Flora, Vegetation and Vertebrate Fauna Environmental Impact Assessment – Two Rocks Beach Access, Two Rocks

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Front Cover: Images from the project area

Contents

Chart

Tables

Figures

Appendices

EXECUTIVE SUMMARY

The City of Wanneroo requested a flora, vegetation and vertebrate fauna environmental impact assessment for a portion of the foreshore reserve in Two Rocks. This area is bound by the Indian Ocean to its west and Two Rocks Road to its east. The area lies within Bush Forever Site 397 and consists of approximately 13ha of land owned by the Western Australian Planning Commission (WAPC) and the Crown.

The project area includes an unformed sand track from Two Rocks Road to the beach and powerline access track that runs approximately parallel to Two Rocks Road. There is a smaller clearing that joins the powerline access track to Two Rock Road. Vegetation condition in the project area ranges from Degraded to Very Good to Excellent condition, and similarly fauna habitat condition ranges from highly degraded to excellent.

The project area contains three Priority plant species (i.e. *Leucopogon maritimus* (P1), *Beyeria cinerea* subsp. *cinerea* (P3) and *Stylidium maritimum* (P3)) and two Priority Ecological Communities (i.e. Swan 21 and 26).

The coastal dunes will have a few amphibian species, 8-15 reptile species, a few bird species and a couple of mammal species. Conservation significant fauna species potentially utilising the project area are Quenda (Priority 4) and Black-striped Snake (Priority 3). Carnaby's and Forest Red-tail Black-Cockatoos fly over the project area and may very infrequently forage in the project area as it isn't their preferred foraging habitat, and they would not roost or nest in the area. There is a low probability that the Peregrine Falcon, Osprey and Fork-tailed Swift would be seen flying over the project area. No species listed under the *Environment Protection and Biodiversity Conservation Act* will be significantly impacted by vegetation clearing in the project area, so a referral to the Commonwealth Department of Environment and Energy under this Act is not required.

It is recommended that a Flora and Vegetation Management Plan, a Fauna Management Plan and Construction Environmental Management Plan are prepared for the proposed development, to address the potential impacts identified in this report.

1 INTRODUCTION

1.1 Background

The City of Wanneroo (City) requested a flora, vegetation and vertebrate fauna environmental impact assessment for a portion of the foreshore reserve in Two Rocks. This area is bound by the Indian Ocean to its west and Two Rocks Road to its east. The area lies within Bush Forever Site 397 and consists of approximately 13ha of land owned by the Western Australian Planning Commission (WAPC) and the Crown ('project area').

The specific areas included in this environmental impact assessment (EIA) include:

- the entire Lot 8613 of Deposited Plan 213232 (94 Two Rocks Road, Two Rocks);
- part Lot 8989 of Deposited Plan 213232 owned by the WAPC, located adjacent to Lot 8613; and
- part Lot 15452 of Deposited Plan 40341 of Foreshore Reserve managed by the City, located adjacent to Lot 8613.

The City is proposing to construct a car park, access road and beach access track with preliminary designs showing a construction boundary (i.e. total vegetation clearing) of 3.78ha.

1.2 Project objectives and scope of works

Terrestrial Ecosystems was commissioned by the City of Wanneroo to undertake a Level 1 vertebrate fauna survey (2020) and One Tree Botanical was commissioned to undertake a three-phase Detailed and Targeted Flora and Vegetation Assessment (2020) for the project area.

This environmental impact assessment (EIA) report utilises the scientific content from each of these surveys and should be read in combination with the original survey documents.

The purpose of this report is to separately identify and assesses the impacts of the proposal against the following:

- Native Vegetation Clearing Principles;
- Diagnostic criteria – Banksia Woodlands of the Swan Coastal Plain;
- Key diagnostic characteristics – Tuart woodlands and forests of the Swan Coastal Plain ecological community; and
- Significant impact criteria for Threatened Ecological Communities.

1.3 Legislation and Guidelines

1.3.1 Planning and Development Act 2005

Much of the area was considered in the Bush Forever project that identified regionally significant bushland for protection by reservation or within a statutory planning framework (Department of Planning 2000b). The project area is within Bush Forever Site 397: "Coastal Strip from Wilbinga to Mindarie" (Government of Western Australia, 2000).

Bush Forever sites have some protection under State Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region under the *Planning and Development Act 2005*. There are a number of specific requirements for Environmental Impact Assessment (EIA) when a Bush Forever site is involved.

1.3.2 Western Australian Biodiversity Conservation Act 2016

State-listed Threatened Flora (TF) and Threatened Ecological Communities (TECs) are protected under the *Biodiversity Conservation (BC) Act 2016* as are Threatened and migratory fauna species.

1.3.3 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Threatened Flora (TF) and Threatened Ecological Communities (TECs) are listed as Matters of National Environmental Significance (MNES) and are protected under the *Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999* along with Threatened and migratory fauna species.

1.3.4 Western Australian Environmental Protection Act 1986

The *Environmental Protection (EP) Act 1986* is the guiding legislation for EIAs in Western Australia. Formal assessments for projects that are likely to have significant impacts are undertaken by the Environmental Protection Authority (EPA) under this legislation.

1.3.5 Technical Guidance under the EP Act 1986

The EPA's (2016c) technical guidance for flora and vegetation surveys for environmental impact assessment outlines the supporting information required for botanical assessments under the *EP Act 1996*. This includes, but is not limited to, formal assessment by the EPA and clearing permit applications by the Department of Water and Environmental Regulation (DWER).

The methodology for the vertebrate fauna survey for environmental impact assessment is based on guidance provided in the Environmental Protection Authority (EPA) *Technical Guidance Terrestrial Fauna Surveys* (EPA 2016b) and the *Technical Guidance - Sampling methods for terrestrial vertebrate fauna* (EPA 2016a).

1.3.6 Environmental Protection (Clearing of Native Vegetation) Regulations 2004

The *EP Act 1986* includes the *Clearance of Native Vegetation Regulations 2004* under which clearing permits are required to clear native vegetation.

2 EXISTING ENVIRONMENT

2.1 Location of project area

The project area is within the Swan Coastal Plain 2 (SWA2) Interim Biogeographic Regionalisation of Australia (IBRA) subregion. This subregion is a low lying coastal plain, once vegetated by Banksia and Tuart on sandy soils, and *Casuarina obesa* on outwash plains and paperbark in swampy areas (Mitchell et al. 2002). The subregion is part of the West Botanical Province and has high species richness and diversity in flora and vegetation which in turn results in high diversity for the vertebrate fauna.

2.2 Landforms and soils

The project area is in the Quindalup Dunes, which are calcareous sands formed into parabolic dunes and beach ridge plains (Churchward and McArthur 1980, Gozzard 2007). These dunes are Holocene in age (McArthur and Bettenay 1974).

2.3 Land use history

The dominant land uses in the bioregion are urban, rural residential, industrial, cultivation, forestry plantations, grazing and conservation areas. The greater Perth metropolitan area now extends almost from Mandurah to Alkimos, with residential areas further north at Yanchep and Two Rocks and east over the Darling Scarp. Much of the area is therefore highly disturbed as it was the site of early settlement in Western Australia. The subregion includes multiple conservation areas and nature reserves.

The project area consists of a relatively intact area of natural vegetation. An old vehicle track is present surrounded by comparatively undisturbed vegetation. It is possible that pastoral activities have occurred in the past or the area provided access to the beach and other areas prior to construction of Two Rocks Road. A corridor had been historically cleared for a powerline. An informal pedestrian track is present from Two Rocks Road to the beachfront and the beachfront is currently utilised for recreational purposes.

The project area is a part of a much larger unexploded ordinance (UXO) area: Yanchep Two Rocks Artillery Range (ID: 1035) (Department of Defence 2019). After WWII the broader area was used by Armed Forces for target practice. It is unclear whether any activity occurred specifically within the project area. The City of Wanneroo stated that it is within a zone described as having a ‘substantial occurrence’ of UXOs and that they would be conducting searches and undertaking remediation.

2.4 Climate

The project area is characterised as warm Mediterranean (Mitchell et al. 2002). Lancelin, which is approximately 70km to the north, but situated on the coast, has an annual rainfall of approximately 604mm, although this varies considerably from year-to-year. Although not closest, this is the most appropriate weather due to its proximity to the coast.

The highest mean maximum and minimum temperatures in Lancelin are between January and March (Bureau of Meteorology 2019). The lowest mean daily maximum and minimum temperatures occur in July (Chart 1). Rainfall predominantly occurs between May and August and winter rains result from low pressure cells moving in an easterly direction.

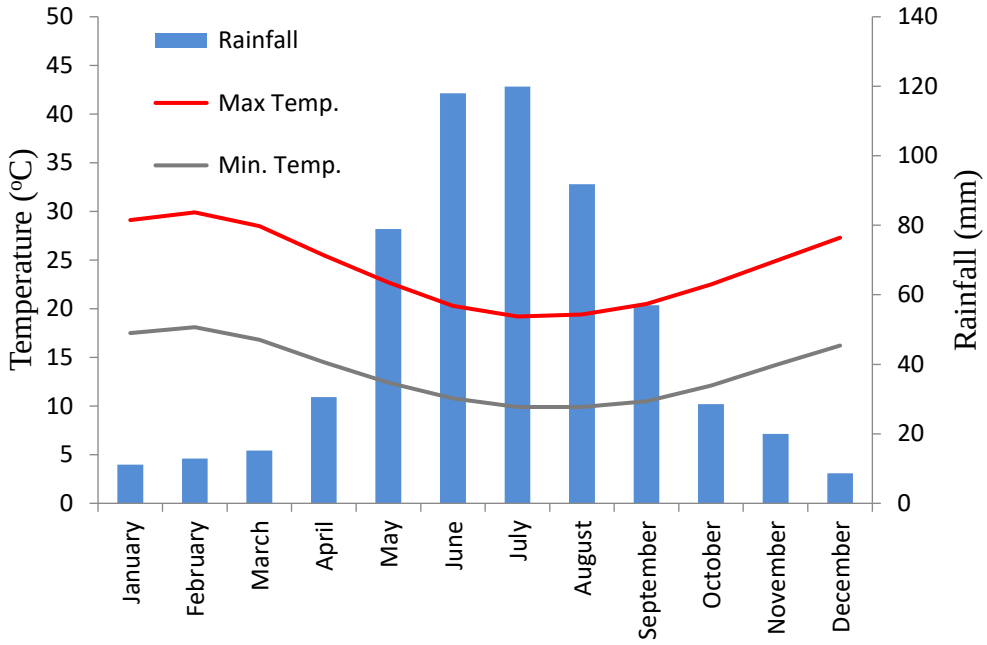

Chart 1. Climatic averages for Lancelin

The mean annual rainfall between 1965 and 2019 for Bureau of Meteorology weather recording station at Lancelin is 604mm (http://www.bom.gov.au/climate/averages/tables/cw_009114.shtml). Rainfall for the months of April to September 2019 leading up to the field survey was 458.7mm (http://www.bom.gov.au/climate/dwo/IDCJDW6071.latest.shtml); this is compared to a 54 year average for Lancelin over the same period of 495.7mm (http://www.bom.gov.au/climate/averages/tables/cw_009114.shtml).

2.5 Background and contextual information about species and communities at risk

2.5.1.1 Flora

Priority (PF) and Threatened (TF) Flora are an indicator of flora species at risk.

In the Sub-region of Swan Coastal Plain 2: Perth there are 64 TF species documented and 302 PF (this includes lichen, fungi and seagrasses). One species is presumed to be extinct.

2.5.1.2 Vegetation

No comprehensive contextual information is available to enable a meaningful analysis of which ecological communities that are at risk across the subregion.

Priority (PEC) and Threatened (TEC) Ecological Communities are a broad indication of which vegetation communities are restricted in distribution. However, there are usually numerous vegetation types within a defined ecological community, very few of which have been defined. Neither PECs nor their sub-types have been geographically quantified in a regional context.

There are 24 TECs listed for the Swan Coastal Plain bioregion, of which the project area is a part. There are 32 PECs listed for the Department of Biodiversity Conservation and Attractions (DBCA) Swan management region, of which the project area is a part.

2.5.1.3 Fauna

Mitchell et al. (2002) reported multiple vertebrate fauna species at risk in the subregion. Most of these species have not been recorded near the project area for many years (e.g. *Myrmecobius fasciatus, Pseudocheirus occidentalis, Setonix brachyurus*), however, species such as *Calyptorhynchus latirostris, Calyptorhynchus banksii naso, Isoodon fusciventer* and *Neelaps calonotos* are still present, and regularly encountered.

2.6 Bush Forever

The project area lies in, but on the northern end of the Bush Forever Site 397 – Coastal strip from Wilbinga to Mindarie. This site is approximately 400ha in size.

Vegetation in the Bush Forever site was described as ranging from near-pristine to degraded, with areas of severe local disturbance (Department of Planning 2000a). No detailed survey was completed for this site (Department of Planning 2000a) although multiple part-surveys have been completed. A part-survey by Robinson (1995) of coastal reserves north of Quinns Rocks indicated that there were 83 native flora and 23 weed flora present, representing >60% of the expected flora.

