Beharra Springs Deep 2 Native Vegetation Clearing Permit Supporting Document

Appraisal Well – Beharra Springs Deep 2

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THE THREE WHATS
What can go wrong?
What could cause it to go wrong?
What can I do to prevent it?

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Acronyms and Abbreviations

Acronym / Abbreviation	Definition
Beach	Beach Energy Resources (Perth Basin) Pty Ltd
DMIRS	Department of Mines, Industry Regulations and Safety
EP320	Exploration Permit 320
EP Act	*Environmental Protection Act 1986*
(the) Facility	Beharra Springs Gas Facility
ha	hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre
NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Community
SRE	Short Range Endemic
TEC	Threatened Ecological Community
WA	Western Australia

1 Introduction

Beach Energy Resources (Perth Basin) Pty Ltd (Beach) is part owner of the Beharra Springs Gas Facility (the Facility). The Facility incorporates the gas field production wells and flowlines, gas production plant, sales gas pipeline and associated infrastructure.

The Facility is located approximately 20 kilometres (km) south of Dongara and 350 km north of Perth, Western Australia (WA). The Facility is contained within Production Licence L11 and Exploration Permit EP320 and Pipeline Licence PL18 (Figure 1-1).

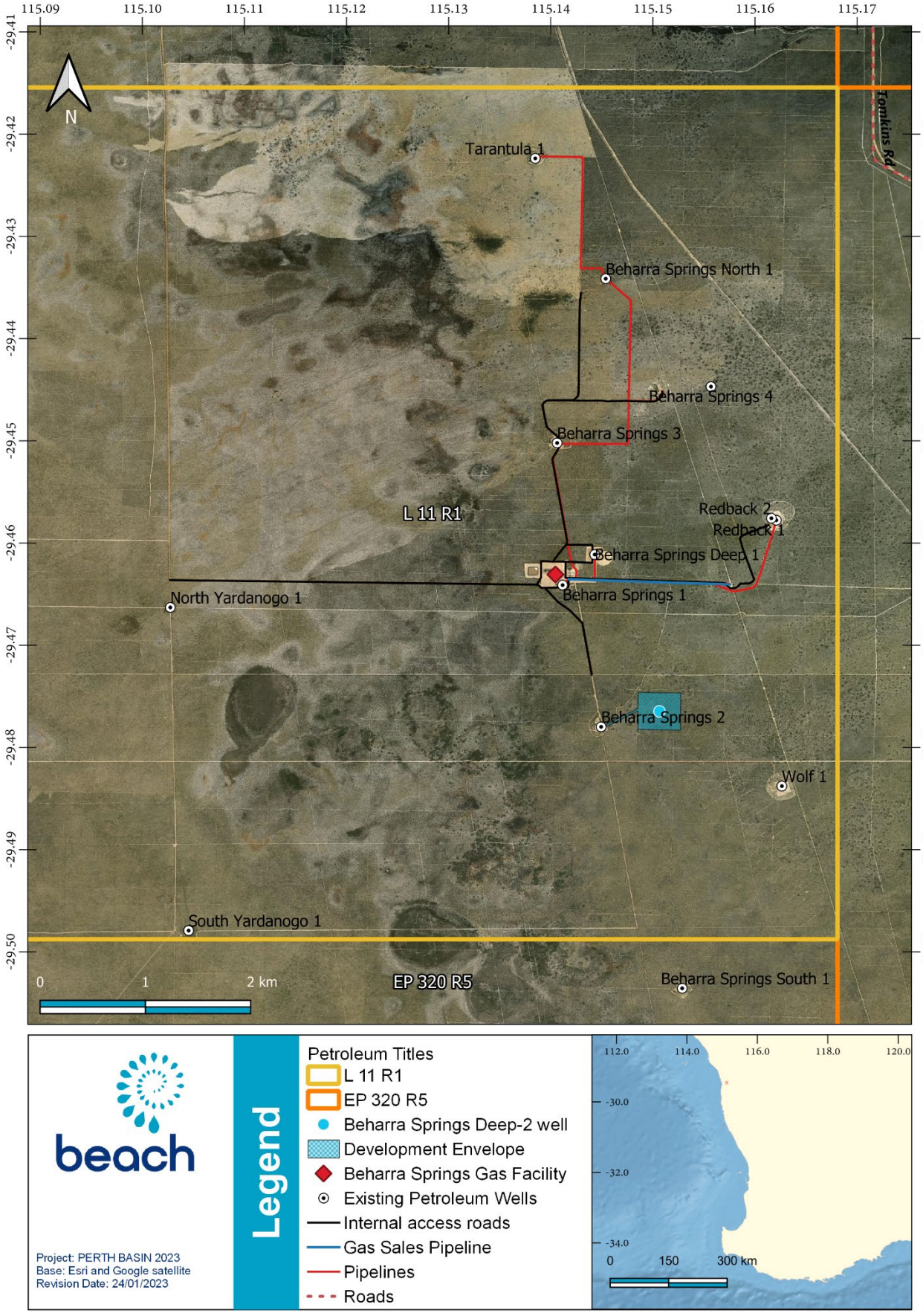


Figure 1-1 Location of the Beharra Springs Gas Facility

1.1 Proposed Location and Area

As part of the development of the Facility, Beach is proposing to drill an additional gas appraisal well within the L11 area. This appraisal well, named Beharra Springs Deep 2, is located in the Shire of Irwin, approximately 30 km southeast of Dongara, within unallocated Crown Land (Lot 12453, Plan P221090). The Development Envelope is shown on Figure 1-2.

The proposed location will require disturbance of up to 6 hectares (ha) of native vegetation within the ~17.1 ha Development Envelope. The operational area at the well site that will remain permanently cleared is approximately 2 ha resulting in 4 ha being rehabilitated post development. Areas cleared for construction that are no longer required for operational activities at the well site will be rehabilitated.

1.2 Purpose

The purpose of this document is to provide the necessary information and justification, as prescribed within the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, to seek approval under Part V of the *Environmental Protection Act 1986* (EP Act) to clear native vegetation.

This document has been prepared to support a Native Vegetation Clearing Permit (NVCP) application, to be submitted to the Department of Mines, Industry Regulation and Safety (DMIRS) for assessment.

Beach has been granted a clearing permit, CPS 6643/4, for the gas production plant and associated infrastructure including accommodation building, workshop and evaporation ponds. This includes the Facility's operational well lease areas (Beharra Springs 1, 2, 3, 4, Beharra Springs North 1, Tarantula 1, Redback South 1 and Redback 2); associated flowlines; sales gas pipeline and access road right of ways within L11/L22, L1 and PL18 (Figure 1-1). This permit allows up to 45.35 ha of clearing within the permitted area and is valid from 26 September 2015 until 30 September 2025.

Beach is now seeking approval to clear up to 6 ha of native vegetation to develop the Beharra Springs Deep 2 appraisal well (Figure 1-2).

1.3 Site Selection

An appraisal gas well is designed to intersect a subsurface prospect. The prospect being targeted for the Beharra Springs Deep 2 well is 4 km below the ground. The surface well site location, and subsequent clearing footprint is then dictated based upon the well design. Although wells can be drilled horizontally, this is much more expensive than a vertical well. The potential to drill the Beharra Springs Deep 2 well horizontally was considered as an avoidance mitigation to minimise impacts to native vegetation, however based upon the required separation of the well from existing facilities and the lack of cleared areas large enough to support the drilling rig, no feasible alternative was available. As such the surface location was selected based upon the vertical well design at the location that gave Beach Energy the best chance to meet the drilling program's objectives.

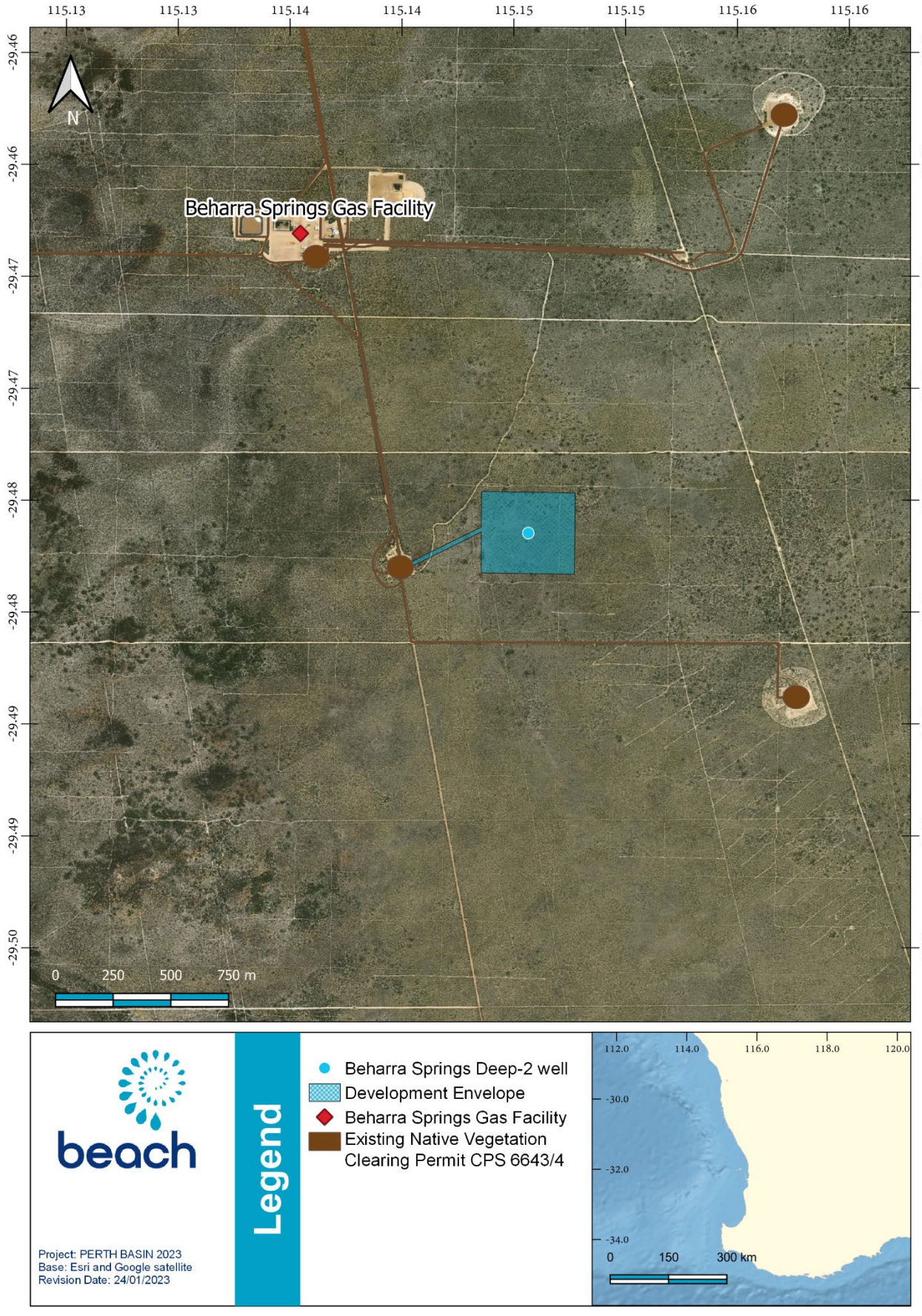


Figure 1-2 Location of Beharra Springs Deep 2 and associated Development Envelope

2 Site Overview

2.1 Climate

The regional climate is classified as subtropical with hot, dry summers and mild winters, where the rainfall is winter dominant, marked as wet winters and dry summers (BOM, 2016). Based on the nearest Bureau of Meteorology (BOM) weather station (Morowa, located approximately 78 km north-east of the well site), the mean monthly minimum temperature recorded for region ranges from 6.3°C in July to 19.5°C in February and the mean monthly maximum temperature ranges from 18.2°C in July to 36.7°C in February (BOM, 2022). The average annual rainfall is 334.8 mm with the majority of rainfall occurring during the winter months (BOM, 2022). A strong south-east morning breeze is a part of summer weather conditions. The winds during the winter months are more variable and influenced by the cold fronts coming in from the Indian Ocean.

2.2 Geology and Landforms

The Development Envelope is located within the Lesueur Sandplain subregion of the Geraldton Sandplains Bioregion (Department of the Environment, 2012). The Geraldton Sandplains Bioregion is composed mainly of proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain mantling Permian to Cretaceous strata (Department of the Environment, 2012; Department of Conservation and Land Management, 2002).

The Geraldton Sandplains are characterised by a series of old dunes which run parallel to the coast. The younger Quindalup dunes occur near the contemporary coastline, with the Spearwood dunes occurring further inland. The soils are typically sandy with some areas of exposed limestone, and a series of wetlands occurs along the plains. In the east lateritic rises occur.

Generally, soils within the Perth Basin are light and sandy and well drained. Beard (1967) described the soils as "calcareous sand soils of minimal development". The soils consist of calcareous and siliceous sand underlain by aeolianite, which is often exposed. The Beharra Springs Deep 2 Development Envelope is located within a singular soil-landscape system: Beharra System (221Be) – level to very gently inclined sandplain with areas of dunes, small playas, and swampy depressions. Yellow and pale deep sands, some sandy duplexes, loams, and wet soils.

2.3 Surface Water and Wetlands

The closest waterbodies to the Development Envelope are two small non-perennial watercourses; one located approximately 3.8 km to the east which is not connected to any other watercourses, and the second approximately 7.7 km south-east of the well site, which flows into the Arrowsmith River (Landgate, 2015).

There are no listed wetlands in or near the proposed appraisal well site or the Development Envelope.

3 Environmental Impact Assessment

3.1 Flora and Vegetation

The proposed Development Envelope is located within a singular vegetation association; Eridoon_378; which is defined as scrub-heath, mixed heath with scattered tall *Acacia* spp., Proteaceae and Myrtaceae (Beard, 1967). The extent of the pre-European vegetation remaining is presented in Table 3-1.

Table 3-1 Vegetation Association and Extent

Vegetation System Association	Description	IBRA Region Extent of Vegetation System	Pre-European Extent of Vegetation Association	Current Extent of Vegetation Association	Pre-European Extent Remaining
Eridoon_378	Mixed heath with scattered tall shrubs Acacia spp., Proteaceae and Myrtaceae.	3,142,149.97 ha	93,523.98 ha	61,031.79 ha	65.04%

No known conservation-significant ecological communities were identified in or near the proposed appraisal well and their potential occurrences were deemed very unlikely to unlikely (Strategen-JBS&G, 2022a) based on assessment of available pre-European vegetation, hydrology, soils, landform and geology information.

A number of native vegetation surveys were undertaken to inform Beach's understanding of site specific sensitivities. A reconnaissance level flora and vegetation survey, and basic fauna survey, were undertaken in May and June 2022, to supplement the desktop assessment of the proposed appraisal well (Strategen-JBS&G, 2022a). In addition to this, a targeted flora survey for conservation-listed flora was completed over the same survey area between 31 October 2022 and 17 November 2022 to support and validate the initial survey findings (Strategen-JBS&G, 2022b).

3.1.1 Conservation Significant Flora

No Threatened Flora were recorded during the reconnaissance field survey (Strategen-JBS&G, 2022a). However, as the proposed area for the appraisal well is considered suitable habitat for the Threatened species *Paracaleana dixonii* (Sandplain Duck Orchid) [State = VU; National = EN]. As such, Beach commissioned a targeted flora survey between 31 October 2022 and 17 November 2022 targeting the peak flowering period for this species. During this survey, no *Paracaleana dixonii* individuals were identified (Strategen-JBS&G, 2022b). One listed Priority species was identified within the Development Envelope; *Beyeria gardneri* (P3) with ~a dozen counts of the species recorded.

***Beyeria gardneri* (P3)**

Beyeria gardneri (P3) is a shrub growing up to 0.5 m high which occurs on sand and gravelly loam (Western Australian Herbarium, 1998-). This taxon is known from 43 records (Atlas of Living Australia, 2022) but is widespread across four Interim Biogeographic Regionalisation for Australia (IBRA) regions including Avon Wheatbelt, Geraldton Sandplains, Swan Coastal Plain, Yalgoo (Western Australian Herbarium, 1998-).

In addition to the know records, data sharing with other operators in the Midwest identified that 51 *Beyeria gardneri* individuals have been previously recorded within the area surrounding the Beharra Springs Gas Facility (Tronox, Iluka and MEPAU, 2019). In addition to the 15 records of the species identified in Spring 2022 (Strategen-JBS&G, 2022b) within or in close proximity to the Development Envelope, Beach Energy are aware that a total of 109 individuals have been previously recorded.

Based upon the clearing footprint for Beharra Springs Deep 2 within the Development Envelope, 4 individuals will be impacted. As such, this activity will result in disturbance of approximately 3.7% of the known records. This project is not considered to result in a significant impact to the species as:

- although relatively unknown, the taxon has been recorded across a broader number of IBRA regions suggesting any local impacts would not result in population level impacts
- surveys indicate the species has a larger localised presence than previously known (Figure 3-1).

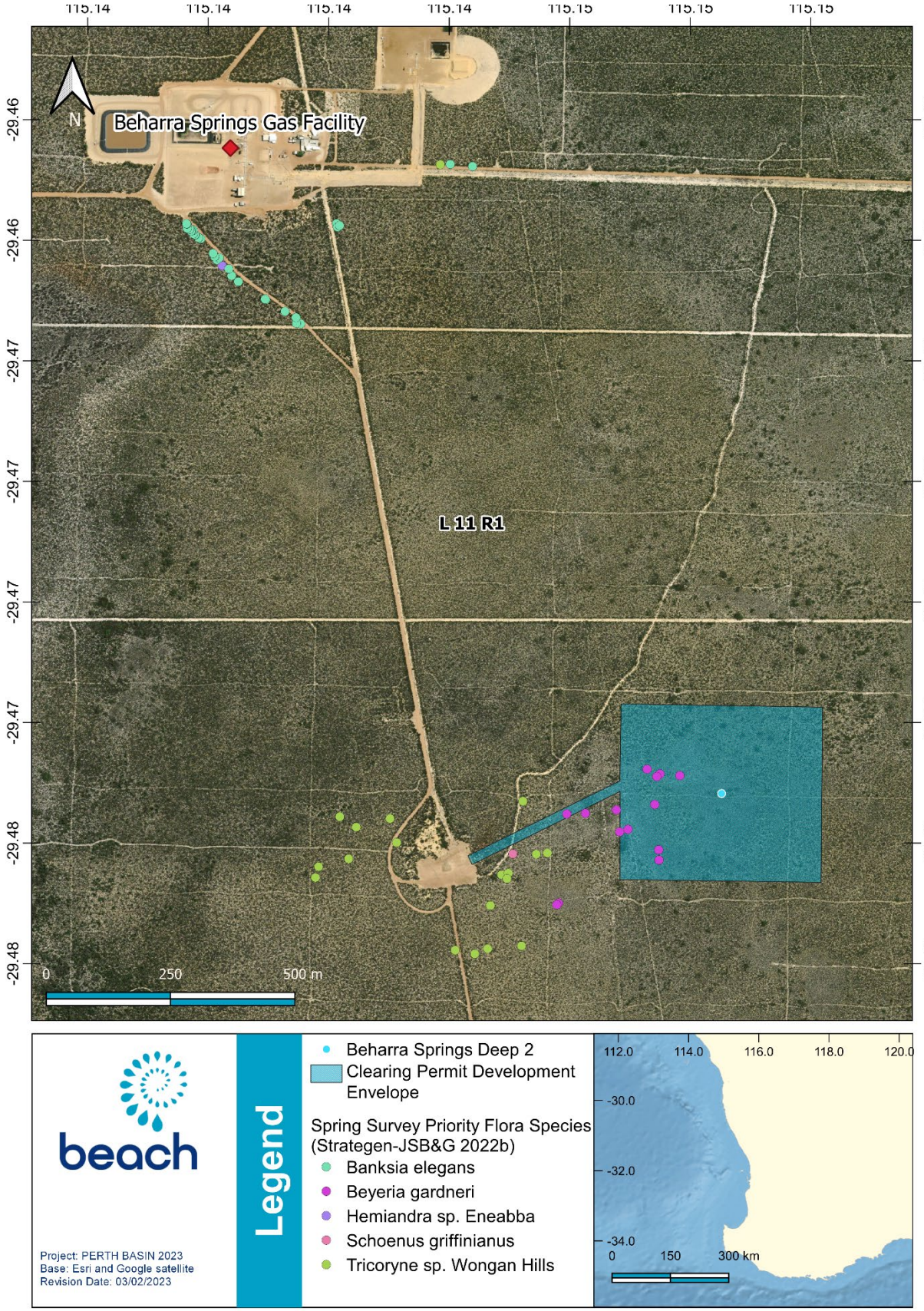


Figure 3-1: Distribution of Priority listed flora locations within and surrounding the Development Envelope

3.1.2 Introduced Flora

No WoNS or Declared Pest plant species were recorded during survey (Strategen-JBS&G, 2022a).

3.1.3 Vegetation Type and Condition

The Beharra Springs Deep 2 well Development Envelope (Strategen-JBS&G, 2022a) has been identified to predominantly contain vegetation (BaEmMS) of open mid shrubland of *Banksia attenuata*, with or without isolated emergent *Acacia spp.*, *Eucalyptus todtiana* or *Xylomelum angustifolium*, over *Ecdeiocolea monostachya*, *Mesomelaena pseudostygia* and *Lepidobolus sp.* sparse sedgeland. Within this vegetation (BaEmMS), exists an area of is isolated low shrubs of *Banksia attenuata*, *Banksia shuttleworthiana* and *Calothamnus glaber*, over *Ecdeiocolea monostachya*, *Mesomelaena pseudostygia* and *Lepidobolus sp.* sedgeland vegetation (EmSL) within the proposed well site location. Both units of vegetation are well defined based on the floristic analysis undertaken by Strategen-JBS&G (2022a).

3.2 Fauna and Habitat

3.2.1 Fauna Survey

A basic fauna survey was completed to identify broad faunal assemblages and habitats present within the survey area (Strategen-JBS&G, 2022a). The Beharra Springs Deep 2 Development Envelope has been identified mostly as kwongan fauna habitat, with low scrub or heath of Banksia and Myrtaceous low shrubs, with sedges on pale undulating sandplain. Areas of sedgeland fauna habitat are also present at the proposed well site location (Strategen-JBS&G, 2022a), containing low-lying heath or open sedgeland over closed depressions or basin with loose, low cover.

No priority species or otherwise conservation-listed fauna taxa were recorded in the Beharra Springs Deep 2 Development Envelope.

The basic fauna survey also identified that the Beharra Springs Deep 2 Development Envelope does not have high potential to support Short Range Endemic (SRE) species. No invertebrates considered likely to represent SRE taxa were observed during the survey, despite the survey being undertaken within the optimal season and in seasonally wet conditions. There remains potential for SRE species to occur but the likelihood is considered to be low based on the absence of likely suitable habitat.

3.2.2 Conservation Significant Fauna

The Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) [EN; EN] was observed as part of a broader vegetation survey across the L11 area (Strategen-JBS&G, 2022a), however the Development Envelope does not occur within the species' breeding range. Although no significant trees likely to support Carnaby's Black Cockatoo nesting or roosting activity were observed within the proposed clearing footprint within the Development Envelope for Beharra Springs Deep 2, the native vegetation present is deemed suitable for Black Cockatoo foraging habitat.

Given this information, Beach engaged Bamford Consulting Ecologists to undertake an additional survey for Carnaby's Black Cockatoo foraging habitat consistent with the Commonwealth guidelines (Commonwealth of Australia, 2022). The proposed location of the Beharra Springs Deep 2 proposed well site and associated access track has been identified as having no to low to moderate foraging values (Bamford Consulting Ecologists, 2022). The construction and operation of the appraisal well will result in some disturbance of these values of foraging habitat. However, this has been minimised using existing cleared areas, i.e., access tracks, and/or limit to areas of low foraging value.

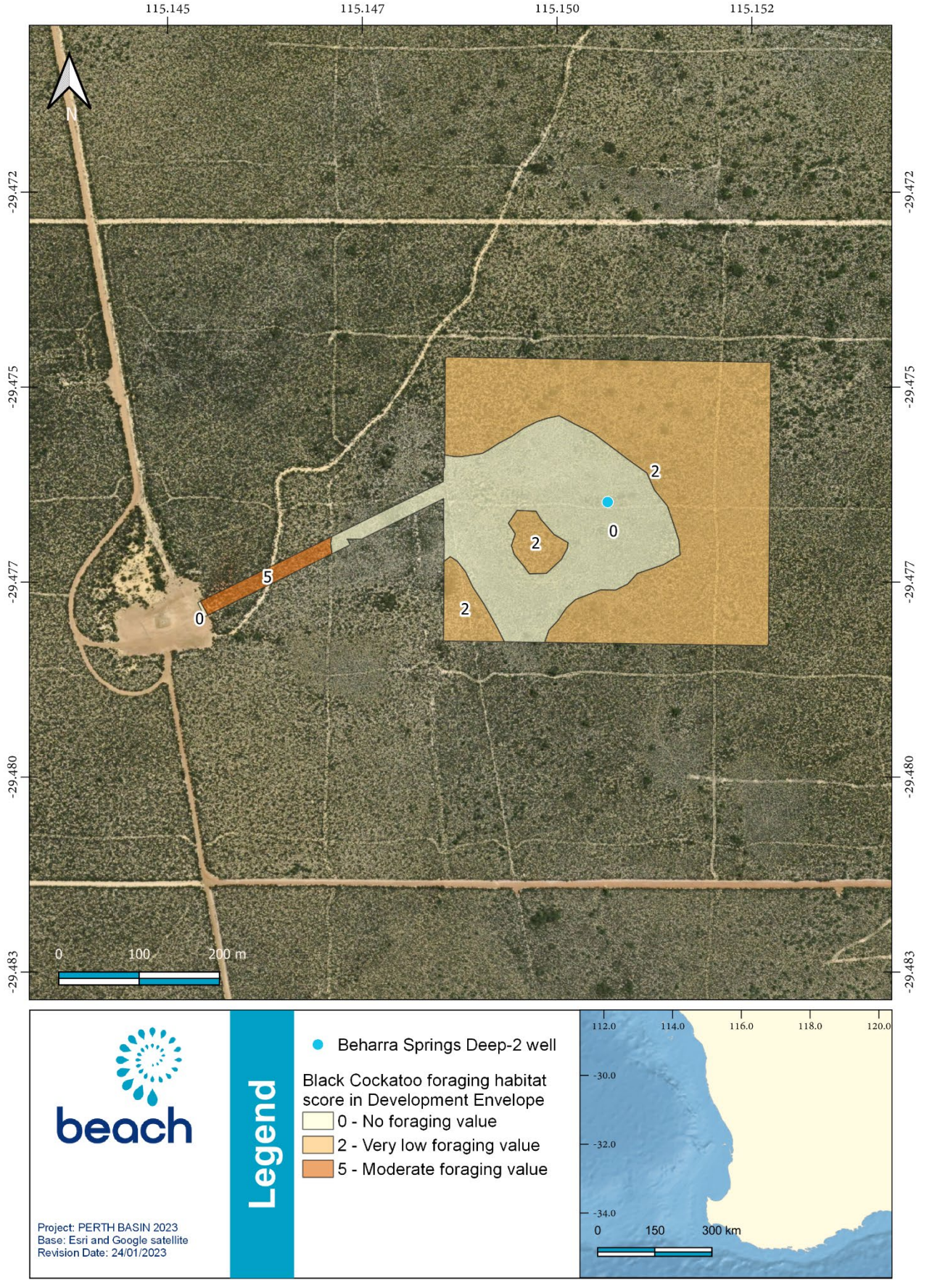


Figure 3-2 Carnaby's Black Cockatoo foraging habitat quality and score within the Development Envelope

Clearing for the Beharra Springs Deep 2 appraisal well site is planned to impact habitat of very low foraging value (2/10) in coastal blackbutt woody pear woodland and banksia shrubland, and areas of no foraging value in sedgeland vegetation, with the access tracks also intersecting moderate foraging value (5/10) banksia shrubland. Beach does not believe that this project will pose a significant impact to this species. Strategen-JBS&G (2022a) note that the majority of vegetation surveyed is pristine and ubiquitous suggesting that the activity will not result in significant fragmentation or reduction in vegetation association percentage remaining. The clearing footprint represents a very small area within 15 km of the total areas surveyed (total of 35,660 ha surveyed) that provides extensive foraging habitat of similar and higher quality value (Bamford Consulting Ecologists, 2022).

4 Environmental Management Measures and Rehabilitation

Environmental management measures that will be implemented to avoid, minimise and reduce the impacts associated with clearing up to 6 ha include:

- ground disturbance permit procedures will be implemented prior to clearing
- areas designated for clearing will be surveyed and boundaries clearly demarcated. Personnel will be familiar with areas of demarcation prior to commencement of clearing to ensure no clearing is undertaken beyond the clearing zones
- existing access tracks or other cleared areas will be utilised to prevent unnecessary clearing
- earth-moving equipment will be inspected for the presence of soils and vegetation matter prior to mobilisation to the of clearing site
- clearing will be undertaken progressively so only those areas absolutely required for the appraisal well are disturbed
- vehicles and equipment will adhere to speed limits and avoid driving over, or parking on, vegetation and/or tree roots that are not designated for clearing
- effective waste containment and disposal procedures will be implemented to prevent attraction of feral predators, such as cats and foxes
- personnel will be inducted and educated on environmental requirements of the project.

Rehabilitation of the appraisal well and associated infrastructure will be undertaken in accordance with the DMIRS accepted Beharra Springs Petroleum Production Operations Environment Plan (CDN/ID 3677584). Specifically, the Environment Plan sets out reinstatement and rehabilitation objectives and criteria consistent with Table 4-1.

Table 4-1: Rehabilitation Objectives

	Objective	Criteria	Monitoring	Remedial Action
Vegetation	To facilitate the natural recovery of native vegetation	**Vegetation regrowth:** No bare patches larger than 15 m^2 after 12-24 months.	Visual inspection (post site reinstatement and biennial).	Continue monitoring. Where progressive native vegetation regrowth is not observed, active rehabilitation strategies will be investigated[1].
		Native species richness: Perennial native species richness equals or exceeds 50% of that of control areas.	Biennial visual assessment of rehabilitated site for presence of keystone native species.	Investigate active rehabilitation strategies[1] where perennial native species richness is less than 50% of that of control areas after 3 years of rehabilitating the site.
		Native plant foliage cover: Perennial native species foliage cover equals or exceeds 50% of that of control areas.	Biennial visual inspection (post site reinstatement and biennial).	Investigate active rehabilitation strategies[1] where the total perennial native species foliage cover is less than 50% of that of control areas after 3 years of rehabilitating the site.

4.1 Dieback and Weeds

When undertaking any clearing or other activity authorised under such Permit, Beach and their contractors will ensure the following steps are implemented to minimise the risk of the introduction and spread of weeds and dieback:

- clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared
- ensure that soil, mulch, fill and/or other material brought into the area to be cleared are verified low risk of dieback and weed
- restrict the movement of vehicles and machinery to the limits of the areas to be cleared.

[1] Active rehabilitation strategies are likely to be supported with increased monitoring efforts and may include:
- fencing off areas to limit external pressures
- weed management to reduce competition
- direct seeding or re-seeding.

5 Assessment Against the 10 Clearing Principles

Clearing Principle	Assessment
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	The application area is small (6 ha). However, based on the vegetation survey undertaken by Strategen-JBS&G (2022a), the surrounding area is in pristine condition, based on structural integrity and floristic composition. Desktop investigations indicated one conservation significant flora species, *Paracaleana dixonii* (Sandplain Duck Orchid), listed as Vulnerable (State) and Endangered (Commonwealth) has the potential to be present. This species is relatively common within appropriate habitat types throughout the region. However, no individuals of *Paracaleana dixonii* were recorded during the reconnaissance field survey or targeted field survey completed during the optimal flowering period (October to December or January) (Western Australian Herbarium, 1998-). Four listed Priority species were identified during the targeted survey, with only one Priority flora species; *Beyeria gardneri* (P3) that will be disturbed due to clearing for the Beharra Springs Deep 2 appraisal well. Impacts to this species were evaluated in Section 3.1.1. The disturbance to the listed priority species is not considered to be significant as review of biological data indicated that the species has a large localised presence as well as a wide ranging distribution such that any localised impacts would not impact on broader populations. The vegetation surveyed within the Development Envelope consists of vegetation types BaEmMS and EmSL (Strategen-JBS&G, 2022a), with the majority of the Development Envelope mapped as BaEmMS vegetation, dominated by open mid-shrubland of *Banksia attenuata* over sedges. This can also be characterised as Kwongan scrub or heath, which is a prominent vegetation type within the region. Both these vegetation types are not considered significant vegetation and are both locally and regionally. Additionally, no Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were identified or known to occur.. The application area is not considered to contain a high level of biodiversity as: • no threatened flora species will be impacted • the vegetation types are regionally well represented around the Beharra Springs Area • no TECs will be impacted • in majority, very low value Black Cockatoo foraging habitat, and minor areas (<1 ha) of moderate habitat will be impacted (see below in Clearing Principle b) • although four counts of one listed priority flora species will be impacted, the species is well represented locally and widespread across bioregions indicating any impacts will be localised and not affect broader populations. Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**

Clearing Principle	Assessment
(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	There are no significant trees likely to support nesting or roosting activity of Carnaby's Black Cockatoos and the native vegetation is considered of no, to very low, to moderate value foraging habitat (Bamford Consulting Ecologists, 2022) within the Development Envelope, and includes a large area of no foraging value within the proposed well site location (Figure 3-2). The 6 ha of clearing within the Development Envelope consists approximately of: • ~65% (~3.92 ha) of no foraging value (foraging score of 0/10) • ~32% (~1.92 ha) of very low foraging habitat (foraging score of 2/10) • ~3% (<0.16 ha) of moderate foraging habitat (foraging score of 5/10). The foraging habitat present within the Development Envelope comprises a small percentage of the surrounding vegetation. As Carnaby's Black Cockatoos are mobile species, clearing for the purpose of this activity will not result in any fragmentation impacts, and due to the lack of suitable nesting or roosting habitat would not be expected to result in significant impact these species. No other species were identified by the surveys to indicate that the vegetation provides significant habitat to any other species of indigenous or conservation significant fauna. Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**
(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	Desktop investigations indicated one conservation significant species were likely to be present, however no species listed as Threatened under the BC Act or under the EPBC Act were recorded during the reconnaissance and targeted field survey (Strategen-JBS&G, 2022a; Strategen-JBS&G, 2022b). As such, the application is not known to support any rare flora. Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**
(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	No TECs or PECs exist within the Development Area. The potential of TECs to occur has been assessed as very unlikely to unlikely (Strategen-JBS&G, 2022a). Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**
(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area	Two types of vegetation communities were identified within the survey area as low and open mid Banksia shrublands. The application area falls within the Geraldton Sandplains IBRA bioregion, which retains more than 44% of its pre-European vegetation extent (Government of Western Australia, 2019). This also falls within the Eridoon_378 vegetation association which has 65% remaining in the bioregion (Government of Western Australia, 2019). The clearing associated with the proposed appraisal well

Clearing Principle	Assessment
that has been extensively cleared.	program is not in an ecological community with an extent below 30 per cent of that present pre-1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001). The application area is very small (6 ha in total).and represents 0.009 % of the current extent remaining. The vegetation association Eridoon_378 is well represented in the region and the vegetation within the application area is not considered to be significant as a remnant of native vegetation that has been extensively cleared. Additionally, the vegetation types identified by the surveys; BaEmMS and EmSL; are also well represented within the region around the Beharra Springs Area. Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**
(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	The closest waterbodies to the Development Envelope are two small non-perennial watercourses; one located approximately 3.8 km to the east which is not connected to any other watercourses, and the second approximately 7.7 km south-east of the well site, which flows into the Arrowsmith River (Landgate 2015). The Arrowsmith Lake is located approximately 9 km south-west of the Development Envelope. There are no listed wetlands or watercourses in or near the Development Envelope. Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The area proposed for clearing is small (6 ha) and will have hardstand (compacted gravel / limestone) established as part of the civil works campaign, therefore providing a stable landform structure highly unlikely to result in appreciable land degradation. The proposed clearing is not expected to increase wind, water or soil erosion, salinity, nutrient export, acidification, waterlogging or flooding that could affect the present or future use of the land. Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**
(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The Yardanogo Nature Reserve (Reserve Number WA 36203) is the closest conservation area located approximately 5 km to the north-west of the closest point of the Development Envelope The proposed clearing is not located near an Environmentally Sensitive Area (ESA), Bush Forever Area or Recommended Red Book Conservation Area. Given the distance to any conservation area, **the proposed clearing is not likely to be at variance to this Principle.**
(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The closest river to the Beharra Springs Deep 2 appraisal well is the Arrowsmith River. The poorly defined drainage lines of the Arrowsmith River flow in a westerly direction to the south of L11 prior to turning north-west to enter the terminal swamps and lakes of the Arrowsmith Lake area. Given the distance to this watercourse and small clearing footprint within the defined Development Envelope, the proposed clearing is not likely to cause deterioration in the quality of surface water. Similarly, the proposed clearing is not likely to have a significant impact on the quality of groundwater and/or lead to a perceptible rise in the water table.

