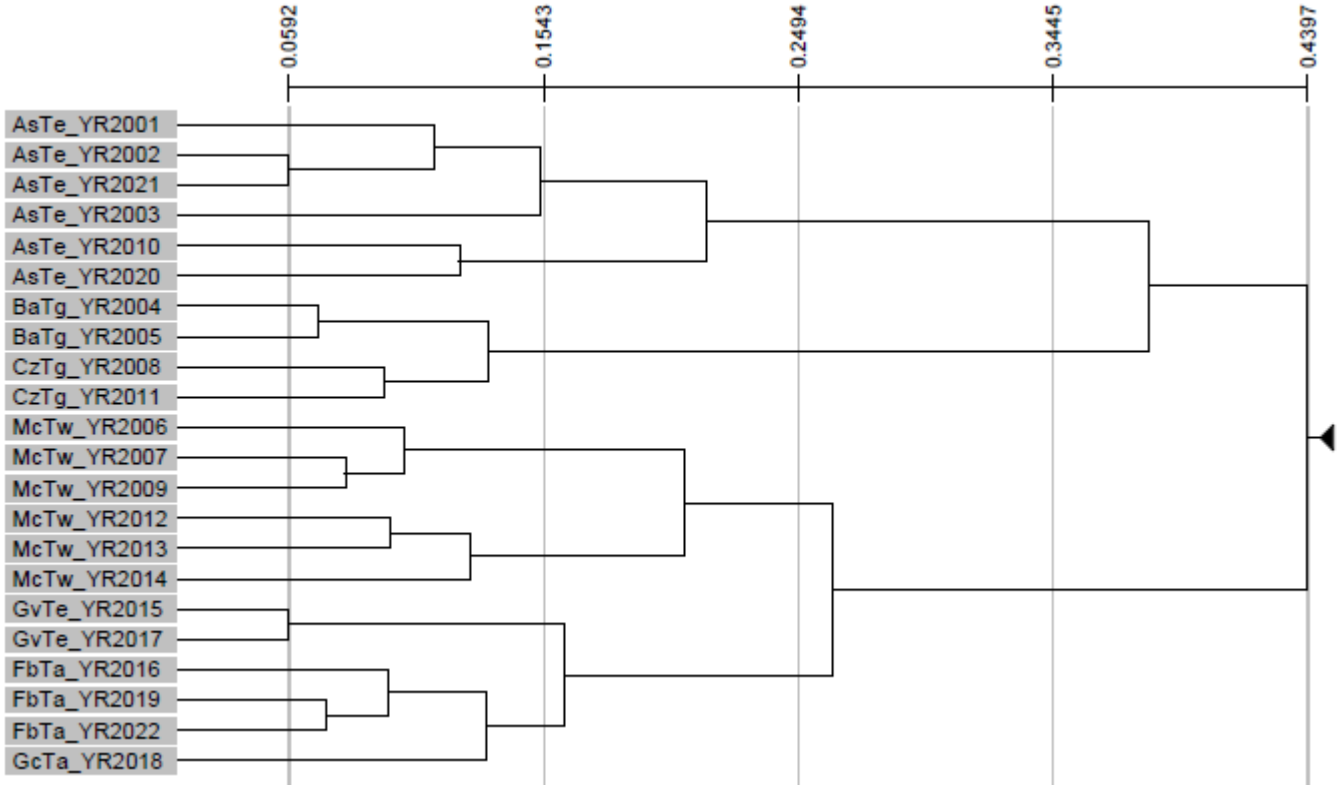

Figure 3: Floristic analysis dendrogram

4.1.2.5 Vegetation Condition

The vegetation condition within the survey area ranged from Excellent to Degraded condition, with the majority in Excellent (53.75%) or Very Good (32.28%) condition (**Table 7**, **Map 5**). Areas in lesser condition were in close proximity to the existing Yardie Creek Road, generally rated as such due to the presence of weeds as well as partial historical clearing.

Table 7: Vegetation condition

Vegetation condition	Extent (ha)	Proportion (%)
Excellent	22.97	53.75
Very Good	13.79	32.28
Good	0.88	2.07
Poor	0.26	0.6
Degraded	3.07	7.19
Completely Degraded	-	-
Not vegetated	1.76	4.11

4.1.2.6 Adequacy of Survey

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area.

A species accumulation curve was generated using quadrat data (**Figure 4**). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve suggests that the majority of species present within the survey area have been recorded. This is supported by the Michaelis-Menten estimate of species richness of 176.5 that is only slightly higher than the 170 taxa recorded when taking opportunistic records into account. This indicates that 96.3% of the flora taxa have likely been recorded.

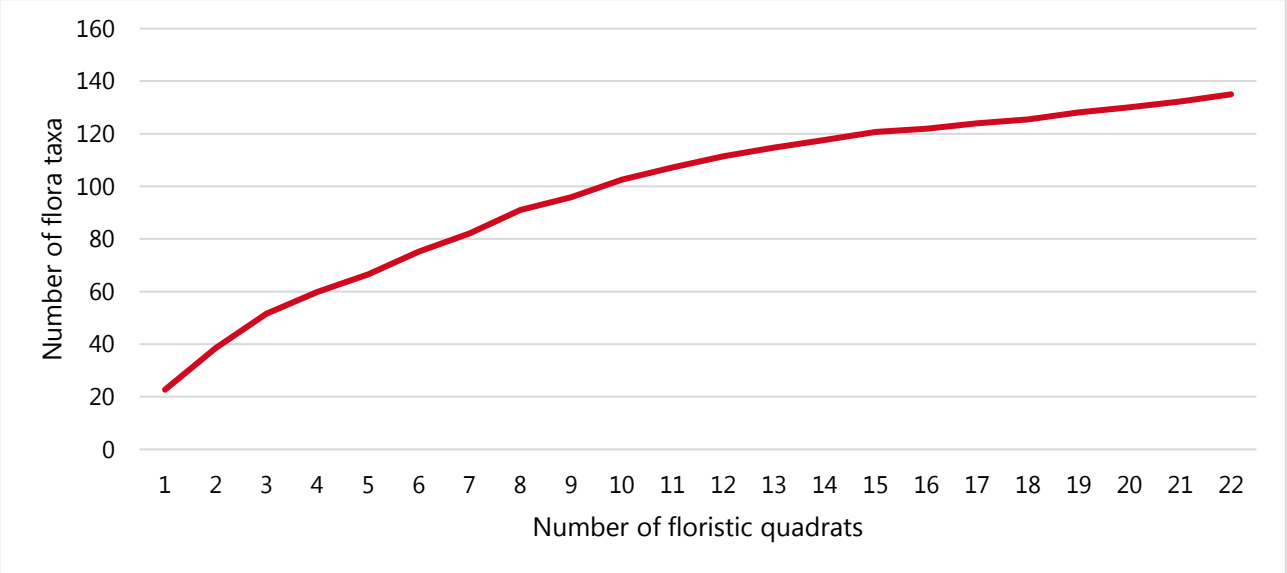

Figure 4: Species accumulation curve

4.1.3 BOTANICAL LIMITATIONS

Survey design: Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation-listed flora. Results from previous surveys were considered as part of survey design and the desktop assessment.

Survey type: Detailed flora and vegetation survey with extensive searches for significant flora searches conducted over a single phase. All areas were adequately surveyed through the use of floristic quadrats to sample vegetation types, and targeted searches for conservation-listed flora.

Type of vegetation classification system: Vegetation classified at NVIS Level V (NVIS Technical Working Group & DotEE 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

Survey timing, which was not optimal for the bioregion was considered a moderate constraint. A full summary of botanical limitations is presented in **Table 8**.

Table 8: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	Negligible	There were several flora and vegetation surveys that have been conducted in the general vicinity, as identified in Section 2.3.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The botanist conducting the field survey has 15 years experience undertaking flora and vegetation surveys within Western Australia, including numerous within the Carnarvon bioregion.
Proportion of the flora recorded and/or collected, and any identification issues	Negligible	170 vascular flora taxa were recorded during the field survey of which 1.76% could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered a relatively low level of unidentified taxa. None of the unidentified taxa are considered similar to any conservation-listed taxa from the region.
Was the appropriate area fully surveyed (effort and extent)	Negligible	The survey area was covered sufficiently to develop a thorough understanding of the flora and vegetation. The majority of the survey area was traversed on foot at 50 m intervals or less. Slight additions were made to the survey area following the field survey, requiring extrapolation of vegetation types and condition across these areas. There areas have potential to support additional plants of conservation-listed flora. However, the additional areas are not considered likely to contain any different vegetation types and this limitation is considered negligible.
Access restrictions within the survey area	No	The entire survey area was easily accessible on foot.
Survey timing, rainfall, season of survey	Moderate	The field survey was conducted during August which is outside the season considered optimal for a primary season for survey in the Carnarvon bioregion. Additionally, the rainfall in the six months prior to the field survey (56.8 mm) was below the average for this period (225.7 mm). This below average rainfall is presented in **Figure 2**, also indicated by the BoM rainfall deciles (**Figure 5**).

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
		The survey timing and seasonal conditions may represent a constraint for the number of annual or ephemeral taxa recorded.
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	There were no recent disturbances that would have affected the results of the survey. None of the survey area had been recently burnt.

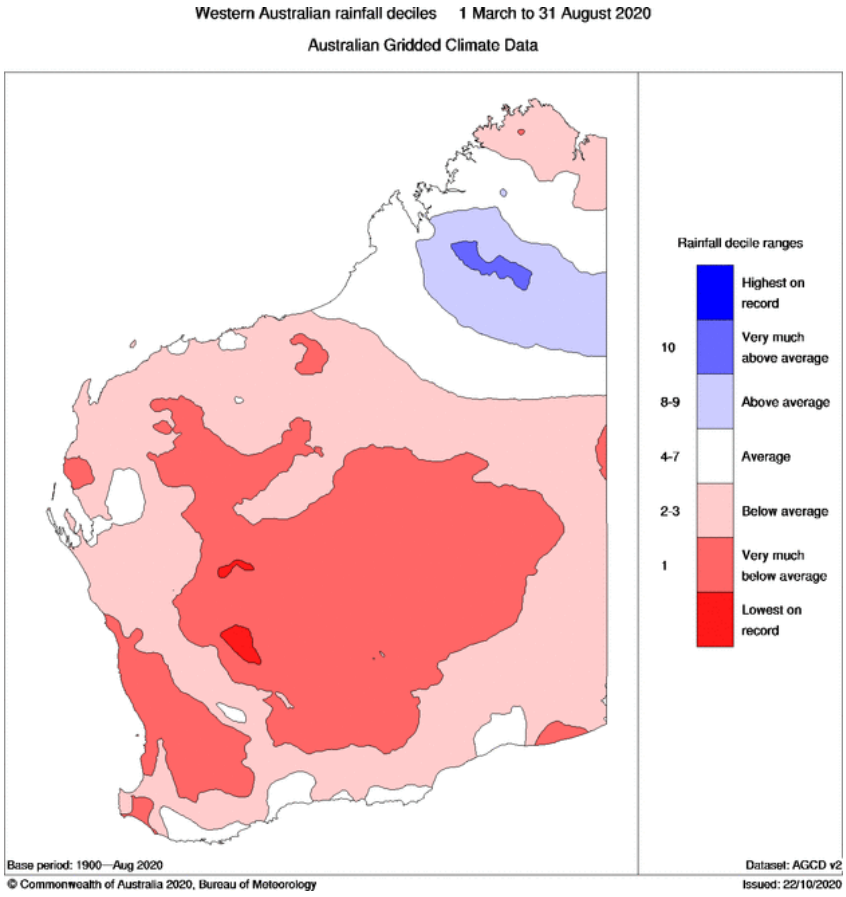

Figure 5: Rainfall deciles for the six months prior to the field survey

4.2 VERTEBRATE FAUNA SURVEY

The fauna survey was conducted by Bruce Turner (Senior Zoologist) during 18-21 August 2020. The survey was conducted in accordance with the requirements outlined in the Fauna Technical Guidance (EPA 2020a). The survey also complied with the conditions of *Fauna Taking (Biological Assessment) Licence* Number BA27000287.

The entire site was traversed on foot and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species. Habitat assessment points, bird survey points and trail camera sites were all used to determine habitat quality and type (**Table 22** in **Appendix Three**) and provided information for mapping of the fauna habitat types (**Map 6**).

4.2.1 FAUNA ASSEMBLAGE

Twenty vertebrate fauna species, none of which are conservation-listed, were recorded during the survey (**Table 9**), consisting of:

- five mammals (one introduced)
- ten birds
- five reptiles.

The species recorded are typical for the habitats they were found in and are well represented in the region. The survey was undertaken in mid-August which is not ideal for the detection of the reptile assemblage which is likely to be underrepresented in the list of recorded species.

Table 9: Recorded fauna species

Species	Common name	EPBC Act status	Western Australian status
Mammals			
Notomys alexis	Spinifex Hopping-mouse	-	-
Osphranter robustus	Euro	-	-
Sminthopsis youngsoni	Lesser hairy-footed dunnart	-	-
Zyzomys argurus	Common Rock-rat	-	-
**Canis familiaris dingo*	Dingo	-	-
Birds			
Aquila audax	Wedge-tailed Eagle	-	-
Corvus bennetti	Little Crow	-	-
Cracticus nigrogularis	Pied Butcherbird	-	-
Gavicalis virescens	Singing Honeyeater	-	-
Geophaps plumifera	Spinifex Pigeon	-	-
Lichenostomus leucotis	White-eared Honeyeater	-	-
Malurus leucopterus	White-winged Fairy-wren	-	-
Manorina flavigula	Yellow-throated Miner	-	-
Ocyphaps lophotes	Crested Pigeon	-	-
Rhipidura leucophrys	Willie Wagtail	-	-
Reptiles			
Ctenophorus femoralis	Dune Dragon	-	-
Ctenotus iapetus		-	-
Lerista bipes		-	-

Species	Common name	EPBC Act status	Western Australian status
Lerista elegans		-	-
Varanus gouldii	Bungarra or Sand Monitor	-	-

4.2.2 FAUNA HABITAT

Three fauna habitat types were recorded from within the survey area from 16 habitat assessment points as follows:

- Dunes (includes dune crests and swales, swales)
- Hummock Grasslands
- Sheltered gullies and minor caves.

None of the habitat types are confined to the survey area and all occur commonly in areas adjacent to the survey area. The most confined of these habitat types are those associated with the red Pindan dunes, that while occupying an estimated 3,500 ha in the local area (including approximately 7 ha within the survey area), are isolated by at least 40 km from the nearest similar habitat type. Approximately 1.4 ha (4.04%) of the survey area was recorded as cleared and does not constitute fauna habitat.

The quality of each habitat type was based on the field surveyor's experience and takes into consideration the level of disturbance to habitats from weeds, the amount of native vegetation, vegetation cover (density) and the context of the habitat with the surrounding landscape.

Table 10: Fauna habitat types

Habitat type	Description	Photograph
Dunes (crests and swales)	**Description** The eastern and south eastern portion of the survey area, east of the Cape Range, was occupied by red sand dunes, known as Pindan dunes, of aeolian origin. The dune crests and swales formed roughly parallel north-south ridges and were vegetated with low shrubs and Spinifex (Triodia) hummock grasses with extensive bare areas with emergent limestone pavement. Except directly under more dense shrubs, and within the Spinifex hummocks, there is virtually no leaf litter, and due to the lack of trees, no logs are present. The dunes formed significant habitat for some of the reptile assemblage, including *Aprasia rostrata* (Ningaloo Worm-lizard, P3) and birds, particularly when *Banksia ashbyi* is flowering. **Extent**: 7.34 ha; 17.17%	

Habitat type	Description	Photograph
Hummock Grassland (on both limestone and sandy soils)	**Description** The rocky hills and slopes of the Cape Range, with extensive areas of exposed limestone and loose limestone rocks, were vegetated largely by Spinifex (Triodia) hummock grasses. Leaf litter is almost entirely absent and there are no logs present in this habitat. This type includes hummock grasslands on sandy soils which form a mosaic of soil types with the same fauna habitat characteristics. The loose limestone rocks provide significant habitat for much of the reptile assemblage including *Diplodactylus capensis* (Cape Range Stone Gecko, P2). **Extent**: 32.93 ha; 77.05%	
Sheltered gullies and minor caves	**Description** The rugged limestone Cape Range had a small number of sheltered gullies that included minor caves, providing shaded habitat for fauna species. The vegetation within these gullies included taller shrubs and small trees (e.g. *Acacia tetragonophylla, Ficus brachypoda*), as well as low shrubs and Spinifex (*Triodia*) hummock grasses. Leaf litter was present in some of the more sheltered areas, not including the minor creeklines that formed these gullies. The sheltered gullies, and in particular the minor caves, provided habitat for reptiles including *Lerista allochira* (Cape Range Slider, P3) and *Diplodactylus capensis* (Cape Range Stone Gecko, P2), and small mammals including *Pseudantechinus roryi*. In areas more isolated from human contact, the gullies would provide habitat for *Petrogale lateralis* (Black-flanked Rock Wallaby, EN), however, the Wallaby was not present within the survey area most likely due to proximity of human activity. **Extent**: 0.71 ha; 1.66%	

4.2.3 FAUNA SURVEY LIMITATIONS

The limitations of the basic fauna survey are summarised in **Table 11** below. There were no or negligible constraints in relation to survey adequacy.