Inferred Floristic Community Types present at Bush Forever Site 397 are listed as:

- Supergroup 2: Seasonal Wetlands:
  - FCT 16: Highly saline seasonal wetlands (*Frankenia pauciflora* on Tamala Limestone Cliffs);
- Supergroup 4: Uplands centred on Quindalup and Spearwood Dunes:
  - FCT 29a: Coastal shrublands on shallow sands (recorded in project area and equivalent to PEC SWAN 21);
  - FCT 29b: Acacia shrublands on taller dunes;
  - FCT S11: Northern *Acacia rostellifera – Melaleuca systena* shrublands;
  - FCT S13: Northern *Olearia axillaris – Scaevola crassifolia* shrublands (recorded in project area and equivalent to PEC SWAN 21); and
  - FCT S14: *Spinifex longifolius* grasslands and low shrublands (recorded in project area).

FCT 24 (equivalent to PEC SWAN 21) was recorded in the project area, which potentially represents a new FCT record for Bush Forever Site 397. It may have been documented for the site subsequent to the Department of Planning (2000a) report.

The Bush Forever report suggested there were limited bird species (~30), one native mammal and eight reptile species based on a report by LeProvost Environmental Consultants.

3 RESULTS FROM THE FLORA, VEGETATION AND FAUNA SURVEYS

3.1 Flora

A full assessment of the flora in the project area is contained in One Tree Botanical (2020) report. A summary of the findings are provided below.

A total of 158 taxa were recorded from the project area, of which 99 or 63% were natives.

3.1.1 Threatened and Priority Flora

The DBCA Threatened Species and Communities Branch species database search did not identify any records of State listed TF or PF as being previously known from within the project area. A search of the *EPBC Act* Protected Matters Search Tool listed nine Threatened Flora (TF) as potentially occurring in the region. None of these species have previously been recorded from within the project area.

Table 1 provides a summary of the results from both the DBCA Threatened Species and Communities Branch flora database search and the *EPBC Act* Protected Matters Report and identifies the likelihood of each occurring within the project area.

Table 1. Threatened and Priority flora database search results

WESTERN AUSTRALIA	CONSERVATION STATUS*			OCCURRENCE (Known/Likely/Possible/Unlikely)
	Rating	WA	EPBC	
Chorizema varium	T	EN	EN	Possible, habitat present (sand over limestone) but known from further north.
Diuris micrantha	T	VU	EN	Unlikely. Known from wetland habitats.
Diuris purdiei	T	EN	EN	Unlikely. Known from wetland habitats further south and east.
Drakaea elastica	T	CR	VU	Unlikely. Known from areas adjacent to wetlands, mostly further south and inland.
Drakaea micrantha	T	EN	VU	Unlikely. Known from further south and/or more inland.
Eleocharis keigheryi	T	VU	VU	Unlikely. Known from wetlands.
Eucalyptus argutifolia	T	VU	VU	Possible, within known distribution and habitat present (sand over limestone). Not recorded.
Marianthus paralius	T	EN	EN	Possible, within known distribution and habitat present (sand over limestone). Not recorded.
Melaleuca sp. Wanneroo (G.J. Keighery 16705)	T	EN	EN	Possible but unlikely, assumed distribution to the south-east.
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	P1			Possible but unlikely, limestone ridges further inland. P1 are not well understood species.
Grevillea sp. Ocean Reef (D. Pike Joon 4)	P1			Possible. Further north than recorded but habitat present (sand over limestone). Not recorded.
Haloragis sp. Parrot Ridge (G.J. Keighery 11563)	P1			Possible but unlikely, distribution limestone ridges further inland. P1 are poorly understood.
Leucopogon maritimus	P1			Recorded during this survey.
Acacia benthamii	P2			Possible. Not recorded.
Fabronia hampeana	P2			Moss. Outside scope of study.
Hakea oligoneura	P2			Possible. Not recorded.
Lecania turicensis var. *turicensis*	P2			Lichen. Outside scope of study.
Austrostipa mundula	P3			Possible but unlikely. Known distribution further inland and to south.
Beyeria cinerea subsp. *cinerea*	P3			Recorded during this survey.
Calandrinia oraria	P3			Possible. Coastal dunes. Not recorded.
Conostylis bracteata	P3			Possible. Not recorded.

WESTERN AUSTRALIA	CONSERVATION STATUS*			OCCURRENCE (Known/Likely/Possible/Unlikely)
	Rating	WA	EPBC	
Hibbertia spicata subsp. *leptotheca*	P3			Possible. Known from sand over limestone. Not recorded.
Lasiopetalum membranaceum	P3			Possible but unlikely. Habitat sand over limestone. Known distribution further inland.
Leucopogon sp. Yanchep (M. Hislop 1986)	P3			Possible. Within known distribution. Various coastal habitats, sand and limestone. Not recorded.
Pimelea calcicola	P3			Possible. Within known distribution. Coastal limestone ridges. Not recorded.
Sarcozona bicarinata	P3			Possible. Within known distribution. Coastal sand. Not recorded.
Sphaerolobium calcicola	P3			Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.
Stylidium maritimum	P3			Recorded during this survey.
Stylidium paludicola	P3			Unlikely. Wetland habitat.
Caladenia speciosa	P4			Possible. Known from sand over limestone. Within known distribution. Not recorded.
Conostylis pauciflora subsp. *euryrhipis*	P4			Possible. Within distribution, coastal dune habitat present. Not recorded.
Conostylis pauciflora subsp. *pauciflora*	P4			Possible. Within distribution, coastal dune habitat present. Not recorded.
Dodonaea hackettiana	P4			Possible. Not recorded.
Jacksonia sericea	P4			Possible but unlikely. A fairly common species but further north than known distribution. Not recorded.
Lepidium pseudotasmanicum	P4			Possible. Known from area on sand. Not recorded.

Three Priority Flora (PF) were recorded in the project area. Please see Figure 2 (One Tree Botanical, 2020) for the distribution of each taxa.

Leucopogon maritimus (Priority 1 Flora)

This plant is a low spreading shrub to 40cm tall by 60cm wide from the heath family (Ericaceae). It has a fire sensitive rootstock. Flowers are small and white and clustered at the end of the branchlets. The flowers are white-hairy on the inside as is typical of *Leucopogon*. Flowering is documented as occurring between November and August, with the peak likely to be between April and June (Hislop 2011). During the field survey, plants were in flower in early September but had finished by the end of the month. It is an inconspicuous shrub when not in flower.

There are 17 collections of this species in the WA Herbarium (Council of Heads of Australasian Herbaria 2013) known from a small range in a narrow coastal band from Alkimos to north of Two Rocks. During the survey approximately 13 individuals were recorded from the project area. The distribution of this plant in the project area was restricted to Vegetation Type C (One Tree Botanical 2020).

Priority 1 Flora are those flora species that are poorly known, from fewer than five populations and that are potentially under threat. Such species are in urgent need of further survey to enable assessment for Threatened status.

Beyeria cinerea* subsp. *cinerea (Priority 3 Flora)

This plant is an open, erect to spreading shrub to 70cm tall from the spurge family (Euphorbiaceae). Its flowers are fairly inconspicuous with flowering recorded in July and from September to November. It is known from coastal heath and shrublands on sandy soil over limestone. It is differentiated from the more common *Beyeria cinerea* subsp. *borealis* by having truncate (blunt) to cuneate (wedge-shaped) rather than cordate (heart shaped) leaf bases as well as a more southerly distribution (Halford and Henderson 2008).

There are 51 collections of this species in the WA Herbarium (Council of Heads of Australasian Herbaria 2013) distributed in a narrow near-coastal band between Mandurah and Port Gregory. During the field survey 490 individuals were recorded from the project area. The distribution of this plant in the project area was restricted to Vegetation Type C (One Tree Botanical 2020).

Priority 3 Flora are those flora species that are known from several locations and do not appear to be under immediate threat. Can be comparatively well known but still not meet survey requirements for assessment for Threatened Flora status.

Stylidium maritimum (Priority 3 Flora)

This plant is a perennial herb to 70cm tall, with tufted linear strappy grass-like leaves 10-40cm long to 5.5cm wide from the triggerplant family (Stylidiaceae). Flowers are showy, in panicles on long stems, large white to purple but commonly pink triggerplant-shaped flowers, with flowering in September to November. Grows on sand over limestone, dunes, coastal heath and/or Banksia woodland (Western Australian Herbarium 1998).

There are 42 collections of this species in the WA Herbarium (Council of Heads of Australasian Herbaria 2013) distributed in a narrow near-coastal band between Mandurah and Leeman. During the field survey 35 individuals were recorded from the project area. The distribution of this plant in the project area was restricted to Vegetation Type C (One Tree Botanical 2020).

Priority 3 Flora are those flora species that are known from several locations and does not appear to be under immediate threat. Can be comparatively well known but still not meet survey requirements for assessment for Threatened Flora status.

3.1.2 Species of 'Other' Conservation Significance

Due to the project area being located on the western coastline of the continent, most species recorded are at the western most extent of their known range. Only those species that have extra range implications over and above westerly extent have been listed here. Table 2 presents those species with range implications.

Table 2. Species of 'Other Conservation Significance' as defined by EPA (2016)

Species	Significance
Cassytha aurea var. *aurea*	Southern extent known range. 20km range extension (closest collection from Guilderton).
Melaleuca cardiophylla	Close to southern extent of known range.
Stylidium hesperium	Poorly collected, only 2 records in WA Herbarium. Possibly a database error.
Leucopogon maritimus (P1)	Short range endemic <50km. Endemic to Swan Coastal Plain.

No further action is required for these particular taxa, however any plant material collected will be forwarded to the WA Herbarium to provide verifiable records for the extended range of each.

3.1.3 Weeds

Of the 59 species of weed recorded in the project area, nine were given a High rating for invasiveness and spread as environmental weeds under the Western Australian Environmental Weed Strategy (WAEWS) (Department of Conservation and Land Management 1999). Twenty-nine weeds recorded in the project area were given a Moderate rating.

3.2 Vegetation

3.2.1 Context

An assessment of the vegetation in the project area is contained in One Tree Botanical (2020) report. A summary of the findings of this report are provided below.

According to 1:250,000-scale vegetation mapping by Heddle et al. (1980), the project area is in vegetation complex 55: Quindalup. The original extent of Quindalup Complex within the IBRA region of Swan Coastal Plain has been calculated as 54,574ha, of which 33,012ha or 60.49 % remains (Government of Western Australia, 2019a).

Beard (1979) mapped the project area as occurring within Vegetation Association 1007: "Coastal heath and thicket on recent dunes".

Vegetation Association 1007 is described as originally consisting of 30,408ha of which 20,691ha or 68% remains. Of what remains, 2,755ha or 13.31% is protected or proposed for protection (Government of WA, 2019b). The Bush Forever portion of the project area would represent a part of those areas protected or proposed for protection.

3.2.2 Threatened and Priority Ecological Communities

The DBCA Threatened Species and Communities Branch database search did not identify any records of state listed TECs or PECs as being previously known from within the project area boundaries.

A search of the *EPBC Act* Protected Matters Search Tool (Department of Environment and Energy, 2019) listed five TECs as potentially occurring in the region. None of these species have previously been recorded from within the project area.

Table 3 summarises the results from the database searches and identifies the likelihood of each occurring within the project area.

Table 3: Threatened and Priority Ecological Communities Database Search Results (DBCA PEC and TEC Databases and EPBC Protected Matters Database)

WESTERN AUSTRALIA	COMMONWEALTH EQUIVALENT *(EPBC Act 1999)*	CONSERVATION STATUS*			OCCURRENCE Known/Likely/Possible/Unlikely
		DBCA	*BC Act*	*EPBC Act*	
Banksia Dominated Woodlands of the Swan Coastal Plain (SCP) IBRA Region	Banksia Woodlands of the SCP.	P3		EN	Unlikely. Project area is too close to the coast.
SCP20a: *Banksia attenuata* woodlands over species rich dense shrublands	Sub-type of above.		EN	EN	Unlikely. Project area is too close to the coast.
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the SCP.	Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP.	P3		CR	Unlikely. FCT24 and FCT29a can be associated with this TEC, however, no Tuart was recorded in or seen adjacent to the project area.
SCP25: Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands	Sub-type of above.	P3		CR	Unlikely. Known from further south.