Clearing Principle	Assessment
	No watercourses or wetlands are located in the proposed clearing area or Development Envelope. The proposed clearing will not: • lead to adverse environmental impacts through sedimentation of waterbodies • contribute to increased nutrient levels in the catchment • have the potential for low pH waters and/or acid sulphate soils to form • contribute to increased salinity in catchments already affected by or likely to be affected by salinity • lead to changes in water regimes of, or result in breaches of environmental water provisions for groundwater-dependent ecosystems on or offsite and subsequent degradation of the biological communities associated with these systems. Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**
(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	There are no watercourses or drainage lines in the vicinity of the Development Envelope. The activity would not result in any changes to flooding of the area. The small area of clearing and associated project footprint will be managed to prevent uncontrolled loss of water to the surrounding environment utilising the porous and permeable soil-landscape system which allows rainwater to infiltrate to the water table rather than running off the land surface Based on the above, **the proposed clearing is not likely to be at variance to this Principle.**

6 Conclusion

This document outlines Beach's application for a NVCP in accordance with the EP Act to clear up to 6 ha of native vegetation to allow construction and operation of the Beharra Springs Deep 2 appraisal well. The following conclusions associated with the permit application are listed below:

- fora taxa within the Development Envelope, including the one Priority species recorded, are known to occur at other locations and are well represented outside of the proposed area
- there are no TECs or listed Threatened flora within the proposed clearing footprint
- impacts to fauna from the proposed clearing are expected to be minimal as the clearing permit area is comprised of a small area which is well represented locally and regionally and not considered to be a significant occurrence
- the proposed clearing is not likely to be at significant variance to any of the clearing principles
- weed and dieback hygiene protocols will be implemented during vegetation clearing and subsequent earthworks to minimise the risk of introduction or spread
- disturbance to surrounding soil and other vegetation shall be kept to the minimum amount required
- rehabilitation objectives and criteria have been defined and will be implemented.

7 References

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Appendix A Flora and Fauna Survey 2022 – Strategen-JBS&G 2022a –Perth Basin Ecological Studies – Reconnaissance and Basic Autumn Surveys

Beach Energy Pty Ltd

Perth Basin Ecological Studies Interim Report

February 23

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

62676/147,393 (Rev 1)

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Abbreviations

Term	Definition
BAM Act	*Western Australian Biosecurity and Agriculture Management Act 2007*
BC Act	*Western Australian Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DAWE	Commonwealth Department of Agriculture, Water and the Environment (2020-2022, now DCCEEW)
DBCA	Western Australian Department of Biodiversity, Conservations and Attractions
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DEC	Western Australian Department of Environment and Conservation (2006-2013, now DBCA)
DSEWPaC	Commonwealth Department of Sustainability Environment Water Population and Communities (2010-2013, now DCCEEW)
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (conservation status as listed under the Commonwealth EPBC Act and/or State BC Act)
EP Act	Western Australian Environmental Protection Act 1986
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
GDE	Groundwater Dependent Ecosystem
GDV	Groundwater Dependent Vegetation
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre/kilometres
m	metre/metres
MA	Marine species (fauna protected under the Commonwealth EPBC Act or international agreements)
MI	Migratory species (fauna specially protected under the Western Australian BC Act or Commonwealth EPBC Act)
MS	Ministerial Statement
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
OS	Other specially protected species (specially protected Fauna species listed under the Western Australian BC Act)
P1, P2, P3, P4, P5	Priority Flora, Fauna or Ecological Community ranking (P1-P5) as per DBCA listings
PEC	Priority Ecological Community
PF	Priority Flora
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)
SFDV	Sheet Flow Dependent Vegetation
SoW	Scope of Works
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
SRE	Short Range Endemic
S1	Schedule 1 Fauna species as listed under the Western Australian BC Act
TEC	Threatened Ecological Community
TF	Threatened Flora (previously Declared Rare Flora [DRF] in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (conservation status as listed under the Commonwealth EPBC Act and/or State BC Act)
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WAOL	Western Australian Organism List
WONS	Weeds of National Significance
*	Introduced flora species (i.e. weed)

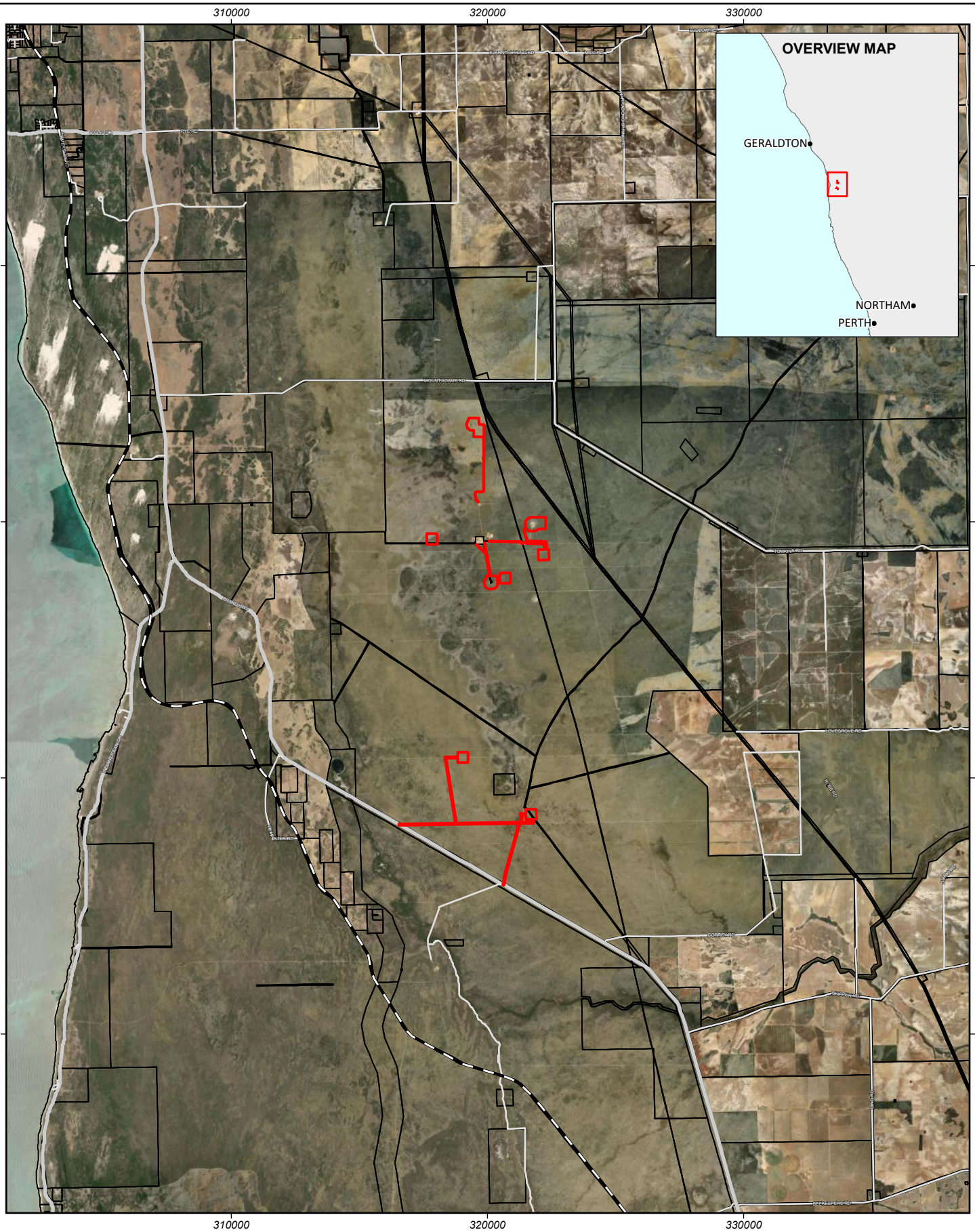
1. Introduction

1.1 Background

As part of the development of the Beharra Springs Facility, Beach Energy Limited (Beach) are proposing to drill a number of gas exploration and development wells in EP 320 and L 11. In order to support environmental approvals for the proposed works, Beach engaged JBS&G to undertake ecological studies including a Reconnaissance flora survey and Basic fauna survey to assess broad vegetation units and fauna habitat at seven sites and associated access corridors. This flora and fauna survey was undertaken in Autumn 2022.

1.2 Survey Area

The area for which ecological survey is required to be undertaken (Survey Area) is located in Arrowsmith, approximately 30 km southeast of Dongara, Western Australia in the Shire of Irwin. The Survey Area totals 255.58 hectares, spanning approximately 20 km, and is positioned south of Mount Adams Road and East of Brand Highway. The Survey Area is comprised of native vegetation, as well as vegetation corridors adjacent to associated access tracks (Figure 1.1)



Legend

- Survey area
- Cadastre (LGATE-002)
- Rail line
- Major road
- Minor road

Scale: 1:200,000 at A4 (0 2½ 5 Kilometres)		**Perth Basin Ecological Studies**
Coord. Sys. GDA2020 MGA Zone 50		**SURVEY AREA**
Job Number: 62676		
Client: Beach Energy		**FIGURE 1.1**
Version: R01 Rev A	Date: 06-Sep-2022	strategen JBS&G
Drawn By: cthatcher	Checked By: TJ	

File Name: W:\Projects\1)Open\Beach Energy\62676 Perth Basin Ecological Surveys\GIS\Maps\R01_Rev_A\62676_PerthBasin_Ecology_R01_v1.aprx
Image Reference: World Imagery: Earthstar Geographics

1.3 Compliance

Various legislative documents, policies and guidelines are relevant to the environmental assessment of the Survey Area and provide guidance on survey methodology and outcomes.

1.3.1 Legislative Context

Flora and fauna in Western Australia (WA) are protected formally and informally by various legislative and non-legislative measures, including:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Commonwealth;
- *Biodiversity Conservation Act 2016* (BC Act) – State;
- *Environmental Protection Act 1986* (EP Act) – State;
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) – State; and
- WA Department of Biodiversity, Conservation and Attractions (DBCA) Priority lists for flora, ecological communities and fauna.

A short contextual description of each legislative measure is provided below. Other definitions, including species conservation categories, are provided in **Appendix A**.

1.3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act aims to protect Matters of National Environmental Significance (MNES), which are detailed in Appendix A. Under the EPBC Act, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) lists protected species and Threatened Ecological Communities (TECs) by criteria set out in the Act. Species are conservation significant if they are listed as Threatened (i.e. Critically Endangered, Endangered and Vulnerable) or Migratory.

Bird species protected as Migratory under the EPBC Act include those listed under international migratory bird agreements relating to the protection of birds which migrate between Australia and other countries, for which Australia has agreed. This includes the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Some marine fauna or terrestrial fauna that use marine habitats are listed as Marine under the EPBC Act. These species are only considered conservation significant when a proposed development occurs in a Commonwealth marine area (i.e. any Commonwealth Waters or Commonwealth Marine Protected Area). Outside of such areas, the EPBC Act does not consider these species to be MNES and therefore are not protected under the EPBC Act.

1.3.1.2 Biodiversity Conservation Act 2016

DBCA lists taxa (flora and fauna) under the provisions of the BC Act as protected and are classified as according to their need for protection (see Appendix A). The BC Act makes it an offence to 'take' threatened species without an appropriate licence. There are financial penalties for contravening the BC Act.

Under the *Biodiversity Conservation Act 2016* (BC Act), DBCA lists species as Threatened (T) (Declared Rare) or Priority Flora (P1, P2, P3 or P4).

1.3.1.3 Environmental Protection Act 1986

Threatened flora, fauna (and significant habitat necessary for the maintenance of indigenous fauna) and ecological communities are given special consideration in environmental impact assessments and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the

Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Exemptions for a clearing permit do not apply in, or within 50 m of, an ESA.

1.3.1.4 Biosecurity and Agriculture Management Act 2007

The BAM Act provides for management and control of listed organisms, including introduced flora species (weeds). Species listed as Declared Pests under the BAM Act are classified under three categories:

- C1 Exclusion: Pests assigned under this category are not established in Western Australia, and control measures are to be taken to prevent them entering and establishing in the State.
- C2 Eradication: Pests assigned under this category are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
- C3 Management: Pests assigned under this category are established in Western Australia, but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area that is currently free of that pest.

Under the BAM Act, land managers are required to manage populations of Declared Pests as outlined under the relevant category.

1.3.2 Relevant Guidelines

Additionally, the following factors, guidelines and government listings were taken into consideration when conducting ecological studies within the Survey Area:

- Department of Agriculture, Water and the Environment (DAWE) (2022a) *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black- cockatoo*, referred to hereafter as the Black Cockatoo Referral Guidelines;
- Department of Environment, Water, Heritage and the Arts (DEWHA) (2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999;*
- DEWHA (2010) *Survey guidelines for Australia's threatened birds;*
- Department of Sustainability Environment Water Population and Communities (DSEWPaC) (2011) *Survey guidelines for Australia's threatened mammals;*
- EPA (2020a) *Statement of Environmental Principles, Factors and Objectives;*
- EPA (2016a) *Environmental Factor Guideline – Flora and Vegetation;*
- EPA (2016b) *Environmental Factor Guideline – Terrestrial Fauna;*
- EPA (2016c) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, referred to hereafter as the Flora and Vegetation Technical Guidance;
- EPA (2020) *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, referred to hereafter as the Fauna Technical Guidance;
- Threatened Species Scientific Committee (TSSC 2016) *Approved conservation advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community;*
- Weeds of National Significance (WoNS); and
- Locally significant populations recognised by the DBCA.

2. Methods

2.1 Rationale for Survey Approach

The following survey methods were proposed and discussed as being appropriate to define impacts on flora and vegetation within the Survey Area as a result of the proposed drilling program:

1. Desktop assessment of available ecological data and reports;
2. Reconnaissance (formerly level 1) flora and vegetation survey per *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016c) to characterise broad vegetation units and condition across the Survey Area;
3. Basic (formerly level 1) fauna survey as per *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) to identify broad faunal assemblages and habitats present within the Survey Area; and
4. Targeted survey for conservation-listed flora within well sites and associated access corridors requiring disturbance, to enable assessment of direct impacts and inform avoidance and mitigation where possible.

A Reconnaissance level flora and vegetation survey, and Basic fauna survey, was considered appropriate given the absence of conservation significant communities occurring within the Survey Area as defined by initial desktop assessment, the relatively low level of impact of the proposed works, and the extent of Targeted flora survey proposed which would add supplementary information to the initial coverage.

To supplement the Reconnaissance flora and vegetation survey, Targeted flora survey within proposed areas of disturbance will be conducted in mid-late spring 2022 to fully inform the density and distribution of conservation significant flora species with potential to be impacted by the works. The search for flora of conservation significance will utilise parallel transects at 10 m intervals. The findings of these surveys will be presented in separate reports for section of the Project.

An outline of the field survey schedule is shown in **Table 2-1**.

Table 2-1: Survey Schedule

Dates	Phase	Objective
9 May – 9 June 2022	Basic Fauna Survey	• Map broad fauna habitat units • Identify general faunal assemblage • Assess likelihood of occurrence of conservation-listed species
24 May – 9 June 2022	Reconnaissance Flora and Vegetation Survey	• Map broad vegetation units and condition • Identify areas of significant vegetation • Assess likelihood of occurrence of conservation-listed species
October - November 2022	Targeted Flora Survey at Tarantula Deep, Redback 1 and Redback 1 Deep, Redback South, , Beharra Deep 2 and associated access tracks.	• Identify presence of conservation-listed flora

2.2 Desktop Assessment

Desktop methodology was undertaken in accordance with current EPA guidance (EPA 2016c; 2020). A comprehensive review of contextual environmental information was undertaken including climate, biogeography, land systems, and pre-European vegetation. Databases listed in **Table 2-2** were queried to generate a list of species and ecological communities previously recorded within, and in

the vicinity of, the Survey Area – with an emphasis on species and communities of conservation significance and introduced species. Buffers were applied to all searches to provide appropriate contextualisation of the biogeographic region and are listed in **Table 2-2**.

Table 2-2: Database searches conducted for the desktop assessment

Custodian	Database	Search Group	Search Extent (from Survey Area boundary)
Department of Biodiversity Conservation and Attractions	Threatened and Priority Ecological Communities database	Ecological communities	50 km
	Threatened and Priority Flora database	Flora species	18 km
	Threatened and Priority Fauna database	Fauna species	30km
Department of Agriculture, Water and the Environment	Protected Matters Search Tool	Matters of National Environmental Significance	20 km
	State and Commonwealth Heritage	European Heritage	Not Applicable
Department of Planning, Land and Heritage	Aboriginal Heritage Inquiry System	Aboriginal Heritage (Registered and Other)	Not Applicable
WA Herbarium	Western Australian Herbarium (FloraBase)	Flora species	18 km

Reports that document regional flora and fauna within the surrounds of the Survey Area were also reviewed prior to the field assessment. These included:

- Ecologia (2018). *West Erregulla Targeted Flora Survey*;
- Eco Logical Australia (2020). *West Erregulla Pipeline Flora and Fauna Survey.*
- Eco Logical (2021). *West Erregulla Pipeline Flora and Vegetation Survey*;
- Maia Environmental Consultancy Pty Ltd (2013). Drover - 01 Study Area Reconnaissance and Targeted Flora Surveys. Document prepared for AWE Limited.
- Mattiske Consulting Pty Ltd (2021a). Flora and Vegetation Assessment Arrowsmith North Survey Area. Document prepared for VRX Silica Ltd.
- Mattiske Consulting Pty Ltd (2021b). Flora and Vegetation Assessment Arrowsmith North Transport Corridor Survey Area. Document prepared for VRX Silica Ltd.
- Strategen-JBS&G (2020). *Natta 3D Seismic Flora and Vegetation Survey*;
- Strategen-JBS&G (2020). *Zemira 3D Seismic Flora and Vegetation Survey*;
- Woodman Environmental Consulting (2009). *West Erregulla 2 Well Site Flora and Vegetation Assessment*;
- Woodman Environmental Consulting (2013). *West Erregulla Project Flora and Vegetation Assessment;*
- Woodman Environmental Consulting (2018a). *Proposed Xyris Lateral Flora and Vegetation Assessment*;
- Woodman Environmental Consulting (2018b). *Waitsia 3 Flowline Corridor Flora, Vegetation and Fauna Assessment*;

- Woodman Environmental Consulting (2020a) *West Erregulla Exploration Program*; and
- Woodman Environmental Consulting (2020b). *West Erregulla Wells 4 & 5 Flora and Vegetation Risk Assessment*.

Following environmental contextualisation of the Survey Area and evaluation of likely landforms and broad habitats present, the criteria listed in Sections 3.6, 3.7 and 3.8 were applied to regionally significant conservation values to determine the likelihood of occurrence of significant species and communities occurring within the Survey Area. These likelihoods were reassessed following field survey after habitats and landforms had been ground-truthed, and with consideration of in-field survey effort and recorded observations.

2.3 Field Assessment

2.3.1 Reconnaissance Flora and Vegetation Survey

A Reconnaissance survey was undertaken between 24 May and 9 June 2022 by experienced Ecologists Terri Jones (Associate Ecologist; FB62000191), Rachael Pratt (Senior Ecologist; FB 62000141) and Emma Bentley (Ecologist; FB 62000336-2), with field assistance from Logan Penman (Environmental Scientist). In line with EPA Flora and Vegetation Technical Guidance, the objectives of the Reconnaissance survey were to:

- Verify the information obtained during initial desktop study;
- Characterise the flora and delineate the vegetation units present;
- Undertake low intensity sampling of flora and vegetation to describe the general vegetation characteristics and condition; and
- Clarify whether the area may support any significant flora or vegetation.

2.3.1.1 Relevés

During the survey, data was collected from a minimum of one representative relevé within each vegetation type identified, allowing for assessment of additional relevés to provide adequate spatial coverage of the Survey Area.

Within each relevé the following information was recorded:

- Name of recorder;
- Date;
- GPS co-ordinates (recorded in WGS84 MGA Zone 50 and converted to GDA2020 MGA Zone 50);
- Dimensions (radius) of the relevé;
- Photograph of the vegetation;
- Vegetation condition;
- Brief vegetation description;
- Topography;
- Soil type and colour;
- Geology (type, size and cover of any rocks, stones, gravel or outcropping);
- Average percentage cover of leaf litter and bare ground;

- Disturbance details including fire history (time since last fire), and physical disturbance including evidence of erosion, grazing and weed invasion; and
- All vascular flora taxa present (with average height and total percentage foliage cover of each taxon).

2.3.1.2 Flora

All vascular flora species (both native and exotic) observed within relevés were recorded. For any taxa known to be conservation significant, or where an introduced flora (weed) species constituting a Weed of National Significance (WoNS) or Declared Pest plant (DPP) was observed, a GPS location and a count of the individuals present or percentage foliage cover were recorded. Where applicable, the extent of any conservation significant population was also recorded to enable mapping of populations and to inform avoidance and mitigation strategies.

Opportunistic observations of supplementary or conservation-listed flora taxa made whilst traversing the Survey Area were additionally recorded.

2.3.1.3 Vegetation Units

Vegetation units were identified and described using a combination of geotagged photography from the targeted surveys, site observations and relevé data. Aerial photography, soil-landscape mapping interpretation and field notes taken during the survey were then used to develop polygon boundaries over the Survey Area.

Vegetation descriptions and classifications were recorded at Level V as per the National Vegetation Information System (NVIS) framework (NVIS Technical Working Group 2017). Terminology and categories relevant to the NVIS classifications are presented in Appendix A. Up to three species per stratum from each defined stratum present (upper, mid and ground) were used to form descriptions applied to relevés and derived vegetation types. Based on the large sandplain areas and large beta diversity, finer scale vegetation mapping was not deemed possible based on the reconnaissance level survey.

Codes applied to vegetation types described were formulated using the dominant species of the highest stratum present within the vegetation type that had >2% cover, with the upper case first letter referring to the genus, and lower case letter (or letters) referring to the species, and additional upper case letters at the conclusion of the code referring to the stratum structure. For example, **EtLW** refers to *Eucalyptus todtiana* low woodland.

2.3.1.4 Vegetation Condition

Vegetation condition was recorded within all relevés, and opportunistically within the Survey Area during the field assessments. Vegetation condition polygon boundaries were developed using this information in conjunction with aerial photography interpretation and data collected during targeted surveys and were digitised as for vegetation type mapping polygon boundaries. Vegetation condition was described using the EPA recommended vegetation condition scale for the Southwest Botanical Province (Table 2-3).

Table 2-3: Vegetation Condition Scale for Southwest and Interzone Botanical Provinces (EPA 2016)

Vegetation Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

2.3.1.5 Flora Identification and Nomenclature

Where flora could not be identified confidently in the field, specimens were collected in accordance with procedures outlined by the Western Australian Herbarium (WAH) (DBCA 2020a). Plant specimens collected during the field surveys were identified either in-house by experienced ecologists using appropriate reference material, or submitted for identification with experienced independent taxonomist Bethea Loudon. Nomenclature of species recorded was undertaken in accordance with WAH (1998-).

2.3.1.6 Statistical Analysis

Floristic analysis is not typically required for a Reconnaissance level of survey and has limited application in this instance due to the low intensity of sampling and absence of replicate relevés for some vegetation units. However, analyses were conducted to confirm if vegetation types identified in the field had a basis in the floristic composition of the assessed relevés.

PATN© software (Belbin & Collins 2013) is a multivariate analysis tool used to generate estimates of association (resemblance, affinity, distance) between sets of data and group the datasets accordingly. The software was used to generate floristic groups using the data collected from the relevés, in order to better delineate and understand local significance of floristic units.

A species accumulation curve was additionally generated using relevé data to demonstrate adequacy of sampling, utilising EstimateS© statistical software (Colwell 2013). However, for a reconnaissance survey with low intensity sampling, the species inventory is not anticipated to be comprehensive.

2.3.2 Basic Fauna Survey

A Basic fauna survey was undertaken between 9 May and 9 June 2022 by experienced Ecologists Terri Jones (Associate Ecologist) and Emma Bentley (Ecologist). In line with EPA Fauna Technical Guidance, the purpose of the Basic fauna survey was to gather broad fauna habitat information, with specific objectives being to:

- verify the information obtained during initial desktop study; and
- map and describe fauna habitats.

2.3.2.1 Fauna Habitat Assessment Points

Evaluation was made at one or more assessment sites within each discernible habitat unit, with replicates to allow for spatial distribution of assessment across the Survey Area. Each habitat assessment point made record of:

- Name of recorder;
- Date;
- GPS co-ordinates (recorded in WGS84 MGA Zone 50);
- Representative photograph of the habitat;
- Brief vegetation description;
- Presence of significant trees suitable for Black Cockatoo Breeding;
- Topography;
- Soil type and colour;
- Geology (type, size and cover of any rocks, stones, gravel or outcropping);
- Average percentage cover of leaf litter and bare ground;
- Disturbance details including fire history (time since last fire), and physical disturbance including evidence of erosion, grazing and weed invasion; and
- All fauna species, or secondary evidence thereof, observed.

2.3.2.2 Bird Survey

Periods of ornithological survey were undertaken in different vegetation units to help identify bird assemblages relevant to the habitat types present in the Survey Area. Bird species identifiable via opportunistic sighting or call observations whilst moving throughout the site were additionally recorded.

2.3.2.3 Active Searches

Active searching was undertaken within areas of suitable microhabitat such as rockpiles, coarse woody debris and logs, and accumulated litter. Where applicable, raking of litter or temporary displacement of timber was undertaken, with care taken not to create lasting disturbance of habitat.

2.3.2.4 Secondary Evidence

All observations of secondary fauna evidence were recorded and identified to species level where possible. This included recognisable tracks, scat material or other evidence such as burrows or scrapes.

2.3.2.5 Fauna Habitat Mapping

Values recorded at fauna habitat assessment points, as well as observations undertaken continuously during traverses, were utilised in conjunction with vegetation unit mapping to define and map fauna habitat types present in the Survey Area. Habitat units are distinguished based on landform, soil type, vegetation composition and structure, and faunal assemblage observed. Potential for utilisation by fauna with specialised requirements (such as hollow-nesting species), or isolated or restricted habitats, was considered throughout the survey.

Additionally, previous habitat mapping and available aerial imagery was used to further refine and characterise habitat units. Habitats were mapped spatially and extents within the Survey Area calculated using Geographic Information System (GIS) software.

2.3.2.6 Short Range Endemic Habitat Assessment

Short Range Endemic (SRE) species are defined as terrestrial or freshwater invertebrates which have a naturally restricted distribution, typically of less than 10,000 km2 (EPA 2009). Within their known range, SRE species may occur discontinuously in fragmented and highly specialised habitats.

Prior to field survey, previous survey literature and aerial imagery of the area was inspected to identify areas more likely to contain SRE taxa based on geographic features and landform, as well as vegetation and visible ecological linkage features. During the field survey, all habitat types were evaluated for potential to support SRE species. In particular, the area was assessed for examples of restricted or sheltered habitats known to have greater potential to support SRE species (EPA 2009). This includes such features as:

- Sheltered habitats and microhabitats:
    - Southwest facing slopes;
    - Rock piles, gorges, cliff faces or breakaways;
    - Naturally occurring springs;
    - Drainage lines;
    - Areas of vine thicket or exposed root systems; and
    - Fire refugia.
- Habitat isolates:
    - Outcrops and boulder piles;
    - Mesas and plateau remnants;
    - Areas of banded ironstone, exposed calcrete or dolomite dykes; and
    - Isolated birridas or lakes.

Observational and foraging techniques were additionally utilised in the field to actively search for evidence of SRE species in areas of more suitable habitat. This involved raking of leaf litter, targeted searching for presence of trapdoor spider burrow entrances and inspection of rock piles or coarse woody debris.

2.3.2.7 Black Cockatoo Habitat Assessment

As part of the desktop assessment, known locations of Black Cockatoo breeding and roosting sites in the vicinity were reviewed (DBCA 2019a; 2019b). During field assessment, the Survey Area was surveyed for presence of Black Cockatoos, and observed occurrences of any significant trees with potential for Black Cockatoo breeding or roosting recorded. Vegetation was additionally assessed for suitability as foraging habitat against the foraging quality scoring tool set out in the Black Cockatoo Referral Guidelines (DAWE 2022a). The scoring tool is provided in Appendix A.

At each fauna habitat assessment point (Appendix G), the following factors were evaluated and recorded:

- Presence of vegetation favoured for foraging (as listed in the Black Cockatoo Referral Guidelines), including Proteaceous species, Eucalypt species, Pinus species etc.;
- Evidence of foraging e.g. chewed Eucalypt nuts;

- GPS location of potential nesting or night roosting trees; and
- Evidence of any vegetation disease, such as *Phytophthora* dieback or Marri Canker.

2.3.3 Well Site Photographic Records

Each of the proposed and established well sites within the Survey Area was photographed from the central GPS location to provide photographic record. Photographs were taken from the centre point facing north, east, south and west respectively. Images are provided in Appendix F.

3. Desktop Assessment Results

This section describes the existing physical environment of the Survey Area and identifies relevant values and sensitivities of the environment that may be affected by the Project.

The region has a dry warm Mediterranean climate with warm, dry summers and cool, wet winters, but seven to eight dry months per year. At the Eneabba automatic weather station (station 008225), which operated from 1964-2017, the average annual rainfall during this period was 489.6 mm, with the highest monthly rainfall occurring from June to August (Figure 2.1). The wettest year on record was 1999, with an annual rainfall of 850.6 mm, 220.6 mm of which fell in May. The highest recorded monthly rainfall was 280.2 mm which fell in June 1964.

The average monthly maximum temperature ranged from 19.7 °C in July to 36.5 °C in February. Average monthly minimum temperatures ranged from 8.9 °C in July to 19.6 °C in February. The hottest recorded day was 48.7 °C in February 1991, and the lowest minimum temperature of 0.5 °C was recorded on in July 1998.

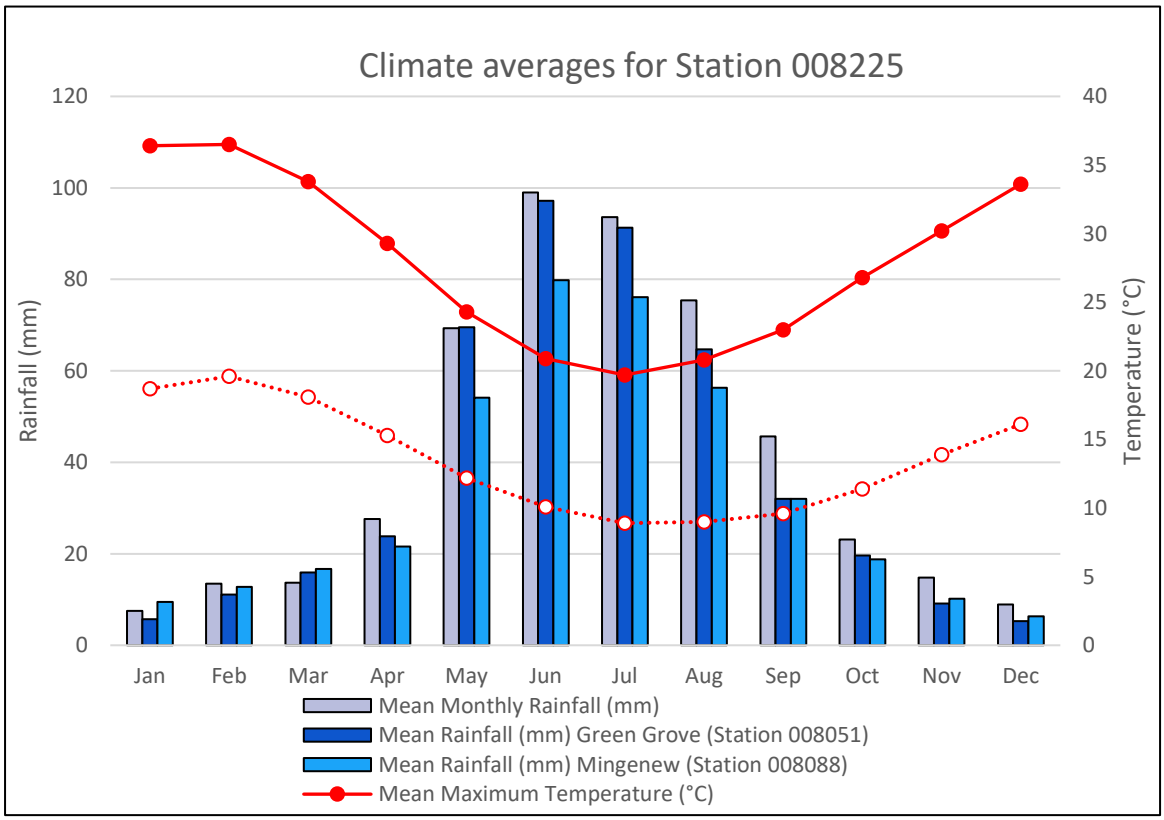
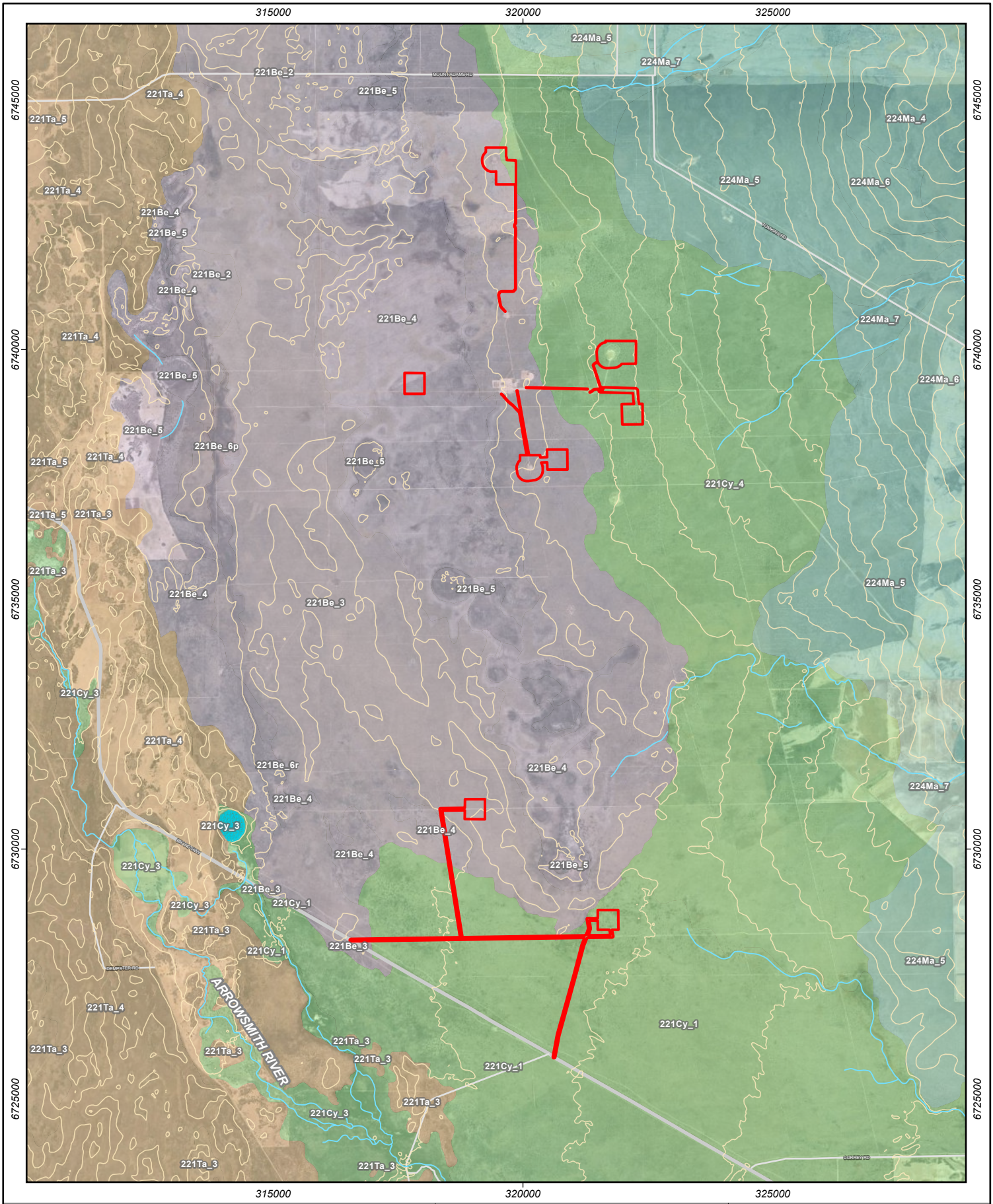


Figure 2.1: Climate data

3.1 Soils and Landforms

The Geraldton Sandplains are characterised by a series of old dunes which run parallel to the coast. The younger Quindalup dunes occur near the contemporary coastline, with the Spearwood dunes occurring further inland. The soils are typically sandy with some areas of exposed limestone, and a series of wetlands occurs along the plains. In the east lateritic rises occur.