Table 11: Fauna survey limitations

Possible limitations	Constraints (yes/no): Significant, moderate, or negligible	Comment
Competency/experience of the consultant conducting the survey	No	The fauna field surveyor was experienced with the fauna survey methods used and with the identification of fauna taxa.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	The survey was conducted as a Level 1 fauna assessment. Sufficient time was allocated to the fauna survey, which included active diurnal searches and motion cameras, to adequately describe the fauna assemblage present in the survey area.
Proportion of fauna identified, recorded and/or collected.	No	All fauna species opportunistically observed were identified in the field.
Sources of information (previously available information as distinct from new data).	Negligible	Few sources referencing field surveys in the vicinity were available. None to negligible constraints were associated with this lack of previous data.
The proportion of the task achieved and further work which might be needed.	No	The survey area was adequately searched.
Timing/weather/season/cycle.	Negligible	The timing of the field survey was within a period suitable to identify most components of the expected fauna assemblage if they were present on site except for reptiles. The seasonal conditions were suitable for fauna survey with warm daytime temperatures and fine weather during the survey period.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	No	No disturbance to the survey was detected.
Intensity (in retrospect was the intensity adequate).	No	The survey was considered suitable to determine the presence or potential presence of conservation significant fauna.
Completeness (e.g. was relevant area fully surveyed), remoteness and/or access problems	No	The entire survey area was adequately searched and was entirely accessible.
Resources (e.g. degree of expertise available in animal identification to taxon level).	No	Field staff has over 35 years' experience identifying fauna. All terrestrial vertebrate fauna was identified to species level.
Availability of contextual (e.g. biogeographic) information on the region).	Negligible	Few fauna surveys appear to have been conducted in the general region i.e. the Cape Range subregion of the Carnarvon IBRA region. However, there is 1990s literature available describing the suite of species present at that time, giving context to the discussion in this report.

Possible limitations	Constraints (yes/no): Significant, moderate, or negligible	Comment
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	No	The survey was conducted as a Level 1 fauna assessment. All fauna species opportunistically observed were identified in the field. The survey did not include marine or subterranean species, nor invertebrates.

5 DISCUSSION

5.1 FLORA SIGNIFICANCE

A total of 170 vascular flora taxa were recorded from the survey area, including three that could not be identified with certainty due to lack of reproductive material. The species accumulation curve using quadrat data indicates that additional species would have been recorded with additional survey, however, the Michaelis-Menten estimate of species richness indicates that, when taking opportunistic observations into account, most species would have been recorded. Ecoscape considers that additional annual or ephemeral species would occur within the survey area if surveyed during the optimal survey timing and seasonal conditions. However, there are unlikely to be any such annual species of conservation significance occurring within the survey area.

There were 169 vascular flora taxa recorded from the adjacent survey area (Ecoscape 2018) from a larger area (112.2 ha), further indicating that the majority of species have likely been recorded from the Yardie Creek Road realignment survey area.

5.1.1 CONSERVATION-LISTED FLORA SPECIES

No TF species listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded from the survey area. No TF species were identified by the DBCA database searches and therefore no TF species were likely to occur within the survey area.

Seven PF species were identified with certainty from within the survey area:

- *Daviesia pleurophylla* (P2) is represented by seven records on *NatureMap* (DBCA 2007-2020) from a restricted distribution, endemic to the North West Cape. A total of 17 plants were recorded within the survey area plus an additional 94 plants recorded from adjacent area. Therefore the number of plants within the survey area represents a maximum of 13.8% of the local population, considering the surrounding area was not fully surveyed, this is almost certainly an overestimate.
- *Tinospora esiangkara* (P2) is represented by nine records on *NatureMap* (DBCA 2007-2020) within Western Australia from the North West Cape, but also occurs in the Northern Territory and Queensland (Atlas of Living Australia 2020). There were 37 plants recorded from the survey area and 10 plants from adjacent areas, suitable habitat (limestone outcrops/ridges) is extensive outside of the survey area, particularly to the south.
- *Corchorus congener* (P3) is represented by 142 records on *NatureMap* (DBCA 2007-2020) from an east-west distribution of 426 km. There were 13 plants recorded within the survey area plus two in adjacent areas where suitable habitat is likely to be widespread.
- *Eremophila forrestii* subsp. *capensis* (P3) is represented by eight records on *NatureMap* (DBCA 2007-2020), endemic to the North West Cape from a restricted distribution of 50 km (north-south). There were 68 plants recorded within the survey area plus 19 in adjacent areas where it was recorded from a range of vegetation types and landforms. Suitable habitat is likely to be widespread in adjacent areas.
- *Grevillea calcicola* (P3) is represented by 15 records on *NatureMap* (DBCA 2007-2020), endemic to the North West Cape from a restricted distribution of 68 km (north-south). There were 14 plants recorded within the survey area. Suitable rocky limestone habitat is likely to be widespread in adjacent areas.
- *Stackhousia umbellata* (P3) is represented by 19 records on *NatureMap* (DBCA 2007-2020), largely endemic to the North West Cape with a single outlier record from the Dampier Archipelago. There were 61 plants

recorded within the survey area plus an additional 38 plants from adjacent areas. Suitable rocky limestone habitat is likely to be widespread in adjacent areas of the Cape Range.

- *Brachychiton obtusilobus* (P4) is represented by 13 records on *NatureMap* (DBCA 2007-2020), endemic to the North West Cape from a restricted distribution of 60 km (north-south). There were 10 plants recorded within the survey area plus an additional 10 plants from adjacent areas.

All of the PF recorded within the survey area were also recorded from the adjacent survey area (Ecoscape 2018) indicating none are restricted to the survey area.

5.1.1.1 Post-survey Likelihood Assessment

The likelihood of conservation significant flora occurring in the survey area was revised following the field survey. This revised likelihood, that took into account vegetation condition, grazing and other disturbances, actual habitat availability and search effort, is included in **Table 19** in **Appendix Two**. Following this likelihood assessment, with the exception of those species recorded, all species identified by the database searches are considered unlikely or highly unlikely.

5.1.2 OTHER SIGNIFICANT FLORA

The vascular flora of the area is known to have both southern, temperate and Eremaean, arid and semi-arid, affinities (Keighery & Gibson 1993), and many species from either of these zones are at either the northern (for southern species) or southern (for Eremaean species) end of their natural range. Geographically, all species are at the western extent of their distribution due to the survey area location. Physical characteristics of many species, including attributes such as leaf size and shape, and the amount of hairiness of some species, were also at the extremes of their recorded physiological ranges.

Notwithstanding the above, species that can be considered of greatest significance according to the EPA (EPA 2016) Flora and Vegetation Technical Guidance are:

- *Alyogyne pinoniana* that was recorded from the survey area has potential to be of significance as it displays anomalous features in respect to its leaf shape. The only other record of this taxon in the Western Australian Herbarium from the vicinity also displays these anomalous features, suggesting there may be variation within the species confined to this area.
- *Olax aurantia*, the records from the North West Cape form a known disjunct population, separated from the main southwest distribution by approximately 500 km.
- *Owenia reticulata*, with the exception of the survey of the adjacent area (Ecoscape 2018) this species has not been recorded from the North West Cape and is over 100 km from the nearest record on *NatureMap* (DBCA 2007-2020).

5.1.3 INTRODUCED FLORA

Six introduced flora species (weeds) were recorded during the field survey. None of the introduced flora have any specific significance i.e. none are Declared Pest plants or WoNS species.

5.2 VEGETATION SIGNIFICANCE

Seven vegetation types were recorded from the survey area with the floristic analysis confirming them to be distinct. The vegetation of the survey area was considered to be broadly similar to much of the local area based on observations of areas adjacent to the survey area and comparison with the vegetation types recorded from the adjacent area (Ecoscape 2018).

The vegetation types correspond with two broad landform types:

- sand dunes and plains: **AsTe**, **BaTg** and **CzTg**
- limestone hills (and associated gullies): **FbTa**, **GcTa**, **GvTe** and **McTw**.

None of the vegetation types are considered to represent a TEC or PEC, nor are any vegetation types considered to have other significance according to the Flora and Vegetation Technical Guidance (EPA 2016). Furthermore, none of the vegetation represents a GDE or wetland vegetation type.

Minor differences in vegetation type interpretation are evident between the survey area and the adjacent area (Ecoscape 2018). This is largely a consequence of ground truthing effort and slightly more detailed delineation of vegetation types recorded. Naming of vegetation types follows a slightly difference system and codes were developed according to the most dominant species recorded from quadrats of the survey area. A summary of vegetation types from the survey area that are considered comparable with those of the adjacent area is provided in **Table 12**.

Table 12: Vegetation type comparison

Ecoscape 2020	Comparable vegetation (Ecoscape 2018)
AsTe	**AcRp shrubland**
BaTg	**BaDp shrubland**
CzTg	
FbTa	**AbFb shrubland**
GcTa	**AbSaAt shrubland**
GvTe	**-**
McTw	**Mc shrubland**

Ecoscape (2018) identified that the 'BaDp shrubland' (*Banksia ashbyi* and *Daviesia pleurophylla* shrubland), recorded from red Pindan dunes may potentially be of local and regional significance. This vegetation type is similar to others documented as being confined to a restricted landform (Meissner 2010a, Meissner 2010b) or having unique floristic composition (Keighery & Gibson 1993; Pringle 1987). This vegetation is comparable to the **BaTg** and **CzTg** vegetation types recorded from the survey area and these therefore have the potential to be considered of local or regional significance.

5.2.1 VEGETATION CONDITION

The vegetation ranged in condition from Degraded, in areas close to roads and the powerline, to Excellent with no obvious signs of disturbance. Vegetation condition is largely comparable to that assessed from the adjacent area (Ecoscape 2018), minor inconsistencies likely resulting from differing levels of ground truthing or interpretation.

Sandy soils close to the existing Yardie Creek Road tended to have the lesser vegetation condition ratings, with the best recorded condition being Very Good due to weed invasion and historical impacts such as partial clearing.

The limestone hills and crests of the survey area were situated further distances from areas of human disturbance and appeared to be more resistant to the invasion of Buffel Grass.

5.3 FAUNA SIGNIFICANCE

5.3.1 FAUNA HABITAT TYPES

Three fauna habitat types were recorded from within the survey area, consisting of red Pindan dunes, hummock grasslands on limestone and interspersed sandy soils, and Sheltered gullies and minor caves. Each of these habitat types suits various suites of reptiles, mammals, and birds.

Many of the conservation significant species (birds) identified from the database searches as having been recorded within the vicinity of the survey area are listed as being protected under international agreements (**Table 20** in **Appendix Two**). These are unlikely to use the survey area itself as most species are shorebirds, only using beaches, or would only overfly the area to get to the shorelines. None is considered to be dependent on the survey area. There was no suitable habitat recorded for *Charadrius mongolus* (Lesser Sand Plover).

On a regional basis, the red Pindan dunes is the most restricted in extent. Fauna species, particularly reptiles, are likely to require the sandy soils of this habitat, however, none of the species likely to occur are dependent on this habitat type within the survey area. Minor portions of this habitat type, particularly the swales have emergent limestone pavement and is possibly an ecotone with the Hummock Grassland habitat. No species of conservation significance were recorded in the red Pindan dunes during the field survey, although *Aprasia rostrata*, (Ningaloo Worm-lizard, P3) is likely to occur.

The limestone Cape Range provides the most prominent habitat types within the region and was present within the survey area recorded as Hummock Grassland on limestone. A number of conservation significant fauna species have been previously recorded from the limestone hills, and in particular the sheltered gorges and minor caves. Endangered *Petrogale lateralis* (Black-flanked Rock Wallaby) are dependent on the gorges and minor caves, however, were not recorded within the survey area and are unlikely to occur due to the amount of human activity in the area, the small areas of available gorge habitat and that the survey area is on the edge of the species' potential local range. It is far more likely to occur further south where there are larger gorges and clusters of DBCA records. Two conservation significant lizards were recorded from close to the survey area during the Ecoscape field survey of 2018 adjacent to this survey area, *Lerista allochira* (Cape Range Slider, P3) and *Diplodactylus capensis* (Cape Range Stone Gecko, P2) are known from the limestone habitat types.

No fauna species inhabiting or likely to inhabit the survey area is dependent on the survey area.

5.3.2 FAUNA ASSEMBLAGE

Twenty vertebrate fauna species were recorded during the field survey.

Five mammals were recorded, none of which were of conservation significance and one of which was introduced (Dingo). The native species were Euro (*Osphranter robustus*), Spinifex Hopping-mouse (*Notomys alexis*), Lesser Hairy-footed Dunnart (*Sminthopsis youngsoni*) and Common Rock-rat (*Zyzomys argurus*) all of which are common, frequently encountered, highly visible and wide-ranging and not requiring specific habitat types.

Five reptiles were recorded during the field survey, none of which were of conservation significance. All habitat types provided suitable areas for various reptile species. Ecoscape considers that the suite of reptiles, and the number of individuals observed during the field survey was low due to the cooler temperatures at the time of survey in early August, compared to what was expected given warmer weather conditions. Ecoscape considers that *Aprasia rostrata* (Ningaloo Worm-lizard, P3) should have been located during the field survey if it was present, however, *Diplodactylus capensis* (Cape Range Stone Gecko, P2) was not expected to be recorded as

temperatures were not sufficiently high. Both species were considered to have a Medium likelihood of occurring.

Ten bird species were recorded, none of which were of conservation significance, and all are species considered as commonly occurring throughout the region.

5.3.3 CONSERVATION-LISTED SPECIES

5.3.3.1 Post-survey Likelihood Assessment

The remaining (i.e. those not recorded) conservation-listed fauna species identified during the desktop assessment as having a Medium to High likelihood of occurring are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort. The post-survey likelihood assessment is incorporated into **Table 20** in **Appendix Two**.

Black-footed Rock-Wallaby (*Petrogale lateralis*) – EPBC status EN; BC status EN

Endangered *Petrogale lateralis* (Black-flanked Rock Wallaby) are dependent on gorges and minor caves, however, were not recorded within the survey area and are unlikely to occur due to the amount of human activity in the area, the small areas of available gorge habitat and that the survey area is on the edge of the species' potential local range. The species is well known to avoid human interaction and is cryptic in nature, it is more likely to occur further south where there are larger gorges and cave systems and little disturbance. The post survey likelihood of occurrence was assessed as Low.

Lesser Sand Plover (Charadrius mongolus) - EPBC status EN & MI; BC status MI

The Lesser Sand Plover is a northern hemisphere migratory species that winters in east Africa, south Asia, and Australasia (Marchant & Higgins 1993). The birds require sandy beaches for foraging which are absent within the survey area and therefore this species is unlikely to occur.

Osprey (*Pandion cristatus*) – EPBC status MI; BC status MI

The Osprey (*Pandion haliaetus*) was recorded as perching close to the survey area by Ecoscape (2018), it was not recorded during this survey. This species would not be dependent on the survey area to provide habitat, and no evidence of nesting activity was observed.

Crested Tern (*Sterna bergii*) – EPBC status MI; BC status MI

The Crested Tern is an ocean-going shorebird dependent on the fringing coastlines for feeding and breeding grounds. There is no suitable habitat within the survey area, and it is highly unlikely this species would be dependent on the survey area.

Cape Range Slider (*Lerista allochira*) – DBCA status P3

This species is known only from the North West Cape peninsula, inhabiting a known range of approximately 70 km north-south and 20 km east-west (DBCA 2007). The hummock grassland and rocky gullies habitats are suitable habitat for this species, and it is expected to occur within the survey area as evident from the nearby Ecoscape survey record of 2018.

Cape Range Stone Gecko (*Diplodactylus capensis*) - DBCA status P2

This species is known to prefer the hummock grassland habitats on limestone present within the survey area however it was not expected to be recorded as temperatures were not sufficiently high. The species is restricted

to the North West Cape region and is considered to have a medium likelihood of occurrence within the survey area.

Ningaloo Worm-lizard (*Aprasia rostrata*) - DBCA status P3

Known to occur on the coastal dunes, it also occurs in other sandy habitats (including the red Pindan dunes within the survey area) however is not dependent on the coastal dunes. This species was not recorded during the survey but is considered to have a medium likelihood of occurrence within the survey area.