WESTERN AUSTRALIA	COMMONWEALTH EQUIVALENT *(EPBC Act 1999)*	CONSERVATION STATUS*			OCCURRENCE Known/Likely/Possible/Unlikely
		DBCA	*BC Act*	*EPBC Act*	
SCP24: Northern Spearwood shrublands and woodlands		P3			Probable occurrence recorded during current study. Equivalent to SCP SWAN 24. Equivalent to FCT24 (Gibson et al., 1994). Non-typical, some affiliation with FCT29b, further west than generally known, may be an atypical subtype.
SCP29a: Coastal shrublands on shallow sands		P3			Recorded during current study. Equivalent to PEC SWAN 21. Equivalent to FCT29a (Gibson et al., 1994).
SCP29b: Acacia shrublands on taller dunes		P3			Possible. However statistical analysis indicated that FCT29a is present more dominantly than FCT29b.
SCP26a: *Melaleuca huegelii - Melaleuca systena* shrublands on limestone ridges (FCT 26a as originally described in Gibson *et al.* (1994))			EN		Unlikely. Related to FCT24 but generally known from Spearwood Dunes which are typically further inland.
SCP30a: *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands, SCP.			VU		Unlikely. Known distribution further south. Thought to be an apex community within for example FCT29-type communities.
SCP19b: Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson *et al.* (1994).	Sedgelands in Holocene dune swales of the southern SCP.		CR	EN	Beach ridge plain (Vegetation Type 1A-1C) may represent a pre-cursor potential habitat for this ecological community. However, the floristic analysis did not support this, or only very distantly. See One Tree Botanical (2020) for further discussion.
CAVES SCP01: Aquatic Root Mat Community Number 1 of Caves of the SCP.	Aquatic Root Mat Community in Caves of the SCP.		CR	EN	Unlikely. Subterranean ecology outside the scope of this assessment.
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh			VU	Unlikely. An estuarine ecological community.

Six vegetation types were identified in One Tree Botanical (2020) as occurring within the project area:

A Low-lying primary dunes on unconsolidated sand

- **A1:** Incipient Foredune (younger): Uniform regrowth of Grassland *Spinifex longifolius*.
- **A2:** Established Foredune (older): Sparse Shrubland *Olearia axillaris* over Grassland *Spinifex longifolius*.
- **A3:** Beach-ridge Plain: Open Shrubland *Olearia axillaris, Rhagodia baccata* subsp. *baccata* and *Pelargonium capitatum* over Sparse Grassland *Spinifex longifolius* and Sparse Vineland *Cassytha flava* var. *flava*.

B: Tall secondary dunes on unconsolidated sand

B1: Shrubland dominated by *Acacia cyclops, Scaevola crassifolia, Spyridium globulosum, Santalum acuminatum, Myoporum insulare, Olearia axillaris, Rhagodia baccata* subsp. *baccata* and *Acanthocarpus preissii*, Sparse Vineland *Hardenbergia comptoniana* and *Cassytha flava* var. *flava*. Over Forbland dominated by *Senecio pinnatifolius* var. *latilobus*.

C: Low dunes on semi-consolidated sand

C1: Species rich low Shrubland dominated by *Melaleuca systena* and species rich Forbland dominated by *Lomandra maritima* and Sparse Sedgeland *Lepidosperma calcicola* and Sparse Rushland *Desmocladus asper*.

D: Low rises with limestone outcropping

D1: Closed Shrubland *Melaleuca cardiophylla* with other typical shrubs *Melaleuca huegelii, Acacia xanthina* and *Dodonaea aptera* with Sparse Vineland *Cassytha aurea* var. *aurea* over Forbland of native and introduced herbs.

E: Cleared areas

E1: Historically cleared areas; informal walking paths, informal vehicular sand tracks (unused and partially overgrown).

Please see Figure 3 (One Tree Botanical, 2020) for vegetation type mapping.

3.2.3 Threatened ecological communities

No TECs protected under the *BC Act 2016* or the *EPBC Act 1999* were recorded in the project area.

3.2.4 Priority Ecological Communities

Two Priority 3 PECs were recorded in the project area:

Priority Ecological Community (PEC) SWAN 21: "Coastal shrublands on shallow sands, southern Swan Coastal Plain". Described as heaths on shallow sands over limestone close to the coast, with no single dominant but including *Spyridium globulosum, Rhagodia baccata* and *Olearia axillaris* (Department of Biodiversity Conservation and Attractions 2019). Also known as Floristic Community Type (FCT) 29a (Gibson et al. 1994). Represented in Vegetation Types A3, B1 and D1 (Figure 3 of One Tree Botanical (2020)).

Priority Ecological Community (PEC) SWAN 26: Northern Spearwood shrublands and woodlands. Also known as Floristic Community Type (FCT) 24 (Gibson et al. 1994). Described by DBCA (Department of Biodiversity Conservation and Attractions 2019) as "Heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system." This PEC is associated with the Tuart Woodlands TEC, however, no Tuart was observed within or adjacent to the project area. Likely to represent an unusual subtype, due to its extreme westerly distribution and three Priority Flora forming a substantial component of species assemblage of the vegetation. Represented in Vegetation Type C1 (Figure 3 of One Tree Botanical (2020)).

3.3 Vertebrate Fauna

An assessment of the vertebrate fauna in the project area is contained in Terrestrial Ecosystems (2020) . A summary of the findings of this report are provided below.

3.3.1 Fauna habitat

There are three broad fauna habitats in the project area (Table 4). Some of the site is highly disturbed or cleared and provides no habitat value.

Table 4. Habitat types

Habitat category	Description	Area (ha)
Coastal low heath on sand	Low coastal heath on unconsolidated sandy low primary dunes. The quality of fauna habitat was variable.	1.915
Mixed open shrubland and heath on sand	Mixed open shrubs on taller unconsolidated sandy dunes. The quality of fauna habitat was variable.	6.22
Mixed closed shrubland over sand and limestone	Mixed closed shrubs on sand with limestone outcropping. The quality of fauna habitat was variable.	1.973
Highly disturbed		0.302

Some of the site is highly disturbed or cleared and provides no habitat value (0.302ha).The condition of the fauna habitat varied from high quality, particularly in areas where the dense vegetation inhibits human access, to areas that are highly degraded, mostly by people accessing the beach.

3.3.2 Bioregional vertebrate fauna assemblage

Tables 5-8 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna surveys completed in the region (Terrestrial Ecosystems 2020).

Table 5. Birds potentially found near the project area

Family	Species	Common Name
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk
	Accipiter fasciatus	Brown Goshawk
	Aquila audax	Wedge-tailed Eagle
	Circus approximans	Swamp Harrier
	Elanus axillaris	Black-shouldered Kite
	Haliastur sphenurus	Whistling Kite
	Hieraaetus morphnoides	Little Eagle
	Lophoictinia isura	Square-tailed Kite
Anatidae	*Tadorna tadornoides*	Australian Shelduck
Podargidae	*Podargus strigoides*	Tawny Frogmouth
Casuariidae	*Dromaius novaehollandiae*	Emu
Laridae	*Chroicocephalus novaehollandiae*	Silver Gull
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis
Columbidae	*Columba livia*	Domestic Pigeon
	Ocyphaps lophotes	Crested Pigeon
	Phaps chalcoptera	Common Bronzewing
	Phaps elegans	Brush Bronzewing
	Spilopelia senegalensis	Laughing Turtle-dove
	Spilpopelia chinensis	Spotted Turtle-dove
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra
	Todiramphus sanctus	Sacred Kingfisher
Meropidae	*Merops ornatus*	Rainbow Bee-eater
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo
	Chalcites basalis	Horsfield's Bronze-cuckoo
	Chalcites lucidus	Shining Bronze-cuckoo
	Heteroscenes pallidus	Pallid Cuckoo
Falconidae	*Falco berigora*	Brown Falcon
Falconidae	*Falco cenchroides*	Nankeen Kestrel
	Falco longipennis	Australian Hobby
	Falco peregrinus	Peregrine Falcon
Phasianidae	*Coturnix pectoralis*	Stubble Quail
Otididae	*Ardeotis australis*	Australian Bustard
Rallidae	*Porzana tabuensis*	Spotless Crake
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Acanthiza inornata	Western Thornbill
	Gerygone fusca	Western Gerygone
	Sericornis frontalis	White-browed Scrubwren
	Smicrornis brevirostris	Weebill
Acrocephalidae	*Acrocephalus australis*	Australian Reed-warbler
Artamidae	*Artamus cinereus*	Black-faced Woodswallow
	Artamus cyanopterus	Dusky Woodswallow
	Artamus personatus	Masked Woodswallow
	Cracticus nigrogularis	Pied Butcherbird
	Cracticus torquatus	Grey Butcherbird
	Gymnorhina tibicen	Australian Magpie
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
	Lalage tricolor	White-winged Triller
Corvidae	*Corvus coronoides*	Australian Raven
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow
	Hirundo neoxena	Welcome Swallow
	Petrochelidon nigricans	Tree Martin
Maluridae	*Malurus lamberti*	Variegated Fairy-wren
	Malurus leucopterus	White-winged Fairy-wren
	Malurus splendens	Splendid Fairy-wren
	Stipiturus malachurus	Southern Emu-wren
Megaluridae	*Cincloramphus mathewsi*	Rufous Songlark
	Acanthorhynchus superciliosus	Western Spinebill
	Anthochaera carunculata	Red Wattlebird
	Anthochaera chrysoptera	Little Wattlebird
	Anthochaera lunulata	Western Little Wattlebird
	Epthianura albifrons	White-fronted Chat
	Gavicalis virescens	Singing Honeyeater
	Gliciphila melanops	Tawny-crowned Honeyeater
	Lichenostomus ornatus	Yellow-plumed Honeyeater
	Lichmera indistincta	Brown Honeyeater
	Manorina flavigula	Yellow-throated Miner
	Melithreptus lunatus	White-naped Honeyeater
	Sugomel nigrum	Black Honeyeater
	Phylidonyris niger	White-cheeked Honeyeater
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater
Monarchidae	*Grallina cyanoleuca*	Magpie-lark
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoe Bird
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush

Family	Species	Common Name
	Pachycephala pectoralis	Golden Whistler
	Pachycephala rufiventris	Rufous Whistler
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote
	Pardalotus striatus	Striated Pardalote
Petroicidae	*Eopsaltria georgiana*	White-breasted Robin
	Petroica boodang	Scarlet Robin
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail
	Rhipidura leucophrys	Willie Wagtail
Timaliidae	*Zosterops lateralis*	Silvereye

Family	Species	Common Name
Cacatuidae	*Cacatua sanguinea*	Little Corella
	Calyptorhynchus banksii naso	Forest Red-tailed Cockatoo
	Calyptorhynchus latirostris	Carnaby's Cockatoo
	Eolophus roseicapilla	Galah
Psittacidae	*Barnardius zonarius*	Australian Ringneck
	Neophema elegans	Elegant Parrot
	Trichoglossus haematodus	Rainbow Lorikeet
Strigidae	*Ninox boobook*	Southern Boobook

Table 6. Amphibians potentially found near the project area

Family	Species	Common Name
Hylidae	*Litoria moorei*	Motorbike Frog
Limnodynastidae	*Heleioporus eyrei*	Moaning Frog
	Limnodynastes dorsalis	Western Banjo Frog

Family	Species	Common Name
Myobatrachidae	*Crinia insignifera*	Squelching Froglet
	Myobatrachus gouldii	Turtle Frog
	Pseudophryne guentheri	Gunther's Toadlet

Table 7. Mammals potentially found near the project area

Family	Species	Common Name
Canidae	*Vulpes vulpes*	Red Fox
Felidae	*Felis catus*	Cat
Dasyuridae	*Sminthopsis fuliginosus*	Grey-bellied Dunnart
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo
	Notamacropus irma	Western Brush Wallaby
Tarsipedidae	*Tarsipes rostratus*	Honey Possum

Family	Species	Common Name
Leporidae	*Oryctolagus cuniculus*	Rabbit
Peramelidae	*Isoodon fusciventer*	Quenda
Muridae	*Mus musculus*	House Mouse
	Rattus fuscipes	Bush Rat
	Rattus rattus	Black Rat
Vespertilionidae	*Vespadelus regulus*	Southern Forest Bat

Table 8. Reptiles potentially found near the project area

Family	Species	Common Name
Agamidae	*Ctenophorus adelaidensis*	Western Heath Dragon
	Pogona minor	Dwarf Bearded Dragon
Diplodactylidae	*Crenadactylus ocellatus*	Clawless Gecko
	Diplodactylus polyophthalmus	Speckled Stone Gecko
	Strophurus elderi	Jewelled Gecko
	Strophurus spinigerus	South-western Spiny-tailed Gecko
Elapidae	*Brachyurophis fasciolata*	Narrow-banded Burrowing Snake
	Brachyurophis semifasciata	Half-girdled Snake
	Demansia psammophis	Yellow-faced Whipsnake
	Echiopsis curta	Bardick
	Neelaps bimaculatus	Black-naped Burrowing Snake
	Neelaps calonotus	Black-striped Burrowing Snake
	Parasuta gouldii	Gould's Snake
	Pseudonaja affinis	Dugite
	Pseudonaja mengdeni	Western Brown Snake
	Simoselaps bertholdi	Jan's Banded Snake
	Simoselaps littoralis	West Coast Banded Snake
Gekkonidae	*Christinus marmoratus*	Marbled Gecko
Pygopodidae	*Aprasia repens*	Southwest Sandplain Worm Lizard
	Delma concinna	Javelin Lizard
	Delma fraseri	Fraser's Delma
	Delma grayii	Side-barred Delma
	Lialis burtonis	Burton's Legless Lizard
	Pletholax gracilis	Keeled Legless Lizard

Family	Species	Common Name
	Pygopus lepidopodus	Common Scaly-foot
Pythonidae	*Morelia spilota*	Carpet Python
Scincidae	*Acritoscincus trilineatus*	Western Three-lined Skink
	Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink
	Ctenotus australis	Western Limestone Ctenotus
	Ctenotus fallens	West-coast Laterite Ctenotus
	Cyclodomorphus celatus	Western Slender Bluetongue
	Egernia kingii	King's Skink
	Egernia napoleonis	Southwestern Crevice Skink
	Hemiergis quadrilineatum	Two-toed Earless Skink
	Lerista distinguenda	South-western Orange-tailed Slider
	Lerista elegans	West Coast Four-toed Lerista
	Lerista lineopunctulata	Dotted-line Robust Slider
	Lerista praepedita	Blunt-tailed West-coast Slider
	Menetia greyii	Common Dwarf Skink
	Morethia lineoocellata	Pale-flecked Morethia
	Morethia obscura	Shrubland Pale-flecked Morethia
	Tiliqua occipitalis	Western Blue-tongued Lizard
	Tiliqua rugosa	Bobtail
Typhlopidae	*Anilios australis*	Austral Blind Snake
	Anilios pinguis	Rotund Blind Snake
Varanidae	*Varanus gouldii*	Gould's Goanna
	Varanus tristis	Black-headed Monitor

These lists include species commonly found in Banksia and Tuart woodlands on the inland side of the coastal dunes, so there are many species shown in these lists that are unlikely to utilise the coastal dunes, although they may infrequently be recorded as vagrants, particularly for the avian species.