Based on the 2017 soil and landform mapping dataset DPIRD-027 from the Department of Primary Industries and Regional Development (DPIRD), there are four main soil-land subsystems comprising the Survey Area (**Table** 3-1). The soil-land sub-systems have been used to inform potential presence of conservation significant flora and communities.



Legend

- Survey area
- Lake
- Soil Landscape Mapping - Best Available (DPIRD-027)
  - 221Be
  - 221Cy
  - 221Ta
  - 224Ma
- Topographic contours (mAHD)
- Watercourses
- Major road
- Minor road

Scale: 1:100,000 at A4 (0, 1, 2 Kilometres)	**Perth Basin Ecological Studies**
Coord. Sys. GDA2020 MGA Zone 50	**SOILS, LANDFORMS AND HYDROLOGY**
Job Number: 62676	
Client: Beach Energy	**FIGURE 3.1**
Version: R01 Rev A — Date: 06-Sep-2022	strategen JBS&G
Drawn By: cthatcher — Checked By: TJ	

File Name: W:\Projects\1)Open\Beach Energy\62676 Perth Basin Ecological Surveys\GIS\Maps\R01_Rev_A\62676_PerthBasin_Ecology_R01_v1.aprx
Image Reference: World Imagery: Earthstar Geographics

Table 3-1: Soil Landscape Subsystems (DPIRD-027)

Reference	Soil subsystem	Description	Extent within Survey Area (ha)	% within Survey Area
221Be_3	Beharra 3 subsystem	Level to gently undulating sandplain; yellow deep sand	96.00	38%
221Be_4	Beharra 4 subsystem	Level to gently undulating sandplain with numerous small playas and swampy depressions; Yellow and pale deeps sands with some swamp soils	19.82	8%
221Cy_1	Correy 1 Subsystem	Alluvial plain; Pale deep sands dominate with yellow deep sands and shallow and deep sandy duplexes	63.03	25%
221Cy_4	Correy 4 subsystem	Alluvial fans and dunes outwashed from scarp; pale and yellow deep sands	76.74	30%

3.2 Topography

The topography of the Survey Area is low lying with a gentle inclination to the east. In the northern section of the Survey Area, the lowest elevation is 40 m AHD to the west and the highest elevation is 70 m AHD to the east, with the northern and southern parts of the section at 50 m AHD. In the southern section of the Survey Area the lowest elevation is 40 m AHD to the west, rising to 50 m AHD in the east (Figure 3.1).

3.3 Surface Water and Wetlands

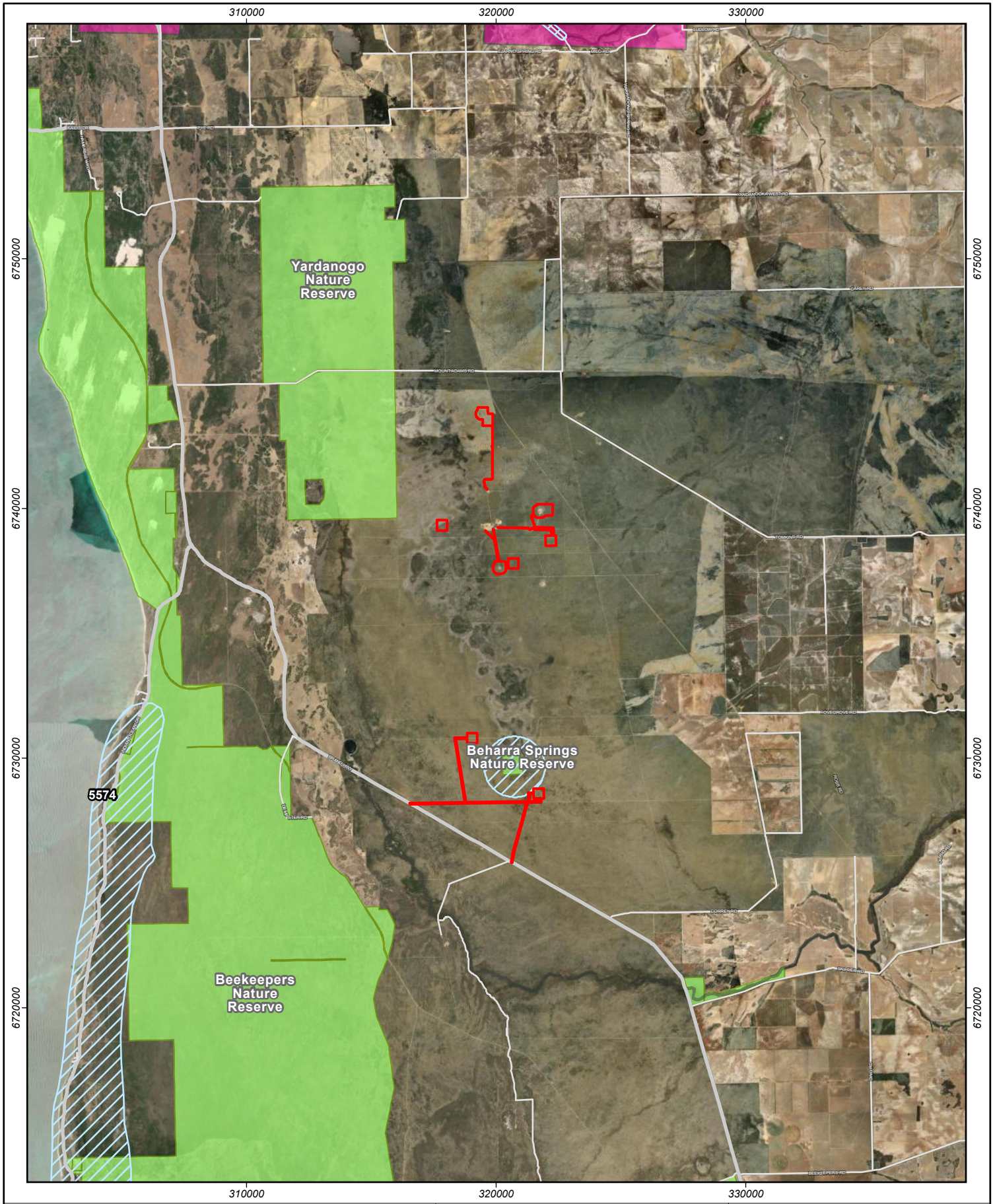
There are two ephemeral surface water courses identified to the southwest and southeast of the Survey Area, Arrowsmith Lake and the Arrowsmith River (Figure 3.1). There are no listed wetlands in or near the Survey Area.

3.4 Heritage and Conservation Reserves

One registered Aboriginal heritage site was found in proximity to the Survey Area – the Arrowsmith River (ID 30068), which runs from the south-west of the Survey Area around to east, with its closest point approximately 1.2 km to the southwest of the Survey Area (Figure 3.2). The registered site follows the course of the main river. None of the tributaries close to the Survey Area form part of the registered site.

Another Heritage Place; 5217 (Stored Data/Not a Site), is located within the most southern point of the Survey Area (Figure 3.2).

Four heritage survey areas were identified by the search within or adjacent to the Survey Area. One heritage survey area mostly covers and extends beyond the Survey Area is associated with archaeological study of proposed seismic programme, Beharra Springs. Two heritage survey sites approximately 0.5km to the northeast running adjacent to the Survey Area, are heritage monitoring of Aboriginal Sites within Loop 7 of DBNGP Stage 5B, Midlands Road to Yandanooka Hills, associated with a Natural Gas Pipeline and an ethnographic survey of two proposed deviations to the Dampier to Bunbury Gas Pipeline Route. Approximately 6km west of the southern section of the Survey Area is a heritage survey area for a Summary of Burial Sites Investigation 1976-77 (Figure 3.2).



Legend

- Survey area
- Conservation areas

Aboriginal heritage places (DPLH-001)

- Registered site
- Other heritage place
- Major road
- Minor road

Scale: 1:200,000 at A4	0 2½ 5 Kilometres
Coord. Sys. GDA2020 MGA Zone 50	
Job Number: 62676	
Client: Beach Energy	
Version: R01 Rev A	Date: 06-Sep-2022
Drawn By: cthatcher	Checked By: TJ

Perth Basin Ecological Studies

CONSERVATION AREAS

FIGURE 3.2

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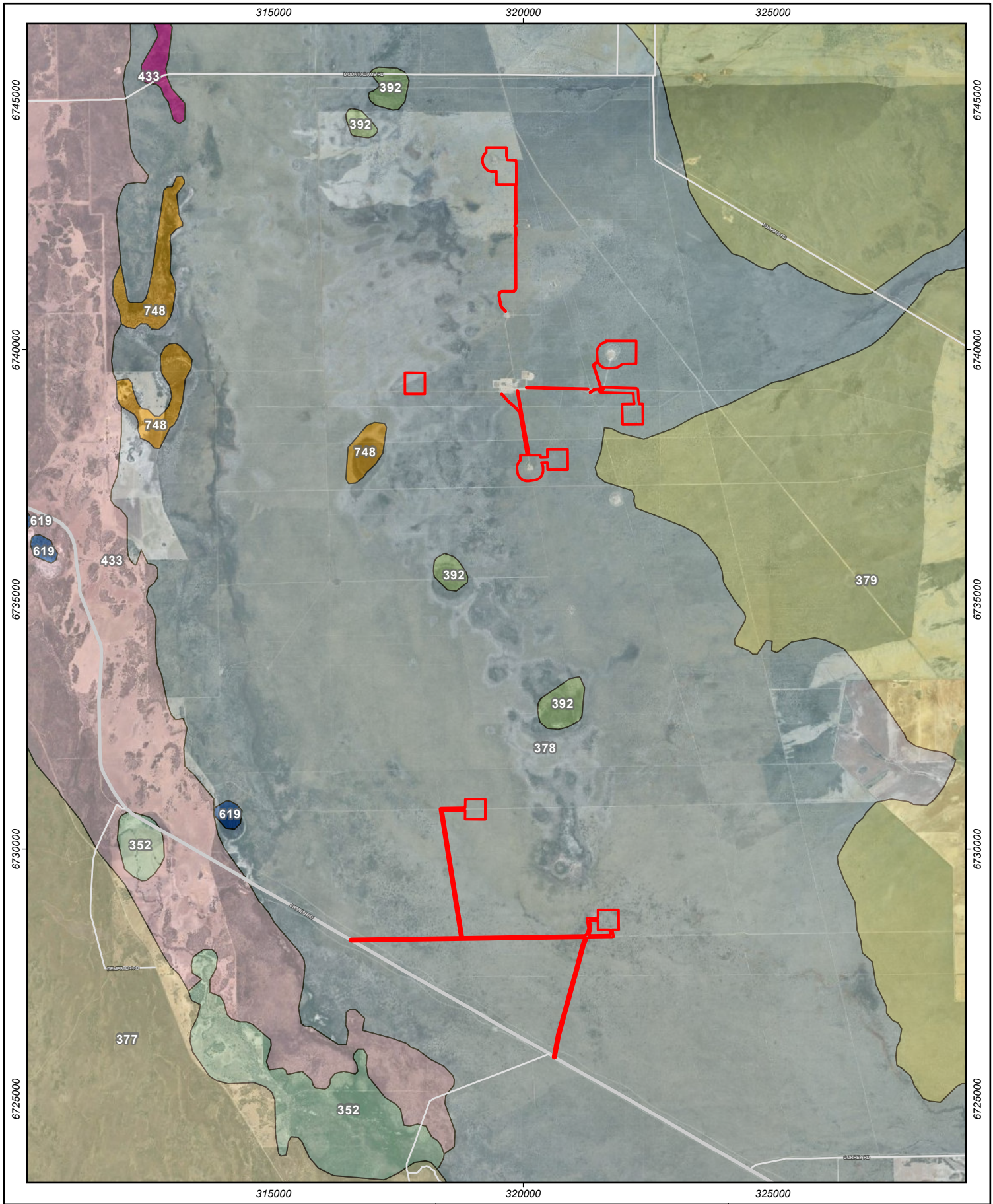
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Image Reference: World Imagery: Earthstar Geographics

3.5 Pre-European Vegetation

Shephard et al. (2001) mapped the extent of pre-European vegetation across Western Australia, with recent updates reflecting the National Vegetation Information System (NVIS) Standards. One vegetation associations correspond with the Survey Area: Eridoon_378. The pre-European and current extent of each vegetation association is available from the State-wide Vegetation Statistics Dataset (Government of Western Australia, 2019) and is provided in Figure 3.3 and Table 3-2.

Table 3-2: Vegetation Associations

System	Association	Pre-European extent within IBRA region (ha)	Percent remaining within IBRA region (%)
Eridoon	378 – Scrub-Heath. Mixed heath with scattered tall Acacia spp., PROTEACEAE and MYRTACEAE.	93,523.98	65.04



Legend

- Survey area

Pre-European vegetation (DPIRD-006)

- Erindoon 378
- Erindoon 392
- Erindoon 433
- Erindoon 748
- Illyarrie 352
- Illyarrie 377
- Illyarrie 433
- Illyarrie 619
- Tathra 379
- Major road
- Minor road

Scale: 1:100,000 at A4 (0, 1, 2 Kilometres)	**Perth Basin Ecological Studies**
Coord. Sys. GDA2020 MGA Zone 50	**PRE-EUROPEAN VEGETATION**
Job Number: 62676	
Client: Beach Energy	**FIGURE 3.3**
Version: R01 Rev A — Date: 06-Sep-2022	strategen JBS&G
Drawn By: cthatcher — Checked By: TJ	

File Name: W:\Projects\1)Open\Beach Energy\62676 Perth Basin Ecological Surveys\GIS\Maps\R01_Rev_A\62676_PerthBasin_Ecology_R01_v1.aprx
Image Reference: World Imagery: Earthstar Geographics

3.6 Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)

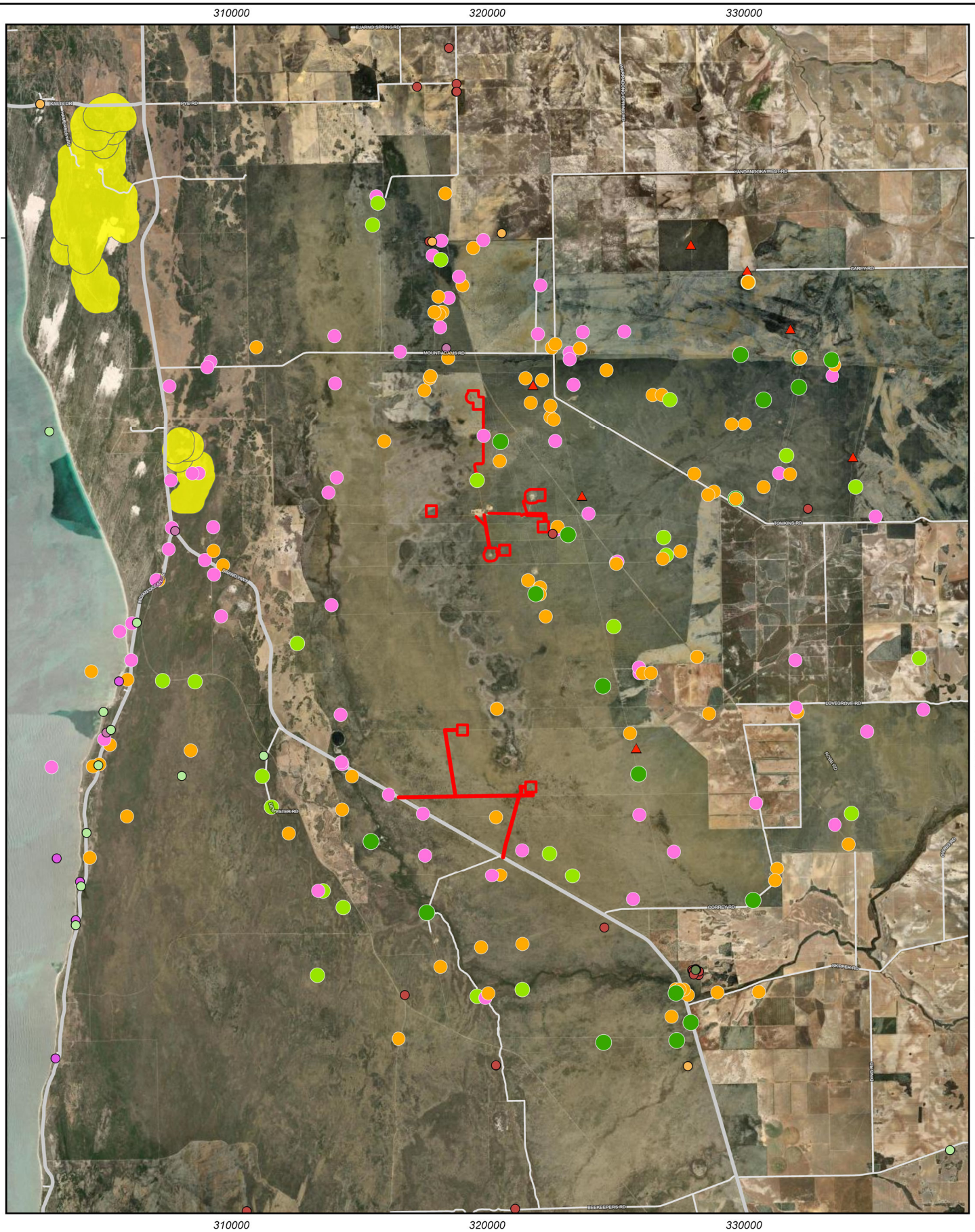
Seven conservation-significant ecological communities were identified by database searches within 50 km of the Survey Area (Figure 3.4). The ecological communities consisted of two Priority Ecological Community (PEC) and two Threatened Ecological Communities (TEC). The results also identified three Preliminary Threatened Ecological Communities; Freshwater basin wetlands of the central wheatbelt, Freshwater basin wetlands of the northern agricultural areas dominated by Eucalyptus camaldulensis, and Freshwater basin wetlands of the Southern Wheatbelt.

None of the ecological communities were identified within the Survey Area, with all being more than 10 km from the Survey Area boundary. However, the potential for occurrence of each of these ecological communities has been assessed based on available pre-European vegetation, hydrology, soils, landform and geology information (**Table 3-3**).

Table 3-3: Threatened Ecological Communities Potentially Occurring within the Survey Area

Floristic Community	Conservation Status		Description	Likelihood of Occurrence
	BC Act	EPBC Act		
Assemblages of organic mound springs of the Three Springs area	EN	Not listed	The habitat of this community is characterised by continuous discharge of groundwater in raised areas of peat. The peat and surrounds provide a stable, permanently moist series of microhabitats. The vegetation component of the community contains many moisture loving species including an overstorey of *Melaleuca preissiana* trees. *Eucalyptus camaldulensis* and *E. rudis* are also found in a number of the mound springs. The shrub layer often includes *Hypocalymma angustifolium* and *Acacia saligna* over *Baumea vaginalis* and other sedges. The herbaceous *Patersonia occidentalis* (swamp variant) was recorded at several mound springs.	Very Unlikely (based on mapped vegetation units, soils and landform)
Coastal sands dominated by *Acacia rostellifera*, *Eucalyptus oraria* and *Eucalyptus obtusiflora* (Geraldton area)	P1	Not listed	Floristically, this community is similar to other *Acacia rostellifera* communities but is differentiated on structure, being dominated by mallee eucalypts. The community occurs on limestone ridges, in some swales in the coastal dunes between Cape Burney and Dongara, on the Greenough Alluvial Flats on limestone soil and near Tarcoola Beach. Some very small occurrences have also been recorded on the limestone scarp north of the Buller River.	Very Unlikely (based on geographic position, soils and landform)
Ferricrete floristic community (Rocky Springs type)	VU	Not listed	This tall shrubland is located on irregularly inundated red brown sandy loams over ferricrete dominated by *Acacia blakelyi, Allocasuarina campestris, Dryandra stricta* and *Labichea lanceolata subsp. lanceolata*. Associated species include *Alyogyne hakeifolia, Borya sphaerocephala, Isotoma hypocrateriformis, Petrophile seminuda, Stylidium dichotomum, Thysanotus patersonii* and *Waitzia paniculata*.	Unlikely (based on mapped vegetation units, soils and landform)

Floristic Community	Conservation Status		Description	Likelihood of Occurrence
	BC Act	EPBC Act		
Subtropical and Temperate Coastal Saltmarsh	P3	VU	Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23oS latitude). It occurs on the coastal margin, along estuaries and coastal embayments and on low wave energy coast in places with at least some tidal connection, including rarely-inundated supratidal areas, intermittently opened or closed lagoons, and groundwater tidal influences. The community occurs on sandy or muddy substrate and may include coastal clay pans and similar habitats. It consists of dense to patchy areas of characteristic coastal saltmarsh plant species that include salt- tolerant herbs, succulent shrubs or grasses, and may also include bare sediment as part of the mosaic. It can occur where the proportional cover by tree canopy such as mangroves, Melaleucas or Casuarinas or seagrass is not greater than 50%. The description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this Priority ecological community	Very Unlikely (based on geographic position, mapped vegetation units, soils and landform)



Legend

- Survey area

Threatened and priority ecological communities (DBCA)

- Coastal sands dominated by Acacia rostellifera, Eucalyptus oraria and Eucalyptus obtusiflora (Geraldton area)

Conservation significant flora (DBCA)

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

Conservation significant fauna (DBCA)

- Conservation dependent
- Critically endangered
- Endangered
- Migratory
- Other specially protected
- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Vulnerable

- Major road
- Minor road

Scale: 1:200,000 at A4 (0 – 5 Kilometres)

Coord. Sys. GDA2020 MGA Zone 50

Job Number: 62676

Client: Beach Energy

Version: R01 Rev A | Date: 06-Sep-2022

Drawn By: cthatcher | Checked By: TJ

Perth Basin Ecological Studies

DATABASE SEARCH RESULTS

FIGURE 3.4

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Image Reference: World Imagery: Earthstar Geographics

3.7 Conservation Significant Flora

A total of 72 conservation significant flora species were identified within the search area (Figure 3.4, Table 3-5). A likelihood of occurrence assessment was undertaken on all species and is provided in Appendix C.

The likelihood assessment for conservation significant flora was undertaken in line with the criteria outlined in Table 3-4.

Table 3-4: Criteria for Flora Likelihood Assessment

Likelihood	Criteria
Recorded	Species or community has been recorded previously and/or from the field survey.
Likely	Species or community likely to occur as suitable habitat is present and existing records are close to the Survey Area (within 4.5 km).
Possible	Species or community might occur as there are existing records in the vicinity (within 9 km) and suitable habitat is likely to be present. Species or community may also be present if there is insufficient information to exclude presence.
Unlikely	Species or community is unlikely to occur as habitat is not present, or habitat is present, but there are no records within the vicinity.

A total of 13 'Threatened' flora species as listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999* (C'th) (EPBC Act) and Section 19(1) of the *Biodiversity Conservation Act 2016* (WA) (BC Act) were identified in the search area (Table 3-5 and Figure 3.4).

The Threatened flora species with potential to occur in the Survey Area are shown in Table 3-5.

Table 3-5: Threatened Flora Species Potentially Occurring in the Survey Area

Taxon	Conservation Status		Description	Likelihood of occurrence
	WA status	C'wealth status		
Andersonia gracilis	VU	EN	A slender shrub up to 50 cm tall with few, spreading branches. Pink to pale mauve flowers are clustered in ovoid or oblong groups of 4 to 14 on terminal heads. Occurs on seasonally damp, black sandy clay flats near or on the margins of swamps, often on duplex soils supporting low open heath vegetation.	Unlikely (based on habitat preference)
Conostylis dielsii subsp. *teres*	VU	VU	A low, perennial monocot with terete leaves from 60-160 mm long and 0.5-1 mm wide. Short bristles of 0.8-1 mm long are present on the leaf margin and hairs on the leaf surface. Creamy yellow flowers appear from July to August. Occurs on sand/gravel.	Unlikely (based on lack of proximal records)
Conostylis micrantha	VU	VU	A low, perennial monocot with terete leaves from 70-145 mm long and 0.8-1 mm wide. Bristles of 8-10.5 mm length are present on the leaf margin, but the leaves are otherwise hairless. Yellow flowers appear from July to August. This species occurs in sandy areas.	Unlikely (based on lack of proximal records)
Daviesia speciosa	EN	EN	A low shrub with terete, pungent branchlets, that has a leafless appearance and red flowers that appear from April to May. Found in gravelly lateritic soils, undulating plains and rises.	Unlikely (based on lack of proximal records)
Eucalyptus crispata	EN	EN	A lignotuberous mallee from 3-7 m high, with rough bark on the trunk, in partly decorticated curls. Yellow-cream flowers appear from March to June. Prefers lateritic soils.	Unlikely (based on lack of proximal records)
Eucalyptus leprophloia	EN	EN	Lignotuberous mallee from 2-5(-8) m high with rough, loose & flaky bark to 1 m. Creamy white flowers appear from August to October. Occurs on a variety of soils.	Unlikely (based on lack of proximal records

Taxon	Conservation Status		Description	Likelihood of occurrence
	WA status	C'wealth status		
Hakea megalosperma	VU	VU	A spreading, lignotuberous shrub from 1-2 m high. White-cream/pink flowers appear from May to June, nuts are retained year-round. Occurs on grey sand, loam, lateritic hills and rocks.	Unlikely (based on lack of proximal records)
Hemiandra gardneri	CR	EN	Prostrate, pungent shrub, 0.1-0.2 m high, to 1 m wide. Fl. red/pink-red, Aug to Oct. Grey or yellow sand, clayey sand. Sandplains.	Unlikely (based on lack of proximal records)
Leucopogon obtectus (Styphelia obtecta (Benth.) F.Muell.)	EN	EN	A spindly erect shrub from 0.5-1.7 m high, with leaves which closely clasp the stem, obscuring the ends of branchlets. Tiny white to creamy yellow flowers appear in the leaf axils from August to October. Occurs on grey sands.	Unlikely (Habitat not present and no records within the vicinity <9km)
Paracaleana dixonii	VU	EN	A tuberous perennial orchid from 90-200 mm high, with a single, small basal leaf. Brown-yellow-green-red flowers in the shape of a duck appear from October to December or January. Found in shrubland under *Banksia* on deep sand, or in heath on shallow sand over laterite.	Likely (based on habitat preference and location of previous records)
Tetratheca nephelioides	EN	CR	Caespitose, dwarf shrub, to 0.3 m high. Fl. purple, Sep. White-grey sand, yellow-brown clayey sand, gravel, laterite. Outcrops, undulating hills, ridges.	Unlikely (based on habitat preference)
Thelymitra stellata	EN	EN	A tuberous, perennial orchid from 150-250 mm high. Its yellow and brown flowers appear from October to November. Occurs on sand, gravel and lateritic loam.	Unlikely (based on lack of proximal records)
Wurmbea tubulosa	VU	VU	A cormous, perennial herb growing at ground level, from 10-30 mm tall with only three leaves, two of them larger. White-pink flowers appear from June to August. Found in clay and loam on river banks and seasonally-wet places.	Unlikely (based on lack of proximal records)

The remaining species were listed as 'Priority' flora species by the Department of Biodiversity, Conservation and Attractions (DBCA) as follows:

- Priority 1 flora (P1) – 5 taxa;
- Priority 2 flora (P2) – 12 taxa;
- Priority 3 flora (P3) – 29 taxa; and
- Priority 4 flora (P4) – 12 taxa.

A comprehensive likelihood assessment is included in Appendix C.

3.8 Conservation Significant Fauna

A total of 59 conservation significant fauna species were identified by the database search within 30 km of the Survey Area (Appendix B).

Of these, 24 'Threatened' fauna species were listed under Section 178 of the EPBC Act and Section 19(1) of the BC Act, with the closest being one record of *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo) located approximately 0.17 km to the south east of the northern section of the Survey Area (Figure 3.4).

A likelihood of occurrence assessment was undertaken on all fauna species returned from database searches and is provided in Appendix C. Criteria applied as part of the likelihood assessment are described in Table 3-6.

Marine Species

An additional 52 marine species were also returned in the database searches, mainly from the EPBC PMST. The Survey Area is inland from the ocean and does not contain marine habitat, as such, these species have been omitted from any further discussion.

Table 3-6: Criteria for Fauna Likelihood Assessment

Likelihood	Criteria
Recorded	Species has been recorded previously from the study site.
Likely	Species considered likely to occur as suitable habitat is present and multiple existing records are close to the Survey Area (within 7.5 km).
Possible	Species has potential to occur as suitable habitat is likely to be present, and there are existing records in the wider vicinity (within 15 km) or the area is insufficiently surveyed to exclude local occurrence.
Unlikely	Species is unlikely to occur as suitable habitat is not considered to be present, or habitat may be present but there are no recent (<25yr) existing records in the wider vicinity (within 15 km).
Very Unlikely	Species is very unlikely to occur as suitable habitat is not considered to be present, and there are no existing records in the wider vicinity (within 15 km).

The Threatened fauna species with potential to occur within the Survey Area are shown in Table 3-7.

Table 3-7: Threatened Fauna Species Potentially Occurring within the Survey Area

Taxon	Description	Likelihood of Occurrence
Anous tenuirostris melanops Australian Lesser Noddy (EN)	The Australian lesser noddy is a small dark-plumaged, tropical tern with a long slender straight bill, long narrow wings and slightly wedge-shaped tail. It is confined to the tropical and subtropical Indian Ocean. It breeds only on three islands in the Houtman Abrolhos, off Western Australia, where it nests in mangroves. The Australian lesser noddy is only known to breed in Houtman Abrolhos, where colonies on Pelsaert, Wooded and Morley Islands occupy a total of 5 ha. Behaviourally, it tends to remain near the breeding islands all year. It has been hypothesised that a population thought to be Australian lesser noddy possibly breeds on Ashmore Reef and may be colonising Cocos (Keeling) Island; however, the subspecific identity has not been confirmed. The distribution and range of the Australian lesser noddy is largely unknown.	Very Unlikely (habitat not considered to be present)
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater (VU)	The Flesh-footed shearwater is a large broad-winged, black-brown shearwater with pale, black tipped horn bill and flesh pink legs and feet. It is common to the waters of the continental shelf and continental slope off Southern Australia. Known breeding grounds on Lord Howe Island. The distribution of the Flesh-footed Shearwater is naturally fragmented with colonies scattered across islands in the south-east Indian Ocean and the south-west Pacific Ocean	Very Unlikely (habitat not considered to be present)
Calidris canutus Red Knot, Knot (EN) CALIDRIDINAE	The Red Knot is a short-necked and long bodied wader with a short straight bill. Their wings extend beyond the tail and legs. Differs in appearance from the Great Knot, with a smaller body, shorter bill, and different markings on plumage. Populations of the Red Knot are largely found all around the coast of Australia, with their main populations in the north-west of Australia. It is occasionally recorded inland. Main habitats include intertidal mudflats, sandflats, and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours, sometimes on sandy ocean beaches. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools, and pans, and recorded on sewage ponds and saltwork but rarely in freshwater swamps or inland lakes.	Very Unlikely (habitat not considered to be present)

Taxon	Description	Likelihood of Occurrence
Calidris ferruginea Curlew Sandpiper (CR) SCOLOPACIDAE	The Curlew Sandpiper is a small to medium-sized wader (migratory shorebird). It has a long, black bill with a down-curved end and black legs and feet. In its non-breeding plumage, it is grey-brown above, white below, with a white wing bar visible in flight. In breeding plumage, it is bright reddish brown below and the wings are barred black. The Curlew Sandpiper is a common summer migrant from north-eastern Siberia and Alaska, found in many Australian coastal sites and may also be seen inland in suitable habitats. It is most common in the far south-east and north-west of Australia. It is also found in Africa, across southern Asia to Indonesia and New Guinea, and in New Zealand. The Curlew Sandpiper is found on intertidal mudflats of estuaries, lagoons, mangroves, as well as beaches, rocky shores and around lakes, dams and floodwaters. Its breeding habitat is the lowland tundra of Siberia.	Unlikely (no local records)
Calyptorhynchus latirostris Carnaby's Black-Cockatoo (EN) CACATUIDAE	The Carnaby's Black-Cockatoo is a large, dull-black cockatoo with a short erectile crest and a large bill. The bird is mostly grey-black, with narrow off-white fringes to the feathers, giving it a scaly appearance. This is relieved by a patch of cream-coloured feathers on the ear-coverts, and the tail has large white panels, especially noticeable when the bird is flying. Carnaby's Black-Cockatoos occur only in south-western Western Australia, between Cape Arid and Kalbarri. The Carnaby's Black-Cockatoo inhabits native woodlands dominated by eucalypts such as Wandoo and Salmon Gum, as well as nearby heathlands. From late winter till summer, they usually occupy inland parts of their range, in woodlands dominated by eucalypts such as Wandoo and Salmon Gum which are utilised for breeding. In late summer they move to coastal and near-coastal areas, where they forage within proteaceous shrublands or woodlands of *Banksia* and are sometimes observed in built-up areas.	Likely (recent proximal records)
Calyptorhynchus sp. 'white-tailed black cockatoo' White-tailed black cockatoo (EN)	Carnaby's and Baudin's Black Cockatoo are very similar in appearance and often an identification cannot be confirmed in sightings. Both have brownish-black plumage with narrow off-white scalloped tips, white cheeks and white panels on their tails, visible in flight. The species can be distinguished by the shape of their bills. Carnaby's Black Cockatoo has a short and wide bill whilst Baudin's have a long narrow bill. Baudin's Black Cockatoo inhabits Jarrah and Marri Forest and is usually only found in woodlands and forests of the south-west of Western Australia.	Unlikely (no local records)
Diomedea amsterdamensis Amsterdam Albatross (CR)	The Amsterdam Albatross is a very large, full-bodied albatross with extremely long wings (between 2.5 – 3.5m) and a short wedge-shaped tail. It has dark brown plumage with a contrasting white mask similar in appearance to the Wandering Albatross. The Amsterdam Albatross is a non-resident visitor to Australia and mainly occurs in the south-west and south Australian oceans.	Very Unlikely (habitat not considered to be present)
Diomedea epomophora Southern Royal Albatross (VU)	The Southern Royal Albatross is a large bird with long, slender wings Predominantly white with pinkish bill and black tips on the wings. This marine species occurs in the open oceans of the southern hemisphere, breeding on remote islands.	Very Unlikely (habitat not considered to be present) Very Unlikely (habitat not considered to be present)
Diomedea exulans Wandering Albatross (VU)	The Wandering Albatross is a marine, pelagic and aerial species. In the Australian region it occurs inshore, offshore and in pelagic waters and in breeding season nests on coastal or inland ridges, slopes, plains, often with marshy ground.	Very Unlikely (habitat not considered to be present)

Taxon	Description	Likelihood of Occurrence
Falco hypoleucos Grey Falcon (VU)	Known to occur widely in arid or semi-arid zones of Australia where annual rainfall does not exceed 500 mm, this species frequents lowland wooded plains and shrublands, especially *Acacia* shrublands netted by watercourses. It hunts primarily on avian prey including doves, pigeons, finches and small psittacines within grasslands. Breeding occurs from June to November, with young staying with the parents for more than 12 months after fledging, even if a new brood is reared. Nests are built in the tallest available tree along a watercourse, typically in species such as *Eucalyptus camaldulensis* (River Red Gum). This bird occurs at very low densities throughout Australia, and is considered to be an elusive species. It is unlikely to nest within the Survey Area due to lack of suitable nesting or roosting trees, however, use of the area as foraging habitat is possible.	Unlikely (no local records)
Leipoa ocellata Malleefowl (VU) MEGAPODIIDAE	The Malleefowl is a large ground-dwelling bird with strong feet and a short bill. The head and neck are mostly grey, with a dark stripe extending down along foreneck from the throat to the upper breast, and the underparts are mostly creamy-coloured, but it is the upperparts that are most striking. The upperwings are a complex combination of mottles, barring and variegations of grey, cream, black and Rufous. The bill is blackish, and the legs and feet are pale greyish. The Malleefowl occurs in semi-arid parts of mainland Australia, ranging from New South Wales (west of the Great Divide), extending into north-western Victoria and the Riverland of South Australia; on the Eyre Peninsula of South Australia, extending into the Great Victoria Desert; and in southern and western parts of Western Australia. Malleefowl usually occur in mallee eucalypt woodlands with a dense but discontinuous canopy and varied shrubby understorey, especially where the mallee trees are multi-stemmed. They also very occasionally occur in other types of dry eucalypt forests. The key to their presence is the period since the habitat was last burnt, with habitat that has not been burnt for 40–60 years preferred; frequently burnt areas are unsuitable and do not support populations of Malleefowl.	Possible (recent records in the vicinity)
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bartailed Godwit (CR)	The Bar-tailed Godwit is a large migratory shorebird. It has streaked brown forehead, crown, and nape with scalloped upperparts. The underparts are white with fine brown streaking on the breast and flanks. The species is recorded along the coastline, mostly in the northern parts of Australia, including major islands. They forage in intertidal mudflats or occasionally in shallow waters.	Unlikely (habitat present but no local records)
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew (CR) SCOLOPACIDAE	Found in all states and territories of Australia in primarily coastal areas, this migratory bird occupies Australian habitat through the non-breeding season, moving north through Asia to breed from early May to late June. During its Australian inhabitation it is associated with estuaries and coastal lagoons, favouring large mudflats, saltmarsh and mangrove habitats. They roost on sandy spits or amongst vegetation of marshy areas, preferring to roost in large flocks separated from other shorebirds. Crustaceans such as crabs and prawns, molluscs and invertebrates form the bulk of the bird's diet. Feeding activity is governed by the tide and is thus both diurnal and nocturnal.	Unlikely (no local records)