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MAPS

LEGEND

Survey Area 2021

Pre-European Vegetation

- 662: Hummock grassland with scattered low trees over dwarf shrubs or mixed short grass and spinifex mixed species, Triodia spp.
- 663: Hummock grassland with scattered shrubs or mallee Triodia spp. Acacia spp., Grevillea spp. Eucalyptus spp
- 664: Hummock grassland with sparse Eucalypts e.g. bloodwoods & snappy gum Triodia spp., Corymbia dichromophloia, C. opaca, Eucalyptus leucophoia

DATA SOURCES:
SOURCE DATA: PRE-EUROPEAN VEGETATION – WESTERN AUSTRALIA (NVIS COMPLIANT VERSION 20110715)
AERIAL: LANDGATE WA NOW 2014
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS:

ecoscape

YARDIE CREEK RD REALIGNMENT BIOLOGICAL SURVEY

PRE-EUROPEAN VEGETATION ASSOCIATIONS

mainroads WESTERN AUSTRALIA

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

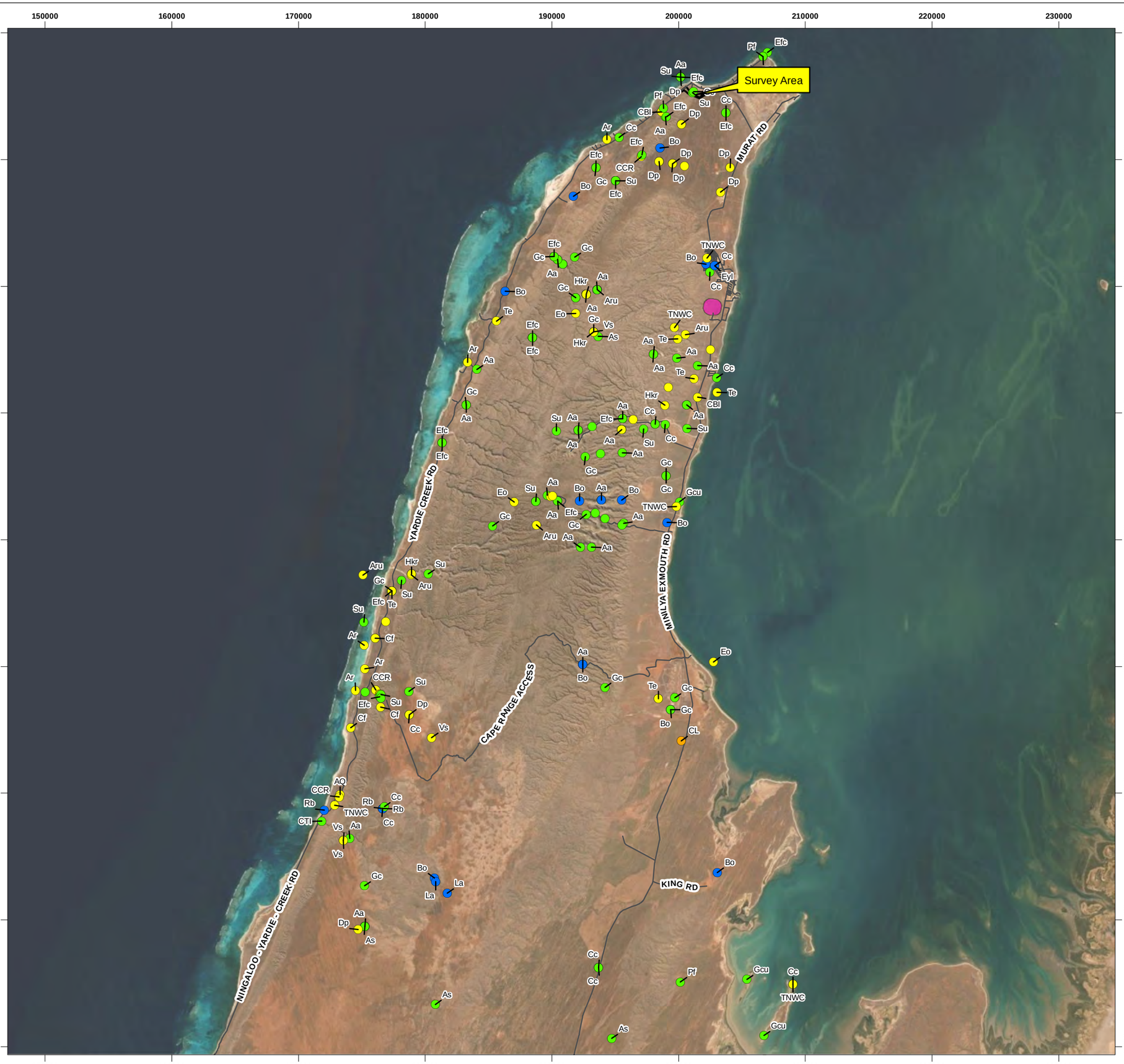
SCALE: 1:9,000 @ A3

0 80 160 240 320 400 m

PROJECT NO: 4555-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	29/10/2020
01	KP	SB	25/11/2020
02	KP	SB	21/04/2021

MAP 1



LEGEND

Survey Area

Conservation Significant Flora (DBCA 2020)

- Priority 1
- Priority 2
- Priority 3
- Priority 4

TEC/PEC (DBCA 2020)

Camerons Cave Troglobitic Community

Code	Species	Status
AQ	*Abutilon* sp. Quobba (H. Demarz 3858)	2
Aa	*Acacia alexandri*	3
Ar	*Acacia ryaniana*	2
As	*Acacia startii*	3
Aru	*Acanthocarpus rupestris*	2
Bo	*Brachychiton obtusilobus*	4
CCR	*Calandrinia* sp. Cape Range (F. Obbens FO 10/18)	2
CL	*Calytrix* sp. Learmonth (S. Fox EMopp 1)	1
CTI	*Carpobrotus* sp. Thevenard Island (M. White 050)	3
Cc	*Corchorus congener*	3
Cf	*Crinum flaccidum*	2
CBI	*Cucumis* sp. Barrow Island (D.W. Goodall 1264)	2
Dp	*Daviesia pleurophylla*	2
Efc	*Eremophila forrestii* subsp. *capensis*	3
Eo	*Eremophila occidens*	2
Eyl	*Eremophila youngii* subsp. *lepidota*	4
Gc	*Grevillea calcicola*	3
Gcu	*Gymnanthera cunninghamii*	3
Hkr	*Harnieria kempeana* subsp. *rhadinophylla*	2
Lb	*Lepidium biplicatum*	3
La	*Livistona alfredii*	4
Pf	*Phyllanthus fuernrohrii*	3
Rb	*Rhynchosia bungarensis*	4
Su	*Stackhousia umbellata*	3
TNWC	*Tephrosia* sp. North West Cape (G. Marsh 81)	2
Te	*Tinospora esiangkara*	2
Vs	*Verticordia serotina*	2

DATA SOURCES:
AERIAL: ESRI BASEMAP, 2019
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

YARDIE CREEK RD REALIGNMENT BIOLOGICAL SURVEY

FLORA AND COMMUNITIES DATABASE SEARCH RESULTS

mainroads WESTERN AUSTRALIA

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

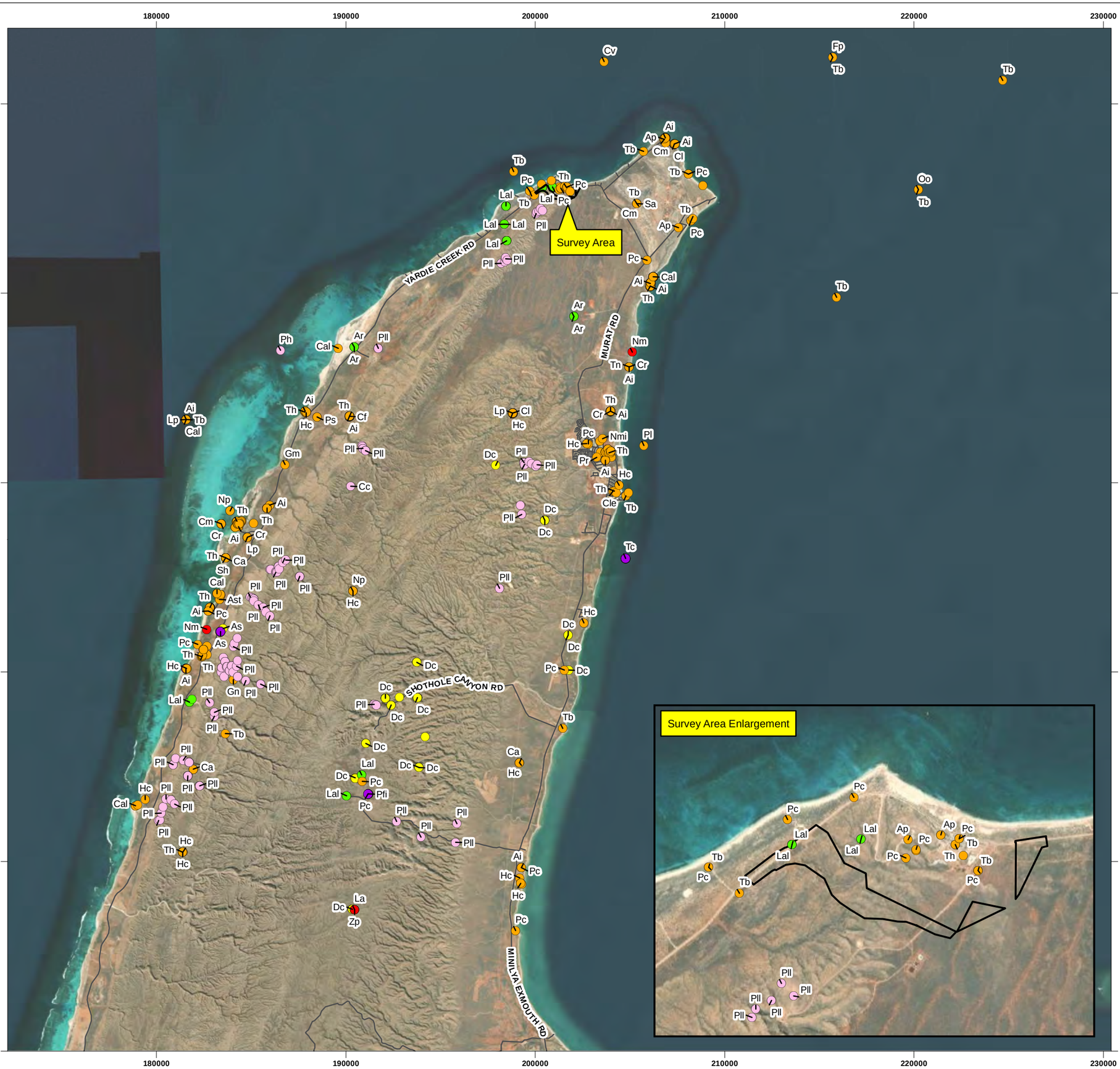
SCALE: 1:300,000 @ A3

0 5 10 15 km

PROJECT NO: 4555-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	29/10/2020

MAP 2



LEGEND

Survey Area

Conservation Significant Fauna (DBCA 2020)

- Conservation dependent
- Critically endangered
- Endangered
- Vulnerable
- Extinct
- Protected under international agreement
- Other specially protected species
- Priority 2
- Priority 3
- Priority 4

Code	Species	Status	Code	Species	Status
Th	*Tringa hypoleucos*	IA	Nmi	*Numenius minutus*	IA
As	*Anilios splendidus*	P2	Np	*Numenius phaeopus*	IA
Ast	*Anous stolidus*	IA	Oo	*Oceanites oceanicus*	IA
Ar	*Aprasia rostrata*	P3	Oa	*Onychoprion anaethetus*	IA
Ap	*Ardenna pacifica*	IA	Pc	*Pandion cristatus*	IA
Ai	*Arenaria interpres*	IA	Pll	*Petrogale lateralis lateralis*	EN
Ca	*Calidris acuminata*	IA	Pl	*Phaethon lepturus*	IA
Cal	*Calidris alba*	IA	Pr	*Phaethon rubricauda*	IA
Cc	*Calidris canutus*	EN	Pc	*Phascogale calura*	CD
Cf	*Calidris ferruginea*	CR	Pf	*Plegadis falcinellus*	IA
Cr	*Calidris ruficollis*	IA	Pfu	*Pluvialis fulva*	IA
Cs	*Calidris subminuta*	IA	Ps	*Pluvialis squatarola*	IA
Cl	*Charadrius leschenaultii*	VU	Pfi	*Pseudomys fieldi*	VU
Cm	*Charadrius mongolus*	EN	Ph	*Puffinus huttoni*	EN
Cv	*Charadrius veredus*	IA	Ra	*Rhinonicteris aurantia*	P4
Cle	*Chlidonias leucopterus*	IA	RaP	*Rhinonicteris aurantia* (Pilbara)	VU
Dc	*Diplodactylus capensis*	P2	Sl	*Sminthopsis longicaudata*	P4
Fp	*Falco peregrinus*	OS	Sd	*Sterna dougallii*	IA
Gs	*Gallinago stenura*	IA	Sh	*Sterna hirundo*	IA
Gn	*Gelochelidon nilotica*	IA	Sa	*Sternula albifrons*	IA
Gm	*Glareola maldivarum*	IA	Snn	*Sternula nereis nereis*	VU
Hc	*Hydroprogne caspia*	IA	Tc	*Thalassarche chlororhynchos*	VU
La	*Leporillus apicalis*	EX	Tb	*Thalasseus bergii*	IA
Lal	*Lerista allochira*	P3	Tbr	*Tringa brevipes*	IA
Lf	*Limicola falcinellus*	IA	Tg	*Tringa glareola*	IA
Lp	*Limosa lapponica*	IA	Tn	*Tringa nebularia*	IA
Ll	*Limosa limosa*	IA	Ts	*Tringa stagnatilis*	IA
Mm	*Mesembriomys macrurus*	P4	Xc	*Xenus cinereus*	IA
Nm	*Numenius madagascariensis*	CR	Zp	*Zyzomys pedunculatus*	CR

DATA SOURCES:
AERIAL: ESRI BASEMAP, 2019
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

ecoscape

YARDIE CREEK RD REALIGNMENT BIOLOGICAL SURVEY

FAUNA DATABASE SEARCH RESULTS

mainroads WESTERN AUSTRALIA

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:200,000 @ A3

0 2 4 6 8 km

PROJECT NO: 4555-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	29/10/2020
01	KP	SB	23/04/2021

MAP

3

Code	Species	Status
Bo	*Brachychiton obtusilobus*	4
Cc	*Corchorus congener*	3
Dp	*Daviesia pleurophylla*	2
Ef	*Eremophila forrestii* subsp. *capensis*	3
Gc	*Grevillea calcicola*	3
Su	*Stackhousia umbellata*	3
Te	*Tinospora esiangkara*	2

LEGEND

- Survey Area
- Survey Track Log
- Quadrat Locations

Conservation-listed_Flora (Ecoscape, 2020)

- Priority 2
- Priority 3
- Priority 4

Vegetation Type (Ecoscape, 2021)

- AsTe: *Acacia sclerosperma* subsp. *sclerosperma, A. bivenosa* mid open shrubland over *Triodia epactia* and *Acacia gregorii* low hummock grassland/shrubland
- BaTg: *Banksia ashbyi* subsp. *boreoscaia, Grevillea stenobotrya* and *Acacia coriacea* subsp. *coriacea* mid open shrubland over *Triodia glabra* low hummock grassland
- CzTg: *Corymbia zygophylla* and *Banksia ashbyi* subsp. *boreoscaia* mid open mallee shrubland over *Triodia glabra* low hummock grassland
- FbTa: *Ficus brachypoda* and *Grevillea variifolia* subsp. *variifolia* mid sparse shrubland over *Triodia angusta* low hummock grassland
- GcTa: *Grevillea calcicola, Acacia coriacea* subsp. *coriacea* and *Ficus brachypoda* tall open shrubland over *Triodia angusta* low open hummock grassland
- GvTe: *Grevillea variifolia* subsp. *variifolia* and *Acacia bivenosa* mid open shrubland over *Triodia epactia* and *T. angusta* low hummock grassland
- McTw: *Melaleuca cardiophylla* and *Hakea stenophylla* subsp. *stenophylla* mid open shrubland over *Triodia wiseana, T. angusta* and *Hibbertia capensis*, low hummock grassland/shrubland
- Cleared

2018 Survey Data (Ecoscape)

- 2018 Survey Area
- 2018 Vegetation Survey

2018 CS Flora

- Priority 2
- Priority 3
- Priority 4

DATASOURCES:
AERIAL: LANDGATE WA NOW 2014
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS:

ecoscape

YARDIE CREEK RD REALIGNMENT BIOLOGICAL SURVEY

VEGETATION TYPES, QUADRATS AND CONSERVATION-LISTED FLORA

mainroads WESTERN AUSTRALIA

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

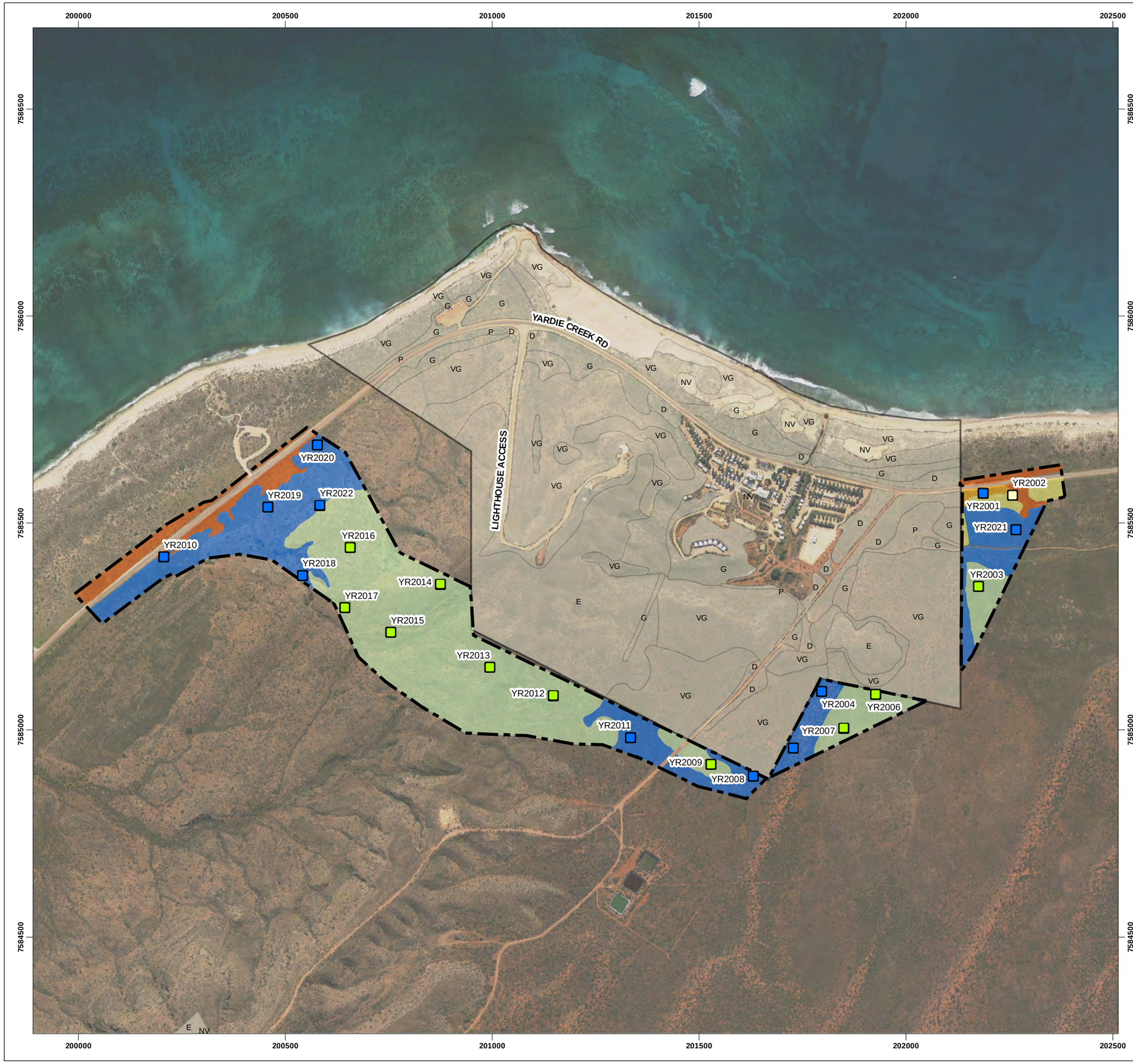
SCALE: 1:9,000 @ A3

0 50 100 150 200 250 300 350 m

PROJECT NO: 4555-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	29/10/2020
01	KP	SB	25/11/2020
02	KP	SB	23/04/2021