3.3.3 Conservation significant vertebrate fauna

Conservation significant fauna are protected by the Commonwealth *EPBC Act 1999*, and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) and the Western Australia (WA) *BC Act 2016*. The *BC Act 2016* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. In addition, DBCA maintains a list of fauna that require monitoring under four priorities based on the current knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *BC Act 2016* imply legislative requirements for the management of anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, other than the DBCA wishes to monitor potential impacts on these species. Environmental practitioners and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the *BC Act 2016* are provided in Appendix B.

The fauna species that have special status in either State or Commonwealth government legislation or are on the DBCA Priority species list and are potentially present in the vicinity of the project area are listed in Table 9. Although they were recorded in the search of the MNES online database, migratory species that typically would be found around the edges of salt lakes, clay pans, estuaries and marshes have been excluded from Table 9 as there is no suitable habitat nearby. Other vertebrate fauna including threatened and conservation significant waders and shorebirds that utilise the beaches along the edge of the ocean or are marine migratory species were also listed as being present in the region, however, they have not been included below as they are not likely to utilise the project area (Terrestrial Ecosystems 2020).

Two threatened species of fauna and two migratory species of birds were identified under the *EPBC Act 1999* as potentially occurring in the project area or surrounds. There is one in the 'Other specially protected fauna category' as listed under the *BC Act 2016* and two species listed on the DBCA's Threatened and Priority Fauna List that potentially occur in the project area or surrounds. The following is an assessment of the likelihood of each of these seven species being found in the project area.

Table 9. Assessment of the potential presence of a conservation significant fauna species in the project area

Species	DBCA Schedule / Priority	Status under Commonwealth *EPBC Act*	Comment on the potential presence of a species
Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Endangered	Endangered	Flies over the project area, but a lack of suitable feeding, roosting and nesting resources means any visits will be infrequent and brief.
Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso*	Vulnerable	Vulnerable	Flies over the project area, but a lack of suitable feeding, roosting and nesting resources means any visits will be infrequent and brief.
Fork-tailed Swift *Apus pacificus*	Migratory	Migratory	May infrequently be seen flying in the region.
Osprey *Pandion haliaetus*	Migratory	Migratory	Regularly seen flying over the project area but there are no roosting trees, so it is unlikely to roost in the project area.
Quenda *Isoodon fusciventer*	P4		Potentially in the project area.
Black-striped Snake *Neelaps calonotos*	P3		Potentially in the project area.
Peregrine Falcon *Falco peregrinus*	OS		May very infrequently be seen in the project area.

P3 and P4 = Priority 3 and 4 species, OS – Other specially protected fauna

Results of the Commonwealth *EPBC Act 1999* protected matters database search are provided in Appendix A.

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) - Vulnerable under the *BC Act* 2016 and *EPBC Act 1999*

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) is a large, pied, cockatoo. Garnett et al. (2011) and the DSEWPaC (2011) reported that Carnaby's Black-Cockatoo inhabits the south-west of Western Australia, from Kalbarri to as east on the south coast as Esperance. It breeds inland and moves to the coastal areas when chicks have fledged (Saunders et al. 1985). Carnaby's Black-Cockatoos are highly gregarious, usually seen in trios, small parties or large flocks (up to 5000 birds; Perry 1948). These flocks usually contain males, females and immature birds.

In some locations, breeding populations have decreased or become locally extinct (Saunders 1986, Saunders and Ingram 1987). For example, in the Coomallo Creek area north of Perth, Black-Cockatoos laid 74 clutches in 1973, 75 in 1974, 82 in 1975 but only 20 in 1994 and 19 in 1996 (Saunders and Ingram 1987). Saunders (1986) reported finding 13 nests at Manmanning in 1969 but by 1977, the species had stopped breeding in the area. Saunders (1990) reported failed nestings due to predation by a cat, galahs broke Carnaby's Black-Cockatoo eggs and took over nests, while other adult birds were killed by vehicles and Wedge-tailed Eagles (*Aquilla audax*).

Carnaby's Black-Cockatoos are partly migratory and partly sedentary (Higgins 1999). In the drier regions of their geographic range where most of the native vegetation has been cleared (e.g. wheatbelt), Carnaby's Black-Cockatoos are postnuptial migrants (Saunders 1980, Saunders and Ingram 1995). After breeding, individuals in these areas migrate to feed in higher rainfall areas including the Swan Coastal Plain, and to a lesser extent, forests dominated by *E. marginata* (Jarrah), *C. calophylla* (Marri) and *E. diversicolor* (Karri; Saunders 1980). On the Swan Coastal Plain, Carnaby's Black-Cockatoos have been recorded foraging in most suburbs and in pine plantations within the greater Perth metropolitan area (Perry 1948). Vagrants have been recorded on Rottnest Island (Winnett 1989) and Garden Island (Wykes et al. 1999). These later two sightings clearly indicate that Carnaby's Black-Cockatoo will fly considerable distances over non-vegetated areas to forage.

Garnett et al. (2011) estimated there were between 10,000 and 60,000 birds in the population.

Saunders (1980) recorded non-breeding cockatoos at Coomallo Creek foraging within a 50km radius of their breeding area, whereas, cockatoos at Manmanning moved a much greater distance to the coastal plain during their non-breeding season. These data suggest that Carnaby's Black-Cockatoo move from areas where there is little food to southern and western coastal areas where food is presumably more plentiful during summer and autumn (Davies 1966, Saunders 1980).

Carnaby's Black-Cockatoo breed between July and November mostly in eucalypt woodland (Saunders 1980, 1986). Carnaby's Black-Cockatoo nest in tree hollows that are created by fire, fungi, termites or old age, with hollows between 2.5 and 12m above the ground (Saunders 1979a, Higgins 1999). Hollows are large, ranging from 10 to over 250cm in depth (Higgins 1999). These hollows are usually in live or dead smooth-barked *Eucalyptus salmonophloia* (Salmon Gum) or *Eucalyptus wandoo* (Wandoo). However, Carnaby's Black-Cockatoo will also nest in *E. longicornis* (Red Morrell), *E. loxophleba* (York Gum), *E. gomphocephala* (Tuart), *E. rudis* (Flooded Gum), *E. salubris* (Gimlet), *E. occidentalis* (Swamp Yate) and *C. calophylla* (Higgins 1999, Cale 2003). When breeding, they most often forage in the surrounding shrubland and kwongan heath (Higgins 1999). On the Swan Coastal Plain, breeding could occur in *E. gomphocephala*, *E. rudis*, *E. occidentalis* and *C. calophylla*. Adults return to the same breeding area each year (Saunders 1977) and some use the same tree hollow for many years in succession to raise their chicks, others shift their nests among a number of trees in the same area (Saunders and Ingram 1998).

Eggs are laid on a mat of wood chips chewed from the sides of the hollow. Clutches are 1-2, but most often only one chick is raised. Incubation takes 29 days, and only the female incubates and broods (Johnstone et al. 2011). Initially the female will return to the nest mid-morning to feed the chick, but after about 2-3 weeks both parents leave in the early morning and return late evening.

Young remain with their parents until the parents return to the breeding area in the following year (Saunders 1980). Immature birds probably do not move into the breeding areas until they are ready to breed, although little is known of the movements of immature Carnaby's Black-Cockatoo until they are ready to breed (Saunders 1977).

The breeding success of Carnaby's Black-Cockatoo is believed to be strongly influenced by the availability of food at breeding sites (Saunders et al. 1985). Saunders (1977) found that birds that foraged within one or two kilometres from nesting sites had greater fledgling success than those from populations that had to travel up to four kilometres to obtain food. In a study that monitored Carnaby's Black-Cockatoo's breeding over 25 years at Coomallo Creek,

Saunders and Ingram (1998) showed that the number of breeding attempts halved by the end of the study. During this period, native vegetation cover was reduced from 90% in 1959 to 25% in 1996. Their study revealed that although there was a surplus of trees with hollows of sufficient sizes, clearing of adjacent foraging habitat had adversely impacted on the success of breeding birds. Therefore, breeding sites typically have nearby areas of scrub and heath where birds forage on seeds and flowers of numerous trees and shrubs including *Banksia*, *Hakea*, *Dryandra*, *Grevillea* and *Callistemon* spp. (Robinson 1965, Saunders 1980, Higgins 1999). Unlike other cockatoo species, Carnaby's Black-Cockatoo will not utilise cereal crops (Saunders et al. 1985), but will feed on *Erodium* seed (Saunders 1980).

At Coomallo Creek, Carnaby's Black-Cockatoo travelled on average 1.4km from their nests to forage, whereas at Manmanning they foraged more widely and travelled an average of 2.5km from their nest to forage (Saunders 1980). At Manmanning, road and railway reserves were extensively used for foraging, presumably as this was the closest food source to their nests. The availability of food near the nest influenced the time spent incubating eggs and fledging body mass (Saunders 1980). At Manmanning, Carnaby's Black-Cockatoo traversed agricultural land to forage in remnant plots of uncleared land.

The social organisation of breeding Carnaby's Black-Cockatoo is known (Saunders 1974, 1977, 1979a, b, 1980, Saunders et al. 1985, Saunders 1986, Higgins 1999). Carnaby's Black-Cockatoo start reproducing at about four years of age and continue for at least 15 years (Cale 2003). Strong pair bonds are then formed, often for life. Females lay one or two eggs asynchronously with an average of 8 days (range 1-12) between the laying of the first and second egg. Egg laying usually occurs in early July to mid-October, with inland birds laying approximately three weeks later than those closer to the coast. Females incubate their 1-2 eggs for 29 days (Saunders 1982).

When two eggs are laid, it is rare for both nestlings to successfully fledge. The female alone broods and feeds the young birds. Initially, the female, and later the chick, rely on the male for food during the brooding and hatching of the eggs (Saunders 1977, 1982). After two to three weeks, both parents forage and return at mid-morning and dusk to feed the young (Saunders 1977, 1982). The young are dependent on parents for several months after fledgling. Fledglings are independent after about 10-11 weeks (Saunders 1977).

Saunders (1980) reported Carnaby's Black-Cockatoo at Coomallo Creek (breeding area) foraged mostly on native plants, with the only exception being *Erodium* sp.. Higgins (Higgins 1999) reported the habitat of Carnaby's Black-Cockatoo was uncleared or remnant woodlands dominated by *Eucalyptus*, particularly *E. wandoo* and *E. salmonophloia* and often in shrubland or kwongan heathland dominated by *Hakea*, *Dryandra*, *Banksia* and *Grevillea* and seasonally in *Pinus* plantations and less often in *C. calophylla*, *E. diversicolor* or *E. marginata*.

The belief that Carnaby's Black-Cockatoo numbers are in serious decline has led to a recovery plan being released in 2012 (Department of Parks and Wildlife 2013). This plan details the current status of the cockatoo and provides conservation measures to increase the population. The five broad recovery actions in this plan are:

- Protect and manage important habitat – identify, protect and manage habitat critical for survival (nesting, foraging and roosting) for Carnaby's Black-Cockatoos across their breeding and non-breeding range;
- Conduct research to inform management – undertake research into the biology, ecology, and conservation management of Carnaby's Black-Cockatoo;
- Undertake regular monitoring – monitor population parameters, habitat, threats and status of the Carnaby's Black-Cockatoo;
- Manage other impacts – monitor the impacts and implement strategies to reduce other factors detrimentally affecting Carnaby's Black-Cockatoo, and support rehabilitation programs;
- Undertake information and communication activities – develop and distribute awareness raising and guidance materials for decision makers, establish joint management agreements and provide for improved sharing of information between agencies; and
- Engage with the broader community – engage with and involve people across the community in the conservation of Carnaby's Black-Cockatoo.