Taxon	Description	Likelihood of Occurrence
Rostratula australis Australian Painted Snipe (EN)	The Australian Painted Snipe is a snipe-like shorebird with a bulbous-tipped bill, broad, rounded wings and longish legs that protrude beyond the tip of the tail when in flight. The sexes differ. Males have a dark-brown crown with a buff median stripe; the rest of the head and neck are dark ashy-grey, with a cream-coloured, comma-shaped mark around the eye. The species occupies shallow freshwater or brackish wetlands, such as saltmarshes, swamps, claypans and waterlogged grasslands, where it forages for aquatic invertebrates and occasionally grass seeds. They may forage during day or night time, but generally remains in dense cover where available.	Unlikely (no local records))
Sternula nereis nereis Australian Fairy Tern (VU)	A small and round bodied piscivorous bird. Pale grey-white plumage during breeding season with a black crown and nape, white forehead, and black patch in front of eyes. Their bill is an orange-yellow and legs are a dull yellow. During non-breeding season the plumage becomes mottled, and the bill turns black. The Australian Fairy Tern nests on sandy beach, spits, and banks above the high tide mark, but below vegetation. Occasionally found in estuaries and wetlands.	Very Unlikely (habitat not considered to be present)
Thalassarche carteri Indian Yellow-nosed Albatross (EN)	A marine bird located in subtropical and subantarctic waters. The Indian Yellow-nosed Albatross has a white head and neck with a small dusky patch before the eye. Their cheeks, ear coverts and tail are grey, and beak is a glossy lack with distinctive yellow-orange strip. The Indian Yellow-nosed Albatross is located in subtropical and subantarctic waters, occupying inshore and offshore waters. Breeding grounds are on islands of the southern Indian Ocean.	Very Unlikely (habitat not considered to be present)
Thalassarche cauta Shy Albatross (VU)	A medium sized albatross, with a white crown and forehead, pale grey face and grey-black upper wing and tail. It has a characteristic black thumb mark at the leading edge of the underwing. The bill is a grey yellow with prominent yellow tip. The Shy Albatross is pelagic and occurs in widely in the southern oceans and breeds on islands off Australia and New Zealand.	Very Unlikely (habitat not considered to be present)
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross (VU)	A medium sized albatross, with a white head and distinctive black brow, a broad black leading edge on the underwing, with a series of bold streaks from the base of the wing and a bright orange-yellow bill. The Campbell Albatross occurs in Antarctica waters, sub-Antarctic waters and subtropical waters of the South Pacific Ocean. They nest of cliffs and ledges by the ocean or on islands.	Very Unlikely (habitat not considered to be present)
Thalassarche melanophris Black-browed Albatross (EN)	The Black-browned Albatross are white with a yellow-orange bill and a black brow, back, upper wing and blueish- grey legs. This marine species occurs in Antarctic, subantarctic and temperate waters and breeds on subantarctic and peri-antarctic islands.	Very Unlikely (habitat not considered to be present)

Taxon	Description	Likelihood of Occurrence
Idiosoma nigrum Shield-backed Trapdoor Spider (VU) IDIOPIDAE	The Shield-backed Trapdoor Spider is dark brown to black, large (females up to 30 mm in body length) and with a distinctive thick and hard cuticle on the abdomen. The end of the abdomen is flattened into a shield and the sides are deeply corrugated. The burrows always have a lightweight, leaf litter and silk door, with leaf and twig trip-lines fanning out from the centre of the front of the burrow rim. The Shield-backed Trapdoor Spider is endemic to semi-arid southwest WA. It occurs in a number of severely fragmented populations in the central and northern Wheatbelt. Further north, the species occurs in more arid, isolated ranges in the Midwest (e.g., Jack Hills, Weld Range, Blue Hills, etc.) and coastal areas of the Midwest (e.g., Murchison River, Shark Bay, etc.). The arid Midwest populations are naturally fragmented or isolated because they persist only on ranges, but the Wheatbelt and coastal Midwest populations are all severely fragmented as a result of land clearing. Arid Midwest populations are associated with rocky habitats, primarily in positions with increased moisture retention properties like gullies and drainage lines on southern facing slopes.	Very Unlikely (habitat not considered to be present)
Dasyurus geoffroii Chuditch; Western Quoll (VU) DASYURIDAE	The Chuditch, also known as the Western Quoll, is the largest carnivorous marsupial that occurs in WA. It has mostly brown fur with distinctive white spots. It has large, rounded ears, a pointed muzzle and a mostly black, brushy tail about three-quarters the length of it head and body. At the time of European settlement, Chuditch were present in all Australian States (except Tasmania); however, they are now only present in approximately 5% of their former range. Most Chuditch are now found in varying densities throughout the jarrah forest and south coast of Western Australia. They also occur at lower densities in the goldfields and wheatbelt, as well as in Kalbarri National Park (translocated). Chuditch use a range of habitats including forest, mallee shrublands, woodland and desert. The densest populations have been found in riparian jarrah forest. Chuditch require adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive. They are capable of travelling long distances and have large home ranges, and even at their most abundant, Chuditch are generally present in low numbers. For this reason, they require habitats that are of a suitable size and not excessively fragmented.	Very Unlikely (habitat not considered to be present)
Macroderma gigas Ghost Bat (VU) MEGADERMATIDAE	The ghost bat is the largest microchiropteran bat in Australia, with a head and body length of 10 – 13 cm and a forearm length of 10 – 11 cm. It is Australia's only carnivorous bat. Its fur is light to dark grey above and paler below. It has long ears which are joined together, large eyes, a simple noseleaf and no tail. Since the arrival of Europeans, ghost bats have contracted further northwards, with much of their arid zone distribution disappearing in the past few decades. Ghost bats occur in the Pilbara, Kimberley (including several islands, northern Northern Territory (including Groote Eylandt), and coastal and near coastal eastern Queensland from Cape York to near Rockhampton. Ghost bats disperse widely when not breeding, but concentrate in a relatively few maternity roost sites when breeding. Few of these sites are known and most are not protected or managed. Roost sites include caves, rock crevices and disused mine adits. Preferred roosting habitat is caves beneath bluffs of low rounded hills.	Very Unlikely (habitat not considered to be present)

Taxon	Description	Likelihood of Occurrence
Parantechinus apicalis Dibbler (EN) DASYURIDAE	This small carnivorous marsupial was formerly widespread along the west and south coasts of Australia but is now restricted to a small number of sites of mainland Western Australia, and several offshore islands near Jurien. Although the species is known to utilise diverse habitats, preferred habitat includes heathland on sandy or occasionally lateritic soils, and long-unburnt vegetation over 1 m high with dense canopy. Diet includes predominantly invertebrates, with a portion comprised of plant matter which varies, likely due to conditions. It is thought that the availability of flowering shrubs from the Proteaceae and Myrtaceae families may be of importance within forage habitat. Breeding is seasonal, with mating taking place over 3-4 weeks from late March, after which males may die as part of a phenomenon termed "facultative male die-off". Young are born in April or May, with litters of up to eight young carried in the female's shallow pouch. Juveniles have been trapped in September.	Very Unlikely (habitat not considered to be present)
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink (EN) SCINCIDAE	The Western Spiny-tailed Skink is one of the larger subspecies of *Egernia stokesii*, growing to 194 mm (snout to vent length). Its skin is coloured with heavily keeled scales. It has a short, flattish, distinctively spiny tail which it uses as anchorage within crevices when defending. There are two forms of Western Spiny-tailed Skink: a reddish brown form, with angular pale blotches arranged in irregular bands and a paler underside, in the northern and central wheatbelt; and a wholly black form in the Murchison region. The Western Spiny-tailed Skink is known to occur in a broad semi-arid area in southwest Western Australia, between Shark Bay and Minnivale and east to Cue. Much of area now known as the wheatbelt has been cleared since the 1960s and suitable microhabitat is now far less abundant, although an increasing number of skinks are being located in altered habitat under piles of wood, scrap metal or under buildings on private property. Most records of the brown form Western Spiny-tailed Skink are in York Gum woodland with some records in Gimlet and Salmon Gum woodland. Populations persist in woodland patches as small as one hectare and completely surrounded by wheatfields. Sites with the greatest number of individuals contain numerous fallen logs and were subjected to low-intensity grazing by domestic.	Very Unlikely (habitat not considered to be present)

The 35 remaining species were listed as either 'Priority' or 'Other Specially Protected Species' under the BC Act, or 'Marine' or 'Migratory' under the EPBC Act.

3.9 Matters of National Environmental Significance

MNES listed under the EPBC Act identified in the vicinity of the Survey Area using the Protected Matters Search Tool (PMST) included Threatened flora, fauna, and ecological communities, or fauna listed as Migratory or Marine (see Appendix B). The potential for these to occur in the Survey Area has been addressed in the above sections, and in Appendices B and C.

The key MNES that are assessed as having high potential to occur and therefore require particular consideration include Carnaby's Black-Cockatoo (Endangered) and The Sandplain Duck Orchid (Endangered). These are discussed further below (with State and Commonwealth conservation status indicated respectively).

3.9.1 *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) [EN; EN]

The desktop assessment identified records of Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) (including known roost sites) in proximity to the Survey Area, with the closest being located approximately 0.17 km to the southeast of the northern section of the Survey Area (Figure 3.4).

Carnaby's Black-Cockatoo is listed as Endangered under the EPBC Act, and a National Recovery Plan is in place (DBCA [formerly the Department of Parks and Wildlife] 2013). However, there is no approved Conservation Advice or Listing Advice for the species. The National Recovery Plan

describes the species' distribution, habitat, and population, and identifies known threats to the species (DBCA 2013).

Distribution and Habitat

Carnaby's Black-Cockatoo is endemic to the southwest of Western Australia, ranging from the Lower Murchison in the north, Esperance in the south and Forrestania in the east. The species exists as two genetically distinct subpopulations: an eastern and western population, the latter subpopulation of which occurs within the broader region (EPA 2019).

There is no accurate estimate of the population number, and little is known about the species' occurrence within the region. Smaller, important populations for the long-term survival of the species have not been defined for Black Cockatoos, due to the mobile and widely dispersed nature of the species, and the variation in flock compositions (DSEWPaC 2012a; DAWE 2017). For this reason, it is more appropriate to consider significance in terms of impacts on habitat and individuals rather than a resident population (DAWE 2017).

Carnaby's Black Cockatoo is predominantly restricted to areas of remnant native woodland with an understory dominated by proteaceous species such as *Banksia*, *Hakea* and *Grevillea*. However, as the species is highly mobile and adaptive, they are able to access resources spread over a relatively large area (DBCA 2013). Mapping of the species has proven difficult due to seasonal migration and movement over long distances. This in combination with the adaptive behaviour of the species indicates that the significance of locations within the species' range, especially in reference to breeding, is likely to continue to change over time (DBCA 2013). Breeding occurs mainly in the Wheatbelt and extends to Hopetoun and Ravensthorpe (DAWE 2017). During the non-breeding season (January to July), the majority of individuals migrate to the Midwest, Swan Coastal Plain and South coastal regions (DAWE 2017).

Identified breeding and nearby feeding habitat, former breeding habitat that has hollows intact, and vegetation that provides habitat for feeding, watering and regular night roosting for Carnaby's Black-Cockatoo are defined as 'habitat critical to the survival' of the species (DBCA 2013). This includes all areas of breeding habitat including known nesting trees, and foraging areas that support breeding.

As stated above, the Survey Area does occur in proximity to known records of the species; however, it does not occur within the species' breeding range (DAWE 2017). Mapping of Carnaby's Black-Cockatoo foraging habitat carried out by Bamford (2020) designated the vegetation in the vicinity of the Survey Area as having 'Low to moderate foraging value'.

3.9.2 *Paracaleana dixonii* (Sandplain Duck Orchid) [VU; EN]

Numerous records of this taxon are known from the vicinity, particularly in areas of unfragmented native vegetation to the immediate east of the Survey Area. The closest records to the site are approximately 2 km from the eastern boundary, as shown in Figure 3.4. Conservation Advice published in 2008 (DEWHA 2008) estimated that there were 57 plants occurring within eight extant populations, distributed across an approximately 540 km^2 range between Gingin and Dongara.

This diminutive plant is most detectable when flowering in November to January, or after summer fires when flowers proliferate, however, vegetative structures are absent for the majority of the year. This means there is a very specific and narrow survey period within which to assess presence of the Sandplain Duck Orchid.

Following significant survey for the species south-east of Dongara, Woodman Environmental Consulting (2013) described the key local habitats for the taxon as:

- Low open woodland of Pricklybark (*Eucalyptus todtiana*) over mid to low shrubland of mixed species dominated by Dwarf Sheoak (*Allocasuarina humilis*), Burma Road Banksia (*Banksia scabrella*), *Calothamnus sanguineus, Eremaea beaufortioides* var. *microphylla, Melaleuca* aff. *leuropoma* and *Hibbertia hypericoides* over low shrubland and sedgeland of mixed species

including *Banksia dallanneyi* subsp*. media, Conostylis canteriata, Mesomelaena pseudostygia* and *Caustis dioica* on grey or brown sand on lower and mid slopes.

- Mid sparse to open shrubland of mixed species including *Calothamnus quadrifidus* subsp. *angustifolius, Grevillea biformis* subsp. *biformis* and Coast Banksia (*Banksia attenuata*) over low shrubland and sedgeland of mixed species dominated by *Ecdeiocolea monostachya*, *Melaleuca leuropoma, Daviesia divaricata* subsp. *divaricata ms, Mesomelaena pseudostygia* and *Banksia shuttleworthiana* on yellow-brown or occasionally grey sand on slopes and valley floors.
- Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* or mid open shrubland of *Allocasuarina campestris* over low shrubland and sedgeland of mixed species dominated by Pink Dryandra (*Banksia carlinoides*), *Ecdeiocolea monostachya, Hakea incrassata, Hibbertia hypericoides* and *Melaleuca aspalathoides* on gravelly grey or brown clay loams or sands, usually with laterite on or near the surface, on slopes and crests.

It is considered that areas of suitable habitat are present broadly across the site in sections of native vegetation.

4. Field Survey Results

4.1 Reconnaissance Flora and Vegetation Survey

During the flora and vegetation survey undertaken in May and June of 2022, 26 relevés were assessed within the Survey Area.

A total of 174 vascular flora taxa were recorded (Table D.1 in Appendix D), from 81 genera, from the relevés and opportunistic observations. Of these, two taxa were introduced (1.15%) and 27 (15.52%) could not be identified to species level due to insufficient diagnostic material being present at the time of survey.

4.1.1 Conservation Significant Flora

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

One Priority-listed flora species was confirmed from taxonomic identifications recorded during the field survey:

- *Stawellia dimorphantha* (P4).

The occurrence observed during the survey consisted of two individuals recorded from relevé RR06 within vegetation adjacent to access tracks south of Tarantula well. DBCA records inspected as part of desktop assessment indicate that there are numerous records of this taxon from within close proximity (<2 km) of the Survey Area, including a record approximately 220 m south of RR06 along the access track.

4.1.2 Other Flora of Significance

No other significant flora taxa or flora specimens of taxonomic interest were recorded from the survey.

4.1.3 Introduced Flora

Two introduced flora taxa (1.15% of total flora) were recorded during the survey:

- **Ursinia anthemoides*
- **Hypochaeris* sp.

Both taxa were recorded from along, or within proximity of, access tracks in the southern (Floreat) portion of the Survey Area. Both are widespread in the region and commonly occur in agricultural and bushland areas. Individuals observed were in early growth stages and flowers were absent or underdeveloped, with the **Hypochaeris* sp. specimen unable to be confirmed to species level due to a lack of diagnostic reproductive material.

No WoNS or Declared Pest plant species were recorded during survey.

4.1.4 Vegetation Units

Six broad structural vegetation types were recorded from within the Survey Area (in addition to cleared areas devoid of native vegetation) as shown in Table 4-1, and mapped in Appendix G:

- **AspTS** – Isolated *Eucalyptus todtiana* over tall shrubland of *Acacia* spp. (*A. blakelyi* and/or *A. scirpifolia* and/or *A. spathulifolia*) over mixed sparse low shrubs, forbs and sedges.
- **BaEmMS** – Open mid shrubland of *Banksia attenuata,* with or without isolated emergent *Acacia* spp., *Eucalyptus todtiana* or *Xylomelum angustifolium*, over *Ecdeiocolea monostachya, Mesomelaena pseudostygia* and *Lepidobolus* sp. sparse sedgeland.

- **BmBaLW** – *Banksia menziesii* sparse low woodland over *Banksia attenuata* and *Scholtzia laxiflora* mid open shrubland, over *Melaleuca ?leuropoma*, *Jacksonia floribunda* and *Stirlingia latifolia* low shrubland over *Alexgeorgea nitens* and *Drosera* sp..
- **EmSL** – Isolated low shrubs of *Banksia attenuata, Banksia shuttleworthiana* and *Calothamnus glaber,* over *Ecdeiocolea monostachya, Mesomelaena pseudostygia* and *Lepidobolus* sp. sedgeland.
- **EtBaLW** – *Eucalyptus todtiana* and *Xylomelum angustifolium* sparse low woodland, over open mid shrubland of *Banksia attenuata*, over myrtaceous low open shrubland and *Ecdeiocolea monostachya and Mesomelaena pseudostygia* open sedgeland.
- **XdJaEmMS** – *Xanthorrhoea drummondii* sparse mid shrubland over *Jacksonia angulata* and *Calytrix depressa* low shrubland with *Ecdeiocolea monostachya* sedges.

The vegetation types were based on observations made during field survey, in conjunction with subsequent data analysis and interpretation.

The majority of the Survey Area (183.66 ha; 71.86%) is comprised of **BaEmMS** vegetation, dominated by open mid-shrubland of Banksia attenuata over sedges. This can also be characterised as Kwongan scrub or heath, and is a prominent vegetation type (VT) within the region. The **XdJaEmMS** grasstree shrubland was the most restricted vegetation unit of the survey area (1.56 ha; 0.61%), forming a small, discrete area within the southern (Floreat) section of the Survey Area. Aerial imagery interpretation suggests there may be further extent beyond the Survey Area boundary in the vicinity of sites RT16 and RT 20 (Appendix G).

Table 4-1: Vegetation Units of the Survey Area

Vegetation Type	Description	Other Key Species	Relevés	Representative Photograph	Extent in Survey Area (ha/%)
AspTS	Isolated *Eucalyptus todtiana* over tall shrubland of *Acacia* spp. (*A. blakelyi* and/or *A. scirpifolia* and/or *A. spathulifolia*) over mixed sparse low shrubs, forbs and sedges.	*Xanthorrhoea drummondii, Jacksonia hakeoides, Banksia shuttleworthiana, Scholtzia laxiflora, Hakea polyanthema, Banksia leptophylla* var. *melletica, Conostylis candicans* subsp. *candicans.*	RT02 RT09 RT15		10.52 ha 4.12 %
BaEmMS	Open mid shrubland of *Banksia attenuata,* with or without isolated emergent *Acacia* spp., *Eucalyptus todtiana* or *Xylomelum angustifolium*, over *Ecdeiocolea monostachya, Mesomelaena pseudostygia* and *Lepidobolus* sp. sparse sedgeland.	*Banksia candolleana, Banksia hookeriana, Calothamnus glaber, Conospermum boreale* subsp. *ascendens, Scaevola canescens, Conostylis* spp.	RR02, RR04 RR05, RT01 RT03, RT05 RT04, RT06 RT08, RT13 RT14, RT17 RT18, RT19 RT20		183.66 ha 71.86 %

Vegetation Type	Description	Other Key Species	Relevés	Representative Photograph	Extent in Survey Area (ha/%)
BmBaLW	*Banksia menziesii* sparse low woodland over *Banksia attenuata* and *Scholtzia laxiflora* mid open shrubland, over *Melaleuca ?leuropoma*, *Jacksonia floribunda* and *Stirlingia latifolia* low shrubland over *Alexgeorgea nitens* and *Drosera sp*..	*Pileanthus filifolius, Verticordia grandis, Eremaea beaufortioides, Schoenus curvifolius, Leucopogon sp. Northern ciliate (R. Davis 3393).*	RT10		16.29 ha 6.37 %
EmSL	Isolated low shrubs of *Banksia attenuata, Banksia shuttleworthiana* and *Calothamnus glaber,* over *Ecdeiocolea monostachya, Mesomelaena pseudostygia* and *Lepidobolus* sp. sedgeland.	*Conospermum boreale* subsp. *ascendens, Darwinia pauciflora, Leptospermum erubescens.*	RR01 RR03 RT07		6.22 ha 2.43 %
EtBaLW	*Eucalyptus todtiana* and *Xylomelum angustifolium* sparse low woodland, over open mid shrubland of *Banksia attenuata*, over myrtaceous low open shrubland and *Ecdeiocolea monostachya and Mesomelaena pseudostygia* open sedgeland.	*Banksia candolleana, Calothamnus glaber, Scholtzia laxiflora, Banksia shuttleworthiana, Beaufortia elegans, Hibbertia hypericoides, Leucopogon inflexus, Melaleuca ?leuropoma.*	RT11 RT12		24.39 ha 9.54 %

Vegetation Type	Description	Other Key Species	Relevés	Representative Photograph	Extent in Survey Area (ha/%)
XdJaEmMS	*Xanthorrhoea drummondii* sparse mid shrubland over *Jacksonia angulata* and *Calytrix depressa* low shrubland with *Ecdeiocolea monostachya* sedges.	*Stylidium repens, Hakea candolleana.*	RT16		1.56 ha 0.61 %
Cleared / Not Vegetated	Access track and cleared well pad sites.	n/a	n/a		12.94 ha 5.06 %
Total					255.58 ha 100%

4.1.5 Conservation Significant Vegetation

No vegetation of conservation significance was observed during the survey, and none was assessed as being consistent with any TECs or PECs.

Whilst Banksia woodland vegetation of the VT **BmBaWL** can be characterised floristically as meeting criteria for the *Banksia Woodlands of the Swan Coastal Plain* TEC, as the Survey Area is geographically positioned in the Geraldton Sandplains IBRA region, not the Swan Coastal Plain IBRA region, it is thus excluded from meeting the TEC conditions. No other vegetation was aligned with any State or Commonwealth-listed ecological communities.

4.1.6 Vegetation Condition

Vegetation condition ranged from Degraded to Pristine within the Survey Area, as shown in Appendix G. The vast majority of the Survey Area (230.86 ha, 90.33%) was found to be in Pristine condition according to the EPA condition scale, based on structural integrity and floristic composition observed at the time of survey. Several narrow areas along tracks and adjacent to Brand Highway in the southern (Floreat) portion of the Survey Area exhibited light weed burden and some disturbance, contributing to decreased condition score.

Table 4-2: Extent of vegetation condition within the survey area.

Condition	Extent
Pristine	230.86 ha; 90.33%
Excellent	0 ha; 0%
Very Good	10.44 ha; 4.08%
Good	0 ha; 0%
Degraded	1.34 ha; 0.53%
Completely Degraded	0 ha; 0%

4.1.7 Statistical Analysis

Results of the statistical floristic analysis indicated the **BaEmMS**, and **EmSL** vegetation units were reasonably well defined, however, interpretation against structural vegetation components and field observations was required in order to define the remaining groups and assess outliers. As the Reconnaissance level of survey involves a lower intensity of sampling it is not expected that statistical analysis of results are conclusive or robust in this case, but merely indicative of key vegetation unit alignments.

The preliminary dendrogram generated as part of analysis is shown in Figure 4.1

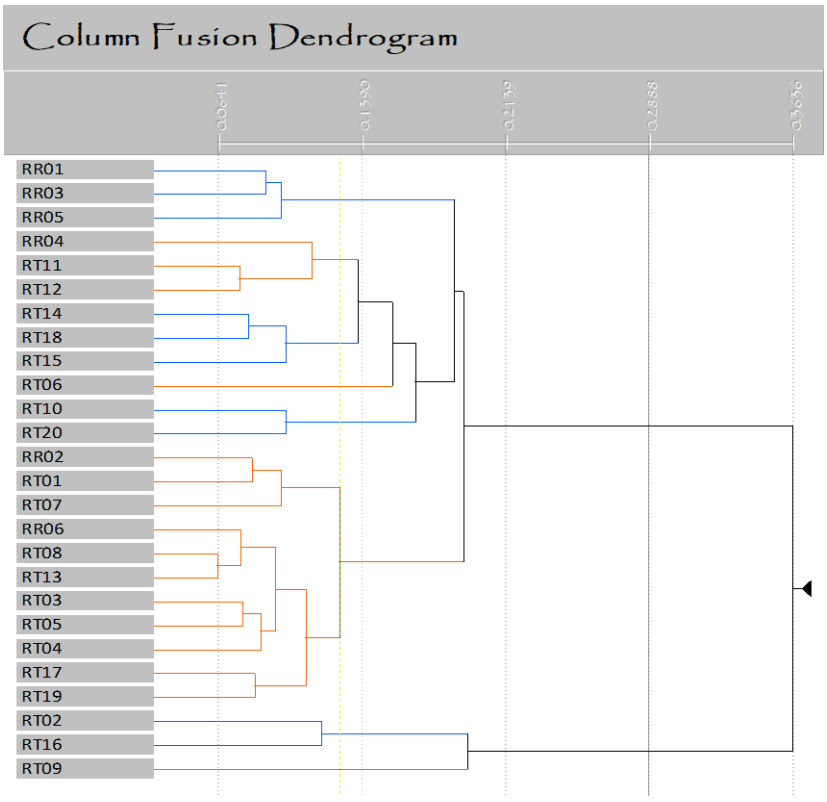


Figure 4.1: Floristic Dendrogram

A species accumulation curve was generated using relevé data (Figure 4.2). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

Figure 4.2 suggests that the curve is flattening and is gradually approaching an asymptote. However, the Bootstrap estimate of species richness is 255.58, which indicates that further survey is required in order to capture all species present within the Survey Area. A Reconnaissance level of survey is not expected to achieve a comprehensive inventory of flora, but the inclusion of opportunistic records and results of scheduled targeted spring searches will contribute towards reaching the estimated cumulative value.

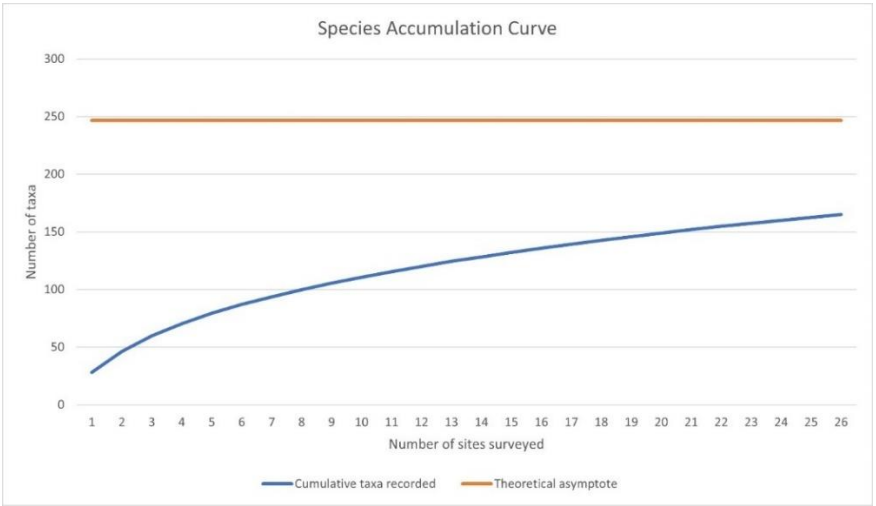


Figure 4.2: Adequacy of Survey

4.1.8 Limitations of Flora and Vegetation Survey

Table 4-3: Botanical Limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	No	A number of flora and vegetation surveys have been conducted in proximity to the survey area, and the majority of the survey area is representative of kwongan vegetation that is well understood from the bioregion. As the role of a Reconnaissance survey is to broadly describe the flora and vegetation attributes of the survey area, this objective is deemed achieved without constraint.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The lead ecologist conducting the field survey has over 10 years experience conducting flora and vegetation surveys within Western Australia, including the bioregion.
Proportion of the flora recorded and/or collected, and any identification issues	Moderate	174 vascular flora taxa were recorded during the field survey of which 27 (15.52%) could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered a Moderate constraint for the Reconnaissance level of survey undertaken.
Was the appropriate area fully surveyed (effort and extent)	No	Spatial coverage of the survey area, and the survey effort applied, was sufficient to describe the flora and vegetation values of the survey area at Reconnaissance level.
Access restrictions within the survey area	No	No restrictions to access were encountered and the area was fully surveyed.
Survey timing, rainfall, season of survey	Moderate	The field survey was conducted during May-June which is not within the primary season for survey in the bioregion. Although it would have been ideal to conduct the survey during spring when a higher proportion of flora species are likely to be flowering, supplementary survey in the form of targeted flora searches for conservation-listed species is scheduled for spring of 2022 and 2023. Twenty-seven taxa (15.52% of the flora inventory) could not be identified with certainty due to a lack of flowering material required for identification. This represents a moderate constraint, however, the objectives of a Reconnaissance survey are to identify broad vegetation units and identify any need for further survey, which has confidently been achieved. The vegetation analysis resulting from the survey conducted was sufficient to characterise broad vegetation types and targeted flora searching within the survey area is scheduled for spring 2022 and 2023 to support identification of any conservation significant flora present.
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	Several portions of the survey area had been recently burnt (<2 yrs). However, immediately adjacent unburnt vegetation representing these vegetation units was available within the survey area thus it was not considered a constraint. There were no other recent disturbances that would have affected the results of the survey.

4.2 Basic Fauna Survey

During the Basic fauna survey undertaken in May and June of 2022, 29 habitat assessment points were evaluated and three dedicated bird surveys undertaken within the Survey Area (Table D.2 in Appendix D). The site was traversed on foot or by vehicle and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species.

Fauna observations recorded during the survey were predominantly of avifauna (birds), with overall records consisting of 35 species including four mammals, 27 birds, three reptiles and one invertebrate group. No amphibians were observed.

Of the species recorded, one is conservation-listed:

- *Calyptorhynchus latirostris* (Carnaby's Cockatoo) – [EN; EN].

Three fauna species recorded are introduced:

- **Capra hircus* (Goat);
- **Oryctolagus cuniculus* (Rabbit); and
- **Vulpes vulpes* (Red Fox).

4.2.1 Conservation Significant Fauna

One Threatened fauna species was recorded during survey: Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) [EN; EN]. A small group (<10 individuals) was observed alighting in vegetation close to the Survey Area, along an access corridor in the southern (Floreat) section of the Survey Area. The group alighted briefly in canopy vegetation strata in an area of Acacia shrubland and Eucalyptus woodland, before flying over the corridor directly a short time later.

No Priority species or otherwise conservation-listed taxa were recorded.

4.2.2 Fauna Habitat Assessment

From the 29 habitat assessment points evaluated within the Survey Area, in conjunction with vegetation mapping, a total of six fauna habitat units (excluding cleared areas) were mapped:

- Banksia Scrub on Yellow Sand Dune;
- Banksia Woodland;
- Eucalypt Woodland;
- Kwongan;
- Sedgeland; and
- Shrubland.

These are described in Table 4.4 and mapped in Appendix G.

Table 4-4: Fauna Habitat Units of the Survey Area

Habitat Unit	Description	Representative Photograph
Banksia Scrub on Yellow Sand Dune	**Scrub or tall heath of Banksia on dunes of deep yellow sand, with isolated emergent tall shrubs or Eucalypts.** Areas of open sand and diverse low or mid-height flowering Proteaceous and Myrtaceous shrubs. Suitable habitat for nectivorous birds (e.g. honeyeaters), Honey Possum, reptiles and predating raptors. Banksia vegetation present may provide forage for Carnaby's Cockatoo. **Assessment points:** FH26 **Extent:** 0.62ha, 0.24%	
Banksia Woodland	**Low woodland of *Banksia menziesii* over *Banksia attenuata* scrub and Myrtaceous low shrubland on pale sandplain.** Areas of open sand and diverse low or mid-height flowering Proteaceous and Myrtaceous shrubs. Suitable habitat for nectivorous birds (e.g. honeyeaters), reptiles and predating raptors as well as small woodland birds. Banksia vegetation present may provide forage for Carnaby's Cockatoo. **Assessment points:** FH28, FH29 **Extent:** 16.29 ha, 6.37%	
Eucalypt Woodland	**Low woodland of *Eucalyptus todtiana* over mixed *Banksia* and Myrtaceous low shrubland and sedges on pale sandplain.** Clumps of low trees or mallee with Proteaceous and Myrtaceous shrubs. Suitable habitat for insectivorous birds, reptiles. Eucalypts may provide tree-hollows for arboreal species and nesting birds and coarse woody debris for small reptiles. **Assessment points:** FH08, FH11 **Extent:** 24.39 ha, 9.54%	
Kwongan	**Low scrub or heath of Banksia and Myrtaceous low shrubs, with sedges on pale undulating sandplain.** Areas of open sand and diverse low or mid-height flowering Proteaceous and Myrtaceous shrubs. Suitable habitat for nectivorous birds (e.g. honeyeaters), Honey Possum, reptiles and predating raptors. Banksia vegetation present may provide forage for Carnaby's Cockatoo. **Assessment points:** FH01, FH02, FH07, FH09, FH10, FH12, FH13, FH14, FH15, FH18, FH22, FH24, FH25 **Extent:** 183.04 ha, 71.61%	

Habitat Unit	Description	Representative Photograph
Sedgeland	**Low-lying heath or open sedgeland.** Closed depressions or basin with loose, low cover. Exposed area preferrable for raptors, some small reptiles and foraging Emu or Kangaroo. May support invertebrates when soils are seasonally damp. **Assessment points:** FH19, FH21 **Extent:** 6.22 ha, 2.43%	
Shrubland	**Tall shrubland of Grasstree or Acacia with deep litter and open understorey of herbs, forbs and low shrubs.** Areas of scrub amongst tall or mid-height shrubs. Suitable habitat for small to medium woodland birds. **Assessment points:** BS02, BS03, FH20 **Extent:** 12.08 ha, 4.72%	
Cleared / Not Vegetated	**Cleared tracks, well pads and lay-down areas**, devoid of vegetation. Unlikely to support fauna, although may be utilised by reptiles or feral mammals when travelling across the site. **Assessment points:** n/a **Extent:** 12.94 ha, 5.06%	

4.2.3 SRE Habitat Assessment

No areas considered to have high potential to support SRE species, such as sheltered microhabitat, habitat isolates, drainage lines, outcrops or sustained dampland environments were observed during survey of vegetation and landforms of the Survey Area. The majority of the vegetation and habitat of the Survey Area is widespread and highly connected across the landscape. The most restricted habitat observed on site was Grasstree Shrubland in the vicinity of RT16, however it did not contain features considered to indicate high potential of SRE occurrence, and inspection did not reveal evidence of SRE presence.

No invertebrates considered likely to represent SRE taxa were observed during the survey, despite the survey being undertaken within the optimal season (May – October) (EPA 2009) and in seasonally wet conditions.

Secondary evidence of presence of Mygalomorph spider in the vicinity was however recorded in the form of a disused and displaced trapdoor burrow collar (webbing sock complete with attached hinged lid) found on the ground surface in absence of any visible burrow (Plate 4-1). The material could not be tied to a any confirmed species. This evidence was recorded from an area of alluvial fan near RT16, and as such was adjacent to the Grasstree Shrubland vegetation unit considered to have the greatest potential for SREs to occur. However, a thorough search of the immediate vicinity did not reveal any potential burrow, and no other indicators were observed in the surrounding vegetation units.



Plate 4-1: Disused trapdoor collar.

Overall, the potential for the Survey Area to house contain SRE species is considered low based on landform, vegetation and absence of suitable habitat isolates. There remains some potential for SRE to occur, particularly given the limited knowledge surrounding many of these species.

No other evidence of invertebrates of potential significance was recorded during survey.

4.2.4 Black Cockatoo Habitat Assessment

Although no significant trees likely to support Black Cockatoos nesting or roosting activity were observed within the Survey Area, much of the native vegetation present is suitable for Black Cockatoo foraging habitat. The known distribution maps for Black Cockatoo species indicate that Baudin's Cockatoo and the Forest Red-tailed Cockatoo are highly unlikely to occur in the area, therefore these taxa have not been considered in assessment of Black Cockatoo habitat in the Survey Area. However, the Survey Area falls within the key range of Carnaby's Cockatoo, and the vegetation units dominated by *Banksia*, other Proteaceous species and Eucalyptus comprising the majority of the Survey Area contain preferred forage species known to support seasonal flocks of Carnaby's Cockatoo (DAWE 2022a).