MAP 4



LEGEND

Survey Area

Quadrat Condition Class

- Excellent
- Very Good
- Good

Vegetation Condition (Ecoscape, 2020)

- Excellent
- Very good
- Good
- Poor
- Degraded

2018 Survey Data (Ecoscape)

- 2018 Survey Area
- 2018 Vegetation Survey

DATA SOURCES:
AERIAL: LANDGATE WA NOW 2014
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS:

ecoscape

YARDIE CREEK RD REALIGNMENT BIOLOGICAL SURVEY

VEGETATION CONDITION

mainroads WESTERN AUSTRALIA

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

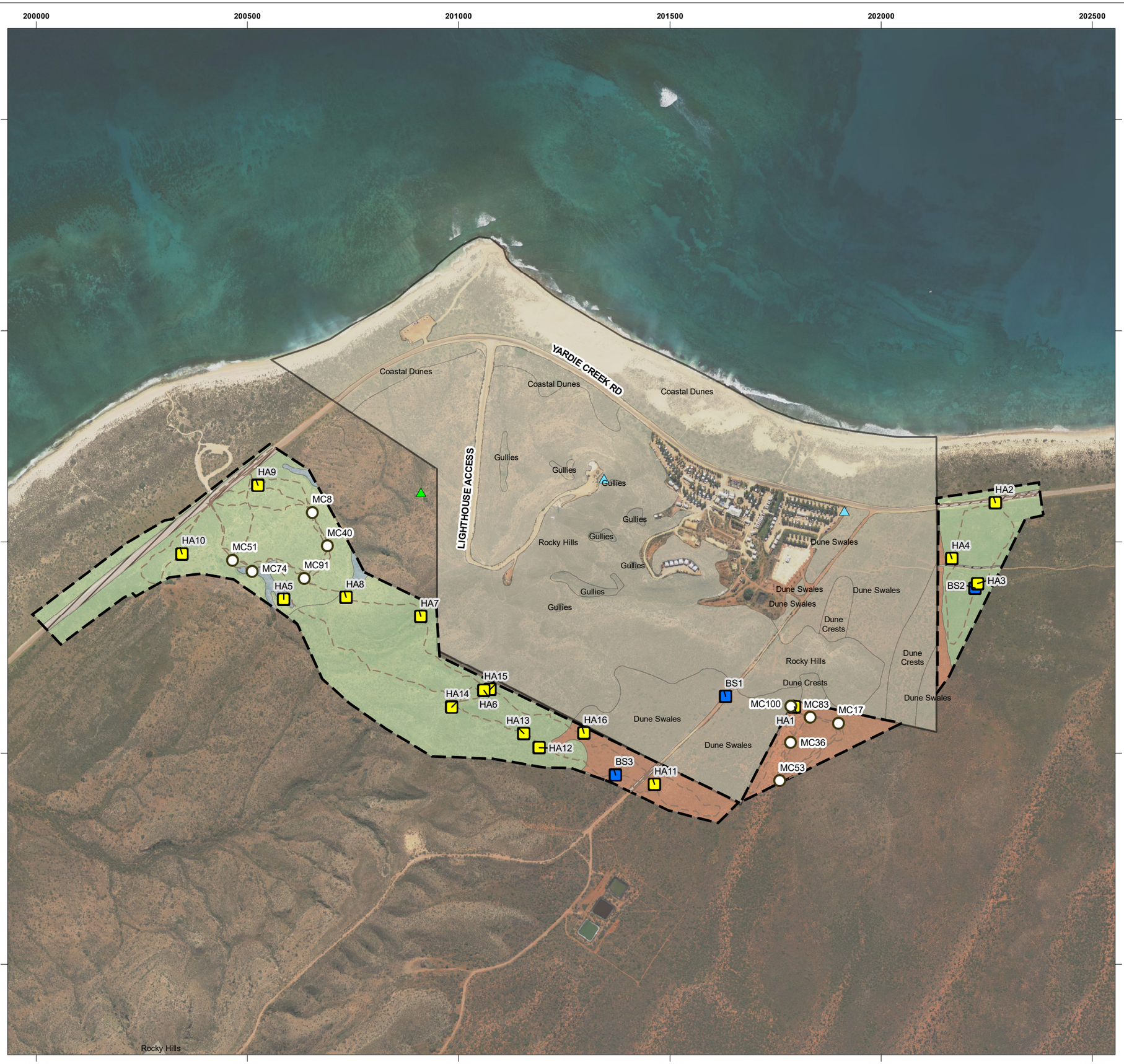
SCALE: 1:9,000 @ A3

0 50 100 150 200 250 300 350 m

PROJECT NO: 4555-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	29/10/2020
01	KP	SB	25/11/2020
02	KP	SB	23/04/2021

MAP 5



LEGEND

- Survey Area (2021)
- Survey Track Log

Sample Sites

- Habitat Assessment
- Ornithological Survey
- Motion Camera

Fauna Habitiat

Habitiat Types

- YcD - Dunes
- YcG - Gullies
- YcH - Hummock Grassland
- Cleared - No Habitat

2018 Survey Data (Ecoscape)

- 2018 Survey Area
- 2018 Fauna Habitat

2018 Priority Fauna

- IA: *Pandion haliaetus* (Osprey)
- P3: *Lerista allochira* (Cape Range slider; a skink)

DATASOURCES:
AERIAL: LANDGATE WA NOW 2014
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS:

ecoscape

YARDIE CREEK RD REALIGNMENT BIOLOGICAL SURVEY

FAUNA SITES AND HABITAT

mainroads WESTERN AUSTRALIA

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:9,000 @ A3

0 50 100 150 200 250 300 350 m

PROJECT NO: 4555-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	29/10/2020
01	KP	SB	25/11/2020
02	KP	SB	23/04/2021

MAP 6

APPENDIX ONE DEFINITIONS AND CRITERIA

Table 13: EPBC Act categories for flora, fauna and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CE)	A native species is eligible to be included in the *critically endangered* category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *critically endangered* category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
Endangered (EN)	A native species is eligible to be included in the *endangered* category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *endangered* category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the *vulnerable* category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *vulnerable* category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

Table 14: Conservation codes for Western Australian flora and fauna (DBCA 2019b)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. **The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.** **Categories of Threatened, Extinct and Specially Protected fauna and flora are:**	
T	**Threatened species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	**Critically endangered species** Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as critically endangered undersection 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.
EN	**Endangered species** Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.
VU	**Vulnerable species** Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as vulnerable undersection 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.
Extinct species **Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.**	
EX	**Extinct species** Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.
EW	Extinct in the wild species Species that "*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species **Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.** **Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.**	

Conservation Codes for Western Australian Flora and Fauna	
MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (conservation dependent fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14of the BC Act). Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18of the BC Act). Published as other specially protected fauna under schedule 7of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
P	**Priority species** Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Conservation Codes for Western Australian Flora and Fauna	
4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
[1] The definition of flora includes algae, fungi and lichens. **[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).**	

Table 15: DBCA definitions and criteria for TECs and PECs (DEC 2013)

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

Criteria	Definition
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C): A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	*Poorly known ecological communities* Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	*Poorly known ecological communities* Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.

Criteria	Definition
Priority Three	*Poorly known ecological communities* i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.
Priority Four	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change These communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	*Conservation Dependent Ecological Communities* Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table 16: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group; DotEE 2017)

	Cover characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	**Height Ranges (m)**	**Structural Formation Classes**						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
herb	<0.5,>0.5	closed herbland	herbland	open herbland	sparse herbland	isolated herbs	isolated clumps of herbs	herb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 17: NVIS height classes (NVIS Technical Working Group; DotEE 2017)

Height		Growth form				
Height Class	**Height Range (m)**	**Tree, vine (M & U), palm (single-stemmed)**	**Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)**	**Tree mallee, mallee shrub**	**Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)**	**Bryophyte, lichen, seagrass, aquatic**
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low

Source: (based on Walker & Hopkins 1990)

Table 18: Vegetation condition scale for the Eremaean and Northern Botanical Provinces

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

APPENDIX TWO DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 19: Flora database search results, habitat and likelihood assessment

Blue shading indicates high likelihood; dark blue indicates species is known (recorded) from the survey area

DBCA	PMST	Species name	Habitat from *FloraBase* (WAH 1998-2020)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
		DBCA Priority 1				
X	-	*Calytrix* sp. Learmonth (S. Fox EMopp 1)	Rocky areas with limestone/coral reef deposits.	Aug	Highly unlikely	Highly unlikely
		DBCA Priority 2				
X	-	*Abutilon* sp. Quobba (H. Demarz 3858)	Sandplains, plains. Low shrubland or grassland.	Jul-Sep	Unlikely	Unlikely
X	-	*Acacia ryaniana*	Coastal sand dunes with white or red sand. Adjacent to mangroves. Open shrubland over hummock grassland. *Acacia tetragonophylla*, *A. coriacea Triodia* sp..	Jun-Nov	Unlikely	Unlikely
X	-	*Acanthocarpus rupestris*	Red sand, limestone. *Acacia tetragonophylla, Melaleuca cardiophylla, Triodia plurinervata, Thryptomene sp..*	May-Jun	Possible	Unlikely
X	-	*Calandrinia* sp. Cape Range (F. Obbens FO 10/18)	Lower slopes. On skeletal limestone soil. Open shrubland over *Triodia* grassland.	Aug	Unlikely	Unlikely
X	-	*Crinum flaccidum*	Swamps, creeks with loam, clay or sandstone.	Most months	Unlikely	Highly unlikely
X	-	*Cucumis* sp. Barrow Island (D.W. Goodall 1264)	Basalt hill slopes, calcrete slopes, limestone plateaus, sandplains. Red-brown sandy loam. *Triodia* grassland or tussock grassland with tall *Acacia* shrubs or *Corymbia hamersleyana*.	May-Oct	Highly unlikely	Highly unlikely
X	-	*Daviesia pleurophylla*	Sand dunes. Red-brown sand. Shrubland of *Acacia* sp., *Grevillea* sp., *Daviesia* sp., *Banksia* sp. *Calytrix* sp. and *Verticordia* sp. over Triodia grassland.	Aug-Oct	Possible	Recorded
X	-	*Eremophila occidens*	Limestone ridges, dunes with orange/brown sandy soil.	Aug-Sep	Possible	Unlikely
X	-	*Harnieria kempeana* subsp. *rhadinophylla*	Amongst limestone rocks, along creek banks. Calcareous loamy soil. Low shrubland or low open *Eucalyptus* forest over shrubland of Acacia sp., Senna sp.	May-Sep	Possible	Unlikely
X	-	*Tephrosia* sp. North West Cape (G. Marsh 81)	Limestone rises with orange soil over exposed limestone or plains with red-brown clay loam over limestone. *Acacia* shrubland over *Triodia* grassland.	May-Jun	Possible	Unlikely
X	-	*Tinospora esiangkara*	Limestone outcrops or ridges, near creek banks. Pebbly orange-brown calcareous loamy soil. *Acacia* tall open shrubland over tussock grassland. Open *Corymbia* or *Eucalyptus* woodland over *Acacia* or *Melaleuca* shrubland over hummock grassland.	Jul-Sep	Possible	Recorded

DBCA	PMST	Species name	Habitat from *FloraBase* (WAH 1998-2020)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
X	-	*Verticordia serotina*	Sand dunes with red sand. *Banksia ashbyi* open heath.	Aug-Sep	Unlikely	Highly unlikely
		DBCA Priority 3				
X	-	*Acacia alexandri*	Stony creeks, steep rocky slopes. Limestone soil. Mixed shrubland or mallee woodland over mixed shrubland over hummock grassland.	Jun-Sep	Possible	Unlikely
X	-	*Acacia startii*	Stony hills, coastal dunes, gentle slopes and watercourses. Calcareuous loam with limestone pebbles. *Triodia* grassland with *Acacia* shrubs. *A. tetragonophylla, A. Victoriae, A. Bivenosa.*	Jul-Aug	Possible	Unlikely
X	-	*Carpobrotus* sp. Thevenard Island (M. White 050)	Sand dunes. Coarse white sand. Coastal low shrubland and grassland. *Atriplex* sp., *Westringia* sp., *Acacia* sp., *Lotus* sp., *Olearia* sp.	Aug	Unlikely	Highly unlikely
X	-	*Corchorus congener*	Sand dunes and plains. Sand, red sandy loam with limestone. Shrubland over tussock and hummock grassland. *Crotalaria cunninghamii, Acacia bivenosa, Grevillea pyramidalis, Triodia wiseana, T. epactia, Scaevola spinescens, A. coriacea, Whiteochloa airoides.*	Aug-Nov	Possible	Recorded
X	-	*Eremophila forrestii* subsp. *capensis*	Ridges, red sandplains. Brown rocky soils, limestone. Sparse mallee woodland or shrubland over *Triodia* grassland. *Acacia tetragonophylla, A. bivenosa, Senna glutinosa, Melaleuca cardiophylla, Corymbia hamersleyana, Gossypium robinsonii.*	Jun-Aug	Possible	Recorded
X	-	*Grevillea calcicola*	Limestone hilltops, creek lines. Limestone soil. Open woodland over low shrubland or shrubland of hummock grassland. *Atriplex bunburyana, Acacia arida, Ptilotus obovatus, Triodia* spp., *Eucalyptus xerothermica, Corymbia hamersleyana.*	May-Aug	Possible	Recorded
X	-	*Gymnanthera cunninghamii*	Creek beds, drainage lines, on margins of mound springs. Sandy soils. *Eucalyptus* open woodland over *Acacia* shrubland over hummock/tussock grassland. *Eucalyptus camaldulensis, E. victrix, Melaleuca argentea, Corymbia hamersleyana, Acacia colei, A. trachycarpa, A. tumida, Triodia epactia, T. angusta.*	Dec-Jan	Unlikely	Highly unlikely
X	-	*Lepidium biplicatum*	Coastal regions. *Acacia* shrubland over *Triodia* grassland. *Acacia tetragonophylla, A. bivenosa, Melaleuca cardiophylla, Scaevola crassifolia, Triodia plurinervata.*	Sep	Unlikely	Highly unlikely
X	-	*Phyllanthus fuernrohrii*	Limestone cliff tops, near salt flats, along creek beds. Red soil over limestone. *Olearia* sp., *Thryptomene* sp.	Aug	Possible	Unlikely

DBCA	PMST	Species name	Habitat from *FloraBase* (WAH 1998-2020)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
X	-	*Stackhousia umbellata*	Limestone range crest, flood plains. Sandy soils over limestone. Shrubland over hummock grassland. *Hibbertia spicata, Triodia wiseana, Acacia bivenosa, A. alexandri, Eremophila forrestii.*	May-Aug	Possible	Recorded
		DBCA Priority 4				
X	-	*Brachychiton obtusilobus*	Rocky limestone ranges, gorges and sandplains. Skeletal soils. Shrubland over hummock grassland. *Acacia arida, Triodia basedowii, A. bivenosa, A. tetragonophylla, T. epactia.*	Aug-Sep	Possible	Recorded
X	-	*Eremophila youngii* subsp. *lepidota*	Flats, plains, sometimes semi-saline, clay flats. Stony red sandy loam. Shrubland over hummock grassland with scattered low trees. *Acacia synchronicia, A. xiphophylla, A. aneura, Triodia longiceps, T. pungens, Eremophila youngii, E. cuneifolia.*	Jun-Sep	Unlikely	Highly unlikely
X	-	*Livistona alfredii*	Edges of permanent pools, drainage lines. *Eucalyptus camaldulensis, Petalostylis labicheoides, Gossypium robinsonii, Acacia ampliceps, Corymbia terminalis.*	Jul-Sep	Highly unlikely	Highly unlikely
X	-	*Rhynchosia bungarensis*	Rock piles, gorges, river beds and alluvial soils. Open woodland or shrubland over hummock grassland. *Triodia wiseana, Acacia eriopoda, Corchorus lasiocarpus, Corymbia hamersleyana, Eucalyptus xerothermica, E. camaldulensis, E. victrix, A. tumida, A. pyrifolia, A. maitlandii, Gossypium robinsonii, Senna artemisioides.*	May-Nov	Highly unlikely	Highly unlikely

Table 20: Fauna database results and likelihood assessments

Blue shading indicates high likelihood; darker blue indicates species is known (recorded) from the survey area

Species (*)	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	BC Act	PMST**	DBCA	*NatureMap*	Desktop	Post-survey
Mammals								
Dasyurus hallucatus	Northern Quoll	EN	EN	species or habitat may occur			Very low	Very low
Leporillus apicalis	Lesser Stick-nest Rat	EX	EX		X		Very low	Very low
Mesembriomys macrurus	Golden-backed Tree-rat		P4		X		Very low	Very low
Petrogale lateralis	Black-footed Rock-Wallaby	EN	EN	X	X	X	High	Low
Phascogale calura	Red-tailed Phascogale	VU	CD		X		Very low	Very low
Pseudomys fieldi	Shark Bay Mouse	VU	VU		X		Very low	Very low
Rhinonicteris aurantia	Orange Leaf-nosed Bat		P4		X		Very low	Very low
Rhinonicteris aurantia (Pilbara)	Pilbara Leaf-nosed Bat	VU	VU	X	X		Very low	Very low
Sminthopsis longicaudata	Long-tailed Dunnart		P4		X		Very low	Very low
Zyzomys pedunculatus	Central Rock-rat	CR	CR		X		Very low	Very low
Birds								
Anous stolidus	Common Noddy	MI	MI	X	X		Very low	Very low
Arenaria interpres	Ruddy Turnstone	MI	MI		X	X	Low	Low
Calidris acuminata	Sharp-tailed Sandpiper	MI	MI	X	X	X	Low	Low
Calidris alba	Sanderling	MI	MI		X	X	Low	Low
Calidris canutus	Red Knot	EN & MI	EN	X	X		Very low	Very low
Calidris ferruginea	Curlew Sandpiper	CR & MI	CR	X	X		Very low	Very low
Calidris ruficollis	Red-necked Stint	MI	MI		X	X	Low	Low
Calidris subminuta	Long-toed Stint	MI	MI		X	X	Low	Low
Charadrius leschenaultii	Greater Sand Plover	VU & MI	MI		X	X	Low	Low
Charadrius mongolus	Lesser Sand Plover	EN & MI	MI		X	X	High	Low
Charadrius veredus	Oriental Plover	MI	MI	X	X		Medium	Low
Falco hypoleucos	Grey Falcon		VU	species or habitat likely to occur			Very low	Very low
Falco peregrinus	Peregrine Falcon		OS		X	X	Very low	Very low