Carnaby's Black-Cockatoo has been recorded in other fauna surveys in the vicinity of the project area and they were observed nearby during the site investigations, however, due to a lack of suitable foraging, nesting and roosting habitat they are unlikely to infrequently utilise the project area. Clearing of the vegetation and development in the project area is unlikely to significantly impact on this species.

Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the *BC Act* 2016 and *EPBC Act 1999*

The Forest Red-tailed Black-Cockatoo is one of three large black-cockatoos found in Western Australia. *Calyptorhynchus banksii naso* frequents the humid to sub-humid south-west of Western Australia from Gingin in the north, to Albany in the south and west to Cape Leeuwin and Bunbury (Department of Sustainability Environment Water Population and Communities 2011). It was mostly seen in the hills, but small numbers of birds were seen at Mundijong, Baldivis, Karnup, Stakehill, Pinjarra, Coolup and in the Lake Clifton area (Johnstone et al. 2011). In 2011, there was an increase in the number of Forest Red-tailed Black-Cockatoo on the coastal strip north from Rockingham to the northern metropolitan suburbs. The reason for the recent increase in abundance is unknown.

Forest red-tailed black cockatoo nest hollows have been recorded between 6.5 and 33m above the ground, with entrance sizes ranging from 10x12cm to 44x150cm and a depth of 0.3-8.2m (Johnstone et al. 2013b, a). Breeding occurs in all months, but peaks in April-June and August-October with an incubation period of 29-31 days. A female broods her hatchling for the first 3-10 days after hatching and then leaves the nest each day at dawn and returns to feed the chick at dusk. Hatchlings are fully feathered at about 48 days. The majority of nests are in Marri, but they have also been recorded in Jarrah, Blackbutt, Bullich and Wandoo. Nest sites are often clustered in an area.

Johnstone, Johnstone and Kirkby (Johnstone et al. 2011) reported the Forest Red-tailed Black-Cockatoo to feed mostly on seeds from *C. calophylla*, *E. marginata*, but also on *Allocasuarina fraseriana* (Sheoak), *Persoonia longifolia* (Snottygobble), *Eucalyptus patens* (Blackbutt) and introduced species such as *M. azedarach* (Cape Lilac) and *Corymbia citriodora* (Lemon-scented Gum).

Loss of breeding habitat in the form of suitable hollows and adequate feeding resources in the vicinity of nesting hollows to enable adults to feed chicks is a primary threat. Abbott (1998) reported that trees within its known breeding distribution was not a factor in limiting breeding. He estimated there were about 15,000 birds and Garnett et al. (2011) thought about 10% of these birds bred each year. Competition for nesting hollows by other cockatoos, Wood Ducks, Galahs and feral Honey Bees appears to also be a significant threat (Garnett et al. 2011).

The Forest Red-tailed Black-Cockatoo is unlikely to frequent the project area as there are very few plants that offer a food resource. There are no Forest Red-tailed Black-Cockatoo nesting or roosting sites in the project area due to a lack of suitable trees. Clearing of vegetation and development in the project area is unlikely to significantly impact on this species.

Fork-tailed Swift (*Apus pacificus*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

This species breeds in the northeast and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara in November and in the southwest land division in mid-December, and leaving by late April. The Fork-tailed Swift is an almost exclusively aerial species, foraging and sleeping on the wing. It rarely comes to ground, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields.

Terrestrial Ecosystems' assessment is that the Fork-tailed Swift may very infrequently be seen flying over the project area, however, the Fork-tailed Swift is essentially an aerial species and would be highly unlikely to land in the project area. The proposed vegetation clearing and development in the project area is unlikely to significantly impact on this species as it will move away to other areas if it is disturbed.

Osprey (*Pandion haliaetus*) – Migratory under the *EPBC Act 1999*

The Osprey is a large raptor that is mostly found in coastal areas, off-shore islands and the lower sections of rivers. It mainly feeds on fish, sea-snakes and large lizards. This species is unlikely to be recorded in the project area due to a lack of suitable habitat.

The Osprey is seen along the coastal area searching for food in the shallow water. It nests on tall structures, rock outcrops and large trees, none of which are in the project area. Although likely to be observed in the region, it is Terrestrial Ecosystems' assessment that clearing vegetation and development in the project area is unlikely to significantly impact this species.

Quenda (*Isoodon fusciventer*) – Priority 4 species with the DBCA

Quenda prefer dense scrub (up to one metre high), with swampy vegetation but are found in a variety of other habitats. They will often feed in adjacent forest and woodland that is open grassland, pasture and crop land lying close to dense cover.

Quenda have been recorded as far north as Two Rocks in the DBCA threatened species database, and Dr Scott Thompson caught them near the old Club Capricorn Resort so it is possible that they are present in low densities in areas that provide suitable habitat. Given the abundance of foxes and feral cats along the coastal vegetation strip, Quenda are only going to survive in areas of dense undergrowth which provide some protection from these predators.

There is a very low probability that Quenda would be impacted during vegetation clearing as they will move to adjacent areas once vegetation clearing commences. The proposed access track to the beach is likely to impede its movement in a north-south direction and it is possible that some individuals will be killed by vehicles when Quenda get caught between the fences whilst crossing the access track. The development of the access track will also fragment sand dunes allowing easier access to foxes and cats which predate on Quenda.

Black-striped Snake (*Neelaps calonotus*) – Priority 3 with DBCA

This species occurs on dunes and sandplains vegetated with heaths and eucalypt/banksia woodlands. It feeds largely on skinks and its distribution is restricted and threatened by urban development. In its natural state, the project area would have been typical habitat for the Black-striped snake. The DBCA threatened species database has records of this snake around Mindarie, and the Atlas of Living Australia records one south of Lancelin, so it is possible that they are in the project area.

This is essentially a fossorial species, so individuals in the area to be cleared and developed will potentially be injured or killed in the process. The access track to the beach will impede its movement in a north-south direction. Although they can move through the fence wire it is likely they will get caught on the curbs of the sealed road and be directed to stormwater drains at the intersection of the sealed road and the curb; these will act as drift-fences and pit traps for this small snake. It is also possible that some individuals will be killed by vehicles on the bitumen access track, particularly when individuals are active early in the evening or warming up on the bitumen after dark. The development of the access track will also fragment sand dunes allowing easier access to foxes and cats which predate on the Black-striped Snake.

Peregrine Falcon (*Falco peregrinus*) – Other specially protected fauna under the *BC Act 2016*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the project area. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years.

The Atlas of Living Australia contains records of this species around Joondalup and Lancelin, so it is possible that they are infrequently seen in the project area. Even though they have been recorded in databases, the habitat in the project area is atypical for this species. Given the very low probability of this species occurring in the area, it is unlikely to be significantly impacted by vegetation clearing and development of infrastructure in the area.

4 RISK ASSESSMENT

Flora, vegetation and fauna surveys to support EIAs are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity on a particular area and region. Potential impacts on flora, vegetation and vertebrate fauna from the proposed development are identified and briefly described in below. Tables 10, 11 and 12 provide a summary of the risk assessment associated with this project.

Table 10. Flora, vegetation and vertebrate fauna impact risk assessment descriptors

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing have an impact on the flora, vegetation and fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 9.

Likelihood		
Level	Description	Criteria
A	Rare	The environmental event may occur, or one or more conservation significant species or ecosystems may be present in exceptional circumstances.
B	Unlikely	The environmental event could occur, or one or more conservation significant species or ecosystems could be present at some time.
C	Moderate	The environmental event should occur, or one or more conservation significant species or ecosystems should be present at some time.
D	Likely	The environmental event will probably occur, or one or more conservation significant species or ecosystems will be present in most circumstances.
E	Almost certain	The environmental event is expected to occur, or one or more conservation significant species or ecosystems is expected be present in most circumstances.
Consequences		
Level	Description	Criteria
1	Insignificant	Insignificant impact on flora, vegetation or vertebrate fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar flora, vegetation or fauna assemblages in the area.
2	Minor	Impact on flora, vegetation or vertebrate fauna is localised and no significant impact on species of conservation significance or ecosystems in the project area. Loss of species and individual conservation significant individuals at the local scale.
3	Moderate	An appreciable loss of flora, vegetation or fauna in a regional context or a limited impact on flora and fauna species of conservation significance or significant ecosystems in the project area.
4	Major	Significant impact on conservation significant flora or fauna or their habitat in the project area and/or regional biodiversity and/or a significant loss in the biodiversity and/or impact on ecosystems at the landscape scale.
5	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as 'vulnerable' or 'endangered' under the *EPBC Act (1999)* at a regional scale.
Acceptability of Risk		
Level of risk	Management Action Required	
Low	No action required.	
Moderate	Avoid if possible, routine management with internal audit and review of monitoring results annually.	
High	Externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually. May require a referral to the Commonwealth under the *EPBC Act 1999.*	
Extreme	Unacceptable, project should be redesigned or not proceed.	

Table 11. Levels of acceptable risk

		Likelihood				
		Rare or very low (A)	Unlikely or low (B)	Moderate (C)	Likely (D)	Almost certain (E)
Consequences	Insignificant (1)	Low	Low	Low	Low	Low
	Minor (2)	Low	Low	Low	Moderate	Moderate
	Moderate (3)	Low	Moderate	Moderate	High	High
	Major (4)	Moderate	Moderate	High	High	Extreme
	Catastrophic (5)	Moderate	High	High	Extreme	Extreme

Table 12. A risk assessment of the impact of ground disturbance activity on fauna

			Before Management				With Management		
Factor	Potential Impact		Inherent Risk			Risk Controls / Management	Residual Risk		
			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Fauna survey data	Inadequate survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	B	2	Low				
	Inadequacy of comparative data	Limits on the availability of comparative data reduced the capacity to assess the uniqueness of the fauna assemblages in the project area.	B	2	Low				
Flora and vegetation survey data	Inadequate survey data to adequately assess the risks to flora species	Unknown loss of flora of conservation significance.	C	3	Mod	A comprehensive flora survey to identify presence and location of flora at risk. Project planning to avoid Priority Flora populations in Very Good condition including buffers where possible.	C	2	Low
	Inadequacy of regional contextual data to assess the risk of loss of representative vegetation	Limits on the availability of comparative data reduced the capacity to assess the uniqueness or otherwise of the vegetation communities in the project area.	C	4	High	A comprehensive vegetation survey within the project area to identify vegetation at risk as comprehensively as possible given the constraints of regional contextual information. Project planning to avoid or minimise impact to vegetation in Very Good or better condition including buffers where possible.	C	3	Mod
Clearing vegetation	Loss of Priority 1 species	Loss of some *Leucopogon maritimus* plants.	C	3	Mod	Aligning the access to minimise impacts on Priority Flora and Priority Ecological Communities in	C	2	Low
	Loss of Priority 3 species	Loss of *Beyeria cinerea* subsp. *cinerea* plants	C	3	Mod		C	2	Low
		Loss of *Stylidium maritimum*	C	3	Mod		C	2	Low
	Loss of Priority Ecological Community	Loss of PEC Swan 21	B	3	Mod		B	2	Low
		Loss of PEC Swan 26	B	3	High		B	2	Mod

			Before Management				With Management		
Factor	Potential Impact		Inherent Risk			Risk Controls / Management	Residual Risk		
			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
						Very Good or better condition.			
	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	D	2	Mod				
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	D	2	Mod				
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	A	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	3	Low				
	Habitat fragmentation	Fauna movement restricted resulting in the death of fauna and a loss of biodiversity.	D	2	Mod				
	Loss of a unique terrestrial fauna ecosystem	Loss of an ecosystem containing fauna with high species richness, high abundance and numerous top of the food chain predators (native species only).	A	1	Low				
Death or loss of conservation significant fauna	Carnaby's Black-Cockatoo	Death or the reduced viability of Carnaby's Black-Cockatoo	A	3	Low				
	Forest Red-tail Black-Cockatoo	Death or the reduced viability of the Forest Red-tailed Black-Cockatoo.	A	2	Low				
	Forktail Swift	Death or the reduced viability of the Forktail Swift.	A	2	Low				
	Quenda	Death or the reduced viability of the Quenda.	B	2	Low				
	Black-striped Snake	Death or the reduced viability of the Black-striped Snake.	B	3	Mod				
	Osprey	Death or the reduced viability of the Osprey	B	2	Low				
	Peregrine Falcon	Death or the reduced viability of Peregrine Falcon.	B	2	Low				
Human impacts	Spread of weeds	Changed vegetation and a resulting loss of fauna habitat.	E	2	Mod	Implementation of a weed management plan.	D	2	Low
	Road killed fauna	Animals being killed by vehicles as they cross roads	E	1	Low	Limiting speeds	E	1	Low
	Increase in feral fauna, specifically the fox, rabbit and cat	Increased predation on the native fauna and habitat degradation	B	2	Low	Implement a feral and pest animal management program.			

4.1 Native vegetation clearing principles as they pertain to flora, vegetation and vertebrate fauna

The *Environmental Protection Act (1986)* outlines 10 principles that are to be used in the assessment of native vegetation clearing permit applications which are also applicable for other assessments and approvals (Table 13). Where possible, native vegetation should not be cleared if any of the following principles are comprised.