The Commonwealth forage habitat scoring tool (DAWE 2022a) was utilised to assess and quantify Carnaby's Cockatoo forage value of the Survey Area as a whole, incorporating all fauna habitat units, as is specified in the Black Cockatoo Referral Guidelines document. The resultant scores are presented in Table 4-5.

Table 4-5: Carnaby's Cockatoo Forage Habitat Assessment

Starting score		Survey Area Scores
10		**10**
Attribute	Subtractions	
Foraging potential	*-2*	**-2**
Connectivity	*-2*	**-0**
Proximity to breeding	*-2*	**-2**
Proximity to roosting	*-1*	**-1**
Impact from significant plant disease	*-1*	**-0**
Total score		**5**
Appraisal		**Banksia-dominated vegetation occurs across the majority of the site. No significant (>500mm DBH) trees have been observed and there is no confirmed breeding or roosting in the vicinity, although water resources are available within 12 km, there are a number of records in proximity and individuals and flocks have been observed overflying the area.**

The Black Cockatoo Referral Guidelines indicate that a score of 5-10 is representative of High Quality native foraging habitat.

4.2.5 Limitations of Fauna Survey

Table 4-6: Zoological Limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of data and information	Negligible	There are several faunal surveys that have been conducted in proximity to the Survey Area in similar habitat that is well understood from the bioregion. In general, availability of data is not considered a constraint, despite there being limited information available with respect to invertebrate species, and a limited density of fauna records. The role of a Basic fauna survey is to broadly describe the habitat attributes of the Survey Area and potential for conservation listed fauna species to occur, which has been achieved.
Competency/experience of the survey team, including bioregion experience	No	The lead Ecologist has over 15 years' experience in fauna ecology, with over 10 years conducting fauna survey in Western Australia.
Scope of survey e.g. excluded fauna groups	No	All vertebrate fauna groups were surveyed for and all recorded with the exception of amphibians. Survey was conducted as a Basic survey, with the emphasis on describing habitat and assessing its suitability for conservation-listed species, thus the scope of survey is not a constraint.
Timing, weather, season	Moderate	The field survey was conducted during May-June, which is outside of the optimal timing for fauna survey in this region for all fauna groups excepting amphibians, which were not targeted during survey. The timing is considered a moderate constraint, although as a Basic level fauna survey, it is not considered a significant impediment to survey validity. The survey period encompassed a range of weather including predominantly fine days with periods of heavy rain preceding one survey period. There is no constraint posed by the preceding weather conditions for this level of survey.
Disturbances that may have affected results	No	Several portions of the survey area had been recently burnt (<2 yrs). However, immediately adjacent unburnt vegetation representing these vegetation units was available within the survey area thus it was not considered a constraint. There were no other recent disturbances that would have affected the results of the survey.
Proportion of fauna identified, recorded or collected	No	Fauna assemblage identified is representative of a Basic level survey with species that are identified in the field by observation and secondary evidence of presence e.g. scats and tracks.
Adequacy of survey intensity and proportion of survey achieved	No	A total of 32 fauna taxa were recorded during the survey, representing taxa from bird, mammal and reptile groups. The survey area is considered to be adequately evaluated for a Basic level of fauna survey.
Access	No	No restrictions to access were encountered and the area was fully surveyed.

5. Discussion

5.1 Flora and Vegetation

No Threatened flora species were recorded during the Reconnaissance flora survey. The Priority 4 species *Stawellia dimorphantha* was recorded in vegetation immediately adjacent to an access track in the northern (Beharra) portion of the Survey Area, in close proximity to a previously recorded occurrence. There are a number of records of this taxon in the area, and as such it is unlikely that the two individuals observed will present a significant constraint to proposed works.

Of the six broad vegetation units identified from the Survey Area, none are considered to be significant, or to represent any conservation-listed ecological community.

No Declared Pest plants or WoNS were identified on the site, and the two species of weed recorded are common and widespread in the area, and were observed at low densities along and adjacent to tracks and disturbed vegetation in the southern (Floreat) portion of the Survey Area where public vehicle access to the vegetation of the UCL is possible and anecdotally reported. The weed taxa recorded represent 1.15% of the overall 174 vascular flora taxa recorded during survey.

Overall, vegetation condition within the Survey Area was generally Pristine, with small extents of Very Good or Degraded vegetation recorded where weeds were present and disturbance had modified vegetation structure.

5.1.1 Likelihood of Flora Occurrence Post-survey

Following conduction of the field survey, the likelihood of occurrence evaluation for taxa identified during desktop assessment was updated based on survey effort and habitat observed to occur in the Survey Area (Table C.1 in Appendix C). This allowed for validation and refinement of the potential for conservation-listed species to occur on site.

Fifteen taxa not observed during survey but considered to have a remaining high likelihood of occurrence include:

- *Banksia elegans* (P4);
- *Banksia fraseri* var. *crebra* (P3);
- *Banksia scabrella* (P4);
- *Beyeria gardneri* (P3);
- *Calytrix chrysantha* (P4);
- *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3);
- *Hypocalymma gardneri* (P3);
- *Lasiopetalum ogilvieanum* (P1);
- *Mesomelaena stygia* subsp. *deflexa* (P3);
- *Paracaleana dixonii* VU (EN);
- *Schoenus griffinianus* (P4);
- *Schoenus sp.* Eneabba (F. Obbens & C. Godden I154) (P2);
- *Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490) (P1);
- *Stylidium drummondianum* (P3); and
- *Thysanotus glaucus* (P4).

These flora species are considered to have high potential to be present despite not being observed in recent survey, based on their low detectability during the period of survey. It is anticipated that the targeted survey to be conducted later in 2022 will provide adequate coverage to identify or excluded their presence.

5.1.2 *Paracaleana dixonii* (Sandplain Duck Orchid) [VU; EN]

One of the remaining likely species, *Paracaleana dixonii [VU; EN],* is a Threatened species and as such is a MNES.

Numerous records of this taxon are known within proximity of the Survey Area, in similar vegetation. The majority of the Survey Area is considered suitable habitat for the species. Although not detected during the Reconnaissance flora survey, this diminutive plant is effective only detectable when flowering in November to January as vegetative structures are absent for the majority of the year. As the Reconnaissance survey was conducted outside of the flowering window for the species, it is unlikely to have been detected at that time, and its presence in the Survey Area cannot be excluded.

Given the availability of habitat, detection difficulty for the taxon and high number of proximal records in the vicinity, there remains a high potential for this species to be present in the Survey Area despite current survey having returned no overlying occurrences. It is anticipated that targeted survey in the appropriate period scheduled for spring 2022 will provide for a more accurate assessment of the occurrence of the *Paracaleana dixonii*.

5.2 Fauna and Habitat

The six habitat units mapped within the Survey Area are likely to support a typical faunal assemblage of the region, including nectivorous and insectivorous birds, reptiles, raptor species, macropods and potentially Honey Possum. Additionally, the dominant habitat (Kwongan) is supportive of Carnaby's Cockatoo seasonal foraging requirements. Those habitats which are less well represented proportionally within the Survey Area are still represented in the wider landscape and have connectivity beyond the Survey Area boundary.

5.2.1 Likelihood of Fauna Occurrence Post-survey

Following conduction of the field survey, the likelihood of occurrence evaluation for taxa identified during desktop assessment was updated based on survey effort and habitat observed to occur in the Survey Area (**Error! Reference source not found.** in Appendix C). This allowed for validation and r efinement of the potential for conservation-listed species to occur on site. Only one conservation-listed fauna taxon (*Neelaps calanotus* [P3]) was not observed during survey but is still considered to have remaining high likelihood of occurrence.

5.2.2 Black-striped Snake *(Neelaps calonotos)* – P3

This species is now primarily restricted to the sandy coastal strip near Perth between Mandurah and Cataby. It inhabits dunes and sand-plains vegetated with heaths and Eucalypt/Banksia woodlands (Wilson & Swan 2017), and feeds largely on *Lerista praepedita,* which is the smallest of the burrowing skinks within its range.

Despite being mostly restricted to areas further south of the Survey Area, this taxon was recorded within 7 km to the north in 2007. Given the availability of highly suitable habitat for the species, its cryptic nature, and the proximal record, it is considered likely that it may occur in the Survey Area. It is unlikely that it is reliant on any portion of the Survey Area habitat for survival; however, it has potential to be directly impacted by clearing activities.

5.2.3 SRE Habitat

No habitats identified within the Survey Area were considered to represent likely habitat for SRE species. The discovery of a displaced trapdoor spider burrow collar does indicate that there are Mygalomorph spiders in at least the vicinity of the Survey Area which may include SRE species. It is

possible that potential SREs do occur within the Survey Area, however, it cannot be ruled out that the secondary evidence of trapdoor spider observed was translocated into the Survey Area by a predating bird or reptile, or perhaps more likely that the burrow was washed out from somewhere higher in the landscape and deposited in the alluvial outwash during heavy rains prior to the survey.

Overall, the potential for the Survey Area to house contain SRE species is considered low based on landform, vegetation and absence of suitable habitat isolates. There remains some potential for SRE to occur, particularly given the limited knowledge surrounding many of these species.

5.2.4 Black Cockatoo Habitat

Although no significant trees likely to support Black Cockatoos nesting or roosting activity were observed within the Survey Area, much of the native vegetation present is suitable for Black Cockatoo foraging habitat, and Carnaby's Cockatoo were observed in adjacent vegetation during survey. Values calculated using the Commonwealth forage habitat scoring tool (DAWE 2022a), with a resultant overall habitat score of five for the Survey Area, indicate the vegetation of the Survey Area is of High Quality as forage habitat for Carnaby's Cockatoo.

The Referral thresholds presented in Table 3 of the Black Cockatoo Referral Guidelines indicate that a score of 5-10 is representative of High Quality native foraging habitat, and as such, loss of greater than or equal to 1 ha is likely to require referral to DCCEEW.

6. Conclusions

Ecological studies including a Reconnaissance flora and vegetation survey, Basic fauna survey, SRE habitat survey and Black Cockatoo habitat assessment were undertaken by JBS&G in May – June 2022 by experienced ecologists.

Findings of the Reconnaissance flora and vegetation survey undertaken included:

- 26 relevés were assessed;
- 174 vascular flora taxa were recorded;
- No Threatened flora taxa were recorded;
- One Priority flora species (*Stawellia dimorphantha* P4) was recorded;
- A further 15 Priority taxa and one Threatened flora taxon (*Paracaleana dixonii* [VU;EN]) are considered likely to occur in the Survey Area despite not being recorded during the current survey. Supplementary targeted survey in Spring will enable identification of conservation significant species not detectable at the time of the current survey;
- Two weed species commonly occurring in the region were recorded (**Hypochaeris* sp. and **Ursinia anthemoides*), neither representing a WoNS or Declared Pest;
- 27 taxa (15.52%) could not be identified to species level due to insufficient diagnostic material being present at the time of survey – primarily due to season of survey;
- Six broad vegetation units were identified from the Survey Area – all are represented outside the Survey Area boundary;
- No vegetation of conservation significance was observed during the survey, and none was assessed as being consistent with any TECs or PECs; an
- Vegetation condition ranged from Degraded to Pristine with the vast majority found to be in Pristine condition.

Findings of the Basic fauna and habitat survey undertaken included:

- 29 habitat assessment points were evaluated;
- Six fauna habitat units were mapped, none of which are considered restricted;
- 35 fauna species including four mammals, 27 birds, three reptiles and one invertebrate group were recorded;
- One Threatened fauna taxon was recorded: *Calyptorhynchus latirostris* (Carnaby's Cockatoo) – [EN; EN];
- No Priority fauna species were recorded;
- One conservation significant species (*Neelaps calonotus* – Black-striped Snake [P3]) is considered to have high potential to occur in the Survey Area despite not being observed during survey; and
- Three introduced fauna species were observed: **Capra hircus* (Goat),**Oryctolagus cuniculus* (Rabbit) and **Vulpes vulpes* (Red Fox).

No areas of habitat considered to have high potential to support SRE species were observed. No invertebrates considered likely to represent SRE taxa were recorded, however, secondary evidence of Mygalomorph spider occurrence was observed as a displaced trapdoor burrow collar found on the ground surface in absence of any visible burrow.

There remains potential for SRE species to occur but likelihood is considered to be low based on the absence of likely suitable habitat.

The majority of the Survey Area constitutes High Quality foraging habitat for Carnaby's Black Cockatoo based on scores calculated using the Black Cockatoo Referral Guidelines (DAWE 2022a). No trees likely to support breeding or roosting activity were observed in the Survey Area.

Impacts anticipated to cause the loss of 1 ha or more of High Quality foraging habitat for Black Cockatoo species are likely to require referral to DCCEEW.

7. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

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Appendix A – Definitions and Classification

Table A.1: EPBC Act categories for flora, fauna and ecological communities

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

Table A.2: Conservation codes for Western Australian flora and fauna (DBCA 2020b)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. *The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species[3] 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 the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species. Threatened flora is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species. The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline (Number 1) and Ministerial Guideline (Number 2) that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria[4], and is based on the national distribution of the species.
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.
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.
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.
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).
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 fauna or flora species listed as extinct in the wild.
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered, or vulnerable) or extinct species under the BC Act cannot also be listed as specially protected species.	
MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Migratory species include birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA)[5] , China (CAMBA)[6] or The Republic of Korea (ROKAMBA)[7], and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)[8], 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.
CD	**Species of special conservation interest (conservation dependent fauna)** Species of special conservation need that are 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).

Conservation Codes for Western Australian Flora and Fauna	
	Currently only fauna are listed as species of special conservation interest.
OS	**Other specially protected species** Species 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). Currently only fauna are listed as species otherwise in need of special protection.
P	**Priority species** Priority is not a listing category under the BC Act. All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land). Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey 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 prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened. Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of priority status is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	**Priority 1: Poorly-known species - known from few locations, none on conservation lands** 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, for example, 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 for threatened listing and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.
2	**Priority 2: Poorly-known species - known from few locations, some on conservation lands** 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, for example, 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 for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.
3	**Priority 3: Poorly-known species - known from several locations** 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. These species need further survey.
4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as a conservation dependent specially protected species. (c) Species that have been removed from the list of threatened species or lists of conservation dependent or other specially protected species, during the past five years for reasons other than taxonomy. (d) Other species in need of monitoring.

[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).

[3] Schedules are not referred to when stating the listing status of threatened, extinct or specially protected species under the BC Act. See the examples provided under each listing category.

[4] Western Australia has assigned species to threat categories using the IUCN Red List of Threatened Species Categories and Criteria since 1996 (referencing all criteria). At the national level, threatened species listings under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) reference only some of the IUCN criteria (http://www.environment.gov.au/biodiversity/threatened/nominations/forms-and-guidelines).

[5] JAMBA - first included in the WA migratory species list in 1980.

[6] CAMBA - first included in the WA migratory species list in 2010.

[7] ROKAMBA - first included in the WA migratory species list in 2010.

[8] Bonn Convention (Birds) - first included in the WA migratory species list in 2015

Table A.3: DBCA definitions and criteria for TECs and PECs (DEC 2013)

Criteria	Definition
Threatened Ecological Communities	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. Current distribution is limited, and one or more of the following apply (i, ii or iii): geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. Current distribution is limited, and one or more of the following apply (i, ii or iii): geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

Criteria	Definition
	The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C): The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	*Poorly known ecological communities* Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	*Poorly known ecological communities* Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.
Priority Three	*Poorly known ecological communities* 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; Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.
Priority Four	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. 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. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	*Conservation Dependent Ecological Communities* Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table A.4: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group 2017)

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

	Cover characteristics							
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table A.5: NVIS height classes (NVIS Technical Working Group 2017)

Height		Growth form				
Height Class	**Height Range (m)**	**Tree, vine (M & U), palm (single-stemmed)**	**Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)**	**Tree mallee, mallee shrub**	**Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)**	**Bryophyte, lichen, seagrass, aquatic**
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low
Source: (based on Walker & Hopkins 1990)						

Table A.6: Foraging quality scoring tool template (DAWE 2022a)

Starting score		Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black-Cockatoo
10		**Start at a score of 10** if your site is native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly Marri, within the range of the species, including along roadsides and parkland cleared areas. Can include planted vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size.**	**Start at a score of 10** if your site is native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size.**	**Start at a score of 10** if your site is Jarrah or Marri woodland and/or forest, or if it is on the edge of Karri forest, or if Wandoo and Blackbutt occur on the site, within the range of the subspecies, including along roadsides and parkland cleared areas. **This tool only applies to sites equal to or larger than 1 hectare in size.**
Attribute	Sub-tractions	Context adjustor (attributes reducing functionality of foraging habitat)		
Foraging potential	**-2**	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.
Connectivity	**-2**	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.
Proximity to breeding	**-2**	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.
Proximity to roosting	**-1**	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.
Impact from significant plant disease	**-1**	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.
Total score		*Enter score*	*Enter score*	*Enter score*
Appraisal		To support your habitat score, you should provide an overall appraisal of the habitat on the impact site and within 20km of the impact area to clearly explain and justify the score. It should include discussion on the foraging habitat's proximity to other resources (e.g. exact distance to proximate resources), frequency of use of proximate sites, the degree of evidence and description of vegetation type and condition.		

Appendix B – PMST Search Results

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Feb-2023

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	53
Listed Migratory Species:	42

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	66
Whales and Other Cetaceans:	11
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	19
Key Ecological Features (Marine):	None
Biologically Important Areas:	10
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Thalassarche steadi](#) White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Zanda latirostris listed as Calyptorhynchus latirostris](#) Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
FISH			
[Thunnus maccoyii](#) Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only
MAMMAL			
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area	In feature area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In buffer area only
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat likely to occur within area	In buffer area only
[Parantechinus apicalis](#) Dibbler [313]	Endangered	Species or species habitat may occur within area	In feature area
PLANT			
[Andersonia gracilis](#) Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area	In feature area
[Caleana dixonii listed as Paracaleana dixonii](#) Sandplain Duck Orchid [87944]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Conostylis dielsii subsp. teres Irwin's Conostylis [3614]	Endangered	Species or species habitat likely to occur within area	In feature area
Conostylis micrantha Small-flowered Conostylis [17635]	Endangered	Species or species habitat may occur within area	In feature area
Daviesia speciosa Beautiful Daviesia [56698]	Endangered	Species or species habitat known to occur within area	In buffer area only
Eucalyptus crispata Yandanooka Mallee [24268]	Vulnerable	Species or species habitat known to occur within area	In feature area
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat known to occur within area	In buffer area only
Hakea megalosperma Lesueur Hakea [10505]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat may occur within area	In buffer area only
Leucopogon marginatus Thick-margined Leucopogon [12527]	Endangered	Species or species habitat may occur within area	In buffer area only
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat likely to occur within area	In feature area
Tetratheca nephelioides [83217]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Wurmbea tubulosa](#) Long-flowered Nancy [12739]	Endangered	Species or species habitat may occur within area	In buffer area only
REPTILE			
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
[Egernia stokesii badia](#) Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area	In feature area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
SHARK			
[Carcharias taurus (west coast population)](#) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
[Pristis pristis](#) Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Sphyrna lewini](#)			
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only
SPIDER			
[Idiosoma nigrum](#)			
Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Anous stolidus](#)			
Common Noddy [825]		Species or species habitat may occur within area	In buffer area only
[Apus pacificus](#)			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
[Ardenna carneipes](#)			
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
[Diomedea amsterdamensis](#)			
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
[Diomedea epomophora](#)			
Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Diomedea exulans](#)			
Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Hydroprogne caspia](#)			
Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
[Macronectes giganteus](#)			
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Macronectes halli](#) Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Sterna dougallii](#) Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
[Sternula albifrons](#) Little Tern [82849]		Species or species habitat may occur within area	In buffer area only
[Thalassarche carteri](#) Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Thalassarche cauta](#) Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
[Thalassarche impavida](#) Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Thalassarche melanophris](#) Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Thalassarche steadi](#) White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Migratory Marine Species			
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within area	In buffer area only
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
[Carcharhinus longimanus](#) Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area	In buffer area only
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In buffer area only
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area	In buffer area only
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In buffer area only
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pandion haliaetus			
Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anous stolidus			
Common Noddy [825]		Species or species habitat may occur within area	In buffer area only
Anous tenuirostris melanops			
Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna carneipes as Puffinus carneipes			
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Stercorarius skua as Catharacta skua Great Skua [823]		Species or species habitat may occur within area	In buffer area only
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area	In buffer area only
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Fish			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area	In buffer area only
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area	In buffer area only
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area	In buffer area only
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area	In buffer area only
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area	In buffer area only
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area	In buffer area only
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area	In buffer area only
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area	In buffer area only
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In buffer area only
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area	In buffer area only
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area	In buffer area only
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In buffer area only
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area	In buffer area only
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area	In buffer area only
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In buffer area only
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In buffer area only
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In buffer area only
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area	In buffer area only
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In buffer area only
Mammal			
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area	In buffer area only
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Reptile			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area	In buffer area only
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area	In buffer area only

Whales and Other Cetaceans			[Resource Information]
Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area	In buffer area only
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In buffer area only
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Current Scientific Name	Status	Type of Presence	Buffer Status
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In buffer area only
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In buffer area only
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In buffer area only
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In buffer area only
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area	In buffer area only
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In buffer area only
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Beekeepers	Nature Reserve	WA	In buffer area only
NTWA Bushland covenant (0084)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0101)	Conservation Covenant	WA	In buffer area only
Unnamed WA25495	Nature Reserve	WA	In buffer area only
Unnamed WA47436	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Yardanogo	Nature Reserve	WA	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Arrowsmith Central Silica Sand Project	2021/9067		Referral Decision	In buffer area only
BEHARRA SILICA SAND PROJECT	2022/09308		Assessment	In buffer area only
West Erregulla Processing Plant and Pipeline	2021/8907		Assessment	In buffer area only
Controlled action				
Arrowsmith North Silica Sand Project	2020/8788	Controlled Action	Proposed Decision	In buffer area only
construction and operation of a unmanned platform at the Cliff Head oil field, a	2003/1300	Controlled Action	Post-Approval	In buffer area only
Expansion of mineral sand mine	2008/4192	Controlled Action	Completed	In buffer area only
Natta 3D Seismic Acquisition Survey, 36 km east of Dongara	2021/8992	Controlled Action	Referral Decision	In buffer area only
Tiwest Dongara Project, mineral sands mining and concentrating operation, 25km	2009/5032	Controlled Action	Post-Approval	In feature area
Trieste 3D seismic survey, WA	2017/8133	Controlled Action	Post-Approval	In buffer area only
Undertake seismic survey to assess shale resources	2013/7088	Controlled Action	Post-Approval	In buffer area only
West Erregulla 3D onshore seismic survey & appraisal drilling exploration program WA	2013/7054	Controlled Action	Post-Approval	In buffer area only
West Erregulla Field Development Program, 40 km southeast of Dongara, WA	2021/8991	Controlled Action	Assessment Approach	In buffer area only
Zemira 3D Seismic Survey	2020/8658	Controlled Action	Assessment Approach	In feature area
Not controlled action				
Cliff Head 6 appraisal well	2004/1702	Not Controlled Action	Completed	In buffer area only
Drilling between Kalbarri and Cliff Head	2005/2185	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Indian Ocean Drive Passing Lane and Widening 52-258 SLK	2017/7884	Not Controlled Action	Completed	In buffer area only
Waitsia Gas Project Stage 2, Yardarino WA	2020/8633	Not Controlled Action	Completed	In buffer area only
Referral decision				
Transmission Line Rebuild and Extension	2009/4972	Referral Decision	Completed	In buffer area only

Biologically Important Areas

Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging (in high numbers)	Known to occur	In buffer area only
Hydroprogne caspia Caspian Tern [808]	Foraging (provisioning young)	Known to occur	In buffer area only
Larus pacificus Pacific Gull [811]	Foraging (in high numbers)	Known to occur	In buffer area only
Puffinus assimilis tunneyi Little Shearwater [59363]	Foraging (in high numbers)	Known to occur	In buffer area only
Sterna dougallii Roseate Tern [817]	Foraging	Known to occur	In buffer area only
Sternula nereis Fairy Tern [82949]	Foraging (in high numbers)	Known to occur	In buffer area only
Seals			
Neophoca cinerea Australian Sea Lion [22]	Foraging (male and female)	Known to occur	In buffer area only
Sharks			

Scientific Name	Behaviour	Presence	Buffer Status
Carcharodon carcharias White Shark [64470]	Foraging	Known to occur	In buffer area only
Whales			
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur	In buffer area only
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

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

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

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

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Appendix C – Likelihood of Occurrence Assessments

Table C.1: Flora Likelihood of Occurrence

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence	Post-field Likelihood of occurrence
	BC Act	EPBC Act				
Acacia latipes subsp. *licina*	P3		Pungent shrub, 0.4-1.2 m high. Fl. yellow, Jun to Sep. White sand, granitic soils. Limestone hills, sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Acacia vittata	P2		Dense, rounded shrub, 1-4 m high. Fl. yellow, Aug. Grey sand, sandy clay. Margins of seasonal lakes.		Possible Habitat present and records within the vicinity	Unlikely Limited potential habitat observed during survey
Andersonia gracilis	VU	EN	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Species or species habitat likely to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Anthocercis intricata	P3		Dense, spinescent shrub, 0.9-3 m high. Fl. white-cream, Jun to Sep. Sand or loam over limestone. Consolidated sand dunes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Baeckea sp. Walkaway (A.S. George 11249)	P3		Dense, multi-stemmed shrub, 0.5-2 m high. Fl. white, Dec or Jan. Yellow/brown or white sand. Undulating plains, hillslopes.		Possible Habitat present and records within the vicinity	Possible
Banksia cypholoba	P3		Prostrate, dwarf, lignotuberous shrub, to 0.3 m high. Fl. yellow-brown, Aug. Sand & gravelly loam.		Possible Habitat present but no records within the vicinity (<9km)	Possible
Banksia elegans	P4		Shrub (with fire-tolerant rootstock, often suckering), 1-4 m high. Fl. yellow/green-yellow, Oct to Nov. Yellow, white or red sand. Sandplains, low consolidated dunes.		Likely Habitat present and existing close records	Likely
Banksia fraseri var. *crebra*	P3		Shrub usually less than 50 cm high. Leaf lobes linear, glaucous. Sandy loam or sandy clay over laterite, in kwongan. Fl. July and August.		Likely Habitat present and records within the vicinity	Likely
Banksia scabrella	P4		Much-branched, lignotuberous shrub, 0.6-2 m high. Fl. yellow & cream & purple, Sep to Dec or Jan. White, grey or yellow sand, sometimes with lateritic gravel. Sandplains, lateritic ridges.		Likely Habitat present and existing close records	Likely
Beyeria cinerea subsp. cinerea	P3		A spreading, erect or prostrate succulent shrub to 70cm, with both male and female, inconspicuous flowers that lack noticable petals, with flowers consisting of a yellow-green calyx. Flowers appear in July and from September to November. Subspecies cinerea has leaf blades with truncate to cuneate bases rather than cordate bases. It grows in coastal heath and shrubland on sandy soils over limestone.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence	Post-field Likelihood of occurrence
	BC Act	EPBC Act				
Beyeria gardneri	P3		Shrub, 0.25-0.5 m high. Fl. yellow, Aug to Sep. Yellow sand.		Likely Habitat present and existing close records	Likely
Caladenia denticulata subsp. *albicans*	P1		15-35 cm height. Flowers dull white or cream. Labellum white with red stripes, spots and blotches. Column opaque cream with red stripes, spots and blotches. Grows in a variety of habitats as well as moist, calcareous sand under Eucalyptus camaldulensis and Acacia species. Also known as Caladenia denticulata subsp. Arrowsmith. Flowers 7-10cm long x 5-9 cm wide.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Calytrix chrysantha	P4		Shrub, 0.3-1.3 m high. Fl. yellow, Dec or Jan to Feb. White, grey or yellow/brown sand. Flats.		Likely Habitat present and existing close records	Likely
Calytrix eneabbensis	P4		Shrub, 0.3-1 m high. Fl. purple & pink & yellow, Jul to Oct. White, grey or yellow sand over laterite. Sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Calytrix superba	P4		Shrub, 0.2-1 m high. Fl. pink-red, Dec or Jan to Feb. Sand over laterite. Flats.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Centrolepis milleri	P3		Specimens of C. milleri grow with their leaves mostly buried by sand. Centrolepis milleri superficially resembles C. drummondiana, but differs from it in the presence of two to five cataphylls at the base of a scape, in the absence of a spikelet in the axil of the lower primary bract, in the dimorphic morphology of the primary bracts and in the presence of one long and one short tepal-like phyllome associated with each flower. The absence of a spikelet in the axil of the lower primary bract and the dimorphic nature of the primary bracts are shared with species such as C. polygyna and C. glabra, to which C. milleri is apparently related. Spring flowering.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Comesperma griffinii	P2		Annual or perennial, herb, to 0.15 m high. Fl. white, Oct. Yellow or grey sand. Plains.		Possible Habitat present and records within the vicinity	Possible
Comesperma rhadinocarpum	P3		Perennial, herb. Fl. blue, Oct to Nov. Sandy soils.		Possible Habitat present and records within the vicinity	Possible
Conostylis dielsii subsp. *teres*	VU	EN	Shortly rhizomatous, tufted perennial, grass-like or herb, 0.13-0.33 m high, leaves terete. Fl. cream-yellow, Jul to Aug. White, grey or yellow sand, gravel. Low open woodland.	Species or species habitat likely to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Conostylis micrantha	VU	EN	Rhizomatous, tufted perennial, grass-like or herb, 0.13-0.24 m high. Fl. yellow-cream/red, Jul to Aug. White or grey sand. Sandplains.	Species or species habitat known to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence	Post-field Likelihood of occurrence
	BC Act	EPBC Act				
Dampiera tephrea			Ascending to erect perennial, herb or shrub, 0.3-0.6 m high, with grey or yellowish hairs on abaxial surface of leaves. Fl. blue, Jul. Sand, gravelly loam.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Daviesia speciosa	EN	EN	Many-stemmed shrub, 0.3-0.8 m high. Fl. red, Apr to May. Gravelly lateritic soils. Undulating plains, rises.	Species or species habitat known to occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Eucalyptus crispata	EN	EN	A lignotuberous mallee from 3-7 m high, with rough bark on the trunk, in partly decorticated curls. Yellow-cream flowers appear from March to June. Prefers lateritic soils.	Species or species habitat likely to occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Eucalyptus foecunda subsp. *aeolica*	P2		Distinguished from E. foecunda subsp. foecunda by its consistently dull, grey-green seedling leaves that are pruinose, at least on the new growth.White, yellowish or pale brown coastal sands overlying limestone, often on limestony dunes, in mallee shrubland or low open woodland. Associated eucalypts include Eucalyptus erythrocorys, E. obtusiflora subsp. dongarrensis, E. petrensis and E. zopherophloia.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Eucalyptus leprophloia	EN	EN	(Mallee), 2-5(-8) m high, bark rough loose & flaky to 1 m. Fl. cream-white, Aug to Oct. White or grey sand over laterite. Valley slopes.	Species or species habitat known to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Eucalyptus macrocarpa subsp. *elachantha*	P4		(Spreading or sprawling mallee), 0.8-4 m high, bark smooth, grey over salmon pink. Fl. red-pink, Aug to Sep or Nov to Dec. White or grey sand over laterite. Hillslopes, ridges, sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Eucalyptus macrocarpa x pyriformis	P3		Erect, open mallee tree, 1.2-6 m high. Fl. red, Apr or Aug to Oct. Sand, lateritic sandy soils. Hills, rocky ironstone ridges, sandplains.		Likely Habitat present and existing close records	Unlikely
Eucalyptus zopherophloia	P4		(Spreading mallee), 2.5-4(-6) m high, bark rough, fibrous. Fl. cream-white, Oct to Dec or Jan. Grey/white sand with limestone rubble. Coastal areas.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Grevillea erinacea	P3		Spindly, prickly, sparingly branched shrub, (0.3-)0.6-1.8 m high. Fl. green-white-cream, Jul to Dec. White, grey or yellow sand, often with lateritic gravel.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Guichenotia alba	P3		Slender, lax, few-branched shrub, 0.1-0.45 m high. Fl. white, Jul to Aug. Sandy & gravelly soils. Low-lying flats, depressions.		Likely Habitat present and existing close records	Possible Limited suitable habitat observed during survey

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence	Post-field Likelihood of occurrence
	BC Act	EPBC Act				
Guichenotia quasicalva	P2		Erect, compact shrub, to 0.5 m high. Fl. blue-purple, Sep to Oct. Sandy clay over laterite. Drainage line.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Hakea megalosperma	VU	VU	Spreading, lignotuberous shrub, 1-2 m high. Fl. white-cream/pink, May to Jun. Grey sand, loam. Lateritic hills & rocks.	Species or species habitat may occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Haloragis foliosa	P3		Perennial, herb or shrub, 0.2-0.5 m high. White/grey sand over limestone.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Hemiandra garderni	CR	EN	Prostrate, pungent shrub, 0.1-0.2 m high, to 1 m wide. Fl. red/pink-red, Aug to Oct. Grey or yellow sand, clayey sand. Sandplains.	Species or species habitat may occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Hemiandra sp. Eneabba (H. Demarz 3687)	P3		Straggly, erect shrub, 0.5-0.9 m high, to 0.4 m wide. Fl. blue/violet, Feb. Sand. Disturbed sites.		Likely Habitat present and existing close records	Likely
Hemigenia saligna	P3		Shrub, 0.3-1 m high. Fl. blue-purple/violet, Jul to Oct. Lateritic & sandy soils.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Hopkinsia anoectocolea	P3		Rhizomatous, tufted perennial, herb, 0.5-1 m high, to 1 m in diameter. Fl. brown, Sep to Dec. White or grey sand, often saline. Winter-wet depressions, floodplains, salt lakes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Hypocalymma gardneri	P3		Shrub, to 0.3 m high. Fl. yellow, Aug to Sep. Grey-brown sand, laterite. Sandplains, upper slopes, heathland.		Likely Habitat present and existing close records	Likely
Hypocalymma tetrapterum	P3		Shrub, 0.4-0.9 m high. Fl. white, Aug. Grey sand, loam, lateritic gravel. Riverbanks, breakaways.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Lasiopetalum ogilvieanum	P1		Shrub, 0.45-1.5 m high. Fl. pink-white, Jul to Oct. White/grey or yellow sand, stony loam. Undulating plains, lateritic rises.		Likely Habitat present and existing close records	Likely
Leucopogon obtectus *(Styphelia obtecta* (Benth.) F.Muell.)	EN	EN	A spindly erect shrub from 0.5-1.7 m high, with leaves which closely clasp the stem, obscuring the ends of branchlets. Tiny white to creamy yellow flowers appear in the leaf axils from August to October. Occurs on grey sands.	Species or species habitat likely to occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence	Post-field Likelihood of occurrence
	BC Act	EPBC Act				
Mesomelaena stygia subsp. *deflexa*	P3		Tufted perennial, grass-like or herb (sedge), 0.1-0.5 m high. Fl. brown-black, Mar to Oct. White, grey or lateritic sand, clay, gravel.		Likely Habitat present and existing close records	Likely
Micromyrtus rogeri	P1		Shrub, 0.2-0.4 m high. Fl. white, Jul to Oct. Yellow-brown sandy soils, gravel, laterite. Breakaways.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Paracaleana dixonii	VU	EN	A tuberous perennial orchid from 90-200 mm high, with a single, small basal leaf. Brown-yellow-green-red flowers in the shape of a duck appear from October to December or January. Found in shrubland under Banksia on deep sand, or in heath on shallow sand over laterite.	Species or species habitat known to occur within area	Likely Habitat present and existing close records	Likely
Persoonia chapmaniana	P3		Erect, spreading shrub, 1-2 m high. Fl. yellow, Sep to Nov. White sandy clay, yellow sand. Vicinity of salt lakes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Persoonia filiformis	P3		Erect, spreading, lignotuberous shrub, 0.07-0.4 m high. Fl. yellow, Nov to Dec. Yellow or white sand over laterite.		Likely Habitat present and existing close records	Possible Limited suitable habitat observed during survey
Persoonia rudis	P3		Erect, often spreading shrub, 0.2-1 m high. Fl. yellow, Sep to Dec or Jan. White, grey or yellow sand, often over laterite.		Likely Habitat present and existing close records	Possible Limited suitable habitat observed during survey
Pityrodia viscida	P4		Viscid shrub, 0.3-0.6(-1) m high. Fl. white, Sep to Dec or Jan to Feb. Lateritic sand.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Schoenus badius	P2		Slender annual, grass-like or herb (sedge), 0.05-0.12 m high. Fl. brown-green, Sep to Oct. Grey sand. Moist areas.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Schoenus griffinianus	P4		Small, tufted perennial, grass-like or herb (sedge), to 0.1 m high. Fl. Sep to Oct. White sand.		Likely Habitat present and existing close records	Likely
Schoenus sp. Eneabba (F. Obbens & C. Godden I154)	P2		Erect, clumped rhizomatous, perennial, grass-like or herb (sedge), to 0.75 m high. Grey, yellow or white sand. Undulatiing sandplains, mid slopes, tops of rises.		Likely Habitat present and existing close records	Likely
Scholtzia calcicola	P2		Erect, dense shrub to 2 m high, with tiny, pale pink flowers in a raceme-like arrangement and a wrinkled hypanthium. It has the smallest flowers in the genus at 2.5-3.5 mm diameter and with petals 1-1.2 mm long. Commonly has 5 stamens, with 0-2 opposite each sepal. Recorded from near Dongara south to Drovers Cave National Park in heath on shallow sand over limestone.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Stawellia dimorphantha	P4		Stilt-rooted perennial, herb, 0.05-0.2 m high. Fl. purple/cream, Jun to Nov. White, grey, yellow sand.		Likely Habitat present and existing close records	**Recorded**