Species (*)	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	BC Act	PMST**	DBCA	*NatureMap*	Desktop	Post-survey
Gallinago stenura	Pin-tailed Snipe	MI	MI		X	X	Very low	Very low
Glareola maldivarum	Oriental Pratincole	MI	MI	X	X	X	Low	Low
Limicola falcinellus	Broad-billed sandpiper	MI	MI		X		Very low	Very low
Limosa lapponica	Bar-tailed Godwit	MI	MI	X	X	X	Low	Low
Limosa limosa	Black-tailed Godwit	MI	MI				Very low	Very low
Macronectes giganteus	Southern Giant-Petrel	EN	EN	species or habitat likely to occur			Very low	Very low
Numenius madagascariensis	Eastern Curlew	MI & CR	CR	X	X	X	Low	Low
Numenius minutus	Little Curlew	MI	MI		X	X	Very low	Very low
Numenius phaeopus	Whimbrel	MI	MI		X	X	Low	Low
Oceanites oceanicus	Wilson's Storm petrel	MI	MI		X	X	Low	Low
Pandion cristatus	Osprey (eastern)	MI	MI		X	X	High	High
Pezoporus occidentalis	Night Parrot	EN	CR	species or habitat likely to occur			Very low	Very low
Phaethon lepturus	White-tailed Tropicbird	MI	MI		X	X	Very low	Very low
Phaethon rubricauda	Red-tailed Tropicbird	MI	MI		X	X	Very low	Very low
Plegadis falcinellus	Glossy Ibis	MI	MI		X		Low	Low
Pluvialis fulva	Pacific Golden Plover	MI	MI		X		Low	Low
Pluvialis squatarola	Grey Plover	MI	MI		X	X	Low	Low
Pterodroma mollis	Soft-plumaged Petrel	VU		species or habitat likely to occur			Very low	Very low
Puffinus huttoni	Hutton's Shearwater		EN		X	X	Very low	Very low
Puffinus pacificus	Wedge-tailed Shearwater	MI	MI		X	X	Very low	Very low
Rostratula australis	Australian Painted Snipe	EN		species or habitat likely to occur			Very low	Very low
Sterna albifrons	Little Tern	MI	MI		X	X	Low	Low
Sterna anaethetus	Bridled Tern	MI	MI		X	X	Very low	Very low
Sterna bergii	Crested Tern	MI	MI		X	X	High	Low
Sterna caspia	Caspian Tern				X	X	Low	Low
Sterna dougallii	Roseate Tern	MI	MI		X	X	Very low	Very low

Species (*)	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	BC Act	PMST**	DBCA	*NatureMap*	Desktop	Post-survey
Sterna hirundo	Common Tern	MI	MI		X	X	Very low	Very low
Sterna leucopterus	White-winged Black Tern	MI	MI		X		Low	Low
Sterna nereis nereis	Fairy Tern	VU	VU	X	X	X	Very low	Very low
Sterna nilotica	Gull-billed Tern	MI	MI		X	X	Very low	Very low
Thalassarche chlororhynchos	Atlantic Yellow-nosed Albatross		VU		X	X	Very low	Very low
Tringa brevipes	Grey-tailed Tattler		MI		X	X	Low	Low
Tringa glareola	Wood Sandpiper	MI	MI		X	X	Low	Low
Tringa hypoleucos	Common Sandpiper	MI	MI	X	X	X	Medium	Low
Tringa nebularia	Common Greenshank	MI	MI		X	X	Low	Low
Tringa stagnatilis	Marsh Sandpiper	MI	MI		X	X	Very low	Very low
Tringa cinereus	Terek Sandpiper	MI	MI		X	X	Very low	Very low
Reptiles								
Anilios splendidus	Splendid Blind Snake (NW Cape)		P2		X		Low	Low
Aprasia rostrata	Ningaloo Worm Lizard		P3		X	X	Medium	Medium
Diplodactylus capensis	Cape Range Stone Gecko		P2		X	X	Medium	Medium
Lerista allochira	Cape Range Slider		P3		X	X	Recorded	High

* introduced

** PMST likelihood of occurrence or likelihood of habitat occurring

APPENDIX THREE FIELD SURVEY RESULTS

Table 21: Flora inventory (site x species)

Family	Species	Intro.	Cons.	YR2001	YR2002	YR2003	YR2004	YR2005	YR2006	YR2007	YR2008	YR2009	YR2010	YR2011	YR2012	YR2013	YR2014	YR2015	YR2016	YR2017	YR2018	YR2019	YR2020	YR2021	YR2022	Opp.
Acanthaceae	*Dipteracanthus australasicus* subsp. *australasicus*																				X					
	Dipteracanthus australasicus subsp. *corynothecus*																								X	X
Aizoaceae	*Trianthema pilosum*						X	X																		
Amaranthaceae	*Aerva javanica*	*		X																						
	Amaranthus undulatus																								X	X
	Ptilotus arthrolasius																									X
	Ptilotus axillaris					X																				
	Ptilotus clementii																									X
	Ptilotus exaltatus															X		X								
	Ptilotus obovatus														X		X	X	X	X	X	X	X		X	X
	Ptilotus polystachyus						X																			
Apocynaceae	*Cynanchum viminale* subsp. *australe*																X	X	X	X		X			X	X
	Vincetoxicum flexuosum																									X
Asparagaceae	*Acanthocarpus humilis*								X	X	X	X				X										
	Acanthocarpus verticillatus				X	X																				
	Thysanotus exfimbriatus			X	X	X	X			X	X		X					X						X		
Asphodelaceae	*Asphodelus fistulosus*	*																								X
Asteraceae	*Bidens subalternans*	*																			X					X
	Decazesia hecatocephala																									X
	Olearia sp. Kennedy Range (G. Byrne 66)							X																		
	Pterocaulon sphaeranthoides																								X	X
	Rhodanthe condensata						X	X																		
	Sonchus oleraceus	*																								
Boraginaceae	*Heliotropium crispatum*			X	X																					
	Heliotropium glanduliferum				X	X				X	X			X										X		
	Trichodesma zeylanicum						X	X										X		X						
Campanulaceae	*Wahlenbergia capillaris*																		X							X
Capparaceae	*Capparis mitchellii*																									X
	Capparis spinosa subsp. *nummularia*																									X

Family	Species	Intro.	Cons.	YR2001	YR2002	YR2003	YR2004	YR2005	YR2006	YR2007	YR2008	YR2009	YR2010	YR2011	YR2012	YR2013	YR2014	YR2015	YR2016	YR2017	YR2018	YR2019	YR2020	YR2021	YR2022	Opp.
Celastraceae	*Stackhousia muricata*															X										
	Stackhousia umbellata		3												X	X	X	X								
Chenopodiaceae	*Chenopodium gaudichaudianum*																									X
	Dysphania melanocarpa forma *leucocarpa*																									X
	Enchylaena tomentosa						X															X	X	X	X	X
	Maireana lanosa			X	X	X																		X		
	Maireana tomentosa																								X	
	Rhagodia eremaea			X	X	X		X																	X	
	Rhagodia preissii subsp. *obovata*						X																			
	Salsola australis						X													X						
Colchicaceae	*Wurmbea odorata*					X							X											X		
Commelinaceae	*Commelina ensifolia*			X																					X	
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*																	X								
	Ipomoea costata																	X			X	X				X
	Polymeria ambigua						X	X																		
Cucurbitaceae	*Cucumis variabilis*				X													X		X		X			X	
Cyperaceae	*Bulbostylis barbata*																									X
Dilleniaceae	*Hibbertia capensis*								X	X		X			X	X	X			X						
Euphorbiaceae	*Adriana tomentosa* var. *tomentosa*			X			X																			
	Euphorbia australis var. *australis*			X																						
	Euphorbia coghlanii				X		X	X	X									X								
	Euphorbia tannensis subsp. *eremophila*				X			X										X						X		
Fabaceae	*Acacia arida*																		X			X			X	X
	Acacia bivenosa				X					X		X	X		X		X	X	X	X			X	X	X	
	Acacia coriacea subsp. *coriacea*			X	X		X	X			X			X					X	X	X		X	X	X	
	Acacia gregorii			X	X	X			X	X	X	X		X	X	X	X							X		
	Acacia pyrifolia var. *pyrifolia*																	X	X			X	X		X	X
	Acacia sclerosperma subsp. *sclerosperma*			X	X																			X		
	Acacia spathulifolia						X		X																	
	Acacia stellaticeps																									X

Family	Species	Intro.	Cons.	YR2001	YR2002	YR2003	YR2004	YR2005	YR2006	YR2007	YR2008	YR2009	YR2010	YR2011	YR2012	YR2013	YR2014	YR2015	YR2016	YR2017	YR2018	YR2019	YR2020	YR2021	YR2022	Opp.
	Acacia tetragonophylla											X		X		X	X	X	X	X	X					X
	Crotalaria cunninghamii						X																			X
	Crotalaria medicaginea var. *neglecta*			X																						
	Cullen pogonocarpum																	X								
	Daviesia pleurophylla		2				X	X																		X
	Indigofera boviperda subsp. *boviperda*			X	X		X	X			X			X						X				X		
	Indigofera monophylla					X			X							X			X						X	
	Isotropis atropurpurea														X											
	Labichea cassioides										X	X														X
	Leptosema macrocarpum								X	X					X	X	X									X
	Lotus australis			X	X																					
	Rhynchosia minima																									X
	Senna artemisioides subsp. *oligophylla*																X	X	X	X			X		X	X
	Senna glutinosa subsp. *glutinosa*																									X
	Senna glutinosa subsp. *pruinosa*																									X
	Senna glutinosa x ?								X																	
	Senna notabilis																									X
	Tephrosia rosea var. *clementii*																					X				X
Geraniaceae	*Erodium cygnorum*												X				X	X		X					X	X
Goodeniaceae	*Dampiera incana* var. *incana*					X			X	X	X	X				X	X									
	Goodenia tenuiloba															X										X
	Scaevola cunninghamii			X	X	X																		X		
	Scaevola pulchella					X				X														X		
	Scaevola sericophylla			X			X	X	X	X	X			X												
	Scaevola spinescens												X				X	X		X						
	Scaevola tomentosa														X		X			X					X	
Gyrostemonaceae	*Gyrostemon ramulosus*																									X
Haloragaceae	*Haloragis gossei* var. *inflata*																									X
	Haloragis trigonocarpa																	X	X						X	
Hemerocallidaceae	*Corynotheca pungens*						X																			
	Tricoryne corynothecoides										X				X	X										X
Lamiaceae	*Clerodendrum tomentosum*																	X								X
	Quoya loxocarpa								X																	X

Family	Species	Intro.	Cons.	YR2001	YR2002	YR2003	YR2004	YR2005	YR2006	YR2007	YR2008	YR2009	YR2010	YR2011	YR2012	YR2013	YR2014	YR2015	YR2016	YR2017	YR2018	YR2019	YR2020	YR2021	YR2022	Opp.
Lauraceae	*Cassytha aurea* var. *aurea*										X														X	
	Cassytha capillaris			X											X	X										
Loganiaceae	*Logania litoralis*																X									
Loranthaceae	*Lysiana casuarinae*																									X
Malvaceae	*Abutilon cunninghamii*								X																	
	Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)							X																		X
	Alyogyne pinoniana						X	X	X		X	X			X									X		X
	Brachychiton obtusilobus		4																							X
	Corchorus congener		3	X						X																
	Corchorus crozophorifolius																					X			X	X
	Gossypium robinsonii																	X		X		X	X			X
	Hannafordia quadrivalvis subsp. *recurva*							X	X	X		X				X		X		X						
	Hibiscus sp. Gardneri (A.L. Payne PRP 1435)																			X						
	Hibiscus sturtii			X																						
	Melhania oblongifolia																	X	X		X	X				
	Seringia hermanniifolia													X												
	Sida fibulifera																									X
	Sida rohlenae subsp. *rohlenae*																									X
Meliaceae	*Owenia reticulata*																									X
Menispermaceae	*Tinospora esiangkara*		2														X	X	X		X	X			X	X
Montiaceae	*Calandrinia* sp.																					X				X
Moraceae	*Ficus brachypoda*																	X			X	X			X	X
	Ficus virens var. *virens*																									X
Myrtaceae	*Calytrix truncatifolia*						X	X																		
	Corymbia hamersleyana																			X						
	Corymbia zygophylla							X		X	X	X		X												X
	Melaleuca cardiophylla					X				X		X	X		X	X	X	X	X	X			X		X	
	Pileanthus septentrionalis							X																		
Nyctaginaceae	*Commicarpus australis*			X			X																			
Olacaceae	*Olax aurantia*																									X
Oleaceae	*Jasminum* sp. Exmouth (G. Marsh 77)						X	X	X		X			X				X	X						X	X
Phyllanthaceae	*Phyllanthus erwinii*																	X								X
	Phyllanthus hamelinii																									X
	Phyllanthus maderaspatensis																		X							

Family	Species	Intro.	Cons.	YR2001	YR2002	YR2003	YR2004	YR2005	YR2006	YR2007	YR2008	YR2009	YR2010	YR2011	YR2012	YR2013	YR2014	YR2015	YR2016	YR2017	YR2018	YR2019	YR2020	YR2021	YR2022	Opp.
Pittosporaceae	*Pittosporum phillyreoides*																									X
Plumbaginaceae	*Plumbago zeylanica*						X														X					
Poaceae	*Aristida holathera*																									X
	Cenchrus ciliaris	*		X	X		X	X					X						X		X	X		X	X	
	Cenchrus setiger	*																								X
	Cymbopogon ambiguus																		X						X	X
	Dichanthium sericeum subsp. humilius																									X
	Enneapogon caerulescens																									X
	Eragrostis eriopoda							X																		X
	Eriachne aristidea						X																			
	Eriachne helmsii															X										X
	Eriachne mucronata					X											X	X								
	Eulalia aurea																	X								X
	Paractaenum refractum						X																			
	Paspalidium clementii								X							X										
	Triodia angusta								X	X		X			X		X	X	X	X	X	X	X		X	
	Triodia epactia			X	X	X			X				X		X			X		X			X	X		
	Triodia glabra			X		X	X	X			X			X												
	Triodia sp.												X													
	Triodia wiseana														X	X	X						X			
Proteaceae	*Banksia ashbyi* subsp. *boreoscaia*			X			X	X				X		X												
	Grevillea calcicola		3																		X					X
	Grevillea eriostachya																									X
	Grevillea stenobotrya						X	X		X	X			X												
	Grevillea variifolia subsp. *variifolia*								X						X		X	X	X	X					X	
	Hakea lorea subsp. *lorea*																									X
	Hakea stenophylla subsp. *stenophylla*								X	X	X	X														
Rubiaceae	*Oldenlandia crouchiana*																								X	X
Santalaceae	*Exocarpos aphyllus*														X	X	X		X	X					X	X
	Exocarpos sparteus																									X
Sapindaceae	*Alectryon oleifolius*																X				X	X				X
	Diplopeltis eriocarpa								X			X				X		X	X	X						
Scrophulariaceae	*Eremophila forrestii* subsp. *capensis*		3					X							X	X	X	X	X	X		X				
	Eremophila longifolia																	X							X	X

Family	Species	Intro.	Cons.	YR2001	YR2002	YR2003	YR2004	YR2005	YR2006	YR2007	YR2008	YR2009	YR2010	YR2011	YR2012	YR2013	YR2014	YR2015	YR2016	YR2017	YR2018	YR2019	YR2020	YR2021	YR2022	Opp.
Solanaceae	*Duboisia hopwoodii*							X																		
	Nicotiana occidentalis subsp. *occidentalis*			X	X		X	X	X						X		X	X	X	X		X		X	X	
	Solanum diversiflorum						X											X								X
	Solanum lasiophyllum			X	X		X	X	X		X	X	X		X	X	X	X	X	X		X	X	X	X	
Thymelaeaceae	*Pimelea ammocharis*						X		X	X				X												X
Violaceae	*Hybanthus aurantiacus*																		X	X						X
Zygophyllaceae	*Roepera retivalvis*															X	X			X						X
	Tribulus macrocarpus						X		X																	
	Tribulus occidentalis																									X
	Tribulus suberosus															X	X	X	X	X						

Table 22: Fauna sites (GDA94, Zone 50)

Site Name	Site Type	Easting	Northing
BS1	Fauna: Ornithological Survey	201631	7585133
BS2	Fauna: Ornithological Survey	202222	7585390
BS3	Fauna: Ornithological Survey	201371	7584948
HA1	Fauna: Habitat Assessment	201794	7585109
HA2	Fauna: Habitat Assessment	202270	7585592
HA3	Fauna: Habitat Assessment	202228	7585401
HA4	Fauna: Habitat Assessment	202167	7585460
HA5	Fauna: Habitat Assessment	200585	7585364
HA6	Fauna: Habitat Assessment	201059	7585148
HA7	Fauna: Habitat Assessment	200910	7585323
HA8	Fauna: Habitat Assessment	200733	7585368
HA9	Fauna: Habitat Assessment	200524	7585634
HA10	Fauna: Habitat Assessment	200345	7585471
HA11	Fauna: Habitat Assessment	201463	7584925
HA12	Fauna: Habitat Assessment	201190	7585013
HA13	Fauna: Habitat Assessment	201154	7585046
HA14	Fauna: Habitat Assessment	200983	7585108
HA15	Fauna: Habitat Assessment	201074	7585150
HA16	Fauna: Habitat Assessment	201296	7585047
MC08	Fauna: Motion Camera	200653	7585570
MC17	Fauna: Motion Camera	201899	7585070
MC36	Fauna: Motion Camera	201785	7585025
MC40	Fauna: Motion Camera	200689	7585490
MC51	Fauna: Motion Camera	200464	7585456
MC53	Fauna: Motion Camera	201760	7584934
MC74	Fauna: Motion Camera	200510	7585430
MC83	Fauna: Motion Camera	201832	7585084
MC91	Fauna: Motion Camera	200634	7585413