Table 13. Assessment of impact using the native vegetation clearing principles

Principles	Two Rocks Beach Access Way
It comprises a high level of biological diversity	Likely to be at variance on a number of measures in relation to flora and vegetation. All criteria referred to and in bold sourced from Government of Western Australia (2014). **Priority Flora (PF) and Priority Ecological Communities (PECs) are considered under this factor.** Three PF species were recorded from the project area.

Principles	Two Rocks Beach Access Way
	Leucopogon maritimus (Priority 1) *Beyeria cinerea* subsp. *cinerea* (Priority 3) *Stylidium maritimum* (Priority 3) Two PECs were recorded from the project area: PEC SWAN 21: "Coastal shrublands on shallow sands, southern Swan Coastal Plain" (FCT29a). PEC SWAN 26: "Northern Spearwood shrublands and woodlands" (FCT24) (potentially uncommon variant) Likely to be at variance with this principle on the basis of clearing a diverse native vegetation remnant that: • has a higher diversity than other examples of an ecological community in a bioregion. • supports the whole or a part of a significant population of priority flora. • comprises the whole or a part of a significant occurrence of a Priority Ecological Community (PEC). Specific measures of diversity relevant to flora and vegetation include: • Total vascular plant taxa diversity • Vascular plant taxa diversity for each ecological community • Number of ecological (plant) communities A total of 158 taxa were recorded from the project area, of which 99 or 63% were natives. This is relatively high for approximately 13ha in a coastal area. This was due to a variety of habitats being present including Quindalup Dune types Q2 to Q4, varying soil depths and consolidation, and limestone outcroppings. The plant community supporting both the Priority Flora and PEC SWAN 26: Northern Spearwood shrublands and woodlands (FCT24) (Figures 2 and 3 of One Tree Botanical (2020)) was more species rich than other documented examples of this Floristic Community Type (FCT). Gibson et al. (1994) 100m2 quadrats contained an average of 41.8 species (14.2 weeds) compared to an average of 48 ± 8.9 (12.7 weeds) species in the project area. The plant community representing PEC SWAN 26: Northern Spearwood shrublands and woodlands (FCT24) supports three Priority Flora species, often as dominants in their respective stratum. It is unclear if this combination of what are near coastal Swan Coastal Plain (SCP) endemic flora co-exist anywhere else. See the full technical report (One Tree Botanical 2020) for detailed discussion. It does not comprise a high level of diversity for vertebrate fauna
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna	The project area has a limited vertebrate fauna assemblage which is also present in other coastal areas. Clearing the vegetation will not result in the loss of significant habitat for indigenous fauna. However, there will be a cumulative impact of the progressive clearing of coastal areas.
It includes, or is necessary for the continued existence of threatened flora	Not at variance.

Principles	Two Rocks Beach Access Way
	No Threatened Flora (TF) species protected under the *Biodiversity Conservation Act 2016* or the *Environment Protection and Biodiversity Conservation Act 1999* were recorded for the project area.
It comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community	Not at variance. No Threatened Ecological Communities (TECs) protected under the *Biodiversity Conservation Act 2016* or the *Environment Protection and Biodiversity Conservation Act 1999* were recorded for the project area.
It is significant as a remnant of native vegetation in an area that has been extensively cleared	Likely to be at variance. There are limitations in being able to quantify this principle, due to inadequate contextual information for vegetation in Western Australia. Government of Western Australia (2014) acknowledges some of the limitations, such as those inherent in setting a blanket 30% retention benchmark for 'ecological communities' within a bioregion. They then request regional representation be quantified using datasets not adequate for this purpose. In particular Government of Western Australia (2014) request that regional representation as a measure of 'significance' in the context of this principle relies on Vegetation Complex mapping (Heddle et al. 1980), Vegetation Associations (Beard 1979) and FCTs (Gibson et al. 1994). The age of these studies alone indicate the inherent problem. Any attempt to update the information has focussed on what form the data should take rather than the content of it. The limitations and recommendations provided by the authors themselves on what further studies are required has never been acted on. However, as it is requested, the following presents the current information available, including a discussion of the limitations for each. **Vegetation Complexes** (Heddle et al. 1980): the project area is within the Quindalup Complex. The original extent within the IBRA region of Swan Coastal Plain has been calculated as 54,573.87ha, of which 33,011.637ha or 60.49% remains (Government of Western Australia 2019a). These figures do not take into account fully the condition of the remaining areas or rarer vegetation types that constitute the complex. **Vegetation Associations** (Beard 1979): the project area is within Vegetation Association 1007: "Coastal heath and thicket on recent dunes" Vegetation Association 1007 is described as originally consisting of 30,408ha of which 20,691ha or 68% remains. Of what remains, 2,755ha or 13.31% is protected or proposed for protection (Government of Western Australia 2019b). These figures do not take into account fully the condition of the remaining areas or rarer vegetation types that constitute the complex. **Floristic Community Type** (FCT) (Gibson et al. 1994): Two FCTs (Gibson et al. 1994) were identified in the project area using statistical methods; FCT24 and FCT29a. A third, FCT S14 was inferred from Griffin (Griffin and Hunt 1993). FCT24 (SWAN PEC 26) and FCT29a (SWAN PEC 21) (See Section 3.2.4) are Priority Ecological Communities (PECs), which indicates an unspecified degree of rarity. While FCTs are closer to a more appropriate scale to assess

Principles	Two Rocks Beach Access Way
	regional significance of vegetation, they have never been mapped or quantified in terms of original extent and area remaining. See the full technical report for flora and vegetation (One Tree Botanical 2020) for detailed discussion. Linkage is also considered under this principle. The project area is a part of Bush Forever Site 397: "Coastal Strip from Wilbinga to Mindarie" (Government of Western Australia 2000), which is a relatively intact, often narrow strip of coastal vegetation which also provides a linkage between larger intact remnants.
It is growing in, or in association with, an environment associated with a watercourse or wetland	Unlikely to be at Variance. The area does not contain a watercourse or wetland.
The clearing of the vegetation is likely to cause appreciable land degradation	Land degradation processes area outside the scope of this assessment, however, in terms of vegetation, coastal areas with unconsolidated sand dunes are fragile and vulnerable to weed invasion once disturbed.
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	Likely to be at variance. The project area is a part of Bush Forever Site 397: "Coastal Strip from Wilbinga to Mindarie" (Government of Western Australia 2000). Clearing of vegetation will also contribute to the cumulative loss of coastal vegetation on the Swan Coastal Plain.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water	Unlikely to be at variance. No impact on the quality of surface or groundwater is envisaged.
The clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding	Unlikely to be at variance. Clearing of vegetation is unlikely to impact on flooding.

4.2 Referral under the EPBC Act

The proposed project is unlikely to significantly impact on a conservation significant vertebrate fauna species or EPBC flora species or ecological community. A referral under the *EPBC Act* is not recommended.

5 POTENTIAL ENVIRONMENTAL IMPACTS

5.1 Flora and vegetation terms and concepts

Flora and vegetation are two separate issues. Flora are at the individual species level and in some ways are more similar to fauna in terms of management. Vegetation is a proxy for ecosystems; it is much more complex and more important in terms of conservation significance as all species within the system rely on it. The impacts to individual species can be managed in a number of ways, however, vegetation and ecosystems due to their complexity can only be managed *in-situ*.

5.1.1 Flora

Clearing of vegetation will potentially result in the removal of one Priority 1 species (*Leucopogon maritimus*) and two Priority 2 species (*Beyeria cinerea* subsp. *cinerea* and *Stylidium maritimum*).

5.1.2 Vegetation

Clearing of vegetation will potentially result in the removal of two Priority Ecological Communities: Priority Ecological Community (PEC) SWAN 21: "Coastal shrublands on shallow sands, southern Swan Coastal Plain", and Priority Ecological Community (PEC) SWAN 26: "Northern Spearwood shrublands and woodlands".

Additionally, the example of PEC SWAN 26 present in the project area may represent a potentially uncommon or even unique variant due to the dominance and co-occurrence of three Priority Flora within it (see One Tree Botanical 2020 for a full discussion). It is also unusually close to the coast for this ecological community, which is more typical of Spearwood Dunes further inland. Near-coastal floristic influences may also contribute to it being a variant. Any direct impact to these ecological communities represents a permanent loss. Indirect impacts (discussed below) may result in slow degradation over time.

5.1.3 Ecological processes

There is a beach ridge plain that runs along the bay between Two Rocks and Yanchep. It currently is intact with no interruptions to deposition which can clearly be seen on aerial photography. It is a young system that is still actively forming. Older systems on the Swan Coastal Plain support the State and Federally listed TEC SCP19: "Sedgelands in Holocene dune swales of the southern Swan Coastal Plain". It is unknown whether, given the time, ecosystems consistent with this TEC would develop in the project area. This may more appropriately be dealt with as a landform factor under EPA guidance, as currently the vegetation present is at an early colonisation stage and does not support the hypothesis (see One Tree Botanical 2020 for a full discussion).

5.1.4 Edge effects

In addition to the immediate impact from clearing, the exposed edges of vegetation suffer a decline over time. Weed invasion is the most obvious manifestation of edge effects in vegetation. Particularly in areas near the coast as sandy soils can be particularly fragile and vulnerable to weed invasion.

Dogs off lead contribute greatly to edge effects adjacent to unfenced access trails in other urban reserves and this is a possibility for this project.

There are weedy areas present in the project area, adjacent to old tracks and infrastructure corridors. These provide an indication of the edge effects that will occur over time along any future clearing corridors.

5.1.5 Increased access

Increased access that the roads and trails provide will introduce greater pressure on fragile near-coastal vegetation. The potential to introduce new weed species is increased. As discussed above, dogs can be particularly damaging to soil and vegetation if allowed to run through vegetation. The level of impact will depend on the numbers of people and dogs contributing to this effect.

5.1.6 Increased fire risk

Increased access may lead to more frequent fire, whether it is deliberate or accidental. A reduction in the intervals between fires can result in a decline in flora species diversity and therefore vegetation structure and integrity. Too frequent fire can also result in increased weed invasion. The logistics of fighting fires can result in physical damage to soil and vegetation. While access to bushland by fire-fighting equipment may be necessary, it can and does result in significant damage to soil and vegetation.

5.1.7 Viability and ecological linkage

There are large areas of intact vegetation in the project area with areas of localised disturbance (see One Tree Botanical 2020 for condition mapping).

The project area is a part of a broader area of relatively continuous vegetation. It is part of a linear corridor of coastal dune vegetation that runs almost continuously from the residential housing development north of Yanchep to south of the Two Rocks townsite. It is comparatively wide, extending further inland than many near-coastal vegetation remnants. The size of this area enables the integrity of near-coastal vegetation to be maintained better than most near-coastal areas in the metropolitan region.

Given that much of the coastal dune vegetation from Fremantle Port to Two Rocks has been cleared, the remaining areas that are in good condition and of a relatively large size are of high ecological value. This was a primary reason for including this coastal strip of vegetation in a Bush Forever site. Introducing linear physical infrastructure will contribute to fragmentation. Gradual and ongoing fragmentation will erode the ecological value of this area in this context over time (cumulative impacts).

5.2 Vertebrate fauna

5.2.1 Biodiversity value of the project area

An ecological assessment of a site should consider its biodiversity value at the genetic, species and ecosystem levels, and its ecological functional value at the ecosystem level. There are inadequate data to assess the ecological value at the genetic level.

Fauna habitat types represented in the project area were once abundant along the coastal dunes, however, vegetation clearing and degradation in the past to support urban development has removed a substantial quantity of this habitat, particularly south of the project area.

In addition, the presence of foxes, cats and rabbits in the sandy coastal dunes has negatively impacted on the vertebrate fauna assemblage. Therefore, the fauna assemblage that is present in the project area will also be present in other areas that are intact, but the overall fauna assemblage will have been reduced.

5.2.2 Ecological functional value at the ecosystem level

Given that much of the coastal dune vegetation from Fremantle Port to Two Rocks has been cleared, the remaining areas that are in good condition and have suffered from minimal disturbance are of high ecological value. This is a primary reason for including this coastal strip of vegetation in a Bush Forever site.

5.2.3 Condition of fauna habitat

Fauna habitats in the project area are generally in very good condition, with small and mostly linear disturbances that are a result of people gaining access to the beach. Vegetation on the coastal dunes, other than for some sand tracks that provide access to the beach is almost continuous from the residential housing north of Yanchep to the southern parts of Two Rocks.

5.2.4 Ecological linkages

The project area is part of a linear corridor of coastal dune vegetation that runs parallel to the beach west of Two Rock Road and is almost continuous from the residential housing development north of Yanchep to south of the Two Rocks townsite. The size of this area enables the maintenance of the coastal dunes vertebrate fauna assemblage to remain intact if it was not for the presence of cats, rabbits and foxes.

5.2.5 Size and scale of the proposed disturbance

The project area is a small (i.e. approximately 13ha) proportion of similar habitat found along the coast west of the Two Rocks Road. The City of Wanneroo is proposing to construct a car park, access road and beach access with preliminary designs indicating a construction boundary (i.e. total vegetation cleared area) of 3.78ha. However, edge effects mean that the disturbance footprint will be much larger than the direct impacts of vegetation clearing.