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence	Post-field Likelihood of occurrence
	BC Act	EPBC Act				
Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490)	P1		Cormaceous herb to 1m with white flowers between Oct – Nov.		Likely Habitat present and existing close records	Likely
Stylidium drummondianum	P3		Rosetted perennial, herb, 0.05-0.22 m high, Leaves narrowly oblanceolate, 0.5-3 cm long, 0.8-2 mm wide, apex mucronate, margin hyaline and serrulate, glabrous. Scape hoary. Inflorescence paniculate. Fl. pink, Aug to Oct. Sand or clayey sand over laterite. Upper hillslopes, breakaways. Low heath, mallee shrubland.		Likely Habitat present and existing close records	Likely
Stylidium longitubum	P4		Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Stylidium pseudocaespitosum	P2		Rosetted perennial, herb, 0.1-0.3 m high, leaves tufted, linear, 2-7 cm long, 0.5-2 mm wide, apex subacute, margin entire, scabrous. Scape glabrous. Inflorescence racemose. Fl. yellow, Sep to Nov. White, grey or yellow sand over laterite. Breakaways and hillslopes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Stylidium sp. Three Springs (J.A. Wege & C. Wilkins JAW 600)	P2		Occurs in yellow-brown clayey sand over laterite, yellow-brown clayey loam over granite, ironstone breakaway, loamy soils over granite, clay loams with scattered gravel, rocky hill with lateritic stones.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Stylidium torticarpum	P3		Caespitose perennial, herb, 0.12-0.27 m high, Leaves tufted, broadly linear, (2-) 5-13 cm long, 0.6-1.5 mm wide, apex mucronate, margin hyaline and serrulate, glabrous. Scape glandular throughout. Inflorescence paniculate. Capsule twisted. Fl. pink, Sep to Nov. Sandy clay and clay loam over laterite. Adjacent to creeklines, depressions, and beneath breakaways. Heath or mallee shrubland.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Synaphea oulopha	P3		Compact shrub, ca 0.2 m high. Fl. yellow, Jul to Oct. Grey sand, gravelly loam, clay. Lateritic breakaways & rises.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Synaphea sparsiflora	P2		Shrub, to 0.6 m high, to 1 m wide. Fl. yellow, Aug to Sep. Sandy loam over laterite.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Tetratheca nephelioides	EN	CR	Caespitose, dwarf shrub, to 0.3 m high. Fl. purple, Sep. White-grey sand, yellow-brown clayey sand, gravel, laterite. Outcrops, undulating hills, ridges,.	Species or species habitat may occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Thelymitra stellata	EN	EN	A tuberous, perennial orchid from 150-250 mm high. Its yellow and brown flowers appear from October to November. Occurs on sand, gravel and lateritic loam.	Species or species habitat likely to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence	Post-field Likelihood of occurrence
	BC Act	EPBC Act				
Thryptomene sp. Lancelin (M.E. Trudgen 14000)	P3		Shrub, ca 0.5 m high. Fl. pink, Sep. Calcareous sand.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Thysanotus glaucus	P4		Caespitose, glaucose perennial, herb, 0.1-0.2 m high. Fl. purple, Oct to Dec or Jan to Mar. White, grey or yellow sand, sandy gravel.		Likely Habitat present and existing close records	Likely
Tricoryne sp. Wongan Hills (B.H. Smith 794)	P2		Multi-stemmed, open, caespitose rhizomatous, perennial, herb, to 0.2 m high. Yellow to grey sand, gravelly clay quartz, laterite, limestone. Midslopes and uplands.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Triglochin protuberans	P3		Annual, herb, 0.03-0.13 m high. Red loam, grey mud over clay. Winter-wet sites, claypans, near salt lakes, margins of pools.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Verticordia argentea	P2		Erect, open shrub, 0.9-2 m high. Fl. pink & white, Nov to Dec or Jan to Apr. White, grey or yellow sand. Sand ridges, undulating plains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Verticordia dasystylis subsp. *oestopoia*	P1		Spreading shrub, 0.1-0.4 m high. Fl. cream-yellow, Oct. Gritty soils over granite. Outcrops.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Verticordia fragrans	P3		Openly branched shrub, 1-3 m high. Fl. pink-white, Sep to Nov. White, grey or yellow sand, clay loam. Low-lying areas, sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Verticordia luteola var. *luteola*	P3		Slender shrub, 0.5-1.4 m high. Fl. white-yellow, Nov to Dec. Grey sand over gravel. Flats.		Likely Habitat present and existing close records	Possible Limited suitable habitat observed during survey
Wurmbea tubulosa	VU	EN	Cormous, perennial, herb, 0.01-0.03 m high, dioecious or sometimes andromonoecious. Fl. white-pink, Jun to Aug. Clay, loam. River banks, seasonally-wet places.	Species or species habitat may occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely

Table C.2: Fauna Likelihood of Occurrence

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST Attribution	Desktop Likelihood of Occurrence	Post-Field Likelihood of Occurrence
MAMMAL	*Dasyurus geoffroii*	Chuditch, Western Quoll	VU	VU	x	x	Species or species habitat likely to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
MAMMAL	*Macroderma gigas*	Ghost Bat	VU	VU		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
MAMMAL	*Notamacropus irma*	Western Brush Wallaby	P4	-	x			Unlikely (no local records)	Unlikely (no local records)
MAMMAL	*Parantechinus apicalis*	Dibbler	EN	EN		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Actitis hypoleucos*	Common Sandpiper	MI	MI, MA	x	x	Species or species habitat known occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Anous stolidus*	Common Noddy	-	MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Anous tenuirostris melanops*	Australian Lesser Noddy	MI	MI	x			Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Apus pacificus*	Fork-Tailed Swift	MI	MI, MA		x	Species or species habitat likely to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Bubbulcus coromandus (Ardea ibis)*	Cattle Egret	MI	MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Ardenna carneipes*	Flesh-Footed Shearwater, Fleshy-Footed Shearwater	VU	MI,MA		x	Foraging, feeding or related behaviour known to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Arenaria interpres*	Ruddy Turnstone	MI	MI	x			Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Calidris acuminata*	Sharp-Tailed Sandpiper	MI	MI, MA	x	x	Species or species habitat may occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Calidris canutus*	Red Knot, Knot	EN	EN		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Calidris ferruginea*	Curlew Sandpiper	CR, MI	CR, MI, MA		x	Species or species habitat likely to occur	Unlikely (no local records)	Unlikely (no local records)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST Attribution	Desktop Likelihood of Occurrence	Post-Field Likelihood of Occurrence
BIRD	*Calidris melanotos*	Pectoral Sandpiper	-	MI, MA		x	Species or species habitat may occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Calidris ruficollis*	Red-Necked Stint	MI	MI	x			Unlikely (no local records)	Unlikely (no local records)
BIRD	*Calyptorhynchus latirostris*	Carnaby's Black Cockatoo, Short-Billed Black-Cockatoo	EN	EN	x	x	Species or species habitat known to occur	Likely (recent proximal records)	**Recorded**
BIRD	*Calyptorhynchus* sp. 'white-tailed black cockatoo'	White-Tailed Black Cockatoo	EN	EN	x			Unlikely (Baudin's Cockatoo habitat not present)	Unlikely (Baudin's Cockatoo habitat not present)
BIRD	*Catharacta skua*	Great Skua	-	MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Chalcites osculans (Chrysococcyx osculans)*	Black-Eared Cuckoo	-	MA		x	Species or species habitat likely to occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Diomedea amsterdamensis*	Amsterdam Albatross	CR	EN,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Diomedea epomophora*	Southern Royal Albatross	VU	VU,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Diomedea exulans*	Wandering Albatross	VU	VU,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Falco hypoleucos*	Grey Falcon	VU	VU		x	Species or species habitat may occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Falco peregrinus*	Peregrine Falcon	OS		x			Unlikely (no local records)	Unlikely (no local records)
BIRD	*Haliaeetus leucogaster*	White-Bellied Sea-Eagle	MI	MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Hydroprogne caspia*	Caspian Tern	-	MI,MA	x	x	Foraging, feeding or related behaviour known to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Larus pacificus*	Pacific Gull	-	MA		x	Foraging, feeding or related behaviour known to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Leipoa ocellata*	Malleefowl	VU	VU	x	x	Species or species habitat likely to occur	Possible (recent records in the vicinity)	Possible (recent records in the vicinity)
BIRD	*Limosa lapponica*	Bar-Tailed Godwit	MI	MI	x	x	Species or species habitat may occur	Unlikely (no local records)	Unlikely (no local records)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST Attribution	Desktop Likelihood of Occurrence	Post-Field Likelihood of Occurrence
BIRD	*Limosa lapponica menzbieri*	Northern Siberian Bar-Tailed Godwit, Russkoye Bartailed Godwit	CR	CR		x	Species or species habitat may occur	Unlikely (habitat present but no local records)	Unlikely (habitat present but no local records)
BIRD	*Macronectes giganteus*	Southern Giant-Petrel, Southern Giant Petrel	-	EN,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Macronectes halli*	Northern Giant Petrel	-	VU,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Merops ornatus*	Rainbow Bee-Eater	-	MA		x	Species or species habitat may occur	Possible (widespread despite lack of local records)	Possible (widespread despite lack of local records)
BIRD	*Motacilla cinerea*	Grey Wagtail	MI	MI		x	Species or species habitat known to occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Numenius madagascariensis*	Eastern Curlew, Far Eastern Curlew	VU, MI	CR, MI, MA		x	Species or species habitat may occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Pandion cristatus (Pandion haliaetus)*	Osprey, Eastern Osprey	MI	MI	x	x	Species or species habitat known to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Pterodroma mollis*	Soft-Plumaged Petrel	-	VU, MI		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Puffinus assimilis*	Little Shearwater	-	MA		x	Foraging, feeding or related behaviour known to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Rostratula australis (Rostratula benghalensis)*	Australian Painted Snipe	EN, MI	EN, MA		x	Species or species habitat may occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Rostratula benghalensis (sensu lato)*	Painted Snipe		MA		x	Foraging, feeding or related behaviour known to occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Sterna albifrons*	Little Tern	-	MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Sterna dougallii*	Roseate Tern	-	MI,MA		x	Foraging, feeding or related behaviour known to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Sternula albifrons*	Little Tern	-	MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Sternula nereis nereis*	Australian Fairy Tern	VU	VU		x	Foraging, feeding or related behaviour known to occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST Attribution	Desktop Likelihood of Occurrence	Post-Field Likelihood of Occurrence
BIRD	*Thalasseus bergii*	Crested Tern	MI	MI	x			Unlikely (no local records)	Unlikely (no local records)
BIRD	*Thalassarche carteri*	Indian Yellow-Nosed Albatross	EN	VU,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Thalassarche cauta*	Shy Albatross	VU	EN,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Thalassarche impavida*	Campbell Albatross, Campbell Black-Browed Albatross	VU	VU,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Thalassarche melanophris*	Black-Browed Albatross	EN	VU,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Thalassarche steadi*	White-Capped Albatross		VU,MI,MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Thinornis rubricollis*	Hooded Plover, Hooded Dotterel	P4	MA		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
BIRD	*Tringa nebularia*	Common Greenshank, Greenshank	MI	MI, MA	x	x	Species or species habitat likely to occur	Unlikely (no local records)	Unlikely (no local records)
BIRD	*Tringa stagnatilis*	Marsh Sandpiper, Little Greenshank			x			Unlikely (no local records)	Unlikely (no local records)
REPTILE	*Egernia stokesii badia*	Western Spiny-Tailed Skink, Baudin Island Spiny-Tailed Skink	VU	EN	x	x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
REPTILE	*Neelaps calonotos*	Black-Striped Snake, Black-Striped Burrowing Snake	P3		x			Likely (recent proximal records)	Likely (recent proximal records)
INVERTEBRATE	*Hylaeus globuliferus*	Woolybush Bee	P3		x			Unlikely (no local records)	Very Unlikely (*Adenanthos* spp. not observed during survey)
INVERTEBRATE	*Idiosoma nigrum*	Shield-Backed Trapdoor Spider, Black Rugose Trapdoor Spider	EN	VU		x	Species or species habitat may occur	Very Unlikely (habitat not considered to be present)	Very Unlikely (habitat not considered to be present)
INVERTEBRATE	*Phasmodes jeeba*	Springtime Corroboree Stick Katydid (Eneabba)	P3	-	x			Unlikely (no local records)	Unlikely (no local records)

Appendix D – Field Survey Results

Table D.1: Flora taxa recorded within the Survey Area during survey

		Site																									
Taxon	Status	RR01	RR02	RR03	RR04	RR05	RR06	RT01	RT02	RT03	RT04	RT05	RT06	RT07	RT08	RT09	RT10	RT11	RT12	RT13	RT14	RT15	RT16	RT17	RT18	RT19	RT20	Opps
Acacia blakelyi									X	X																		
Acacia cavealis													X															
Acacia comans				X																								
Acacia dilitata																						X						
Acacia lasiocarpa var. *lasiocarpa*																					X				X	X		
Acacia saligna																												X
Acacia scirpifolia							X									X						X			X	X		X
Acacia sessilis												X																
Acacia sp.																X												
Acacia spathulifolia																X												
Acacia sphacelata subsp. *sphacelata*						X																						
Acacia stenoptera																						X						
Acanthocarpus sp.		X									X																	
Acanthocarpus sp. Ajana (C.A. Gardner 8596)			X	X	X	X	X						X							X	X	X		X	X	X		
Adenanthos cygnorum subsp. *cygnorum*																												X
Alexgeorgea nitens									X	X			X				X	X	X	X	X	X	X				X	
Allocasuarina campestris						X	X						X															X
Allocasuarina humilis					X		X												X		X					X		
Allocasuarina microstachya																							X					
Allocasuarina thuyoides				X																								
Amphipogon turbinatus																	X											
Andersonia heterophylla																			X								X	X
Anigozanthos humilis subsp. *humilis*																									X			
Anigozanthos sp.																						X						
Austrostipa macalpinei									X																			
Banksia ?dallanneyi					X	X																						
Banksia attenuata			X		X		X	X		X	X	X	X		X		X		X	X				X		X	X	X
Banksia candolleana			X					X							X			X	X	X	X						X	
Banksia dallanneyi		X						X		X																		
Banksia dallanneyi subsp. *media*																												X
Banksia hookeriana						X	X			X	X	X	X		X					X				X				
Banksia leptophylla var. *melletica*									X																			
Banksia menziesii																	X											X
Banksia prionotes																												X
Banksia sessilis var. *flabellifolia*																												X
Banksia shuttleworthiana		X	X	X	X	X		X							X			X	X	X	X	X			X	X		
Beaufortia elegans			X			X		X		X					X				X	X								
Burchardia congesta													X	X	X							X			X	X		
Calectasia hispida		X																										
Callitris arenaria																					X							
Calothamnus blepharospermus						X																						
Calothamnus glaber		X	X	X			X	X		X	X				X			X	X	X	X			X				
Calothamnus quadrifidus subsp. *angustifolius*														X							X		X					
Calothamnus sanguineous																									X			
Calytrix ?sapphirina															X													
Calytrix depressa																							X					
Calytrix fraseri																												X
Calytrix sapphirina						X																						
Cassytha aurea var. *hirta*													X															
Cassytha flava															X													
Cassytha glabella forma *casuarinae*								X				X		X				X	X	X	X	X			X	X		
Cassytha sp.		X			X	X																						
Caustis dioica		X		X																					X			
Chaetospora curvifolia																		X										
Chordifex sinuosus		X	X	X		X	X					X						X			X							

		Site																										
Taxon	Status	RR01	RR02	RR03	RR04	RR05	RR06	RT01	RT02	RT03	RT04	RT05	RT06	RT07	RT08	RT09	RT10	RT11	RT12	RT13	RT14	RT15	RT16	RT17	RT18	RT19	RT20	Opps
Conospermum boreale subsp. *ascendens*		X	X		X	X	X	X		X	X	X	X	X	X				X	X	X	X		X	X	X		
Conospermum brachyphyllum																			X									
Conospermum sp.									X																			
Conostephium preissii												X																
Conostylis ?aculeata																							X		X			
Conostylis ?resinosa																												X
Conostylis aculeata																					X							
Conostylis candicans subsp. *candicans*									X													X		X				
Conostylis canteriata				X		X								X	X			X	X	X					X		X	
Conostylis crassinerva subsp. *absens*																					X							
Conostylis resinosa													X											X		X		
Conostylis setigera subsp. *setigera*										X	X																	
Corynotheca micrantha var. *micrantha*									X											X								
Cristonia stenophylla																							X		X			
Cyanothamnus ramosus subsp. *anethifolius*									X													X						
Dampiera oligophylla					X	X							X		X			X	X									
Dampiera sp.		X																										
Darwinia pauciflora				X		X	X	X			X			X	X					X				X				
Darwinia speciosa					X																							
Daviesia nudiflora subsp. *nudiflora*			X	X	X			X		X								X			X				X	X		
Daviesia triflora					X					X																X		
Desmocladus semiplanus			X												X	X		X	X	X					X			
Drosera ?echinoblastus			X														X											X
Drosera ?erythrorhiza		X																										
Drosera ?menziesii																						X						
Drosera erythrorhiza				X				X	X				X	X		X		X	X			X		X	X	X		
Drosera sp. (climbing)				X		X		X										X			X			X				
Ecdeiocolea monostachya		X	X	X	X	X		X		X	X	X	X	X	X			X		X			X	X	X	X		
Eremaea beaufortioides var. *beaufortioides*				X	X		X				X				X		X		X	X	X	X				X	X	
Eremaea ectadioclada			X																									
Eremaea violacea		X						X																				
Eucalyptus todtiana									X							X		X	X		X	X						
Geleznowia verrucosa		X		X																								
Gompholobium tomentosum									X	X											X	X				X		
Grevillea eriostachya													X			X								X				
Grevillea leucopteris					X																							
Guichenotia ledifolia																												X
Hakea candolleana						X																	X					X
Hakea circumalata														X	X													
Hakea eneabba					X																							
Hakea polyanthema			X	X			X	X		X	X	X	X					X			X	X		X	X	X		
Hibbertia acerosa																							X					
Hibbertia crassifolia																				X							X	
Hibbertia hypericoides							X		X	X	X	X			X			X	X	X	X	X	X	X	X	X	X	
Hibbertia hypericoides subsp. *hypericoides*		X	X	X		X																						
Hibbertia robur																												X
Hypocalymma xanthopetalum								X																				
**Hypochaeris* sp.	Weed								X																			
Isopogon tridens			X			X													X									
Isotropis cuneifolia subsp. *cuneifolia*														X							X							
Jacksonia angulata																							X					
Jacksonia floribunda					X							X					X	X	X								X	
Jacksonia hakeoides													X									X	X	X	X	X		X
Lasiopetalum erectifolium					X													X	X	X								
Laxmannia sessiliflora subsp. *drummondii*							X							X	X						X	X		X	X	X		
Laxmannia squarrosa						X			X		X																	
Lechenaultia linarioides																X												
Lepidobolus preissianus								X		X	X	X	X	X	X					X				X	X	X		

		Site																										
Taxon	Status	RR01	RR02	RR03	RR04	RR05	RR06	RT01	RT02	RT03	RT04	RT05	RT06	RT07	RT08	RT09	RT10	RT11	RT12	RT13	RT14	RT15	RT16	RT17	RT18	RT19	RT20	Opps
Lepidobolus sp.		X																										
Lepidosperma ?apricola		X													X													
Lepidosperma pubisquameum																								X				
Lepidosperma sp.		X		X																								
Leporella fimbriata				X																								
Leptospermum erubescens		X		X	X					X				X				X									X	
Leptospermum spinescens		X		X	X		X	X			X				X			X		X	X	X		X		X		
Leucopogon inflexus										X	X	X							X		X	X	X					
Leucopogon sp. Northern ciliate (R. Davis 3393)									X	X			X				X					X	X		X	X	X	
Lomandra hastilis													X															
Lyginia imberbis																	X	X										X
Lysinema pentapetalum																			X		X							X
Macrozamia riedlei																												X
Melaleuca ?leuropoma		X	X	X	X	X	X	X		X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	
Melaleuca ?trichophylla																		X										
Mesomelaena pseudostygia		X	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X	X		X	X	X	X	
Monotaxis bracteata		X																										
Neurachne alopecuroidea									X						X							X	X	X	X			
Opercularia vaginata														X														
Persoonia acicularis		X	X		X	X	X	X		X	X	X		X	X			X		X				X				
Petrophile ?brevifolia			X	X									X	X												X		
Petrophile drummondii					X															X								
Petrophile linearis										X								X										
Petrophile macrostachya					X						X		X		X					X				X		X	X	
Phlebocarya ciliata		X	X			X	X																					
Pileanthus filifolius							X	X		X	X	X	X	X	X		X			X				X	X	X	X	
Scaevola canescens						X	X			X		X	X		X	X			X		X			X	X	X		
Schoenus clandestinus										X	X	X	X							X				X		X		
Schoenus curvifolius												X					X											
Schoenus latitans		X	X	X		X	X	X						X	X			X	X		X		X		X			
Schoenus pleiostemoneus																			X		X							
Schoenus sp. A3 Ciliate Sheaths (K.R. Newbey 9402)																		X										
Scholtzia chapmanii													X															
Scholtzia laxiflora		X	X	X	X	X	X		X	X		X		X	X		X	X	X	X	X	X			X	X	X	
Stawellia dimorphantha	P4						X																					
Stenanthemum notiale subsp. *notiale*						X				X			X			X				X		X	X	X	X	X		
Stirlingia latifolia					X							X					X	X									X	
Stylidium ?diuroides											X			X													X	
Stylidium crossocephalum																			X		X				X			X
Stylidium repens							X	X		X		X			X				X		X	X	X		X	X		
Styphelia hamulosa													X											X				
Styphelia hispida		X	X	X		X		X						X														
Styphelia microdonta										X											X	X			X			
Styphelia xerophyllum																	X	X	X						X	X	X	
Tersonia cyathiflora						X	X																					
Thysanotus dichotomus			X	X																								
**Ursinia anthemoides*	Weed								X																			X
Verticordia aurea															X													
Verticordia densiflora																						X						
Verticordia densiflora var. *densiflora*				X																					X			X
Verticordia grandis		X			X	X	X	X				X	X		X		X	X	X	X	X				X		X	
Verticordia nobilis			X																									
Verticordia sp.		X					X																					
Xanthorrhoea drummondii																						X	X					
Xylomelum angustifolium							X											X	X									
?Daviesia hakeoides subsp. *subnuda*			X			X		X		X	X	X	X		X					X	X			X		X	X	
?Daviesia triflora							X																					
?Desmocladus flexuosus					X																							

		Site																										
Taxon	Status	RR01	RR02	RR03	RR04	RR05	RR06	RT01	RT02	RT03	RT04	RT05	RT06	RT07	RT08	RT09	RT10	RT11	RT12	RT13	RT14	RT15	RT16	RT17	RT18	RT19	RT20	Opps
?Hibbertia sp.													X															
?Lomandra hastilis																			X									
?Wahlenbergia preissii									X																			

* Denotes invasive flora (weed) taxon.

? Denotes unable to be confirmed to taxon level due to lack of diagnostic material.

Table D.2: Fauna recorded within the Survey Area during survey

Class	Taxon	Common Name	C'wealth Status	WA Status
MAMMAL	**Capra aegagrus* subsp. *hircus*	Goat	Invasive	Invasive
MAMMAL	**Oryctolagus cuniculus*	Rabbit	Invasive	Invasive
MAMMAL	**Vulpes vulpes*	Fox	Invasive	Invasive
MAMMAL	*Macropus fuliginosus* subsp. *melanops*	Western grey		
BIRD	*Acanthagenys rufogularis*	Spiny cheeked honeyeater		
BIRD	*Anthochaera carunculata*	Red wattlebird		
BIRD	*Anthus richardi*	Richard's Pippit		
BIRD	*Artamus cinereus*	Black-faced woodswallow		
BIRD	*Barnardius zonarius* subsp. *semitorquatus*	Australian Ringneck (Twenty-Eight)		
BIRD	*Calyptorhynchus latirostris*	Carnaby's black cockatoo	Endangered	Endangered
BIRD	*Chalcites basalis*	Horsefield's Cuckoo		
BIRD	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		
BIRD	*Corvus coronoides*	Raven		
BIRD	*Cracticus torquatus*	Grey Butcherbird		
BIRD	*Dromaius novaehollandiae*	Emu		
BIRD	*Eolophus roseicapilla*	Galah		
BIRD	*Falco cenchroides*	Nankeen kestrel		
BIRD	*Gavicalis virescens* subsp. *virescens*	Singing honeyeater		
BIRD	*Gliciphila melanops*	Tawny crowned honeyeater		
BIRD	*Hirundo neoxena*	Welcome swallow		
BIRD	*Lichmera indistincta*	Brown honeyeater		
BIRD	*Malurus lamberti*	Variegated wren		
BIRD	*Malurus leucopterus*	White winged fairy-wren		
BIRD	*Malurus* sp.	Wren		
BIRD	*Ocyphaps lophotes*	Crested Pigeon		
BIRD	*Phaps chalcoptera*	Bronzewing		
BIRD	*Phaps elegans*	Brush Bronzewing		
BIRD	*Phylidonyris niger*	White cheeked honeyeater		
BIRD	*Purnella albifrons*	White-fronted honeyeater		
BIRD	*Rhipidura leucophrys*	Willie wagtail		
BIRD	*Sugomel niger*	Black Honeyeater		
REPTILE	*Ctenophorus adelaidensis*	Western heath dragon		
REPTILE	*Ctenophorus maculatus*	Spotted military dragon		
REPTILE	*Pogona minor* subsp. *minor*	Western Bearded Dragon		
INVERTEBRATE	*Mygalomorphae* sp.	Trapdoor Spider		

Table D.3: Fauna Habitat Assessment Point Locations (GDA2020 MGA Zone 50)

Site	Latitude	Longitude	Site Type	Landform	Aspect	Slope	Rock	Soil	Soil Description	Outcrop	Bare Ground	Litter	Large trees	Fire Age	Habitat Unit
BS01	-29.4318	115.1427	Ornithological Survey	plain	SW	Gentle	Nil	sand	Cream sand over yellow	no	35	4	no	3	Kwongan
BS02	-29.5625	115.1173	Ornithological Survey	plain		Flat	Nil	sand	Cream	no	2	95	no	10	Shrubland
BS03	-29.5618	115.1555	Ornithological Survey	plain		Flat	Nil	sandy clay	Cream sand over peach sandy clay	no	12	85	no	5-10	Shrubland
FH01	-29.4237	115.1373	Habitat Assessment	plain	W	Gentle	Nil	sand	Cream over yellow sand	no	35	4	no	3	Kwongan
FH02	-29.4211	115.1392	Habitat Assessment	plain	N	Gentle	Nil	sand	Cream over yellow sand	no	40	6	no	3	Kwongan
FH03	-29.4318	115.1428	Habitat Assessment	plain	S	Very gentle	Nil	sand	Cream over yellow sand	no	45	5	no	3	Kwongan
FH04	-29.4418	115.1425	Habitat Assessment	plain	W	Very gentle	Nil	sand	Cream over yellow sand	no	30	12	no	3	Kwongan
FH05	-29.447	115.1392	Habitat Assessment	plain	W	Very gentle	Nil	sand	Cream over yellow sand	no	20	18	no	3	Kwongan
FH06	-29.4635	115.1501	Habitat Assessment	plain	W	Very gentle	Nil	sand	Cream grey over brown sand	no	40	15	no	3	Kwongan
FH07	-29.4588	115.1641	Habitat Assessment	plain		Flat	Nil	sand	Cream over yellow	no	38	12	no	10	Kwongan
FH08	-29.4572	115.1662	Habitat Assessment	plain		Flat	Nil	sand	Cream	no	35	22	no	10	Eucalypt Woodland
FH09	-29.4579	115.1597	Habitat Assessment	plain		Flat	Nil	sand	Cream sand	no	25	20	no	10	Kwongan
FH10	-29.4643	115.1658	Habitat Assessment	plain		Flat	Nil	sand	Cream sand	no	42	5	no	10	Kwongan
FH11	-29.4688	115.1669	Habitat Assessment	plain	SE	Very gentle	Nil	sand	Cream sand	no	43	10	no	10	Eucalypt Woodland
FH12	-29.5629	115.1258	Habitat Assessment	plain	SW	Very gentle	Nil	sand	Cream sand	no	15	75	no	10	Shrubland
FH13	-29.5555	115.128	Habitat Assessment	plain		Flat	Nil	sand	Cream sand over grey	no	25	18	no	10	Kwongan
FH14	-29.5411	115.1257	Habitat Assessment	plain		Flat	Nil	sand	Cream over yellow	no	30	18	no	10	Kwongan
FH15	-29.5395	115.1312	Habitat Assessment	plain	NE	Very gentle	Nil	sand	Cream over yellow sand	no	40	8	no	10	Kwongan
FH16	-29.466	115.1411	Habitat Assessment	plain		Flat	Nil	sand	Cream over yellow sand	no	30	12	no	10	Kwongan
FH17	-29.472	115.1439	Habitat Assessment	hill	E	Gentle	Nil	sand	Cream over yellow sand	no	26	9	no	10	Kwongan
FH18	-29.4791	115.1458	Habitat Assessment	hill	N	Gentle	Nil	sand	Cream over brown/yellow sand	no	20	14	no	10	Kwongan
FH19	-29.4757	115.1501	Habitat Assessment	depression			Nil	clayey sand	Grey sand over clayey sand	no	50	2	no	10	Sedgeland
FH20	-29.5625	115.1178	Habitat Assessment	plain		Flat	Nil	sand	Cream	no	2	95	no	10	Shrubland
FH21	-29.425	115.1419	Habitat Assessment	depression		Flat	Nil	clayey sand	Cream/yellow over yellow	no	58	2	no	3	Sedgeland
FH22	-29.5801	115.1488	Habitat Assessment	plain		Flat	Nil	sandy clay	Cream sand over grey clayey	no	28	18	no	2-5	Kwongan
FH23	-29.5605	115.1556	Habitat Assessment	plain		Flat	Nil	sandy clay	Cream sand over peach sandy clay	no	6	92	no	5-10	Shrubland
FH24	-29.5598	115.1596	Habitat Assessment	plain		Flat	Nil	sand	Cream	no	20	40	no	5-10	Shrubland
FH25	-29.5626	115.1583	Habitat Assessment	plain		Flat	Nil	sand	Cream	no	50	18	no	5-10	Kwongan
FH26	-29.5627	115.1498	Habitat Assessment	dune	E	Gentle	Nil	sand	Yellow yellow	no	25	38	no	5-10	Banksia Scrub on Yellow Sand Dune
FH27	-29.5696	115.1526	Habitat Assessment	plain		Flat	Nil	sand	White over cream	no	20	30	no	5-10	Kwongan
FH28	-29.4613	115.1205	Habitat Assessment	plain	NW	Very gentle	Nil	sand	White on white	no	65	10	no	2-5	Banksia Woodland
FH29	-29.4632	115.1229	Habitat Assessment	plain	NE	Very gentle	Nil	sand	White	no	20	25	no	5-10	Banksia Woodland

Appendix E – Floristic Relevé Data

Project: 62676 Flora **Date:** 5/26/2022 **Recorder**: LP

Site: RR01 **Coordinates:** -29.478421, 115.146836 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: depression/ basin **Aspect:** **Slope:** Nil

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand

Surface: 50% bare ground, % outcropping, 3% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nil

Vegetation Description: Sedgeland of Ecdeiocolea monostachya, Mesomelaena pseudostygia and Lepidobolus with isolated low shrubs of Calothamnus glaber, Banksia shuttleworthiana and Leptospermum erubescens.



TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Mesomelaena pseudostygia	50	10		
	Ecdeiocolea monostachya	80	5		
	Banksia shuttleworthiana	60	2		
	Lepidobolus sp.	40	0.5		
	Cassytha sp.	30	0.5		
	Melaleuca ?leuropoma	40	0.5		
	Calothamnus glaber	120	0.1		
	Drosera ?erythrorhiza	1	0.1		
	Schoenus latitans	3	0.1		
	Phlebocarya ciliata	30	0.1		
	Caustis dioica	30	0.05		
	Eremaea violacea	35	0.02		
	Leptospermum spinescens	50	0.01		
	Persoonia acicularis	30	0.01		
	Conospermum boreale subsp. ascendens	30	0.01		
	Banksia dallanneyi	25	0.001		
	Verticordia sp.	20	0.001		
	Lepidosperma sp.	30	0.001		
	Monotaxis bracteata	25	0.001		
	Chordifex sinuosus	25	0.001		
	Hibbertia hypericoides subsp. hypericoides / H. ?crassifolia	25	0.001		
	Verticordia grandis	30	0.001		
	Acanthocarpus sp.	35	0.001		
	Lepidosperma ?apricola	50	0.001		
	Styphelia hispida	20	0.001		
	Geleznowia verrucosa	25	0.001		
	Dampiera sp.	30	0.001		
	Leptospermum erubescens				
	Calectasia hispida				
	Scholtzia laxiflora				

Project: 62676 Flora **Date:** 5/26/2022 **Recorder**: RP

Site: RR02 **Coordinates:** -29.468169, 115.143399 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** S **Slope:** Low

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand

Surface: 50% bare ground, % outcropping, 10% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Excellent **Disturbance Notes:** Nearby track

Vegetation Description: Open shrubland of Banksia attenuata, Calothamnus glaber and Beaufortia elegans over Mesomelaena pseudostygia, sparse Ecdeiocolea monostachya and Lepidobolus sp. sedges.



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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Beaufortia elegans	60	10		
	Banksia attenuata	110	3		
	?Daviesia hakeoides subsp. subnuda	70	3		
	Calothamnus glaber	80	2		
	Mesomelaena pseudostygia	40	2		
	Banksia candolleana	60	2		
	Ecdeiocolea monostachya	70	1		
	Hakea polyanthema	80	1		
	Conospermum boreale subsp. ascendens	60	1		
	Banksia shuttleworthiana	60	0.5		
	Isopogon tridens	80	0.5		
	Desmocladus semiplanus	35	0.5		
	Styphelia hispida	20	0.5		
	Chordifex sinuosus	30	0.1		
	Melaleuca ?leuropoma	60	0.1		
	Persoonia acicularis	30	0.1		
	Hibbertia hypericoides subsp. hypericoides / H. ?crassifolia	35	0.1		
	Phlebocarya ciliata	30	0.1		
	Petrophile ?brevifolia	30	0.01		
	Verticordia nobilis	100	0.01		P4 7 individuals
	Daviesia nudiflora subsp. nudiflora	35	0.01		
	Eremaea ectadioclada	35	0.01		
	Schoenus latitans	3	0.01		
	Scholtzia laxiflora	35	0.001		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	25	0.001		
	Thysanotus dichotomus	25	0.001		
	Drosera ?echinoblastus	2	0.001		
	Styphelia hispida	30	0.001		

Project: 62676 Flora **Date:** 5/26/2022 **Recorder**: RP

Site: RR03 **Coordinates:** -29.476531, 115.150666 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 50% bare ground, % outcropping, 3% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Excellent **Disturbance Notes:** Old exploration track, nearly indiscernible

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Vegetation Description: Darwinia pauciflora shrubs over Ecdeiocolea monostachya, Mesomelaena pseudostygia and Lepidobolus sp. sedgeland.



TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Mesomelaena pseudostygia	40	15		
	Ecdeiocolea monostachya	70	10		
	Melaleuca ?leuropoma	45	7		
	Chordifex sinuosus	25	5		
	Caustis dioica	35	5		
	Darwinia pauciflora	70	3		
	Leptospermum erubescens	90	0.5		
	Schoenus latitans	3	0.5		
	Eremaea beaufortioides var. beaufortioides	100	0.5		
	Hibbertia hypericoides subsp. hypericoides / H. ?crassifolia	45	0.1		
	Allocasuarina thuyoides	50	0.1		
	Lepidosperma sp.	35	0.1		
	Scholtzia laxiflora	110	0.1		
	Banksia shuttleworthiana	40	0.1		
	Calothamnus glaber	65	0.1		
	Drosera erythrorhiza	1	0.01		
	Geleznowia verrucosa	40	0.01		
	Verticordia densiflora var. densiflora	110	0.01		
	Acacia comans	120	0.01		
	Thysanotus dichotomus	25	0.01		
	Daviesia nudiflora subsp. nudiflora	30	0.01		
	Leptospermum spinescens	50	0.01		
	Hakea polyanthema	25	0.01		
	Petrophile ?brevifolia	45	0.01		
	Conostylis canteriata	20	0.001		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	30	0.001		
	Styphelia hispida	25	0.001		
	Leporella fimbriata	1	0.001		
	Drosera sp. (climbing)	20	0.001		

Project: 62676 Flora **Date:** 5/26/2022 **Recorder**: RP

Site: RR04 **Coordinates:** -29.463742, 115.155724 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 70% bare ground, % outcropping, 10% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Excellent **Disturbance Notes:** Fire, track

Vegetation Description: Isolated patches of Eucalyptus todtiana over open shrubland of Banksia attenuata and Banksia candolleana over Melaleuca ?leuropoma and Ecdeiocolea monostachya and Mesomelaena pseudostygia sedges.