APPENDIX FOUR FLORISTIC QUADRAT DATA

YR2001

Staff SOK **Date** 17/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 202186 **mE** 7585572 **mN** **Lat.** -21.8086 **Long.** 114.1195

Habitat Dune crest

Aspect N/A **Slope** N/A

Soil Type Red brown sand

Rock Type Nil

Loose Rock 0 % cover **Litter** 15 % cover ; 0-2 cm in depth

Bare ground 30 % cover **Weeds** 1 % cover

Vegetation M+ ^^*Acacia sclerosperma* subsp. *sclerosperma*,*Scaevola sericophylla*,*Banksia ashbyi* subsp. *boreoscaia*\^shrub\3\i;G ^*Triodia epactia*,^*Triodia glabra*\^hummock grass\1\c

Veg. Condition Very Good

Disturbance Road edge effects, minor weeds

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia coriacea subsp. *coriacea*		1	1	
Acacia gregorii		0.4	1	
Acacia sclerosperma subsp. *sclerosperma*		1	8	
Adriana tomentosa var. *tomentosa*		0.1	<1	
**Aerva javanica*		0.5	<1	

Banksia ashbyi subsp. *boreoscaia*		1	1	
Cassytha capillaris		0.3	<1	
**Cenchrus ciliaris*		0.3	1	
Commelina ensifolia		0.3	<1	
Commicarpus australis		0.3	<1	
Corchorus congener	P 3	0.3	<1	1
Crotalaria medicaginea var. *neglecta*		0.2	<1	
Euphorbia australis var. *australis*		0.1	<1	
Heliotropium crispatum		0.2	<1	
Hibiscus sturtii		0.2	<1	
Indigofera boviperda subsp. *boviperda*		0.3	<1	
Lotus australis		0.2	<1	
Maireana lanosa		0.3	<1	
Nicotiana occidentalis subsp. *occidentalis*		0.4	<1	
Rhagodia eremaea		0.4	<1	
Scaevola cunninghamii		0.4	<1	
Scaevola sericophylla		1	4	
Solanum lasiophyllum		0.3	<1	
Thysanotus exfimbriatus		0.3	<1	
Triodia epactia		0.4	35	
Triodia glabra		0.4	15	

YR2002

Staff SOK **Date** 17/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 202257 **mE** 7585568 **mN** **Lat.** -21.8087 **Long.** 114.1202

Habitat Dune swale

Aspect N/A **Slope** N/A

Soil Type Red brown sand

Rock Type Nil

Loose Rock 0 % cover **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 35 % cover **Weeds** 5 % cover

Vegetation M+ ^*Acacia sclerosperma* subsp. *sclerosperma*,^*Acacia bivenosa*\^shrub\3\r;G ^*Triodia epactia*\^hummock grass\1\c

Veg. Condition Good

Disturbance Road edge effects, weeds

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1	2	
Acacia coriacea subsp. *coriacea*		0.8	<1	
Acacia gregorii		0.3	1	
Acacia sclerosperma subsp. *sclerosperma*		1	3	
Acanthocarpus verticillatus		0.3	<1	

**Cenchrus ciliaris*	0.3	5
Cucumis variabilis	0.4	<1
Euphorbia coghlanii	0.3	<1
Euphorbia tannensis subsp. *eremophila*	0.3	<1
Heliotropium crispatum	0.2	<1
Heliotropium glanduliferum	0.3	<1
Indigofera boviperda subsp. *boviperda*	0.3	<1
Lotus australis	0.3	<1
Maireana lanosa	0.3	<1
Nicotiana occidentalis subsp. *occidentalis*	0.3	<1
Rhagodia eremaea	1	<1
Scaevola cunninghamii	0.3	<1
Solanum lasiophyllum	0.4	<1
Thysanotus exfimbriatus	0.3	<1
Triodia epactia	0.4	65

YR2003

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 202175 **mE** 7585347 **mN** **Lat.** -21.8107 **Long.** 114.1194

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Red sand

Rock Type Limestone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-2 cm in depth

Bare ground 25 % cover **Weeds** 0 % cover

Vegetation G+ ^*Triodia epactia*,^*Acacia gregorii*\^hummock grass,shrub\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia gregorii		0.4	10	
Acanthocarpus verticillatus		0.4	<1	
Dampiera incana var. *incana*		0.4	<1	
Eriachne mucronata			<1	
Heliotropium glanduliferum		0.2	<1	

Indigofera monophylla	0.4	<1
Maireana lanosa	0.4	<1
Melaleuca cardiophylla	1	<1
Ptilotus axillaris	0.1	<1
Rhagodia eremaea	0.4	<1
Scaevola cunninghamii	0.4	<1
Scaevola pulchella	0.3	<1
Thysanotus exfimbriatus	0.3	<1
Triodia epactia	0.4	50
Triodia glabra	0.3	1
Wurmbea odorata	0.2	<1

YR2004

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201796 **mE** 7585094 **mN** **Lat.** -21.8129 **Long.** 114.1157

Habitat Dune crest

Aspect N/A **Slope** N/A

Soil Type Red sand

Rock Type Nil

Loose Rock 0 % cover **Litter** 5 % cover ; 0-2 cm in depth

Bare ground 55 % cover **Weeds** <1 % cover

Vegetation M+ ^*Banksia ashbyi* subsp. *boreoscaia*,^*Acacia coriacea* subsp. *coriacea*\^shrub\3\r;G ^*Triodia glabra*\^hummock grass\1\c

Veg. Condition Very Good

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia coriacea subsp. *coriacea*		1.5	3	
Acacia spathulifolia		1	<1	
Adriana tomentosa var. *tomentosa*		0.5	<1	
Alyogyne pinoniana		0.4	<1	
Banksia ashbyi subsp. *boreoscaia*		1.5	5	

Calytrix truncatifolia		0.2	<1	
**Cenchrus ciliaris*		0.3	<1	
Commicarpus australis		0.4	<1	
Corynotheca pungens		0.5	<1	
Crotalaria cunninghamii		0.4	<1	
Daviesia pleurophylla	P 2	2	1	1
Enchylaena tomentosa		0.6	<1	
Eriachne aristidea		0.3	<1	
Euphorbia coghlanii		0.3	<1	
Grevillea stenobotrya		1	<1	
Indigofera boviperda subsp. *boviperda*		0.3	<1	
Jasminum sp. Exmouth (G. Marsh 77)		1	<1	
Nicotiana occidentalis subsp. *occidentalis*		0.4	<1	
Paractaenum refractum		0.3	<1	
Pimelea ammocharis		0.5	<1	
Plumbago zeylanica		0.5	<1	
Polymeria ambigua		0.1	<1	
Ptilotus polystachyus		0.4	<1	
Rhagodia preissii subsp. *obovata*		1	<1	
Rhodanthe condensata		0.3	<1	
Salsola australis		0.3	<1	
Scaevola sericophylla		1	1	
Solanum diversiflorum		0.3	<1	
Solanum lasiophyllum		0.4	<1	
Thysanotus exfimbriatus		0.3	<1	
Trianthema pilosum		0.1	<1	
Tribulus macrocarpus		0.1	<1	
Trichodesma zeylanicum		0.4	<1	
Triodia glabra		0.5	50	

YR2005

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201727 **mE** 7584957 **mN** **Lat.** -21.8141 **Long.** 114.1150

Habitat Dune crest

Aspect N/A **Slope** N/A

Soil Type Red sand

Rock Type Nil

Loose Rock 0 % cover **Litter** 5 % cover ; 0-1 cm in depth

Bare ground 65 % cover **Weeds** <1 % cover

Vegetation M+ ^^*Grevillea stenobotrya*,*Corymbia zygophylla*,*Banksia ashbyi* subsp. *boreoscaia*\^shrub\3\r;G ^*Triodia glabra*,^*Calytrix truncatifolia*\^hummock grass,shrub\1\c

Veg. Condition Very Good

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		0.5	<1	
Acacia coriacea subsp. *coriacea*		1.5	1	
Alyogyne pinoniana		0.4	<1	
Banksia ashbyi subsp. *boreoscaia*		1.5	1	
Calytrix truncatifolia		0.5	3	

**Cenchrus ciliaris*		0.3	<1	
Corymbia zygophylla		1.5	3	
Daviesia pleurophylla	P 2	2	1	3
Duboisia hopwoodii		2	<1	
Eragrostis eriopoda		0.4	<1	
Eremophila forrestii subsp. *capensis*	P 3	1.6	<1	1
Euphorbia coghlanii		0.3	<1	
Euphorbia tannensis subsp. *eremophila*		0.3	<1	
Grevillea stenobotrya		1.5	3	
Hannafordia quadrivalvis subsp. *recurva*		0.4	<1	
Indigofera boviperda subsp. *boviperda*		0.3	<1	
Jasminum sp. Exmouth (G. Marsh 77)		0.3	<1	
Nicotiana occidentalis subsp. *occidentalis*		0.4	<1	
Olearia sp. Kennedy Range (G. Byrne 66)		1	<1	
Pileanthus septentrionalis		0.8	<1	
Polymeria ambigua		0.1	<1	
Rhagodia eremaea		0.5	<1	
Rhodanthe condensata		0.4	<1	
Scaevola sericophylla		0.6	<1	
Solanum lasiophyllum		0.4	<1	
Trianthema pilosum		0.1	<1	
Trichodesma zeylanicum		0.5	<1	
Triodia glabra		0.5	35	

YR2006

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201926 **mE** 7585087 **mN** **Lat.** -21.8130 **Long.** 114.1169

Habitat Slight rise

Aspect E **Slope** Very Gentle

Soil Type Red sand

Rock Type Limestone

Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 50 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia spathulifolia*,^*Senna glutinosa* x ?\^shrub\3\r;G ^*Triodia angusta*,^*Hakea stenophylla* subsp. *stenophylla*\^hummock grass,shrub\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Abutilon cunninghamii		0.4	<1	
Acacia gregorii		0.3	2	
Acacia spathulifolia		1	4	
Acanthocarpus humilis		0.4	<1	
Alyogyne pinoniana		0.5	<1	

Dampiera incana var. *incana*	0.4	<1
Diplopeltis eriocarpa	0.4	<1
Euphorbia coghlanii	0.3	<1
Grevillea variifolia subsp. *variifolia*	1	<1
Hakea stenophylla subsp. *stenophylla*	0.4	10
Hannafordia quadrivalvis subsp. *recurva*	0.4	<1
Hibbertia capensis	0.4	<1
Indigofera monophylla	0.4	<1
Jasminum sp. Exmouth (G. Marsh 77)	0.5	<1
Leptosema macrocarpum	0.4	<1
Nicotiana occidentalis subsp. *occidentalis*	0.2	<1
Paspalidium clementii	0.3	<1
Pimelea ammocharis	0.5	<1
Quoya loxocarpa	0.4	<1
Scaevola sericophylla	0.5	2
Senna glutinosa x ?	1.5	2
Solanum lasiophyllum	0.4	<1
Tribulus macrocarpus	0.1	<1
Triodia angusta	0.4	55
Triodia epactia	0.4	<1

YR2007

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201849 **mE** 7585005 **mN** **Lat.** -21.8137 **Long.** 114.1162

Habitat Slight rise

Aspect NE **Slope** Very Gentle

Soil Type Red loamy sand

Rock Type Limestone

Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 5 % cover ; 0-1 cm in depth

Bare ground 50 % cover **Weeds** 0 % cover

Vegetation M+ ^*Melaleuca cardiophylla*\^shrub\3\i;G ^*Triodia angusta*,^*Hakea stenophylla* subsp. *stenophylla*\^hummock grass,shrub\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1.5	<1	
Acacia gregorii		0.3	<1	
Acanthocarpus humilis		0.4	<1	
Corchorus congener	P 3	0.2	<1	1
Corymbia zygophylla		0.5	<1	

Dampiera incana var. *incana*	0.4	<1
Grevillea stenobotrya	1	<1
Hakea stenophylla subsp. *stenophylla*	0.5	2
Hannafordia quadrivalvis subsp. *recurva*	0.4	<1
Heliotropium glanduliferum	0.4	<1
Hibbertia capensis	0.4	<1
Leptosema macrocarpum	0.4	<1
Melaleuca cardiophylla	1	10
Pimelea ammocharis	0.5	<1
Scaevola pulchella	0.4	<1
Scaevola sericophylla	0.5	<1
Thysanotus exfimbriatus	0.3	<1
Triodia angusta	0.4	50

YR2008

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201630 **mE** 7584889 **mN** **Lat.** -21.8147 **Long.** 114.1140

Habitat Dune swale

Aspect N/A **Slope** N/A

Soil Type Red sand

Rock Type Nil

Loose Rock 0 % cover **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 45 % cover **Weeds** 0 % cover

Vegetation U+ ^*Corymbia zygophylla*\^mallee shrub\6\r;G ^*Triodia glabra*,^*Hakea stenophylla* subsp. *stenophylla*\^hummock grass,shrub\1\c

Veg. Condition Very Good

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia coriacea subsp. *coriacea*		1.5	<1	
Acacia gregorii		0.3	<1	
Acanthocarpus humilis		0.4	<1	
Alyogyne pinoniana		0.5	<1	
Cassytha aurea var. *aurea*		0.5	<1	

Corymbia zygophylla	1.5	5
Dampiera incana var. *incana*	0.5	<1
Grevillea stenobotrya	2.5	<1
Hakea stenophylla subsp. *stenophylla*	0.5	2
Heliotropium glanduliferum	0.2	<1
Indigofera boviperda subsp. *boviperda*	0.2	<1
Jasminum sp. Exmouth (G. Marsh 77)	0.4	<1
Labichea cassioides	1	1
Scaevola sericophylla	0.6	1
Solanum lasiophyllum	0.4	<1
Thysanotus exfimbriatus	0.3	<1
Tricoryne corynothecoides	0.4	<1
Triodia glabra	0.5	55

YR2009

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201528 **mE** 7584917 **mN** **Lat.** -21.8144 **Long.** 114.1131

Habitat Slight rocky rise

Aspect N **Slope** Very Gentle

Soil Type Red loamy sand

Rock Type Limestone

Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 45 % cover **Weeds** 0 % cover

Vegetation M+ ^^*Melaleuca cardiophylla*,*Banksia ashbyi* subsp. *boreoscaia*,*Labichea cassioides*\^shrub\3\i;G^,^*Triodia angusta*\^,hummock grass\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1.5	<1	
Acacia gregorii		0.3	3	
Acacia tetragonophylla		1	<1	
Acanthocarpus humilis		0.4	<1	
Alyogyne pinoniana		0.4	<1	

Banksia ashbyi subsp. *boreoscaia*	1.5	2
Corymbia zygophylla	0.8	<1
Dampiera incana var. *incana*	0.4	<1
Diplopeltis eriocarpa	0.3	<1
Hakea stenophylla subsp. *stenophylla*	0.5	1
Hannafordia quadrivalvis subsp. *recurva*	0.4	<1
Hibbertia capensis	0.4	<1
Labichea cassioides	1	1
Melaleuca cardiophylla	1	10
Solanum lasiophyllum	0.5	<1
Triodia angusta	0.4	45

YR2010

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200207 **mE** 7585419 **mN** **Lat.** -21.8097 **Long.** 114.1004

Habitat Flat, semi coastal

Aspect N/A **Slope** N/A

Soil Type Light grey sand

Rock Type Limestone

Loose Rock <2 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 45 % cover **Weeds** <1 % cover

Vegetation M+ ^*Acacia bivenosa*\^shrub\3\r;G ^*Triodia epactia*,^*Triodia* sp.\^shrub,hummock grass\1\c

Veg. Condition Very Good

Disturbance Road edge effects

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1	5	
**Cenchrus ciliaris*		0.2	<1	
Erodium cygnorum		0.1	<1	
Melaleuca cardiophylla		0.8	<1	
Scaevola spinescens		0.5	<1	

Solanum lasiophyllum	0.4	<1
Thysanotus exfimbriatus	0.3	<1
Triodia epactia	0.4	45
Triodia sp.	0.4	10
Wurmbea odorata	0.2	<1

YR2011

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201334 **mE** 7584982 **mN** **Lat.** -21.8138 **Long.** 114.1112

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Red sand

Rock Type Nil

Loose Rock 0 % cover **Litter** 20 % cover ; 0-2 cm in depth

Bare ground 45 % cover **Weeds** 0 % cover

Vegetation M+ ^*Banksia ashbyi* subsp. *boreoscaia*,^*Corymbia zygophylla*\^shrub\3\i;G ^*Triodia glabra*\^hummock grass\1\c

Veg. Condition Very Good

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia coriacea subsp. *coriacea*		1	<1	
Acacia gregorii		0.4	1	
Acacia tetragonophylla		2	1	
Banksia ashbyi subsp. *boreoscaia*		1.8	10	
Corymbia zygophylla		1	1	

Grevillea stenobotrya	2	<1
Heliotropium glanduliferum	0.3	<1
Indigofera boviperda subsp. *boviperda*	0.3	<1
Jasminum sp. Exmouth (G. Marsh 77)	0.5	<1
Pimelea ammocharis	0.5	<1
Scaevola sericophylla	0.6	<1
Seringia hermanniifolia	0.4	<1
Triodia glabra	0.4	55

YR2012

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 201148 **mE** 7585083 **mN** **Lat.** -21.8129 **Long.** 114.1094

Habitat Mid-Slope

Aspect SE **Slope** Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-2 cm in depth

Bare ground 50 % cover **Weeds** 0 % cover

Vegetation M+ ^*Melaleuca cardiophylla*,^*Exocarpos aphyllus*\^shrub\3\i;G ^*Triodia wiseana*,^*Hibbertia capensis*\^hummock grass,shrub\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.6	<1	
Acacia gregorii		0.3	<1	
Alyogyne pinoniana		0.5	<1	
Cassytha capillaris		0.5	<1	
Eremophila forrestii subsp. *capensis*	P 3	0.5	<1	1