5.2.6 Abundance and distribution of similar habitat in the adjacent areas

Fauna habitats present in the project area are abundant in the linear strip of coastal dunes to the south to the residential housing development north of Yanchep and north to the southern boundary of Two Rocks township. The coastal dune habitat is then present north of Two Rocks and south of the Yanchep town site. Much of the area south of the Yanchep town site is likely to be developed into residential housing.

5.2.7 Animal deaths during the clearing process and displacement of fauna

Clearing native vegetation is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which will inevitably result in these individuals being killed or injured in their burrows or as they attempt to escape. The few larger animals and most of the birds will move into adjacent areas once clearing commences. Shifting animals into adjacent areas will increase the pressure on resources in those areas and it is likely that there will be some disruption to the ecosystems in these areas for a period until a balance is restored.

Clearing of vegetation will potentially affect vertebrate fauna in numerous ways, including death/injury of fauna during clearing, infrastructure development, impacts with vehicles on the access track, the loss of habitat and barriers to movement, although impacts associated with clearing vegetation in the project area in a landscape or bioregional context on the vertebrate fauna are likely to be low as the proposed disturbance area is small relative to the quantity of similar habitat in the bioregion.

5.2.8 Reduction or loss of activity areas and closure of burrows

Clearing vegetation and associated construction activities are likely to destroy reptile and mammal burrows or retreat sites that are currently in use or could be used again. Clearing vegetation that forms part of the activity area of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation.

5.2.9 Edge effects

Clearing linear corridors increases fauna habitat edges. Small mammals can respond both positively and negatively to edges depending on their ecological traits (Laurance 1991, 1994, Goosem and Marsh 1997, Goosem 2000). Edge and disturbance effects can lead to altered and most often higher levels of predation, restricting or increasing fauna movements and altering assemblage structure (Oxley et al. 1974, Paton 1994, Baker et al. 1998, Temple 1998, Luck et al. 1999, Goosem et al. 2001). Goldingay and Whelan (1997) and Clarke and Oldland (2007) reported that edge effects can extend up to 150-200m from the edge for some species, meaning the impact area on vertebrate fauna is likely to be larger than the cleared footprint.

Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change the assemblage structure. The consequence is that the impact area will always be much larger than the cleared area.

5.2.10 Habitat fragmentation

In addition to vegetation clearing, infrastructure including an access road to a car park near the beach, has the potential to fragment habitat. These linear structures that partition existing activity areas and isolate sections of established communities will alter long and medium-term patterns of movement around established home ranges (particularly for small mammals and reptiles). A reduction in the fauna population because of this development would be difficult to detect given our current knowledge of the spatial ecology for most of the small mammals and reptiles known to be in the area.

5.2.11 Introduced fauna and weeds

An increase in habitat fragmentation and human activity is often associated with an increase in the abundance of introduced species such as the house mouse (*Mus musculus*), fox (*Vulpes vulpes*) and cat (*Felis catus*). This increase may be due to a decline in habitat health, increased road kills, poor disposal of waste and easier access to native fauna.

House mice, foxes, cats and rabbits are known to be established in the area. In many situations they have become a 'naturalised' species in the Australian bush. Increases in fox or cat numbers will have a detrimental impact on native fauna because they predate on and compete with native species, severely disrupting the natural balance. The cat is a particularly damaging predator on native fauna and any increase in their numbers would have a detrimental effect on the local native fauna (Kinnear 1993, Bamford 1995, Woinarski et al. 2017, Woinarski et al. 2018, Murphy et al. 2019); hence it is important to ensure that populations of the feral predators, such as cats and foxes are under control.

Introduced plant species can successfully and rapidly invade areas of cleared native vegetation or otherwise disturbed by humans. Introduced plant species may replace native species that provide shelter or foraging areas for native fauna. Major changes to the structure of vegetation will alter the fauna habitat and consequently may influence fauna assemblage and fauna species composition. Preparing and implementing a Flora and Vegetation Management Plan will largely reduce their threat to native fauna species.

Rabbits are in high abundance in the project area. An active management program is necessary to reduce their abundance prior to further fragmentation of the coastal dune system.

5.2.12 Spread of weeds

Anthropogenic activity will contribute to the spread of weeds once the development is in place. Weeds will often replace native vegetation with habitat that is less suitable to native fauna.

5.2.13 Barriers to fauna movement

It is the intention of the City of Wanneroo to provide 'conservation fencing' along all access roads and around the car parks and beach access way. This will impede the movement of medium and large mammals in a north-south direction. They may also get stuck between the fencing and be directed onto Two Rocks Road.

Small mammals and reptiles will readily move through the fencing and it will not be a significant barrier.

5.2.14 Roads and curbs

The construction of a sealed road with curbs and stormwater drain running off the curb-road interface into a stormwater drain will effectively be a series of drift-fences and pit-traps for small mammals and reptiles (i.e. *Neelaps calonotus*) that move onto the road but are unable to mount the curb and move along the curb looking for

an access back into the bushland. This is a long-term issue and will result in a depauperate fauna assemblage near the access road.

5.2.15 Road fauna deaths

An increase in road fauna deaths is likely to occur where new roads / tracks are constructed or upgraded. Species such as goannas, raptors, cats and foxes are attracted to carrion on road verges and therefore, there is an increased propensity for these species to be killed by vehicles.

5.2.16 Fire

Increased human activity is often associated with an altered fire regime which leads to a degradation of natural ecosystems. Fire has been identified as one of the threatening processes for some conservation significant species as a number of small mammal and bird species rely on long unburnt vegetation.

Although much of the vegetation looks green, in summer it could burn in the right conditions. An increased presence of human activity in the area increases the propensity for fires.

5.2.17 Anthropogenic activity

Unnatural noises, artificial light sources, and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from adjacent areas or to alter their activity periods. The overall impact is likely to be confined to a relatively small area and is unlikely to be a significant impact in the bioregional context.

6 MANAGEMENT AND MITIGATION

The purpose of this section is to identify generic management and mitigation strategies to address the potential impacts of development in the project area. Specific management and mitigation strategies to address potential impacts should be addressed in the recommended Flora and Vegetation Management Plan, Fauna Management Plan and Construction Environmental Management Plan.

6.1 Flora and vegetation considerations in design and preparation of management plans

It is worth noting that areas supporting Priority Ecological Community (PEC) SWAN 21: "Coastal shrublands on shallow sands, southern Swan Coastal Plain (SCP)" do not support any Priority Flora, however, it is vegetation that is Priority listed in its own right.

It would be useful in the design of the access road, carpark and beach access track to overlay of Vegetation Condition, Vegetation Type and Significant Flora GIS mapping to identify the core areas of significant flora and vegetation in Very Good and better condition. Once this is completed, planning can then aim to avoid these areas and minimise the project footprint when avoidance is not possible. There is considerable overlap between the areas supporting Priority Flora and areas supporting the PEC SWAN 26: "Northern Spearwood shrublands and woodlands", however, these areas are not identical and there are areas of PEC SWAN 21: "Coastal shrublands on shallow sands, southern SCP" in Very Good condition, that do not overlap with any Priority Flora, but has Priority status in its own right.

It is suggested that the route for the access road to beach car park is located to minimise impacts to Priority Flora populations and Priority Ecological Communities (PECs), particularly those that are in Very Good to Excellent condition. In a way that will minimise long-term erosion and utilise areas that are already disturbed to reduce potential impacts on flora and vegetation in Very Good to Excellent condition.

Some areas that support the Priority 3 species *Beyeria cinerea* subsp. *cinerea* are in Degraded to Good condition. These areas are both less significant than areas supporting Priority Flora in Very Good or better condition, and areas supporting Priority Ecological Communities in Very Good or better condition. Areas in Good to Degraded condition have lost ecosystem integrity and have a significantly reduced prospect of long-term viability. Priority Ecological Communities ostensibly have the same status as Priority Flora. This is particularly important in the case of PEC SWAN 26: "Northern Spearwood shrublands and woodlands", as the example in the project area is potentially an unusual variant.

Again, as for flora, areas of vegetation in Good to Degraded condition have lost ecosystem integrity and have a significantly reduced prospect of long-term viability. The areas of PEC SWAN 26: "Northern Spearwood shrublands and woodlands" (mapped as Vegetation Type C in One Tree Botanical 2020) in the project area vary from Good to Degraded through to Very Good to Excellent condition. The examples in Very Good to Excellent condition should be prioritised for retention over those areas in Good or poorer condition.

Where feasible, buffers should be retained around conservation significant areas. Edge effects mean that any new exposed edges post-clearing will suffer a slow decline through exposure and weed invasion over time. A buffer will absorb the decline and protect the conservation significant areas. Good to Degraded areas can still be valuable in this context, as they are already buffering vegetation in better condition.

Vegetation clearing programs and infrastructure development have a propensity to spread weeds, which in turn impact on fauna habitats. Weeds can be introduced on machinery brought in for the vegetation clearing program. Weeds can also be moved from one area to another within the project area. Transfer can occur during vegetation clearing, infrastructure development and from subsequent human activity.

6.1.1 Flora and Vegetation Management Plan

The following potential impacts should be addressed in the flora and vegetation management plan:

- weed reduction;
- spread of weeds;
- spread of disease;
- buffers around ecologically important areas;
- protection and conservation of Priority Flora populations;
- protection and conservation of Priority Ecological Communities (PECs); and
- rehabilitation program.

6.1.2 Fauna Management Plan

The following potential impacts should be addressed in the fauna management plan:

- control and reduction of feral and unowned cats (trapping);
- control and reduction of rabbits (fumigation, baiting, shooting, virus release);
- control and reduction of foxes (baiting, shooting and trapping);
- vertebrate fauna trapping, salvage and relocation prior to and during vegetation clearing;
- qualified and experienced zoologist present on-site during vegetation clearing (i.e. not wildlife carer);
- weed and disease control;
- fencing barriers as fauna movement;
- habitat fragmentation;
- vegetation clearing protocols;
- vehicle impacts on vertebrate fauna (short and long term);
- anthropogenic activity; and
- movement of kangaroos onto Two Rocks Road.

6.1.3 Construction Environmental Management Plan

The following potential impacts should be addressed in the construction environmental management plan:

- erosion control and minimisation (wind and water);
- changed hydrology and water flow patterns;
- curbs and storm water drains acting a drift fences and pit-traps;
- minimising the potential impact area;
- buffers around ecologically important areas;
- protection of Priority Flora populations and Priority Ecological Communities (PECs) during construction;
- sand and dust management;
- waste management and disposal;
- project area fencing and security;
- fire management;
- barriers to medium and large mammal movements along the coastal vegetation strip; and
- rehabilitating and landscaping disturbed areas.

7 DISCUSSION

7.1 Flora and vegetation

As discussed, there are areas of Priority Flora (flora) and Priority Ecological Communities (vegetation) in Very Good or better condition in the project area that are highly conservation significant.

In the context of EIA, vegetation can only be managed *in-situ*. Any loss is immediate and permanent. Therefore, mitigations at the EIA stage will always revolve around reducing the clearing footprint wherever possible. In this project the mitigations should focus on reducing the size of the disturbance footprint. As well as prioritising for retention areas in Very Good or better condition over areas in Good to Degraded condition.

Innovation will be required in project design and options other than simply building a standard access road to a beach carpark should be considered. For example, placing the carpark along Two Rocks Road and building a raised boardwalk to the beach or providing a carpark in the Good to Degraded patch of vegetation in the central east portion of the project area, then a boardwalk to the beach. While not ideal in terms of quick access for people and dogs, it is a matter of weighing the significance of the vegetation against the importance of beach access at that particular point.

Revegetation is not a mitigation. Revegetation nearly always does more harm by introducing non-local variants of local species, contaminating the local gene pool. This is particularly important in the project area as it has been largely isolated from the influences of cultivated plants. While commitments are often made to use local genetic variants, this is rarely if ever done. In practice it is prohibitively expensive and compromises end up being made. Revegetated areas require intensive and ongoing management, which is rarely done well due the time and expense involved. Due to the lack of maintenance they are often visually unappealing and don't inspire pride in locals to invest care for the area. Revegetated areas involve working with disturbed soil prone to weed invasion, and those areas often provide a point of entry for weed species. And even in the best-case scenario, revegetation never recreates the original vegetation.

The one exception is the foredune areas. These are very simple and naturally dynamic ecosystems that are able to be revegetated relatively effectively. It is assumed that a narrow path only will be required between the car park and the beach. Ideally, a boardwalk that requires no clearing or soil disturbance and encourages people to stay out of the dunes altogether.

Minimising the amount of quality vegetation cleared, then protecting what remains with hard landscaping is a better option. Hard landscaping in this context should first aim to provide engineering solutions that reduce the amount of area cleared in the first place and it should stabilise the soil to prevent wind erosion. Drainage should not result in pooled water where new weeds can establish. Pervious paving could be considered to remove the necessity for drainage basins altogether. Hard surfaces over any disturbed soil reduces opportunities for weed incursion. Fencing along paths that allows native animals to navigate but keeps people and dogs out of vegetation and a raised boardwalk may be the most effective way of doing this. Designing a road that navigates the very steep and tall secondary dunes may provide a challenge in regard to minimising the clearing footprint, due to the potential size of the batter required, particularly when the soil is so unstable.