Exocarpos aphyllus		1	3	
Grevillea variifolia subsp. *variifolia*		1	<1	
Hibbertia capensis		0.4	3	
Isotropis atropurpurea		0.3	<1	
Leptosema macrocarpum		0.4	<1	
Melaleuca cardiophylla		1	10	
Nicotiana occidentalis subsp. *occidentalis*		0.4	<1	
Ptilotus obovatus		0.4	<1	
Scaevola tomentosa		0.4	<1	
Solanum lasiophyllum		0.3	<1	
Stackhousia umbellata	P 3	0.3	<1	1
Tricoryne corynothecoides		0.4	<1	
Triodia angusta		0.5	<1	
Triodia epactia		0.4	<1	
Triodia wiseana		0.4	50	

YR2013

Staff SOK **Date** 18/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200994 **mE** 7585152 **mN** **Lat.** -21.8122 **Long.** 114.1079

Habitat Upper-Slope

Aspect E **Slope** Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 20-50 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 55 % cover **Weeds** 0 % cover

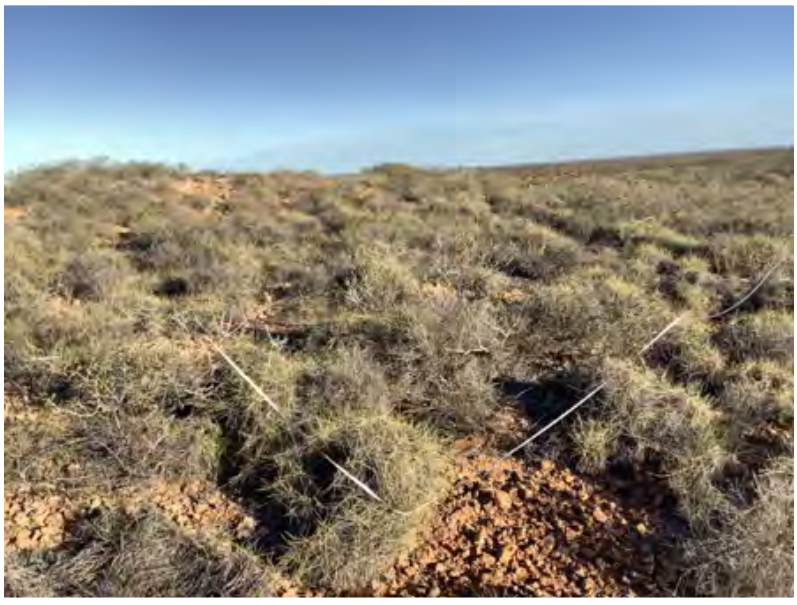
Vegetation M+ ^*Melaleuca cardiophylla*\^shrub\3\i;G ^^*Triodia wiseana*,*Hibbertia capensis*,*Acacia gregorii*\^hummock grass,shrub\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia gregorii		0.3	2	
Acacia tetragonophylla		2	<1	
Acanthocarpus humilis		0.3	<1	
Cassytha capillaris		0.4	<1	
Dampiera incana var. *incana*		0.3	<1	

Diplopeltis eriocarpa		0.2	<1	
Eremophila forrestii subsp. *capensis*	P 3	0.3	<1	1
Eriachne helmsii		0.3	<1	
Exocarpos aphyllus		0.5	<1	
Goodenia tenuiloba		0.2	<1	
Hannafordia quadrivalvis subsp. *recurva*		0.4	<1	
Hibbertia capensis		0.4	3	
Indigofera monophylla		0.2	<1	
Leptosema macrocarpum		0.4	<1	
Melaleuca cardiophylla		1	10	
Paspalidium clementii		0.2	<1	
Ptilotus exaltatus		0.4	<1	
Roepera retivalvis		0.2	<1	
Solanum lasiophyllum		0.3	<1	
Stackhousia muricata		0.3	<1	
Stackhousia umbellata	P 3	0.3	<1	1
Tribulus suberosus		0.3	<1	
Tricoryne corynothecoides		0.4	<1	
Triodia wiseana		0.4	45	

YR2014

Staff SOK **Date** 19/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200875 **mE** 7585352 **mN** **Lat.** -21.8104 **Long.** 114.1068

Habitat Upper-Slope

Aspect S **Slope** Moderate

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 60 % cover **Weeds** 0 % cover

Vegetation M+ ^*Melaleuca cardiophylla*\^shrub\3\i;G ^*Triodia wiseana*,^*Triodia angusta*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		0.8	<1	
Acacia gregorii		0.3	<1	
Acacia tetragonophylla		1	<1	
Alectryon oleifolius		1	<1	
Cynanchum viminale subsp. *australe*		0.5	<1	

Dampiera incana var. *incana*		0.4	<1	
Eremophila forrestii subsp. *capensis*	P 3	0.5	<1	5
Eriachne mucronata		0.4	<1	
Erodium cygnorum		0.1	<1	
Exocarpos aphyllus		0.6	<1	
Grevillea variifolia subsp. *variifolia*		0.7	<1	
Hibbertia capensis		0.4	<1	
Leptosema macrocarpum		0.4	<1	
Logania litoralis		0.5	<1	
Melaleuca cardiophylla		1	20	
Nicotiana occidentalis subsp. *occidentalis*		0.4	<1	
Ptilotus obovatus		0.5	<1	
Roepera retivalvis		0.1	<1	
Scaevola spinescens			<1	
Scaevola tomentosa		0.5	<1	
Senna artemisioides subsp. *oligophylla*		0.8	<1	
Solanum lasiophyllum		0.3	<1	
Stackhousia umbellata	P 3	0.3	<1	5
Tinospora esiangkara	P 2	0.4	<1	4
Tribulus suberosus		0.5	<1	
Triodia angusta		0.5	10	
Triodia wiseana		0.5	35	

YR2015

Staff SOK **Date** 19/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200755 **mE** 7585237 **mN** **Lat.** -21.8114 **Long.** 114.1056

Habitat Lower-Slope

Aspect W **Slope** Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 5 % cover ; 0-1 cm in depth

Bare ground 65 % cover **Weeds** 0 % cover

Vegetation M+ ^*Acacia bivenosa*,^*Grevillea variifolia* subsp. *variifolia*\^shrub\3\r;G ^*Triodia epactia*,^*Triodia angusta*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes Atypical community in depression between hills

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1.2	3	
Acacia pyrifolia var. *pyrifolia*		0.8	<1	
Acacia tetragonophylla		1	<1	
Clerodendrum tomentosum		1.5	<1	
Cucumis variabilis		0.5	<1	

Cullen pogonocarpum		0.1	<1	
Cynanchum viminale subsp. *australe*		0.6	<1	
Diplopeltis eriocarpa		0.2	<1	
Eremophila forrestii subsp. *capensis*	P 3	0.5	<1	3
Eremophila longifolia		1	<1	
Eriachne mucronata		0.4	<1	
Erodium cygnorum		0.1	<1	
Eulalia aurea		0.5	<1	
Euphorbia coghlanii		0.1	<1	
Euphorbia tannensis subsp. *eremophila*		0.3	<1	
Evolvulus alsinoides var. *villosicalyx*		0.1	<1	
Ficus brachypoda		1	<1	
Gossypium robinsonii		0.5	<1	
Grevillea variifolia subsp. *variifolia*		1.2	2	
Haloragis trigonocarpa		0.1	<1	
Hannafordia quadrivalvis subsp. *recurva*		0.5	<1	
Ipomoea costata		1.5	<1	
Jasminum sp. Exmouth (G. Marsh 77)		0.5	<1	
Melaleuca cardiophylla		1.5	<1	
Melhania oblongifolia		0.3	<1	
Nicotiana occidentalis subsp. *occidentalis*		0.3	<1	
Phyllanthus erwinii		0.1	<1	
Ptilotus exaltatus		0.3	<1	
Ptilotus obovatus		0.5	<1	
Scaevola spinescens		1	<1	
Senna artemisioides subsp. *oligophylla*		0.5	<1	
Solanum diversiflorum		0.4	<1	
Solanum lasiophyllum		0.4	<1	
Stackhousia umbellata	P 3	0.3	<1	5
Thysanotus exfimbriatus		0.6	<1	
Tinospora esiangkara	P 2	1	<1	1
Tribulus suberosus		0.5	<1	
Trichodesma zeylanicum		0.4	<1	
Triodia angusta		0.5	10	
Triodia epactia		0.4	25	

YR2016

Staff SOK **Date** 19/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200657 **mE** 7585441 **mN** **Lat.** -21.8096 **Long.** 114.1047

Habitat Lower-Slope

Aspect W **Slope** Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 5 % cover ; 0-1 cm in depth

Bare ground 65 % cover **Weeds** <1 % cover

Vegetation M+ ^^*Melaleuca cardiophylla*,*Grevillea variifolia* subsp. *variifolia*,*Acacia bivenosa*\^shrub\3\i;G ^*Triodia angusta*\^hummock grass\1\

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia arida		0.5	<1	
Acacia bivenosa		1.2	2	
Acacia coriacea subsp. *coriacea*		1	<1	
Acacia pyrifolia var. *pyrifolia*		0.8	<1	
Acacia tetragonophylla		1	<1	

**Cenchrus ciliaris*		0.3	<1	
Cymbopogon ambiguus		0.5	<1	
Cynanchum viminale subsp. *australe*		0.7	<1	
Diplopeltis eriocarpa		0.3	<1	
Eremophila forrestii subsp. *capensis*	P 3	0.5	<1	3
Exocarpos aphyllus		1	<1	
Grevillea variifolia subsp. *variifolia*		1.2	2	
Haloragis trigonocarpa		0.2	<1	
Hybanthus aurantiacus		0.2	<1	
Indigofera monophylla		0.4	<1	
Jasminum sp. Exmouth (G. Marsh 77)		0.5	<1	
Melaleuca cardiophylla		1	15	
Melhania oblongifolia		0.3	<1	
Nicotiana occidentalis subsp. *occidentalis*		0.3	<1	
Phyllanthus maderaspatensis		0.3	<1	
Ptilotus obovatus		0.4	<1	
Senna artemisioides subsp. *oligophylla*		0.6	<1	
Solanum lasiophyllum		0.4	<1	
Tinospora esiangkara	P 2	0.4	<1	1
Tribulus suberosus		0.4	<1	
Triodia angusta		0.4	30	
Wahlenbergia capillaris		0.1	<1	

YR2017

Staff SOK **Date** 19/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200644 **mE** 7585296 **mN** **Lat.** -21.8109 **Long.** 114.1046

Habitat Depression between hills

Aspect E **Slope** Very Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 5 % cover ; 0-1 cm in depth

Bare ground 65 % cover **Weeds** <1 % cover

Vegetation M+ ^^*Grevillea variifolia* subsp. *variifolia*,*Acacia bivenosa*,*Melaleuca cardiophylla*\^shrub\3\i;G ^*Triodia epactia*,^*Triodia angusta*\^hummock grass\1\c

Veg. Condition Excellent

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1.2	3	
Acacia coriacea subsp. *coriacea*		1	<1	
Acacia tetragonophylla		1	<1	
Corymbia hamersleyana		2	<1	
Cucumis variabilis		0.5	<1	

Cynanchum viminale subsp. *australe*		0.8	<1	
Diplopeltis eriocarpa		0.3	<1	
Eremophila forrestii subsp. *capensis*	P 3	0.5	<1	2
Erodium cygnorum		0.1	<1	
Exocarpos aphyllus		1	<1	
Gossypium robinsonii		0.6	<1	
Grevillea variifolia subsp. *variifolia*		1.2	6	
Hannafordia quadrivalvis subsp. *recurva*		0.4	<1	
Hibbertia capensis		0.4	<1	
Hibiscus sp. Gardneri (A.L. Payne PRP 1435)		0.4	<1	
Hybanthus aurantiacus		0.2	<1	
Indigofera boviperda subsp. *boviperda*		0.2	<1	
Melaleuca cardiophylla		1	2	
Nicotiana occidentalis subsp. *occidentalis*		0.3	<1	
Ptilotus obovatus		0.5	<1	
Roepera retivalvis		0.2	<1	
Salsola australis		0.4	<1	
Scaevola spinescens		1	<1	
Scaevola tomentosa		0.4	<1	
Senna artemisioides subsp. *oligophylla*		0.7	<1	
Solanum lasiophyllum		0.3	<1	
Tribulus suberosus		1	<1	
Trichodesma zeylanicum		0.3	<1	
Triodia angusta		0.4	10	
Triodia epactia		0.4	20	

YR2018

Staff SOK **Date** 19/08/2020 **Season** A

Revisit

Type Q 60 m x 15 m

Location

MGA Zone 50 200542 **mE** 7585374 **mN** **Lat.** -21.8101 **Long.** 114.1036

Habitat Gully

Aspect E **Slope** Very Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 20-50 % cover; 60-200 mm in size **Litter** 25 % cover ; 0-2 cm in depth

Bare ground 80 % cover **Weeds** <1 % cover

Vegetation M+ ^^*Grevillea calcicola*,*Acacia coriacea* subsp. *coriacea*,*Ficus brachypoda*\^shrub\4\i;G ^*Triodia angusta*\^hummock grass\2\i

Veg. Condition Very Good

Disturbance Weeds

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia coriacea subsp. *coriacea*		3	10	
Acacia tetragonophylla		1	<1	
Alectryon oleifolius		1	<1	
**Bidens subalternans*		0.3	<1	
**Cenchrus ciliaris*		0.3	<1	

Dipteracanthus australasicus subsp. *australasicus*		0.4	<1	
Ficus brachypoda		3	3	
Grevillea calcicola	P 3	4	15	1
Ipomoea costata		1	<1	
Melhania oblongifolia		0.4	<1	
Plumbago zeylanica		0.5	<1	
Ptilotus obovatus		0.5	<1	
Tinospora esiangkara	P 2	0.4	<1	1
Triodia angusta		0.5	10	

YR2019

Staff SOK **Date** 19/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200458 **mE** 7585539 **mN** **Lat.** -21.8086 **Long.** 114.1028

Habitat Lower-Slope

Aspect W **Slope** Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 5 % cover ; 0-1 cm in depth

Bare ground 50 % cover **Weeds** <1 % cover

Vegetation M+ ^*Ficus brachypoda*\^shrub\3\r;G ^*Triodia angusta*\^shrub\1\c

Veg. Condition Very Good

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia arida		0.6	<1	
Acacia pyrifolia var. *pyrifolia*		0.8	<1	
Alectryon oleifolius		0.5	<1	
Calandrinia sp.		0.2	<1	
**Cenchrus ciliaris*		0.2	<1	

Corchorus crozophorifolius		0.3	<1	
Cucumis variabilis		0.4	<1	
Cynanchum viminale subsp. *australe*		0.3	<1	
Enchylaena tomentosa		0.4	<1	
Eremophila forrestii subsp. *capensis*	P 3	0.2	<1	2
Ficus brachypoda		2	4	
Gossypium robinsonii		0.5	<1	
Ipomoea costata		0.5	<1	
Melhania oblongifolia		0.3	<1	
Nicotiana occidentalis subsp. *occidentalis*		0.2	<1	
Ptilotus obovatus		0.5	<1	
Solanum lasiophyllum		0.3	<1	
Tephrosia rosea var. *clementii*		0.3	<1	
Tinospora esiangkara	P 2	0.3	<1	2
Triodia angusta		0.5	35	

YR2020

Staff SOK **Date** 19/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200578 **mE** 7585689 **mN** **Lat.** -21.8073 **Long.** 114.1040

Habitat Lower-Slope

Aspect W **Slope** Very Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 20-50 % cover; 20-60 mm in size **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 35 % cover **Weeds** <1 % cover

Vegetation M+ ^*Acacia bivenosa*\^shrub\3\r;G ^*Triodia epactia*,^*Triodia angusta*\^hummock grass\1\c

Veg. Condition Very Good

Disturbance Minor weeds

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1	5	
Acacia coriacea subsp. *coriacea*		0.5	<1	
Acacia pyrifolia var. *pyrifolia*		1	<1	
Enchylaena tomentosa		0.4	<1	
Gossypium robinsonii		0.5	<1	

Melaleuca cardiophylla	1	<1
Ptilotus obovatus	0.5	<1
Senna artemisioides subsp. *oligophylla*	1	<1
Solanum lasiophyllum	0.4	<1
Triodia angusta	0.5	10
Triodia epactia	0.4	50
Triodia wiseana	0.5	<1

YR2021

Staff SOK **Date** 21/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 202266 **mE** 7585484 **mN** **Lat.** -21.8094 **Long.** 114.1203

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Red brown sand

Rock Type Nil

Loose Rock 0 % cover **Litter** 10 % cover ; 0-1 cm in depth

Bare ground 55 % cover **Weeds** <1 % cover

Vegetation M+ ^^*Acacia sclerosperma* subsp. *sclerosperma*,*Acacia bivenosa*,*Acacia coriacea* subsp. *coriacea*\^shrub\3\r;G ^*Triodia epactia*,^*Acacia gregorii*\^hummock grass,shrub\1\c

Veg. Condition Very Good

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia bivenosa		1	1	
Acacia coriacea subsp. *coriacea*		1	1	
Acacia gregorii		0.3	5	
Acacia sclerosperma subsp. *sclerosperma*		1	5	
Alyogyne pinoniana		0.5	<1	

**Cenchrus ciliaris*	0.3	<1
Enchylaena tomentosa	0.7	<1
Euphorbia tannensis subsp. *eremophila*	0.3	<1
Heliotropium glanduliferum	0.3	<1
Indigofera boviperda subsp. *boviperda*	0.3	<1
Maireana lanosa	0.4	<1
Nicotiana occidentalis subsp. *occidentalis*	0.3	<1
Scaevola cunninghamii	0.4	<1
Scaevola pulchella	0.3	<1
Solanum lasiophyllum	0.4	<1
Thysanotus exfimbriatus	0.3	<1
Triodia epactia	0.4	45
Wurmbea odorata	0.2	<1

YR2022

Staff SOK **Date** 21/08/2020 **Season** A

Revisit

Type Q 30 m x 30 m

Location

MGA Zone 50 200583 **mE** 7585543 **mN** **Lat.** -21.8086 **Long.** 114.1040

Habitat Lower-Slope

Aspect E **Slope** Gentle

Soil Type Red brown loam

Rock Type Limestone

Loose Rock 20-50 % cover; 20-60 mm in size **Litter** 5 % cover ; 0-1 cm in depth

Bare ground 60 % cover **Weeds** <1 % cover

Vegetation M+ ^^*Ficus brachypoda*,*Grevillea variifolia* subsp. *variifolia*,*Acacia bivenosa*\^shrub\3\r;G ^*Triodia angusta*\^hummock grass\1\c

Veg. Condition Very Good

Disturbance Minimal

Fire Age >5 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia arida		0.6	<1	
Acacia bivenosa		1	1	
Acacia coriacea subsp. *coriacea*		0.5	<1	
Acacia pyrifolia var. *pyrifolia*		0.7	<1	
Amaranthus undulatus		0.2	<1	

Cassytha aurea var. *aurea*		0.5	<1	
**Cenchrus ciliaris*		0.3	<1	
Commelina ensifolia		0.2	<1	
Corchorus crozophorifolius		0.3	<1	
Cucumis variabilis		0.5	<1	
Cymbopogon ambiguus		0.2	<1	
Cynanchum viminale subsp. *australe*		0.5	<1	
Dipteracanthus australasicus subsp. *corynothecus*		0.1	<1	
Enchylaena tomentosa		0.1	<1	
Eremophila longifolia		0.8	<1	
Erodium cygnorum		0.1	<1	
Exocarpos aphyllus		0.4	<1	
Ficus brachypoda		1.7	5	
Grevillea variifolia subsp. *variifolia*		0.7	2	
Haloragis trigonocarpa		0.2	<1	
Indigofera monophylla		0.3	<1	
Jasminum sp. Exmouth (G. Marsh 77)		0.5	<1	
Maireana tomentosa		0.3	<1	
Melaleuca cardiophylla		0.5	<1	
Nicotiana occidentalis subsp. *occidentalis*		0.3	<1	
Oldenlandia crouchiana		0.1	<1	
Pterocaulon sphaeranthoides		0.3	<1	
Ptilotus obovatus		0.4	<1	
Rhagodia eremaea		0.5	<1	
Scaevola tomentosa		0.4	<1	
Senna artemisioides subsp. *oligophylla*		0.5	<1	
Solanum lasiophyllum		0.4	<1	
Tinospora esiangkara	P 2	0.5	<1	1
Triodia angusta		0.4	40	

APPENDIX FIVE DBCA REPORT FORMS

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3a July 2020

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Brachychiton obtusilobus **TPFL Pop. No:**

OBSERVATION DATE: 19/8/2020 **CONSERVATION STATUS:** P4 New population ☒

OBSERVER/S: Stephen Kern **PHONE:** 08 9430 8955

ROLE: Botanist **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Vlamingh Head, approximately 17 km north of Exmouth

Reserve No:

DBCA DISTRICT: Pilbara **LGA:** Shire of Exmouth Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7584976
Long / Easting: 201284
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☒	SLK/Pole ____ to ____	Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	20			
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☒ Dehisced fruit ☐ Percentage in flower: 50%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. 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+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

Threatened and Priority Flora Report Form

Version 1.3a July 2020

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☒
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☒
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☒
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☒
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☒
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

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

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Melaleuca cardiophylla
2. Triodia wiseana, Triodia angusta
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☒ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 15/10/2020

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Species	Cons. Code	Count	Date	Easting	Northing
Brachychiton obtusilobus	P4	1	19/08/2020	201285	7584977
Brachychiton obtusilobus	P4	1	19/08/2020	200900	7585309
Brachychiton obtusilobus	P4	5	19/08/2020	200831	7585492
Brachychiton obtusilobus	P4	1	19/08/2020	200594	7585312
Brachychiton obtusilobus	P4	3	19/08/2020	200550	7585314
Brachychiton obtusilobus	P4	1	19/08/2020	200590	7585369
Brachychiton obtusilobus	P4	2	19/08/2020	200507	7585440
Brachychiton obtusilobus	P4	1	19/08/2020	200615	7585548
Brachychiton obtusilobus	P4	1	19/08/2020	200681	7585616
Brachychiton obtusilobus	P4	1	19/08/2020	200501	7585505
Brachychiton obtusilobus	P4	1	19/08/2020	200449	7585449
Brachychiton obtusilobus	P4	1	19/08/2020	200474	7585421
Brachychiton obtusilobus	P4	1	19/08/2020	200333	7585463

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3a July 2020

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TAXON: Corchorus congener **TPFL Pop. No:**

OBSERVATION DATE: 17/8/2020 **CONSERVATION STATUS:** P3 New population ☒

OBSERVER/S: Stephen Kern **PHONE:** 08 9430 8955

ROLE: Botanist **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Vlamingh Head, approximately 17 km north of Exmouth

Reserve No:

DBCA DISTRICT: Pilbara **LGA:** Shire of Exmouth Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7585571
Long / Easting: 202186
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☒	SLK/Pole ____ to ____	Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	15			
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☒ Dehisced fruit ☐ Percentage in flower: 0%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. 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+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

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Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

Threatened and Priority Flora Report Form

Version 1.3a July 2020

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☒
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☒
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☒
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☒
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☒
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

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

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Acacia sclerosperma subsp. sclerosperma, Acacia coriacea
2. Triodia epactia
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☒ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 15/10/2020

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RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Species	Cons. Code	Count	Date	Easting	Northing
Corchorus congener	P3	1	17/08/2020	202186	7585572
Corchorus congener	P3	1	18/08/2020	201849	7585005
Corchorus congener	P3	1	17/08/2020	202191	7585549
Corchorus congener	P3	2	17/08/2020	202243	7585355
Corchorus congener	P3	2	18/08/2020	202212	7585529
Corchorus congener	P3	2	18/08/2020	202203	7585390
Corchorus congener	P3	1	18/08/2020	202138	7585291
Corchorus congener	P3	2	18/08/2020	202140	7585516
Corchorus congener	P3	1	18/08/2020	202177	7585580
Corchorus congener	P3	2	19/08/2020	202052	7585057

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Version 1.3a July 2020

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TAXON: Daviesia pleurophylla **TPFL Pop. No:**

OBSERVATION DATE: 17/8/2020 **CONSERVATION STATUS:** P2 New population ☒

OBSERVER/S: Stephen Kern **PHONE:** 08 9430 8955

ROLE: Botanist **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Vlamingh Head, approximately 17 km north of Exmouth

Reserve No:

DBCA DISTRICT: Pilbara **LGA:** Shire of Exmouth Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 7584976

Long / Easting: 201284

ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐

No. satellites: Map used:

Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☒	SLK/Pole _____ to _____	Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	111			
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☒ Dehisced fruit ☐ Percentage in flower: 50%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. 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+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

Threatened and Priority Flora Report Form

Version 1.3a July 2020

HABITAT INFORMATION:

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

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☒
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☒
Brown ☐
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

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

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Banksia ashbyi, Grevillea stenobotrya, Acacia coriacea subsp. coriacea
2. Triodia glabra
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☒ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 15/10/2020

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Species	Cons. Code	Count	Date	Easting	Northing
Daviesia pleurophylla	P2	1	18/08/2020	201285	7584977
Daviesia pleurophylla	P2	1	18/08/2020	201796	7585094
Daviesia pleurophylla	P2	3	18/08/2020	201727	7584957
Daviesia pleurophylla	P2	1	18/08/2020	201810	7585072
Daviesia pleurophylla	P2	1	18/08/2020	201826	7585067
Daviesia pleurophylla	P2	1	18/08/2020	201786	7585025
Daviesia pleurophylla	P2	1	18/08/2020	201758	7584998
Daviesia pleurophylla	P2	3	18/08/2020	201739	7584945
Daviesia pleurophylla	P2	5	19/08/2020	201720	7584913
Daviesia pleurophylla	P2	1	19/08/2020	201721	7584886
Daviesia pleurophylla	P2	3	19/08/2020	201690	7584797
Daviesia pleurophylla	P2	5	19/08/2020	201682	7584764
Daviesia pleurophylla	P2	5	19/08/2020	201624	7584649
Daviesia pleurophylla	P2	50	19/08/2020	202340	7584935
Daviesia pleurophylla	P2	30	19/08/2020	201359	7584879

Department of **Biodiversity, Conservation and Attractions**

Threatened and Priority Flora Report Form

Version 1.3a July 2020

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Eremophila forrestii subsp. capensis **TPFL Pop. No:**

OBSERVATION DATE: 18/8/2020 **CONSERVATION STATUS:** P3 New population ☐

OBSERVER/S: Stephen Kern **PHONE:** 08 9430 8955

ROLE: Botanist **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Vlamingh Head, approximately 17 km north of Exmouth

Reserve No:

DBCA DISTRICT: Pilbara **LGA:** Shire of Exmouth Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7584956
Long / Easting: 201727
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☒	SLK/Pole ____ to ____	Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	87			
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☒ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 0%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. 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+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

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RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

Threatened and Priority Flora Report Form

Version 1.3a July 2020

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☒
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☒
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☒
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☒
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☒
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

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

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Melaleuca cardiophylla
2. Triodia wiseana, Triodia angusta
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☒ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 15/10/2020

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RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Species	Cons. Code	Count	Date	Easting	Northing
Eremophila forrestii subsp. *capensis*	P3	1	18/08/2020	201727	7584957
Eremophila forrestii subsp. *capensis*	P3	1	18/08/2020	201148	7585083
Eremophila forrestii subsp. *capensis*	P3	1	18/08/2020	200994	7585152
Eremophila forrestii subsp. *capensis*	P3	5	19/08/2020	200875	7585352
Eremophila forrestii subsp. *capensis*	P3	3	19/08/2020	200755	7585237
Eremophila forrestii subsp. *capensis*	P3	3	19/08/2020	200657	7585441
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200644	7585296
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200458	7585539
Eremophila forrestii subsp. *capensis*	P3	1	18/08/2020	201761	7584942
Eremophila forrestii subsp. *capensis*	P3	2	18/08/2020	201271	7584998
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200949	7585139
Eremophila forrestii subsp. *capensis*	P3	1	19/08/2020	200941	7585200
Eremophila forrestii subsp. *capensis*	P3	4	19/08/2020	200934	7585180
Eremophila forrestii subsp. *capensis*	P3	10	19/08/2020	200883	7585097
Eremophila forrestii subsp. *capensis*	P3	10	19/08/2020	200825	7585091
Eremophila forrestii subsp. *capensis*	P3	10	19/08/2020	200878	7585212
Eremophila forrestii subsp. *capensis*	P3	3	19/08/2020	200920	7585343
Eremophila forrestii subsp. *capensis*	P3	3	19/08/2020	200804	7585173
Eremophila forrestii subsp. *capensis*	P3	1	19/08/2020	200806	7585209
Eremophila forrestii subsp. *capensis*	P3	10	19/08/2020	200870	7585428
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200762	7585305
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200722	7585211
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200737	7585457
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200656	7585442
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200609	7585513
Eremophila forrestii subsp. *capensis*	P3	2	19/08/2020	200644	7585576

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3a July 2020

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TAXON: Grevillea calcicola **TPFL Pop. No:**

OBSERVATION DATE: 19/8/2020 **CONSERVATION STATUS:** P3 New population ☐

OBSERVER/S: Stephen Kern **PHONE:** 08 9430 8955

ROLE: Botanist **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Vlamingh Head, approximately 17 km north of Exmouth

Reserve No:

DBCA DISTRICT: Pilbara **LGA:** Shire of Exmouth Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7584976
Long / Easting: 201284
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☒	SLK/Pole ____ to ____	Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	14			
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☒ Dehisced fruit ☐ Percentage in flower: 0%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. 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+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
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•			

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Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

Threatened and Priority Flora Report Form

Version 1.3a July 2020

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☒
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☒
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☒
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☒
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☒
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

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

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Melaleuca cardiophylla
2. Triodia wiseana, Triodia angusta
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☒ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 15/10/2020

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RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Species	Cons. Code	Count	Date	Easting	Northing
Grevillea calcicola	P3	1	19/08/2020	201285	7584977
Grevillea calcicola	P3	1	19/08/2020	200542	7585374
Grevillea calcicola	P3	1	19/08/2020	200935	7585194
Grevillea calcicola	P3	5	19/08/2020	200589	7585368
Grevillea calcicola	P3	5	19/08/2020	200508	7585426
Grevillea calcicola	P3	1	19/08/2020	200593	7585476

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TAXON: Stackhousia umbellata **TPFL Pop. No:**

OBSERVATION DATE: 18/8/2020 **CONSERVATION STATUS:** P3 New population ☐

OBSERVER/S: Stephen Kern **PHONE:** 08 9430 8955

ROLE: Botanist **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Vlamingh Head, approximately 17 km north of Exmouth

Reserve No:

DBCA DISTRICT: Pilbara **LGA:** Shire of Exmouth Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 7585083

Long / Easting: 201147

ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐

No. satellites: Map used:

Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☒	SLK/Pole _____ to _____	Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	99			
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☒ Dehisced fruit ☐ Percentage in flower: 0%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. 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+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
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HABITAT INFORMATION:

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

ROCK TYPE:
- Granite ☐
- Dolerite ☐
- Laterite ☐
- Ironstone ☐
- Limestone ☒
- Quartz ☐

Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
- 0-10% ☐
- 10-30% ☒
- 30-50% ☐
- 50-100% ☐

SOIL TYPE:
- Sand ☐
- Sandy loam ☐
- Loam ☒
- Clay loam ☐
- Light clay ☐
- Peat ☐

Specify other: _____

SOIL COLOUR:
- Red ☐
- Brown ☐
- Yellow ☐
- White ☐
- Grey ☒
- Black ☐

Specify other: _____

DRAINAGE:
- Well drained ☒
- Seasonally inundated ☐
- Permanently inundated ☐
- Tidal ☐

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

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Melaleuca cardiophylla
2. Triodia wiseana, Triodia angusta
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☒ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☒ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

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SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☒ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Stephen Kern Role: Botanist Signed: Stephen Kern Date: 15/10/2020

Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Species	Cons. Code	Count	Date	Easting	Northing
Stackhousia umbellata	P3	1	18/08/2020	201148	7585083
Stackhousia umbellata	P3	1	18/08/2020	200994	7585152
Stackhousia umbellata	P3	5	19/08/2020	200875	7585352
Stackhousia umbellata	P3	5	19/08/2020	200755	7585237
Stackhousia umbellata	P3	2	19/08/2020	200951	7585149
Stackhousia umbellata	P3	5	19/08/2020	200970	7585194
Stackhousia umbellata	P3	5	19/08/2020	200944	7585209
Stackhousia umbellata	P3	1	19/08/2020	200934	7585193
Stackhousia umbellata	P3	3	19/08/2020	200918	7585348
Stackhousia umbellata	P3	3	19/08/2020	200888	7585323
Stackhousia umbellata	P3	3	19/08/2020	200818	7585318
Stackhousia umbellata	P3	3	19/08/2020	200858	7585386
Stackhousia umbellata	P3	20	19/08/2020	200871	7585400
Stackhousia umbellata	P3	3	21/08/2020	201201	7585054
Stackhousia umbellata	P3	10	21/08/2020	201104	7584991
Stackhousia umbellata	P3	10	21/08/2020	201034	7585014
Stackhousia umbellata	P3	10	21/08/2020	201001	7585048
Stackhousia umbellata	P3	3	21/08/2020	201086	7585079
Stackhousia umbellata	P3	3	21/08/2020	201108	7585077
Stackhousia umbellata	P3	3	21/08/2020	201219	7585079

Department of Biodiversity, Conservation and Attractions

Threatened and Priority Flora Report Form

Version 1.3a July 2020

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Tinospora esiangkara **TPFL Pop. No:**

OBSERVATION DATE: 18/8/2020 **CONSERVATION STATUS:** P2 New population ☐

OBSERVER/S: Stephen Kern **PHONE:** 08 9430 8955

ROLE: Botanist **ORGANISATION:** Ecoscape

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Vlamingh Head, approximately 17 km north of Exmouth

Reserve No:

DBCA DISTRICT: Pilbara **LGA:** Shire of Exmouth Land manager present: ☐

DATUM:
GDA94 / MGA94 ☒
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒
Lat / Northing: 7584976
Long / Easting: 201284
ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐
No. satellites: Map used:
Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☐
Conservation park ☐	Water reserve ☐	UCL ☒	SLK/Pole ____ to ____	Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☒ Full survey ☐ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☒ Count method: (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	47			
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☒ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 0%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. 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+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

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Department of **Biodiversity, Conservation and Attractions**

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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☒
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☒
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☒
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☒
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☒
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

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

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Melaleuca cardiophylla
2. Triodia wiseana, Triodia angusta
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☒ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☒

FENCING: Not required ☒ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

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Tinospora esiangkara	P2	1	18/08/2020	201285	7584977
Tinospora esiangkara	P2	4	19/08/2020	200875	7585352
Tinospora esiangkara	P2	1	19/08/2020	200755	7585237
Tinospora esiangkara	P2	1	19/08/2020	200657	7585441
Tinospora esiangkara	P2	1	19/08/2020	200542	7585374
Tinospora esiangkara	P2	2	19/08/2020	200458	7585539
Tinospora esiangkara	P2	1	21/08/2020	200583	7585543
Tinospora esiangkara	P2	8	18/08/2020	201505	7584938
Tinospora esiangkara	P2	5	18/08/2020	201495	7584916
Tinospora esiangkara	P2	5	18/08/2020	201221	7585086
Tinospora esiangkara	P2	1	18/08/2020	201232	7585080
Tinospora esiangkara	P2	1	19/08/2020	200932	7585195
Tinospora esiangkara	P2	1	19/08/2020	200920	7585342
Tinospora esiangkara	P2	1	19/08/2020	200904	7585320
Tinospora esiangkara	P2	5	19/08/2020	200868	7585453
Tinospora esiangkara	P2	5	19/08/2020	200817	7585475
Tinospora esiangkara	P2	1	19/08/2020	200659	7585330
Tinospora esiangkara	P2	2	19/08/2020	200647	7585293