Spaced planting of trees in strategic gaps in hard landscaping is also better from a visual amenity and ongoing maintenance perspective than small scale revegetation. Trees have a greater impact that is more appropriate to the scale of the area involved. Humans value shaded areas not only for the physical protection but intrinsically. There are two very good options available for this area. *Melaleuca lanceolata* is endemic to the broader area and is a proven resilient shade tree in near-coastal areas. A recent landscaped example of this can be seen at Leighton Beach. More established examples can be seen at South Beach Fremantle. Norfolk Island Pine **Araucaria heterophylla* is an exotic shade tree that tolerates near-coastal conditions. These already line the Two Rocks Road adjacent to the project area. Trees could be used in the middle of car parks and perhaps along the access road. However, Norfolk Island Pine get very large and may affect adjacent vegetation through shading and shedding, so while they might be suitable in the middle of a carpark, they are perhaps less suitable along a narrow roads through native vegetation. There is no reason with innovative design why trees should increase the project footprint either. These species grow quickly and can be trained early on to branch only once they are above pedestrian and vehicle height so that there is no need for extra clearing to accommodate them other than small egress holes in pavements.

Hygiene in terms of disease and weeds management during construction is important, but this is not a mitigation. These issues should be addressed in the Flora and Vegetation Management Plan and Construction Environmental Management Plan.

7.2 Vertebrate fauna

The proposed disturbance includes vegetation clearing and construction of an access track from Two Rocks Road to a car park near the beach in a fauna habitat that is in generally good condition. The most significant impact on the vertebrate fauna would be the presence of cats, rabbits and foxes in the vegetation on the coastal dunes.

Coastal dunes typically support a lower vertebrate fauna diversity than inland woodlands and there are no conservation significant vertebrate fauna species listed under the *EPBC Act 1999* or *BC Act 2016* that will be significantly impacted by the proposed vegetation clearing and infrastructure development. It is possible that the area supports a small population of Quenda (P4) and Black-striped Snakes (P3). Quenda are unlikely to be killed or injured by vegetation clearing but could be injured or killed on the access road to the beach carpark. Conservation fencing is likely to fragment their movement in a north-south direction. The Black-striped Snake could be killed or injured during vegetation clearing, impacted by vehicles using the access road as they will lay on the road in the evening to absorb warmth, and they will be trapped and killed by road design (i.e. curbs and soak well drains).

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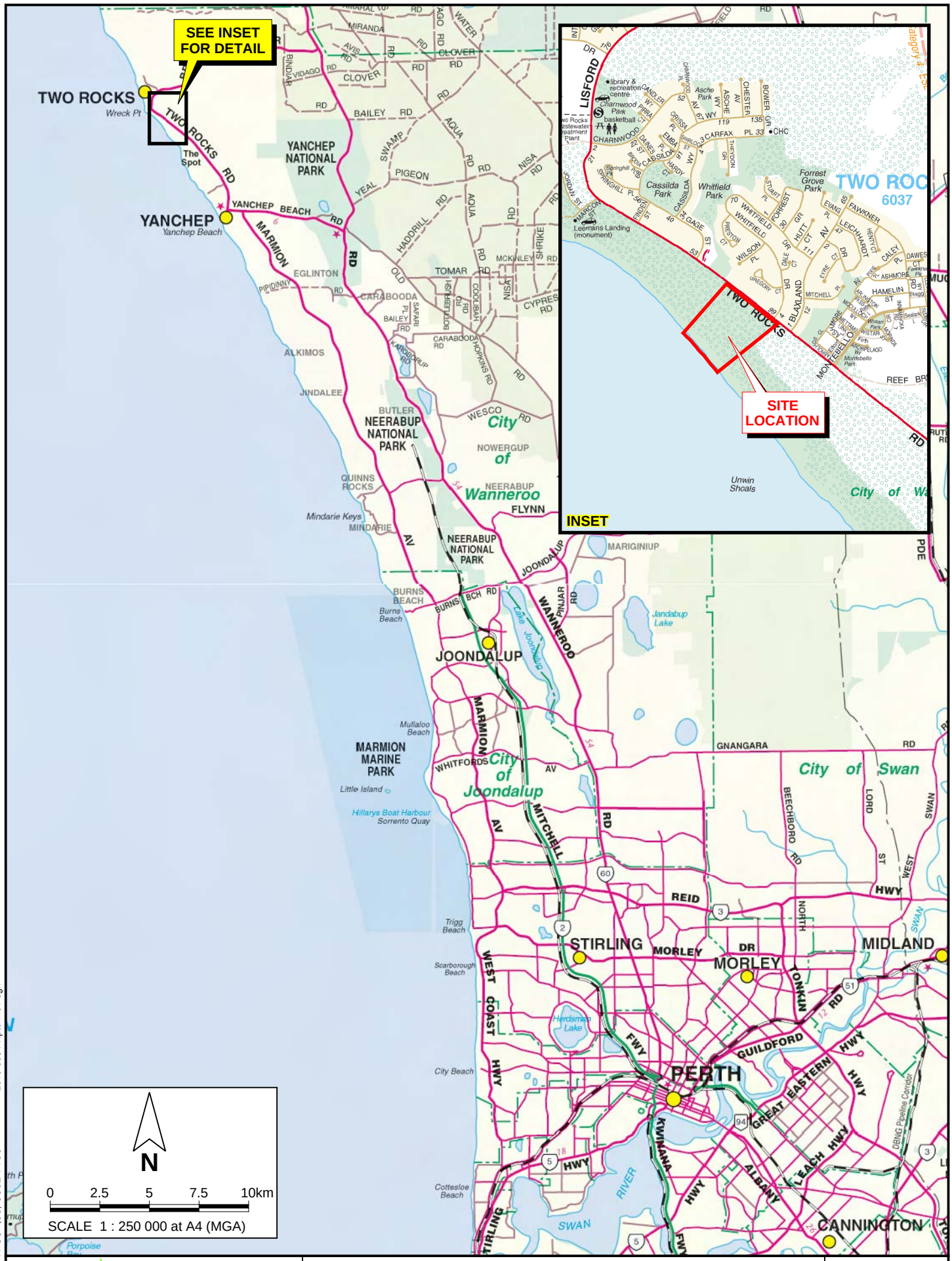
Figure

Flora, Vegetation and Vertebrate Fauna Environmental Impact Assessment – Two Rocks Beach Access, Two Rocks



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TERRESTRIAL ECOSYSTEMS

City of Wanneroo

FLORA, VEGETATION AND VERTEBRATE FAUNA ENVIRONMENTAL IMPACT ASSESSMENT - TWO ROCKS BEACH ACCESS, TWO ROCKS

Figure 1

REGIONAL LOCATION

Drawn: S. Thompson

Date: 17 Dec 2019

Job: 2019-0054

Appendix A
Results of the *EPBC Act* Protected Matters Search

Flora, Vegetation and Vertebrate Fauna Environmental Impact Assessment – Two Rocks Beach Access, Two Rocks

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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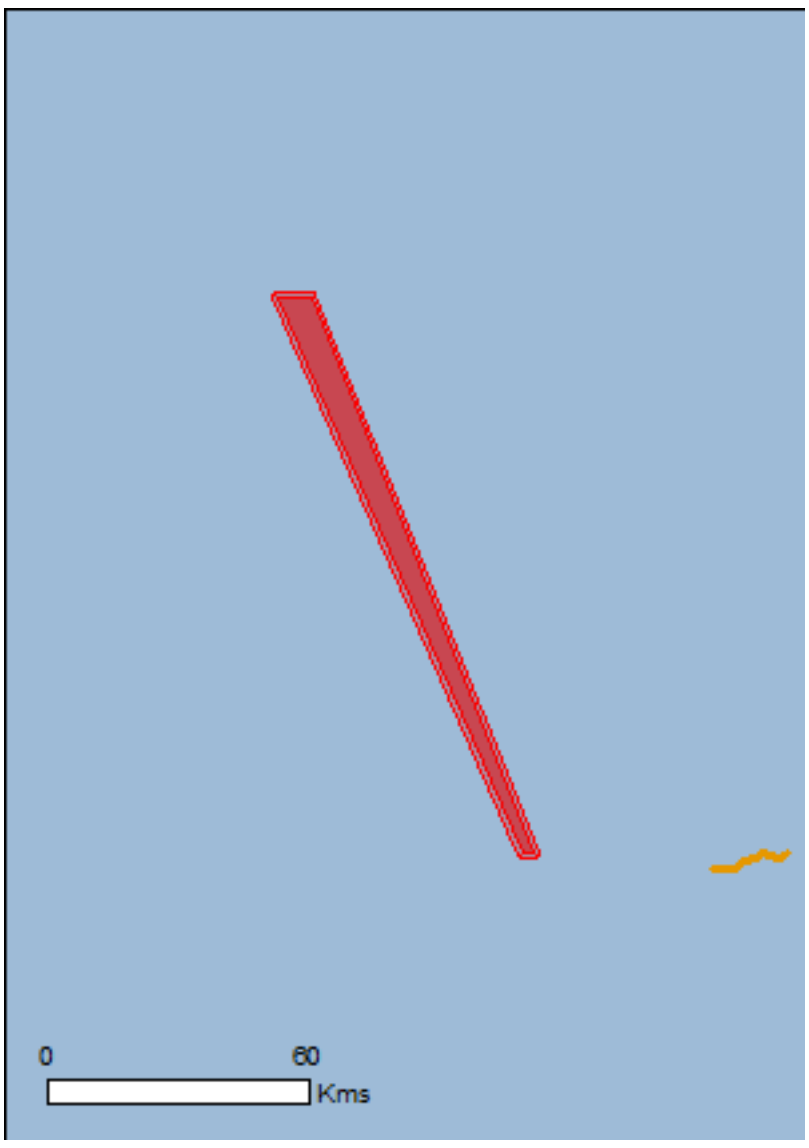
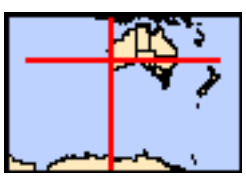


Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	53
Listed Migratory Species:	45

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	2
Commonwealth Heritage Places:	1
Listed Marine Species:	75
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	39
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Insects		
Hesperocolletes douglasi Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Plants		
Chorizema varium Limestone Pea [16981]	Endangered	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Marianthus paralius [83925]	Endangered	Species or species habitat known to occur within area
Reptiles		

Name	Status	Type of Presence
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Ctenotus lancelini		
Lancelin Island Skink [1482]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia		
Caspian Tern [808]		Breeding known to occur within area

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -
Defence - LANCELIN TRAINING AREA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Lancelin Defence Training Area	WA	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Catharacta skua		
Great Skua [59472]		Species or species habitat may occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse		Species or species

Name	Threatened	Type of Presence
[66235]		habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species

Name	Status	Type of Presence
		habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Lancelin And Edwards Islands	WA
Nilgen	WA
Unnamed WA49994	WA

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area

Name	Status	Type of Presence
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-31.8775 115.775,-31.8775 115.8,-30.9 115.34,-30.9 115.269,-31.8775 115.775

Acknowledgements

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

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

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

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

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Appendix B
Definitions of Significant Fauna under the WA *Biodiversity Conservation Act 2016* and Priority Species and Communities

Flora, Vegetation and Vertebrate Fauna Environmental Impact Assessment – Two Rocks Beach Access, Two Rocks

ATTACHMENT B
DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WA *BIODIVERSITY CONSERVATION ACT 2016*

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*. Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened Species

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

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

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

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

CR Critically endangered species

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

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

EN Endangered species

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

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

VU Vulnerable species

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

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

[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).

Extinct Species

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

EX Extinct species

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

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

EW Extinct in the wild species

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

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

Specially Protected Species

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

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

MI Migratory birds protected under an international agreement

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

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

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

CD Species of special conservation interest (conservation dependant fauna)

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

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

OS Other specially protected species

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

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

P Priority species

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

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

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

P1 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.

P2 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.

P3 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.

P4 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.

PRIORITY ECOLOGICAL COMMUNITIES (PECs) (WESTERN AUSTRALIA)

In Western Australia, potential TECs that do not meet criteria or that are not adequately defined or do not have adequate information are added to the Priority Ecological Community (PEC) List as Priority 1, 2 or 3. Communities that are rare but not threatened and are adequately known, or that have been recently removed from the threatened list, are placed in Priority 4 for regular monitoring purposes. Conservation dependent communities are placed in Priority 5.

As of January 2019, there were 393 PECs listed by the DBCA Threatened Species and Communities Branch.

Priority Ecological Communities (PECs) Definitions and Criteria

Priority One: Poorly-known ecological communities	Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two: Poorly-known ecological communities	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
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 with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approx. 10 years), 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, inappropriate fire regimes, clearing, hydrological change etc. 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 a higher threat category. 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.