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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Ecdeiocolea monostachya	100	4		
	Banksia attenuata	150	3		
	Melaleuca ?leuropoma	30	2		
	Conospermum boreale subsp. ascendens	50	2		
	Eremaea beaufortioides var. beaufortioides	70	2		
	Leptospermum erubescens	75	2		
	Mesomelaena pseudostygia	45	1.5		
	Allocasuarina humilis	110	1		
	Grevillea leucopteris	400	1		
	Petrophile drummondii	65	1		
	Banksia shuttleworthiana	45	0.5		
	Scholtzia laxiflora	60	0.5		
	Lasiopetalum erectifolium	40	0.5		
	Jacksonia floribunda	110	0.5		
	Stirlingia latifolia	60	0.5		
	Hakea eneabba	120	0.5		
	Banksia ?dallanneyi	20	0.2		
	Petrophile macrostachya	70	0.1		
	Daviesia nudiflora subsp. nudiflora	60	0.1		
	Cassytha sp.	25	0.05		
	Leptospermum spinescens	60	0.01		
	Persoonia acicularis	20	0.01		
	Verticordia grandis	110	0.01		
	?Desmocladus flexuosus	25	0.01		
	Dampiera oligophylla	10	0.001		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	30	0.001		
	Darwinia speciosa	40	0.001		
	Daviesia triflora	60	0.001		

Project: 62676 Flora **Date:** 6/6/2022 **Recorder**: RP

Site: RR05 **Coordinates:** -29.445852, 115.142247 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** NW **Slope:** Low

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 60% bare ground, % outcropping, 3% litter **Years Since Fire:** unclear yrs

Large Trees Present (>500 mm DBH): no

Condition: Excellent **Disturbance Notes:** Track

Vegetation Description: Open shrubland of Calothamnus glaber, Conospermum boreale subsp. ascendens and Darwinia pauciflora with isolated Banksia attenuata, over Ecdeiocolea monostachya, Mesomelaena pseudostygia and Lepidobolus sp. sedges.



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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Calothamnus blepharospermus	80	10		
	Ecdeiocolea monostachya	90	7		
	Mesomelaena pseudostygia	50	7		
	Banksia hookeriana	120	3		Growing alongside the track
	Conospermum boreale subsp. ascendens	70	2		
	Darwinia pauciflora	65	2		
	Chordifex sinuosus	25	2		
	Melaleuca ?leuropoma	50	1.5		
	Beaufortia elegans	60	1		
	Banksia shuttleworthiana	40	1		
	?Daviesia hakeoides subsp. subnuda	80	1		?Leptomeria
	Scaevola canescens	25	0.5		
	Styphelia hispida	25	0.5		
	Isopogon tridens	50	0.5		
	Hakea candolleana	30	0.4		
	Scholtzia laxiflora	70	0.2		
	Banksia ?dallanneyi	20	0.2		
	Acacia sphacelata subsp. sphacelata	50	0.2		
	Schoenus latitans	3	0.1		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	30	0.02		
	Hibbertia hypericoides subsp. hypericoides / H. ?crassifolia	30	0.01		
	Phlebocarya ciliata	20	0.01		
	Persoonia acicularis	25	0.01		
	Cassytha sp.	25	0.01		
	Verticordia grandis	40	0.005		
	Allocasuarina campestris	40	0.001		
	Dampiera oligophylla	30	0.001		
	Conostylis canteriata	20	0.001		
	Stenanthemum notiale subsp. notiale	12	0.001		
	Drosera sp. (climbing)	20	0.001		
	Laxmannia squarrosa	10	0.001		
	Calytrix sapphirina	30	0.001		
	Chordifex sinuosus	30	0.001		
	Tersonia cyathiflora	0	0		Fruit only

Project: 62676 Flora **Date:** 6/6/2022 **Recorder**: RP

Site: RR06 **Coordinates:** -29.434050, 115.142607 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: dune **Aspect:** NW **Slope:** Mild

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Yellow sand

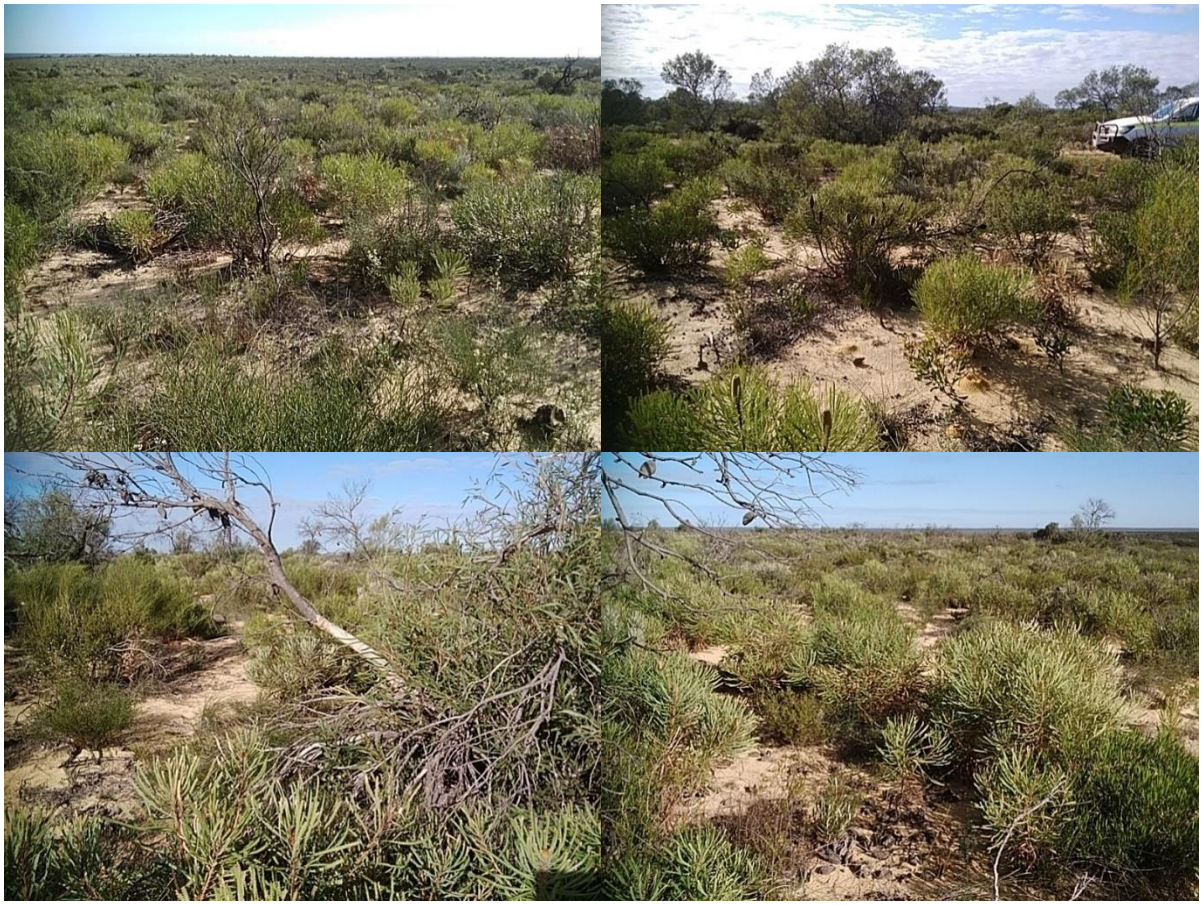
Surface: 70% bare ground, % outcropping, 2% litter **Years Since Fire:** 2-5 yrs

Large Trees Present (>500 mm DBH): no

Condition: Excellent **Disturbance Notes:** Track, recent fire

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Vegetation Description: Sparse Xylomelum angustifolium and Eucalyptus todtiana over open shrubland of Calothamnus glaber, Banksia attenuata and Banksia hookeriana, over Ecdeiocolea monostachya and Phlebocarya ciliata



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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Banksia hookeriana	80	10		
	Banksia attenuata	75	5		
	Xylomelum angustifolium	200	3	1	
	Calothamnus glaber	70	3		
	Eremaea beaufortioides var. beaufortioides	90	2		
	?Daviesia triflora	100	1.5		
	Acacia scirpifolia	150	1.5		
	Conospermum boreale subsp. ascendens	50	1		
	Darwinia pauciflora	60	1		
	Melaleuca ?leuropoma	45	0.5		
	Hakea polyanthema	65	0.2		
	Phlebocarya ciliata	20	0.01		
	Pileanthus filifolius	25	0.01		
	Verticordia grandis	45	0.01		
	Stawellia dimorphantha	8	0.001		Abundance 2
	Laxmannia sessiliflora subsp. drummondii	10	0.001		
	Chordifex sinuosus	25	0.001		
	Scaevola canescens	15	0.001		
	Persoonia acicularis	20	0.001		
	Schoenus latitans	3	0.001		
	Mesomelaena pseudostygia	25	0.001		
	Verticordia sp.	25	0.001		
	Stylidium repens	10	0.001		
	Allocasuarina humilis	3	0.001		Seedling
	Hibbertia hypericoides	12	0.001		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	20	0.001		
	Leptospermum spinescens	70	0.001		
	Allocasuarina campestris	20	0.001		
	Scholtzia laxiflora	10	0.001		
	Tersonia cyathiflora	0	0		Fruit only

Project: 62676 Flora **Date:** 5/27/2022 **Recorder**: LP

Site: RT01 **Coordinates:** -29.477113, 115.14547 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** N **Slope:** Very Gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 50% bare ground, % outcropping, 4% litter **Years Since Fire:** yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** No

Vegetation Description: Open shrubland of Banksia attenuata, Calothamnus glaber and Beaufortia elegans over Ecdeicolea monostachya, Mesomelaena pseudostygia and Schoenus latitans.



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Ecdeiocolea monostachya	70	15		
	Beaufortia elegans	55	5		
	Calothamnus glaber	1.3	3		
	Mesomelaena pseudostygia	35	3		
	Darwinia pauciflora	85	2		
	Hakea polyanthema	70	2		
	Banksia shuttleworthiana	35	2		
	?Daviesia hakeoides subsp. subnuda	80	2		
	Melaleuca ?leuropoma	40	1.5		
	Banksia attenuata	120	1		
	Schoenus latitans	3	1		
	Lepidobolus preissianus	20	0.5		
	Conospermum boreale subsp. ascendens	115	0.1		
	Daviesia nudiflora subsp. nudiflora	0.5	0.1		
	Melaleuca ?leuropoma	30	0.1		
	Eremaea violacea	20	0.1		
	Pileanthus filifolius	40	0.1		
	Banksia dallanneyi	20	0.1		
	Persoonia acicularis	30	0.01		
	Stylidium repens	0.05	0.01		
	Verticordia grandis	100	0.01		
	Cassytha glabella forma casuarinae	30	0.01		
	Hypocalymma xanthopetalum	20	0.01		
	Banksia candolleana	50	0.01		
	Leptospermum spinescens	50	0.01		
	Styphelia hispida	20	0.01		
	Hypocalymma xanthopetalum	15	0.01		
	Drosera sp. (climbing)	5	0.001		
	Drosera erythrorhiza	2	0.001		

Project: 62676 Flora **Date:** 5/25/2022 **Recorder**: LP

Site: RT02 **Coordinates:** -29.562609, 115.119427 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over cream sand

Surface: 1% bare ground, % outcropping, 95% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Very Good **Disturbance Notes:** Nearby track

Vegetation Description: Isolated Eucalyptus todtiana mallee over Acacia blakelyi tall shrubland over sparse Hibbertia hypericoides low shrubs, Conostylis candicans forbs and Mesomalaena pseudostygia sedges.



TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Acacia blakelyi	250	30		
	Conostylis candicans subsp. candicans	30	1.5		
	Eucalyptus todtiana	350	1		
	Banksia leptophylla var. melletica	130	1		
	Mesomelaena pseudostygia	30	0.5		
	Hibbertia hypericoides	40	0.2		
*	Ursinia anthemoides	10	0.1		
*	Hypochaeris sp.	1	0.1		
	Scholtzia laxiflora	150	0.1		
	Drosera erythrorhiza	1	0.1		
	Corynotheca micrantha var. micrantha	15	0.1		
	Neurachne alopecuroidea	4	0.1		
	Alexgeorgea nitens	3	0.1		
	Cyanothamnus ramosus subsp. anethifolius	35	0.1		
	Gompholobium tomentosum	20	0.01		
	Laxmannia squarrosa	5	0.01		
	?Wahlenbergia preissii	6	0.01		
	Conospermum sp.	10	0.01		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	15	0.01		
	Austrostipa macalpinei	20	0.01		

Project: 62676 Flora **Date:** 5/26/2022 **Recorder**: LP

Site: RT03 **Coordinates:** -29.562367, 115.140383 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream over yellow

Surface: 40% bare ground, % outcropping, 10% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby track

Vegetation Description: Isolated Acacia blakelyi or Eucalyptus todtiana over Banksia attenuata, Banksia hookeriana, Conospermum boreale subsp. ascendens, Hakea polyanthema and Pileanthus filifolius low shrubland, over Ecdeicolea monostachya, Conostylis resinosa and Scaevola cane



TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Scaevola canescens	15	8		
	Banksia attenuata	100	4		
	Conospermum boreale subsp. ascendens	110	3.5		
	Hakea polyanthema	100	3		
	Ecdeiocolea monostachya	100	2.5		
	Pileanthus filifolius	60	2		
	Banksia hookeriana	150	1.5		
	Conostylis setigera subsp. setigera	20	1.5		
	Hibbertia hypericoides	50	0.5		
	Mesomelaena pseudostygia	50	0.5		
	Melaleuca ?leuropoma	30	0.3		
	Stenanthemum notiale subsp. notiale	30	0.2		
	Calothamnus glaber	80	0.2		
	Banksia dallanneyi	15	0.1		
	Styphelia microdonta	15	0.1		
	Acacia blakelyi	220	0.1		
	Leptospermum erubescens	110	0.1		
	Gompholobium tomentosum	60	0.1		
	Leucopogon inflexus	50	0.1		
	Daviesia nudiflora subsp. nudiflora	40	0.1		
	Melaleuca ?leuropoma	40	0.1		
	?Daviesia hakeoides subsp. subnuda	60	0.1		
	Alexgeorgea nitens	10	0.1		
	Daviesia triflora	50	0.1		
	Schoenus clandestinus	3	0.1		
	Scholtzia laxiflora	100	0.1		
	Lepidobolus preissianus	30	0.1		
	Beaufortia elegans	80	0.1		
	Petrophile linearis	50	0.1		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	15	0.01		
	Stylidium repens	5	0.01		
	Persoonia acicularis	20	0.01		

Project: 62676 Flora **Date:** 5/27/2022 **Recorder**: TJ

Site: RT04 **Coordinates:** -29.539675, 115.132476 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** NW **Slope:** Gentle

Outcropping: no **Rock Type:** Nil

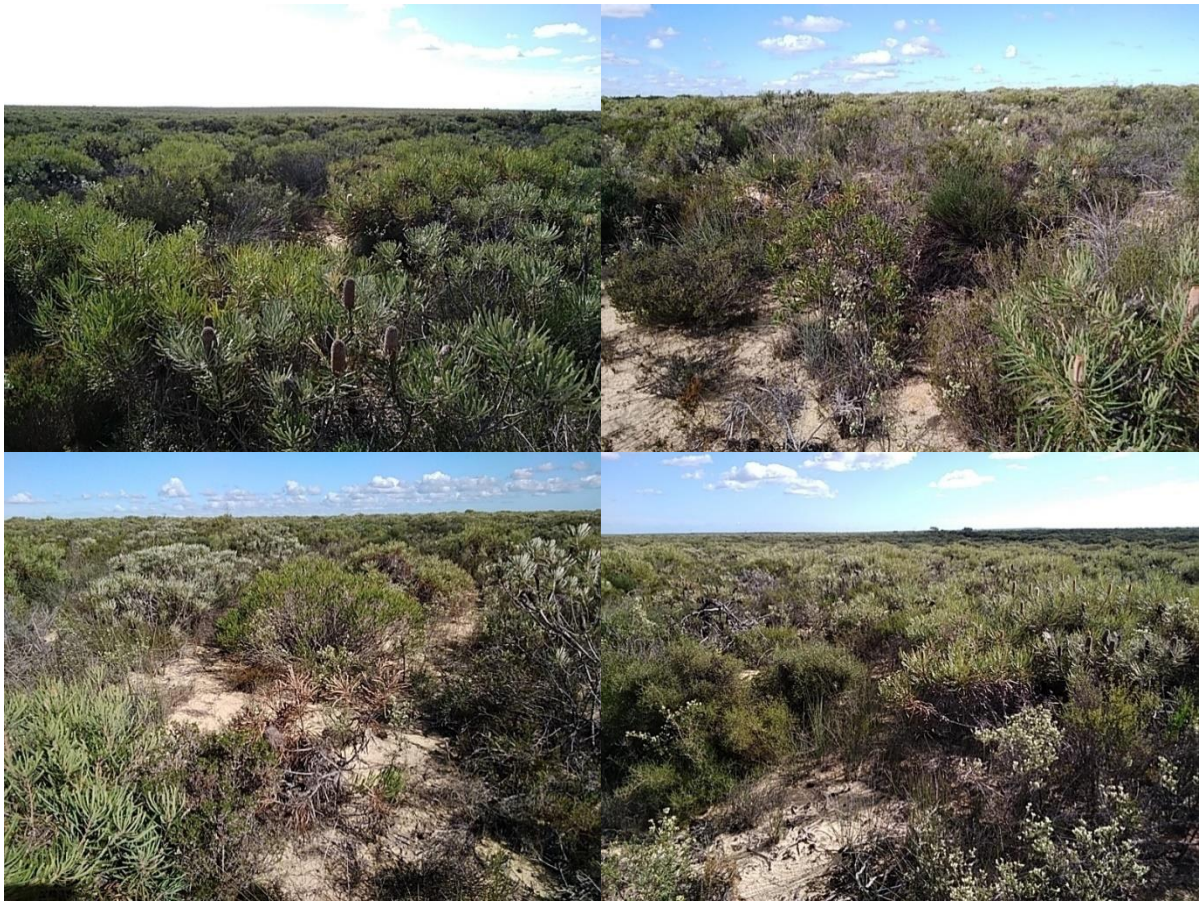
Soil Type: sand **Soil Notes:** Yellow sand

Surface: 25% bare ground, % outcropping, 18% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby tracks

Vegetation Description: Banksia attenuata, Banksia hookeriana and Calothamnus glaber mid shrubland over Darwinia pauciflora sparse low shrubland over Ecdeicolea monostachya, Mesomelaena pseudostygia and Lepidobolus sp. open sedgeland.



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Banksia attenuata	140	6		
	Banksia hookeriana	100	5		
	Ecdeiocolea monostachya	80	4.5		
	Darwinia pauciflora	80	3		
	Melaleuca ?leuropoma	60	2		
	Conospermum boreale subsp. ascendens	90	1.5		
	Lepidobolus preissianus	30	1.5		
	Calothamnus glaber	130	1		
	Hakea polyanthema	100	1		
	Mesomelaena pseudostygia	40	0.8		
	Pileanthus filifolius	40	0.4		
	Schoenus clandestinus	4	0.3		
	Eremaea beaufortioides var. beaufortioides	50	0.1		
	?Daviesia hakeoides subsp. subnuda	80	0.1		
	Petrophile macrostachya	80	0.1		
	Leptospermum spinescens	40	0.1		
	Hibbertia hypericoides	30	0.1		
	Conostylis setigera subsp. setigera	20	0.05		
	Stylidium ?diuroides	5	0.01		
	Laxmannia squarrosa	5	0.01		
	Leucopogon inflexus	70	0.01		
	Persoonia acicularis	15	0.01		
	Acanthocarpus sp.	20	0.01		

Project: 62676 Flora **Date:** 5/25/2022 **Recorder**: TJ

Site: RT05 **Coordinates:** -29.552371, 115.127412 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** N **Slope:** Very Gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand

Surface: 35% bare ground, % outcropping, 12% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby tracks

Vegetation Description: Banksia attenuata and Banksia hookeriana open mid shrubland over Leptospermum erubescens and Melaleuca ?leuropoma open low shrubland over Ecdeicolea monostachya and Mesomelaena pseudostygia sedges.



TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Banksia attenuata	140	5		
	Conospermum boreale subsp. ascendens	100	5		
	Melaleuca ?leuropoma	50	2.5		
	Banksia hookeriana	150	2		
	?Daviesia hakeoides subsp. subnuda	100	2		
	Ecdeiocolea monostachya	90	2		
	Stirlingia latifolia	60	2		
	Hakea polyanthema	110	1		
	Mesomelaena pseudostygia	30	1		
	Cassytha glabella forma casuarinae	20	1		
	Chordifex sinuosus	30	0.8		
	Leucopogon inflexus	50	0.3		
	Lepidobolus preissianus	20	0.1		
	Schoenus clandestinus	4	0.1		
	Pileanthus filifolius	30	0.1		
	Hibbertia hypericoides	40	0.1		
	Scaevola canescens	10	0.1		
	Verticordia grandis	60	0.1		
	Conostephium preissii	50	0.1		
	Jacksonia floribunda	50	0.1		
	Scholtzia laxiflora	80	0.1		
	Schoenus curvifolius	20	0.1		
	Acacia sessilis	40	0.1		
	Persoonia acicularis	20	0.01		
	Stylidium repens	5	0.01		

Project: 62676 Flora **Date:** 5/27/2022 **Recorder**: TJ

Site: RT06 **Coordinates:** -29.562004, 115.109997 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** S **Slope:** Very Gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 15% bare ground, % outcropping, 12% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby tracks

Vegetation Description: Isolated tall shrubs of Acacia blakelyi, Banksia prionotes and Grevillea eriostachya over sparse Banksia attenuata and Banksia hookeriana shrubland over Acacia cavealis and Ecdeicolea monostachya low shrubs and sedges.



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Acacia cavealis	70	40		
	Banksia attenuata	120	3		
	Banksia hookeriana	140	3		
	Ecdeiocolea monostachya	80	2		
	Hakea polyanthema	70	1.5		
	Schoenus clandestinus	4	1.5		
	?Daviesia hakeoides subsp. subnuda	80	1		
	Conostylis resinosa	30	1		
	Verticordia grandis	60	0.8		
	Grevillea eriostachya	160	0.5		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	20	0.4		
	Cassytha aurea var. hirta	40	0.4		
	Mesomelaena pseudostygia	30	0.3		
	Drosera erythrorhiza	1	0.3		
	Conospermum boreale subsp. ascendens	60	0.2		
	Lepidobolus preissianus	20	0.2		
	Pileanthus filifolius	30	0.1		
	Styphelia hamulosa	40	0.1		
	?Hibbertia sp.	50	0.1		
	Dampiera oligophylla	40	0.1		
	Lomandra hastilis	70	0.1		
	Alexgeorgea nitens	10	0.1		
	Petrophile macrostachya	50	0.1		
	Allocasuarina campestris	100	0.1		
	Petrophile ?brevifolia	40	0.1		
	Jacksonia hakeoides	50	0.1		
	Stenanthemum notiale subsp. notiale	25	0.1		
	Scholtzia chapmanii	15	0.1		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	20	0.1		
	Dampiera oligophylla	30	0.1		
	Scaevola canescens	10	0.01		
	Burchardia congesta	30	0.01		

Project: 62676 Flora **Date:** 5/27/2022 **Recorder**: TJ

Site: RT07 **Coordinates:** -29.425155, 115.141525 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 62% bare ground, % outcropping, 4% litter **Years Since Fire:** 2-5 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nil

Vegetation Description: Scholtzia laxiflora, Melaleuca ?leuropoma and Pileanthus filifolius open low shrubland, over Ecdeicolea monostachya, Mesomelaena pseudostygia and Lepidobolus preissianus open sedgeland with Stylidium repens and Conostylis canteriata forbs.



TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Melaleuca ?leuropoma	40	2.2		
	Ecdeiocolea monostachya	70	2		
	Mesomelaena pseudostygia	40	2		
	Scholtzia laxiflora	40	1.2		Resprouter
	Lepidobolus preissianus	20	0.7		
	Pileanthus filifolius	22	0.5		
	Conospermum boreale subsp. ascendens	30	0.5		
	Drosera erythrorhiza	1	0.2		
	Calothamnus quadrifidus subsp. angustifolius	50	0.2		
	Leptospermum erubescens	3	0.1		
	Petrophile ?brevifolia	25	0.1		
	Hakea circumalata	40	0.1		
	Persoonia acicularis	15	0.1		
	Darwinia pauciflora	20	0.1		
	Cassytha glabella forma casuarinae	15	0.1		
	Conostylis canteriata	15	0.05		
	Styphelia hispida	6	0.05		
	Schoenus latitans	3	0.04		
	Laxmannia sessiliflora subsp. drummondii	5	0.01		
	Opercularia vaginata	6	0.01		
	Burchardia congesta	15	0.01		
	Stylidium ?diuroides	5	0.01		
	Isotropis cuneifolia subsp. cuneifolia	10	0.01		

Project: 62676 Flora **Date:** 6/10/2022 **Recorder**: TJ

Site: RT08 **Coordinates:** -29.422788, 115.137324 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** W **Slope:** Gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand

Surface: 43% bare ground, % outcropping, 8% litter **Years Since Fire:** 1-2 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Fire <2, old tracks nearby

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Vegetation Description: Banksia candolleana, Banksia hookeriana, Banksia attenuata and Calothamnus glaber low open scrub, over Eremaea beaufortioides var. beaufortioides, Darwinia pauciflora and Banksia shuttleworthiana low open shrubland with Lepidobolus preissianus, Mesomelaen



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Banksia hookeriana	100	3		
	Banksia candolleana	100	2		
	Calothamnus glaber	90	2		
	Banksia shuttleworthiana	50	2		
	Conostylis canteriata	20	1.8		
	Lepidobolus preissianus	30	1.7		
	Darwinia pauciflora	60	1.2		
	Schoenus latitans	3	1.2		
	Eremaea beaufortioides var. beaufortioides	50	1.2		
	Cassytha flava	15	1		
	Pileanthus filifolius	40	0.8		
	Hibbertia hypericoides	40	0.6		
	Ecdeiocolea monostachya	70	0.5		
	Mesomelaena pseudostygia	40	0.5		
	Banksia attenuata	80	0.3		
	Hakea circumalata	30	0.2		
	Conospermum boreale subsp. ascendens	70	0.1		
	?Daviesia hakeoides subsp. subnuda	50	0.1		
	Verticordia aurea	30	0.1		1 plt
	Verticordia grandis	40	0.1		
	Petrophile macrostachya	40	0.1		
	Persoonia acicularis	30	0.1		
	Leptospermum spinescens	30	0.1		
	Beaufortia elegans	50	0.1		
	Scholtzia laxiflora	60	0.1		
	Dampiera oligophylla	40	0.1		
	Scaevola canescens	6	0.1		
	Laxmannia sessiliflora subsp. drummondii	4	0.05		
	Burchardia congesta	30	0.01		
	Stylidium repens	2	0.01		
	Desmocladus semiplanus	15	0.01		
	Neurachne alopecuroidea	30	0.01		
	Calytrix ?sapphirina	20	0.01		
	Lepidosperma ?apricola	20	0	0.01	

Project: 62676 Flora **Date:** 5/27/2022 **Recorder**: TJ

Site: RT09 **Coordinates:** -29.436357, 115.142149 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** SW **Slope:** Gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand

Surface: 12% bare ground, % outcropping, 67% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Track nearby

Vegetation Description: Isolated Eucalyptus todtiana and Grevillea eriostachya over closed mid shrubland of Acacia spathuifolia over Scaevola canescens and Stenanthemum notiale subsp. notiale sparse herbland.



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Acacia spathulifolia	160	65		
	Grevillea eriostachya	180	2		
	Eucalyptus todtiana	250	1	1	
	Acacia scirpifolia	250	1		
	Acacia sp.	1	0.6		
	Stenanthemum notiale subsp. notiale	25	0.5		
	Scaevola canescens	6	0.3		
	Lechenaultia linarioides	55	0.2		
	Drosera erythrorhiza	1	0.2		
	Desmocladus semiplanus	15	0.01		

Project: 62676 Flora **Date:** 5/28/2022 **Recorder**: TJ

Site: RT10 **Coordinates:** -29.462641, 115.121615 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** NE **Slope:** Very gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** White sand

Surface: 35% bare ground, % outcropping, 50% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Old tracks and firebreak/scar nearby.

Vegetation Description: Banksia menziesii sparse low woodland over Banksia attenuata and Scholtzia laxiflora mid open shrubland, over Melaleuca ?leuropoma, Jacksonia floribunda and Stirlingia latifolia low shrubland over Alexgeorgia nitens and Drosera sp..



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Scholtzia laxiflora	175	6		
	Melaleuca ?leuropoma	70	5		
	Banksia attenuata	160	4		
	Alexgeorgea nitens	5	3	5	
	Banksia menziesii	280	2.5		
	Jacksonia floribunda	110	2		
	Stirlingia latifolia	60	1.8		
	Pileanthus filifolius	60	1.5		
	Drosera ?echinoblastus	0.5	1		
	Eremaea beaufortioides var. beaufortioides	90	0.6		
	Lyginia imberbis	40	0.2		
	Verticordia grandis	140	0.1		
	Schoenus curvifolius	15	0.1		
	Amphipogon turbinatus	15	0.1		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	20	0.1		
	Styphelia xerophyllum	50	0.1		

Project: 62676 Flora **Date:** 5/28/2022 **Recorder**: TJ

Site: RT11 **Coordinates:** -29.45674, 115.165623 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** N **Slope:** Very gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** White sand over cream sand

Surface: 30% bare ground, % outcropping, 20% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Old tracks nearby

Vegetation Description: Xylomelum angustifolium and Eucalyptus todtiana open woodland, over Leptospermum spp., Banksia candolleana, Calothamnus glaber and Scholtzia laxiflora open mid shrubland, over Hibbertia hypericoides and Melaleuca ?leuropoma low open shrubland and Ecdeicol



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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Xylomelum angustifolium	400	6		
	Hibbertia hypericoides	60	2.2		
	Eucalyptus todtiana	450	2		
	Banksia candolleana	125	2		
	Ecdeiocolea monostachya	70	1.9		
	Melaleuca ?leuropoma	50	1.8		
	Leptospermum erubescens	130	1.5		
	Leptospermum spinescens	100	1		
	Calothamnus glaber	120	0.8		
	Mesomelaena pseudostygia	45	0.7		
	Jacksonia floribunda	100	0.7		
	Hakea polyanthema	130	0.6		
	Scholtzia laxiflora	140	0.5		
	Schoenus sp. A3 Ciliate Sheaths (K.R. Newbey 9402)	35	0.5		Approx 10 clumps
	Alexgeorgea nitens	6	0.5	0.6	
	Verticordia grandis	120	0.3		
	Cassytha glabella forma casuarinae	15	0.2		
	Stirlingia latifolia	70	0.2		
	Banksia shuttleworthiana	40	0.1		
	Chordifex sinuosus	25	0.1		
	Daviesia nudiflora subsp. nudiflora	35	0.1		
	Persoonia acicularis	20	0.1		
	Desmocladus semiplanus	18	0.1		
	Styphelia xerophyllum	45	0.1		
	Petrophile linearis	40	0.1		
	Lasiopetalum erectifolium	30	0.1		
	Conostylis canteriata	26	0.1		
	Melaleuca ?trichophylla	30	0.1		
	Lyginia imberbis	25	0.08		
	Schoenus latitans	3	0.03		
	Drosera sp. (climbing)	5	0.01		
	Dampiera oligophylla	50	0.01		
	Chaetospora curvifolia	11	0.01		
	Drosera erythrorhiza	1	0.01		

Project: 62676 Flora **Date:** 5/28/2022 **Recorder**: TJ

Site: RT12 **Coordinates:** -29.468811, 115.167123 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand

Surface: 32% bare ground, % outcropping, 28% litter **Years Since Fire:** >10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby tracks

Vegetation Description: Xylomelum angustifolium and Eucalyptus todtiana sparse woodland, over Banksia attenuata, Banksia candolleana and Calothamnus glaber sparse mid shrubland, over Beaufortia elegans, Hibbertia hypericoides, Banksia shuttleworthiana and Leucopogon inflexus low



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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Xylomelum angustifolium	350	4.5		
	Beaufortia elegans	110	3.8		
	Eucalyptus todtiana	460	3		
	Hibbertia hypericoides	60	3		
	Calothamnus glaber	120	2.8		
	Banksia shuttleworthiana	60	2.8		
	Banksia attenuata	130	1.5		
	Banksia candolleana	100	1.5		
	Leucopogon inflexus	90	1.2		
	Conospermum boreale subsp. ascendens	90	1		
	Scholtzia laxiflora	95	0.9		
	Lasiopetalum erectifolium	40	0.6		
	Melaleuca ?leuropoma	25	0.5		
	Lysinema pentapetalum	130	0.4		
	Allocasuarina humilis	60	0.3		
	Andersonia heterophylla	40	0.3		
	Conospermum brachyphyllum	70	0.3		
	Alexgeorgea nitens	10	0.3		
	Styphelia xerophyllum	80	0.15		
	Eremaea beaufortioides var. beaufortioides	100	0.1		
	Jacksonia floribunda	100	0.1		
	Isopogon tridens	60	0.1		
	Scaevola canescens	15	0.1		
	Schoenus latitans	4	0.1		
	Cassytha glabella forma casuarinae	50	0.1		
	Verticordia grandis	60	0.1		
	?Lomandra hastilis	100	0.1		
	Conostylis canteriata	18	0.02		
	Desmocladus semiplanus	20	0.02		
	Schoenus pleiostemoneus	18	0.02		
	Stylidium repens	3	0.01		
	Drosera erythrorhiza	2	0.01		
	Stylidium crossocephalum	6	0.01		3 plts
	Dampiera oligophylla	45	0.01		

Project: 62676 Flora **Date:** 5/28/2022 **Recorder**: TJ

Site: RT13 **Coordinates:** -29.463214, 115.145126 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** NE **Slope:** Very gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 28% bare ground, % outcropping, 22% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby tracks

Vegetation Description: Banksia attenuata, Banksia hookeriana and Calothamnus glaber open mid shrubland over Banksia candolleana, Conospermum boreale subsp. ascendens, ?Daviesia hakeoides subsp. subnuda and Beaufortia elegans open low shrubland, over Ecdeicolea monostachya, meso



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TAXA

Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
Banksia attenuata	140	6		
?Daviesia hakeoides subsp. subnuda	80	3.8		
Beaufortia elegans	70	3.8		
Banksia hookeriana	140	3		
Calothamnus glaber	130	3		
Lepidobolus preissianus	30	2.8		
Ecdeiocolea monostachya	90	2.5		
Mesomelaena pseudostygia	50	2		
Banksia candolleana	100	1.8		
Conospermum boreale subsp. ascendens	110	1.5		
Conostylis canteriata	20	1.2		
Melaleuca ?leuropoma	40	1		
Schoenus clandestinus	3	0.9		
Darwinia pauciflora	80	0.6		
Alexgeorgea nitens	7	0.6		
Lasiopetalum erectifolium	35	0.5		
Cassytha glabella forma casuarinae	50	0.3		
Pileanthus filifolius	40	0.3		
Acanthocarpus sp. Ajana (C.A. Gardner 8596)	20	0.3		
Scholtzia laxiflora	130	0.3		
Eremaea beaufortioides var. beaufortioides	50	0.2		
Petrophile macrostachya	80	0.1		
Verticordia grandis	120	0.1		
Leptospermum spinescens	40	0.1		
Hibbertia hypericoides	30	0.1		
Stenanthemum notiale subsp. notiale	20	0.1		
Banksia shuttleworthiana	65	0.1		
Corynotheca micrantha var. micrantha	60	0.1		
Desmocladus semiplanus	30	0.1		
Petrophile drummondii	100	0.1		
Persoonia acicularis	15	0.05		
Hibbertia crassifolia	40	0.01		

Project: 62676 Flora **Date:** 6/10/2022 **Recorder**: TJ

Site: RT14 **Coordinates:** -29.580165, 115.148876 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sandy clay **Soil Notes:** Cream sand with grey clay compoment

Surface: 28% bare ground, % outcropping, 18% litter **Years Since Fire:** 2-5 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby track

Vegetation Description: Occasional Eucalyptus todtiana over Callitris arenaria over Banksia candolleana and Hakea polyanthema open low shrubland over Mesomelaena pseudostygia, Chordifex sinuosus and Scaevola canescens open sedgeland/forbland



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Hakea polyanthema	110	6		
	Mesomelaena pseudostygia	35	4		
	Banksia shuttleworthiana	60	4		
	Banksia candolleana	120	3		
	Callitris arenaria	170	2		
	Chordifex sinuosus	45	2		
	Eucalyptus todtiana	250	1		
	Scaevola canescens	20	1		
	?Daviesia hakeoides subsp. subnuda	70	1		
	Allocasuarina humilis	70	1		
	Stylidium crossocephalum	6	0.2		3 plants
	Conospermum boreale subsp. ascendens	60	0.2		
	Calothamnus glaber	120	0.2		
	Hibbertia hypericoides	55	0.2		
	Leucopogon inflexus	60	0.2		
	Leptospermum spinescens	70	0.2		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	20	0.1		
	Lysinema pentapetalum	100	0.1		
	Verticordia grandis	50	0.1		
	Stylidium repens	20	0.1		
	Schoenus latitans	5	0.1		
	Drosera sp. (climbing)	5	0.1		
	Daviesia nudiflora subsp. nudiflora	40	0.1		
	Cassytha glabella forma casuarinae	50	0.1		
	Gompholobium tomentosum	66	0.1		
	Eremaea beaufortioides var. beaufortioides	70	0.1		
	Styphelia microdonta	20	0.1		
	Scholtzia laxiflora	50	0.1		
	Acacia lasiocarpa var. lasiocarpa	75	0.1		
	Melaleuca ?leuropoma	50	0.1		
	Calothamnus quadrifidus subsp. angustifolius	80	0.1		
	Conostylis crassinerva subsp. absens	5	0.1		
	Conostylis aculeata	5	0.1		
	Laxmannia sessiliflora subsp. drummondii	7	0.05		
	Alexgeorgea nitens	20	0.01		
	Isotropis cuneifolia subsp. cuneifolia	10	0.01		
	Schoenus pleiostemoneus	2	0.01		

Project: 62676 Fauna **Date:** 6/9/2022 **Recorder**: EB

Site: RT15 **Coordinates:** -29.56185, 115.155401 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sandy clay **Soil Notes:** Cream sand over peach sandy clay

Surface: 12% bare ground, % outcropping, 80% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby track

Vegetation Description: Acacia scirpifolia and isolated Eucalyptus todtiana tall open shrubland over Xanthorrhoea drummondii sparse mid shrubland over Melaleuca ?leuropoma and Scholtzia laxiflora and Jacksonia hakeoides low shrubland over Mesomelaena pseudostygia and Conostylis



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Acacia scirpifolia	200	35		
	Melaleuca ?leuropoma	50	8		
	Jacksonia hakeoides	40	6		
	Banksia shuttleworthiana	50	2		
	Hakea polyanthema	80	2		
	Xanthorrhoea drummondii	180	1		
	Eucalyptus todtiana	300	1		
	Scholtzia laxiflora	70	1		
	Stenanthemum notiale subsp. notiale	15	0.5		
	Conostylis candicans subsp. candicans	22	0.5		
	Mesomelaena pseudostygia	40	0.5		
	Hibbertia hypericoides	50	0.2		
	Drosera erythrorhiza	2	0.1		
	Gompholobium tomentosum	40	0.1		
	Cassytha glabella forma casuarinae	50	0.1		
	Laxmannia sessiliflora subsp. drummondii	5	0.1		
	Leucopogon inflexus	70	0.1		
	Conospermum boreale subsp. ascendens	50	0.1		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	30	0.1		
	Cyanothamnus ramosus subsp. anethifolius	26	0.1		
	Eremaea beaufortioides var. beaufortioides	55	0.1		
	Styphelia microdonta	30	0.1		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	20	0.1		
	Alexgeorgea nitens	5	0.1		
	Acacia dilatata	40	0.1		
	Leptospermum spinescens	50	0.1		
	Drosera ?menziesii	20	0.01		
	Burchardia congesta	20	0.01		
	Stylidium repens	7	0.01		
	Anigozanthos sp.	8	0.01		
	Neurachne alopecuroidea	5	0.01		
	Acacia stenoptera	40	0.01		
	Verticordia densiflora	50	0.01		

Project: 62676 Flora **Date:** 6/12/2022 **Recorder**: TJ

Site: RT16 **Coordinates:** -29.559581, 115.157664 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: clay,sand **Soil Notes:** White sand over grey clay

Surface: 50% bare ground, % outcropping, 15% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nil

Vegetation Description: Sparse mid shrubland of Xanthorrhoea drummondii over Jacksonia angulata and Calytrix depressa low shrubland with Ecdeicolea monostachya sedges.









TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Jacksonia angulata	35	9		
	Calytrix depressa	40	6		
	Ecdeiocolea monostachya	70	3		
	Xanthorrhoea drummondii	150	2		
	Hakea candolleana	25	1		
	Stylidium repens	5	0.5		
	Melaleuca ?leuropoma	40	0.3		
	Schoenus latitans	3	0.2		
	Alexgeorgea nitens	5	0.2		
	Hibbertia hypericoides	30	0.2		
	Conostylis ?aculeata	15	0.2		
	Leucopogon inflexus	60	0.2		
	Stenanthemum notiale subsp. notiale	20	0.1		
	Allocasuarina microstachya	20	0.1		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	18	0.1		
	Jacksonia hakeoides	25	0.1		
	Neurachne alopecuroidea	6	0.1		
	Calothamnus quadrifidus subsp. angustifolius	60	0.1		
	Hibbertia acerosa	15	0.1		
	Orchidaceae sp.	1	0.04		
	Cristonia stenophylla	10	0.01		

Project: 62676 Flora **Date:** 6/12/2022 **Recorder**: TJ

Site: RT17 **Coordinates:** -29.5626920, 115.148885 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: dune **Aspect:** W **Slope:** Very gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Deep yellow sand

Surface: 35% bare ground, % outcropping, 28% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby tracks

Vegetation Description: Banksia attenuata, Banksia hookeriana and Calothamnus glaber mid shrubland over Darwinia pauciflora open low shrubland over Ecdeicolea monostachya, Mesomelaena pseudostygia and Lepidobolus sp. sparse sedgeland.



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Banksia hookeriana	175	10		
	Calothamnus glaber	140	10		
	Darwinia pauciflora	90	3.5		
	Banksia attenuata	140	2		
	?Daviesia hakeoides subsp. subnuda	80	1.2		
	Conospermum boreale subsp. ascendens	70	1		
	Ecdeiocolea monostachya	70	0.8		
	Hakea polyanthema	90	0.6		
	Conostylis resinosa	18	0.5		
	Stenanthemum notiale subsp. notiale	20	0.5		
	Mesomelaena pseudostygia	30	0.2		
	Hibbertia hypericoides	50	0.2		
	Grevillea eriostachya	120	0.2		
	Petrophile macrostachya	100	0.2		
	Lepidobolus preissianus	30	0.1		
	Laxmannia sessiliflora subsp. drummondii	5	0.1		
	Schoenus clandestinus	3	0.1		
	Melaleuca ?leuropoma	60	0.1		
	Pileanthus filifolius	40	0.1		
	Leptospermum spinescens	30	0.1		
	Persoonia acicularis	20	0.1		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	20	0.1		
	Scaevola canescens	8	0.1		
	Lepidosperma pubisquameum	50	0.1		
	Styphelia hamulosa	50	0.1		
	Jacksonia hakeoides	20	0.1		
	Drosera erythrorhiza	2	0.05		
	Drosera sp. (climbing)	5	0.01		
	Conostylis candicans subsp. candicans	25	0.01		
	Neurachne alopecuroidea	4	0.01		

Project: 62676 Flora **Date:** 6/12/2022 **Recorder**: TJ

Site: RT18 **Coordinates:** -29.569512, 115.15246 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** White sand over cream sand

Surface: 20% bare ground, % outcropping, 30% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby track

Vegetation Description: Isolated Xylomelum angustifolium and Acacia scirpifolia over Hakea polyanthema and Scholtzia laxiflora low shrubland over Ecdeicolea monostachya and Mesomalaena pseudostygia sedges and Stenanthemum notiale subsp. notiale and Scaevola canescens forbland.



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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Ecdeiocolea monostachya	80	2.8		
	Hakea polyanthema	90	2		
	Scaevola canescens	12	2		
	Scholtzia laxiflora	70	1.2		
	Melaleuca ?leuropoma	60	1.2		
	Mesomelaena pseudostygia	50	1.2		
	Hibbertia hypericoides	60	1		
	Stylidium repens	10	1		
	Conospermum boreale subsp. ascendens	50	0.6		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	40	0.6		
	Stenanthemum notiale subsp. notiale	20	0.5		
	Caustis dioica	25	0.5		
	Drosera erythrorhiza	2	0.3		
	Verticordia densiflora var. densiflora	60	0.3		
	Daviesia nudiflora subsp. nudiflora	40	0.2		
	Lepidobolus preissianus	20	0.2		
	Jacksonia hakeoides	30	0.2		
	Acacia scirpifolia	200	0.1		
	Banksia shuttleworthiana	22	0.1		
	Acacia lasiocarpa var. lasiocarpa	30	0.1		
	Cassytha glabella forma casuarinae	40	0.1		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	15	0.1		
	Laxmannia sessiliflora subsp. drummondii	10	0.1		
	Verticordia grandis	80	0.1		
	Desmocladus semiplanus	35	0.1		
	Pileanthus filifolius	30	0.1		
	Styphelia xerophyllum	40	0.1		
	Styphelia microdonta	25	0.1		
	Calothamnus sanguineous	60	0.1		
	Schoenus latitans	2	0.1		
	Conostylis canteriata	15	0.01		
	Burchardia congesta	30	0.01		
	Neurachne alopecuroidea	3	0.01		
	Conostylis ?aculeata	15	0.01		
	Anigozanthos humilis subsp. humilis	10	0.01		
	Stylidium crossocephalum	7	0.01		1 plant
	Cristonia stenophylla	20	0.01		

Project: 62676 Flora **Date:** 6/12/2022 **Recorder**: TJ

Site: RT19 **Coordinates:** -29.5757971, 115.150515 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** Central facing N,E,S,W

Landform: plain **Aspect:** **Slope:** n/a

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** White sand over cream sand

Surface: 40% bare ground, % outcropping, 18% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby track

Vegetation Description: Isolated Xylomelum and Acacia scirpifolia over Banksia attenuata sparse mid shrubland over Hakea polyanthema, Conospermum boreale subsp. ascendens and Scholtzia laxiflora open low shrubland over Ecdeicolea monostachya and Mesomalaena pseudostygia and Scae



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TAXA

	Taxon	Height (m)	Cover (%)	Dead Cover (%)	Comment
	Ecdeiocolea monostachya	90	4		
	Banksia attenuata	150	3		
	Mesomelaena pseudostygia	50	2.8		
	Hakea polyanthema	100	2.6		
	Scholtzia laxiflora	80	1.5		
	Conospermum boreale subsp. ascendens	100	1.5		
	Scaevola canescens	7	1.5		
	Banksia shuttleworthiana	60	1.5		
	Conostylis resinosa	15	1		
	Melaleuca ?leuropoma	40	0.6		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	40	0.6		
	Hibbertia hypericoides	100	0.5		
	Lepidobolus preissianus	30	0.2		
	Jacksonia hakeoides	40	0.2		
	Pileanthus filifolius	40	0.2		
	?Daviesia hakeoides subsp. subnuda	60	0.2		
	Scaevola canescens	8	0.2		
	Acacia scirpifolia	200	0.1		
	Drosera erythrorhiza	2	0.1		
	Stylidium repens	7	0.1		
	Acacia lasiocarpa var. lasiocarpa	30	0.1		
	Stenanthemum notiale subsp. notiale	20	0.1		
	Daviesia nudiflora subsp. nudiflora	40	0.1		
	Cassytha glabella forma casuarinae	40	0.1		
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)	20	0.1		
	Laxmannia sessiliflora subsp. drummondii	10	0.1		
	Styphelia xerophyllum	40	0.1		
	Schoenus clandestinus	5	0.1		
	Petrophile macrostachya	80	0.1		
	Eremaea beaufortioides var. beaufortioides	40	0.1		
	Allocasuarina humilis	60	0.1		
	Leptospermum spinescens	70	0.1		
	Gompholobium tomentosum	50	0.1		
	Daviesia triflora	40	0.1		
	Daviesia triflora	35	0.1		
	Petrophile ?brevifolia	50	0.04		
	Burchardia congesta	30	0.01		

Project: 62676 Flora **Date:** 6/12/2022 **Recorder**: TJ

Site: RT20 **Coordinates:** -29.561433, 115.160317 **Datum:** WGS84 MGA Zone 50 **Site Type:** Releve

Site Size: 10 m diameter **Site Marker:** No marker (temporary site) **Photo Location:** n/a

---

Landform: plain **Aspect:** NE **Slope:** Very gentle

Outcropping: no **Rock Type:** Nil

Soil Type: sand **Soil Notes:** Cream sand over yellow sand

Surface: 28% bare ground, % outcropping, 22% litter **Years Since Fire:** 5-10 yrs

Large Trees Present (>500 mm DBH): no

Condition: Pristine **Disturbance Notes:** Nearby tracks

Vegetation Description: Banksia attenuata open mid shrubland over Banksia candolleana, Stirlingia latifolia, Jacksonia floribunda and Conostephium sp. open low shrubland, over Mesomalaena pseudostygia sedges.

No Photos.

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TAXA

Taxon		Height (m)	Cover (%)	Dead Cover (%)	Comment
	Banksia attenuata	140	4		
	Jacksonia floribunda	70	2.5		
	Styphelia xerophyllum	60	2.2		
	Mesomelaena pseudostygia	45	1		
	Banksia candolleana	70	1		
	Verticordia grandis	130	0.6		
	Leptospermum erubescens	90	0.6		
	Scholtzia laxiflora	100	0.3		
	Leucopogon sp. Northern ciliate (R. Davis 3393)	45	0.3		
	Stirlingia latifolia	50	0.2		
	Eremaea beaufortioides var. beaufortioides	70	0.1		
	Cassytha glabella forma casuarinae	40	0.1		
	?Daviesia hakeoides subsp. subnuda	40	0.1		
	Petrophile macrostachya	90	0.1		
	Melaleuca ?leuropoma	50	0.1		
	Pileanthus filifolius	40	0.1		
	Hibbertia hypericoides	40	0.1		
	Alexgeorgea nitens	7	0.1		
	Conostylis canteriata	18	0.1		
	Andersonia heterophylla	35	0.1		
	Hibbertia crassifolia	30	0.01		
	Stylidium ?diuroides	10	0.01		

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Appendix F – Well Site Photographic Records

Well Site 01			-29.5393171, 115.1325475
			
Looking North	Looking East	Looking South	Looking West
Well Site 02			**-29.4217291, 115.1391219**
			
Looking North	Looking East	Looking South	Looking West

Well Site 03			-29.4243793, 115.1410298
			
Looking North	Looking East	Looking South	Looking West
Well Site 04			**-29.4622627, 115.121494**
			
Looking North	Looking East	Looking South	Looking West

Well Site 05			-29.4573174, 115.164282
			
Looking North	Looking East	Looking South	Looking West
Well Site 06			**-29.4683977, 115.1662517**
			
Looking North	Looking East	Looking South	Looking West

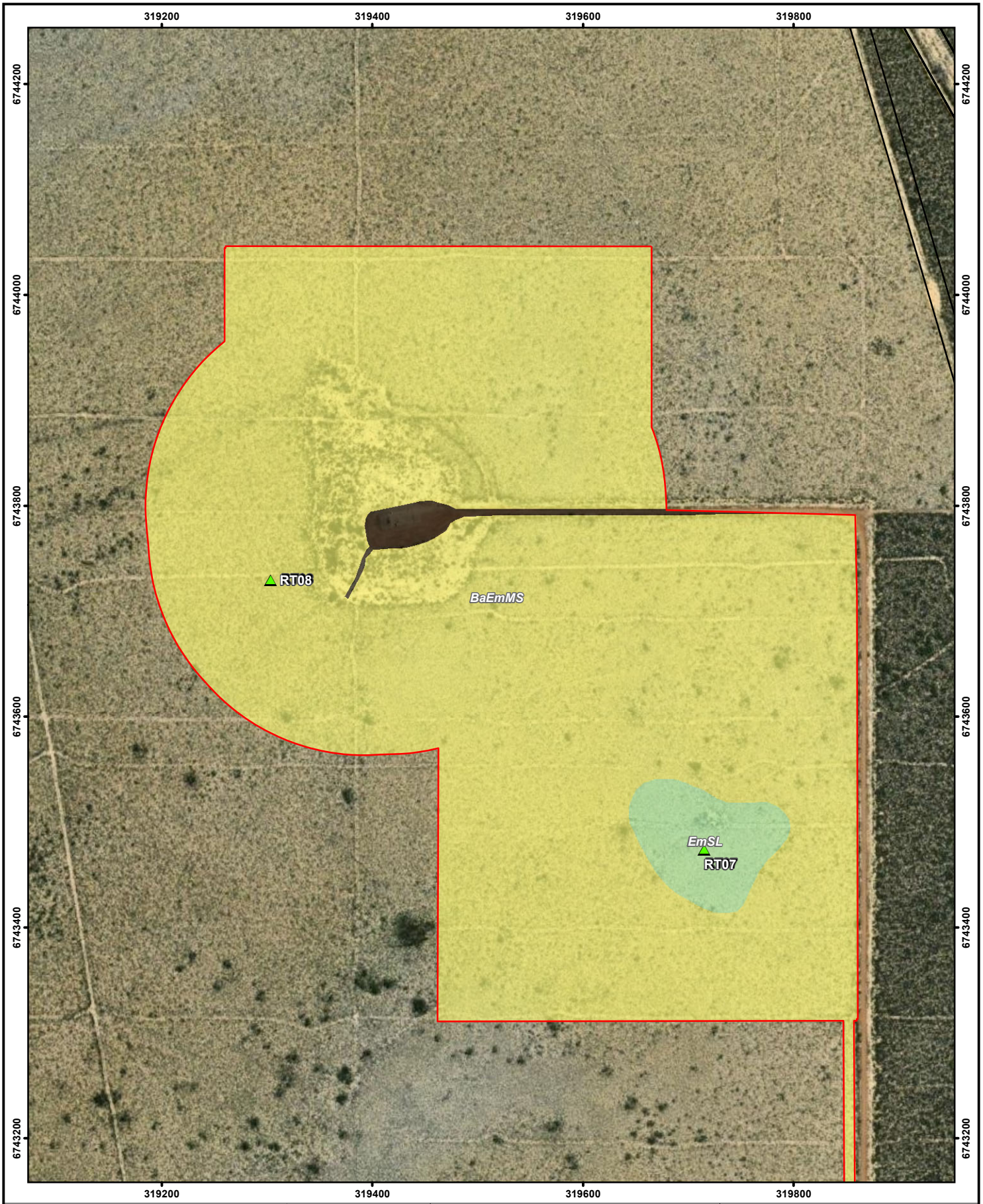
Well Site 07			-29.4581864, 115.1622692
			
Looking North	Looking East	Looking South	Looking West
Well Site 08			**-29.5597684, 115.1596046**
			
Looking North	Looking East	Looking South	Looking West

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Well Site 09 (Tarantula)			-29.42235857, 115.1385487
			
Looking North	Looking East	Looking South	Looking West
Well Site 10			**-29.4778633, 115.1449783**
			
Looking North	Looking East	Looking South	Looking West

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Appendix G – Vegetation and Habitat Mapping



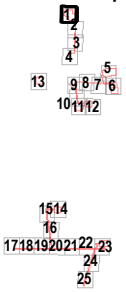
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- EmSL
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

VEGETATION TYPES TARANTULA 1 AND TARANTULA DEEP 1

Appendix G **Page 1 of 25**

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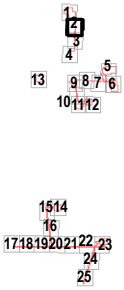
- Survey area
- Cadastral boundary

Vegetation type
- BaEmMS

- Flora releve

Conservation significant flora
- *Stawellia dimorphantha* (P4)

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

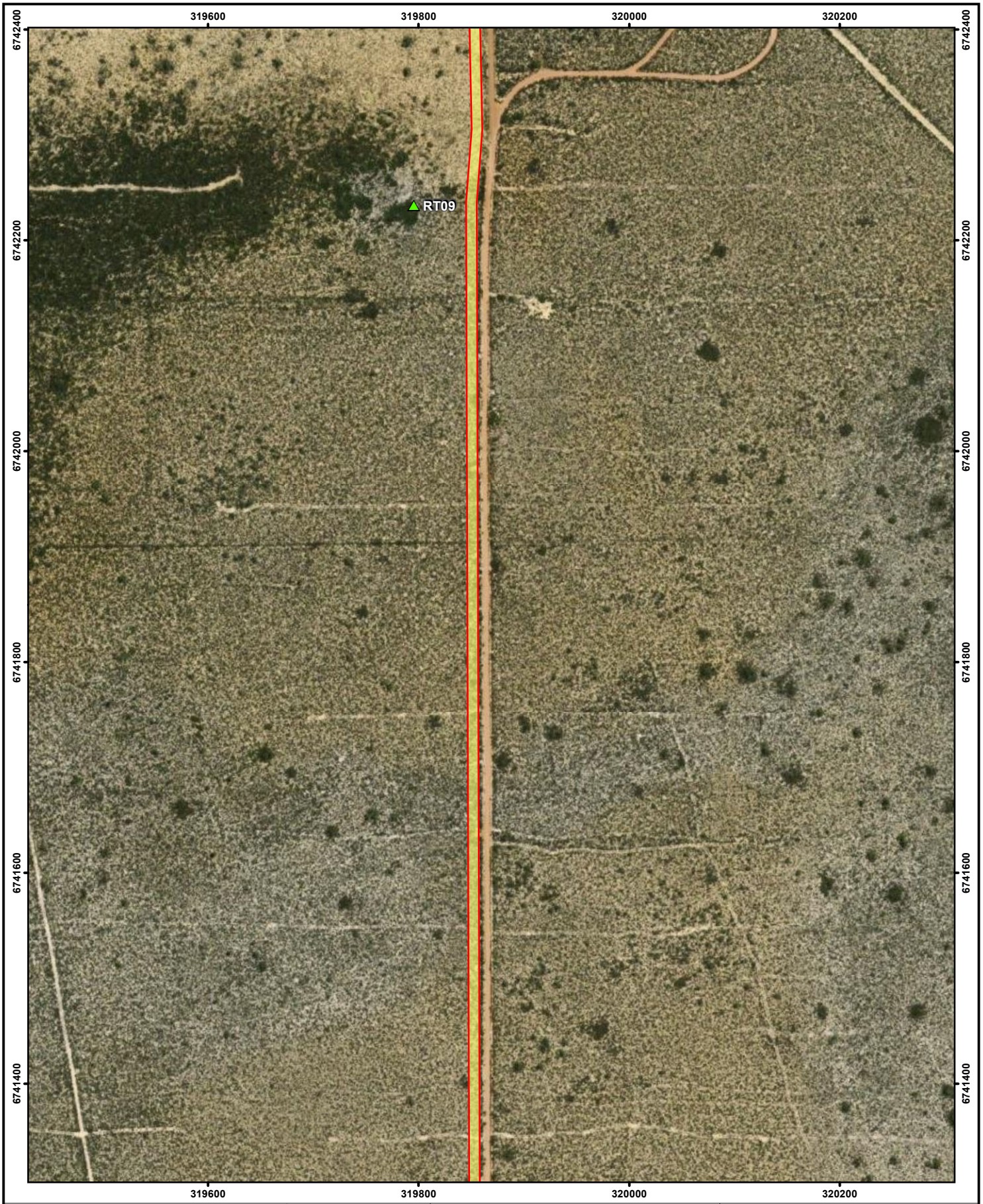
Perth Basin Ecological Studies

VEGETATION TYPES
TARANTULA 1 AND TARANTULA DEEP 1

Appendix G **Page 2 of 25**

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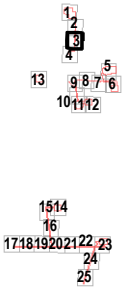
Legend

- Survey area
- Cadastral boundary

Vegetation type
- BaEmMS

- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

VEGETATION TYPES
TARANTULA 1 AND TARANTULA DEEP 1

Appendix G **Page 3 of 25**

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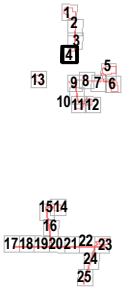
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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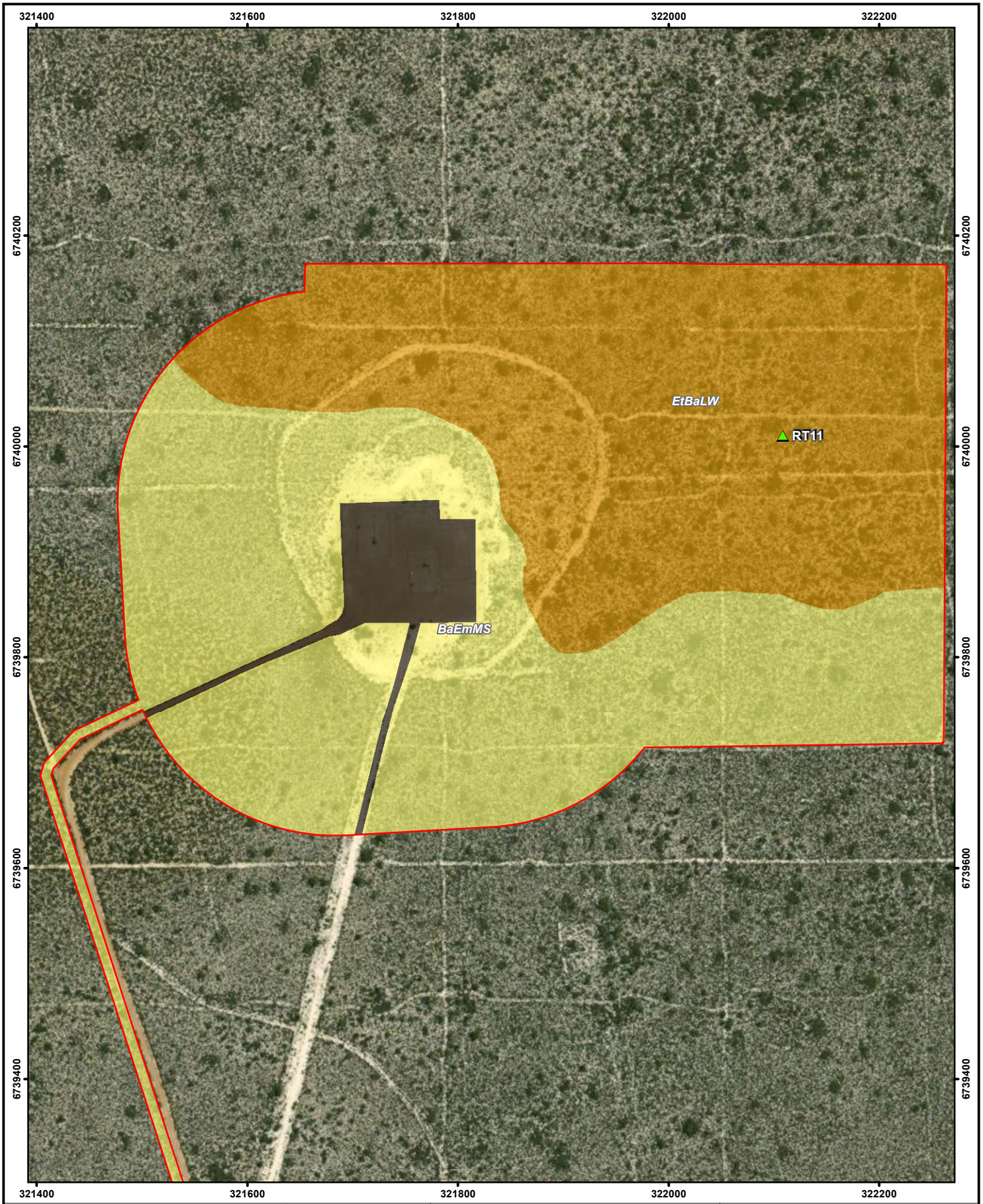
Perth Basin Ecological Studies

VEGETATION TYPES
TARANTULA 1 AND TARANTULA DEEP 1

Appendix G **Page 4 of 25**

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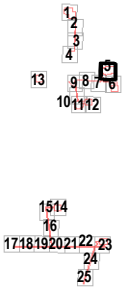
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- EtBaLW
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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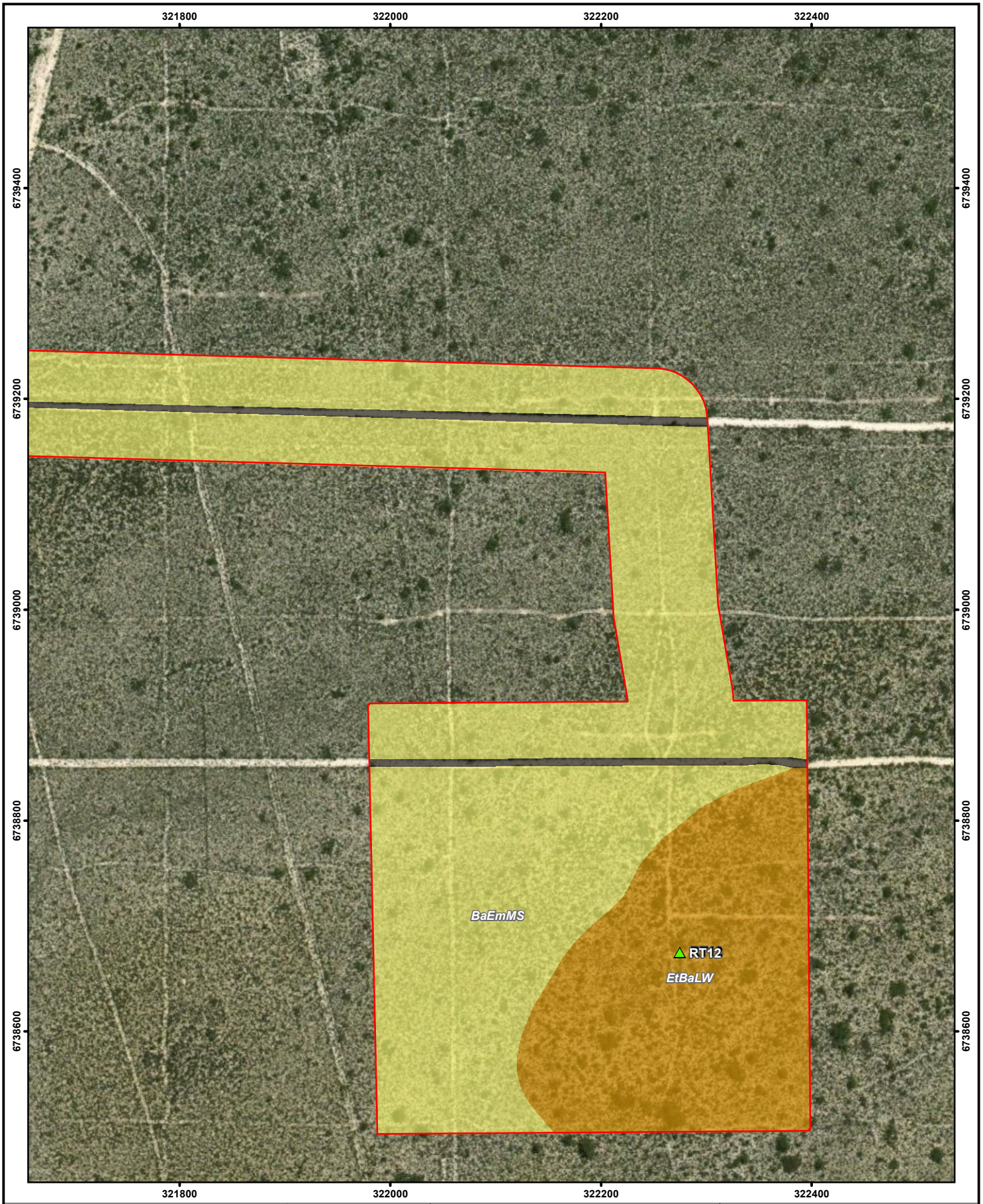
Perth Basin Ecological Studies

VEGETATION TYPES
REDBACK 1 AND REDBACK DEEP 1

Appendix G **Page 5 of 25**

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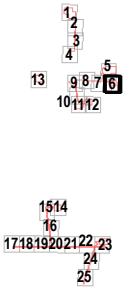
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- EtBaLW
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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VEGETATION TYPES
REDBACK DEEP SOUTH 1

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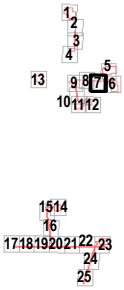
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

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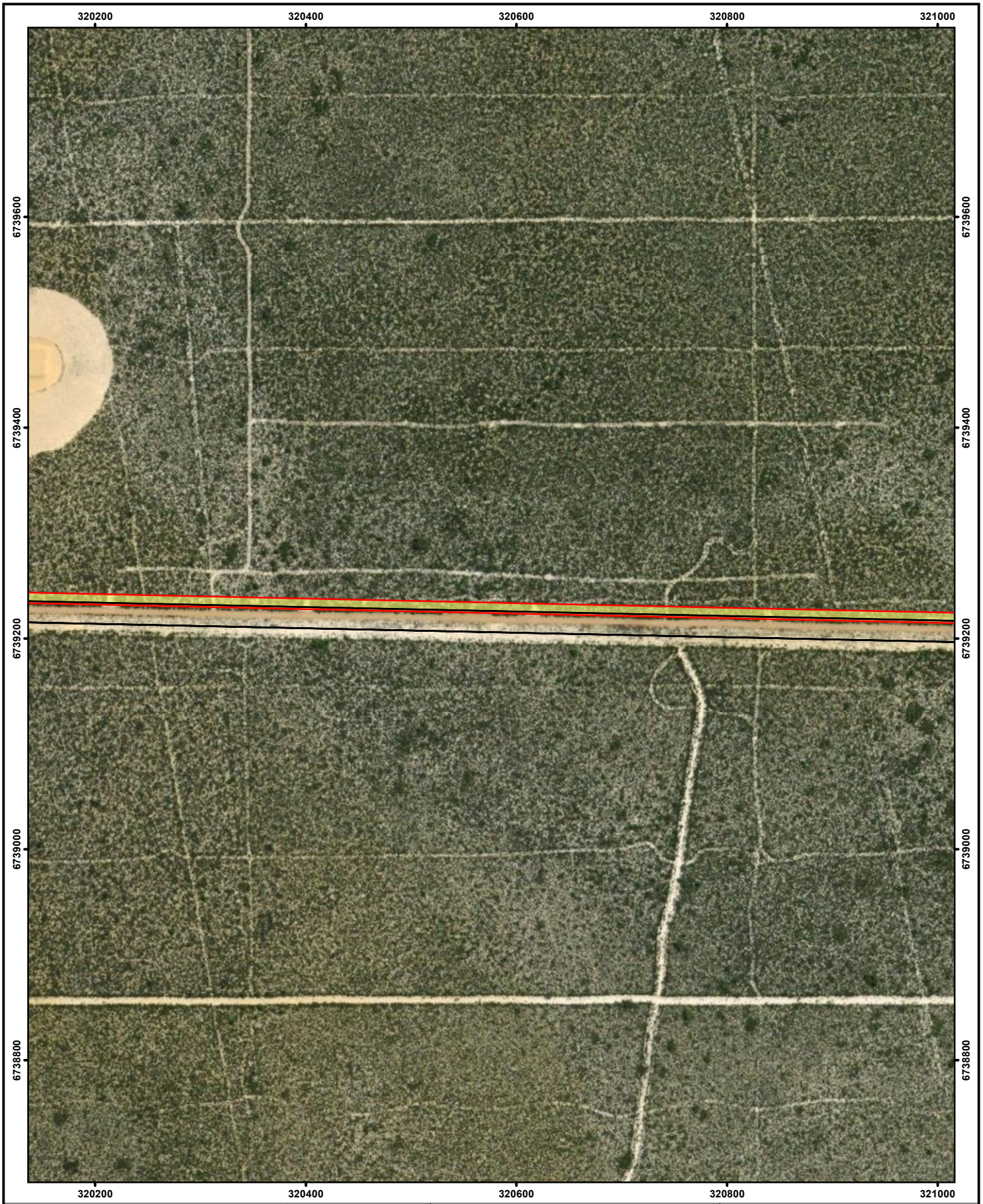
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VEGETATION TYPES
REDBACK DEEP SOUTH 1

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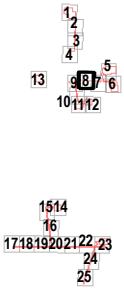
- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS

- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

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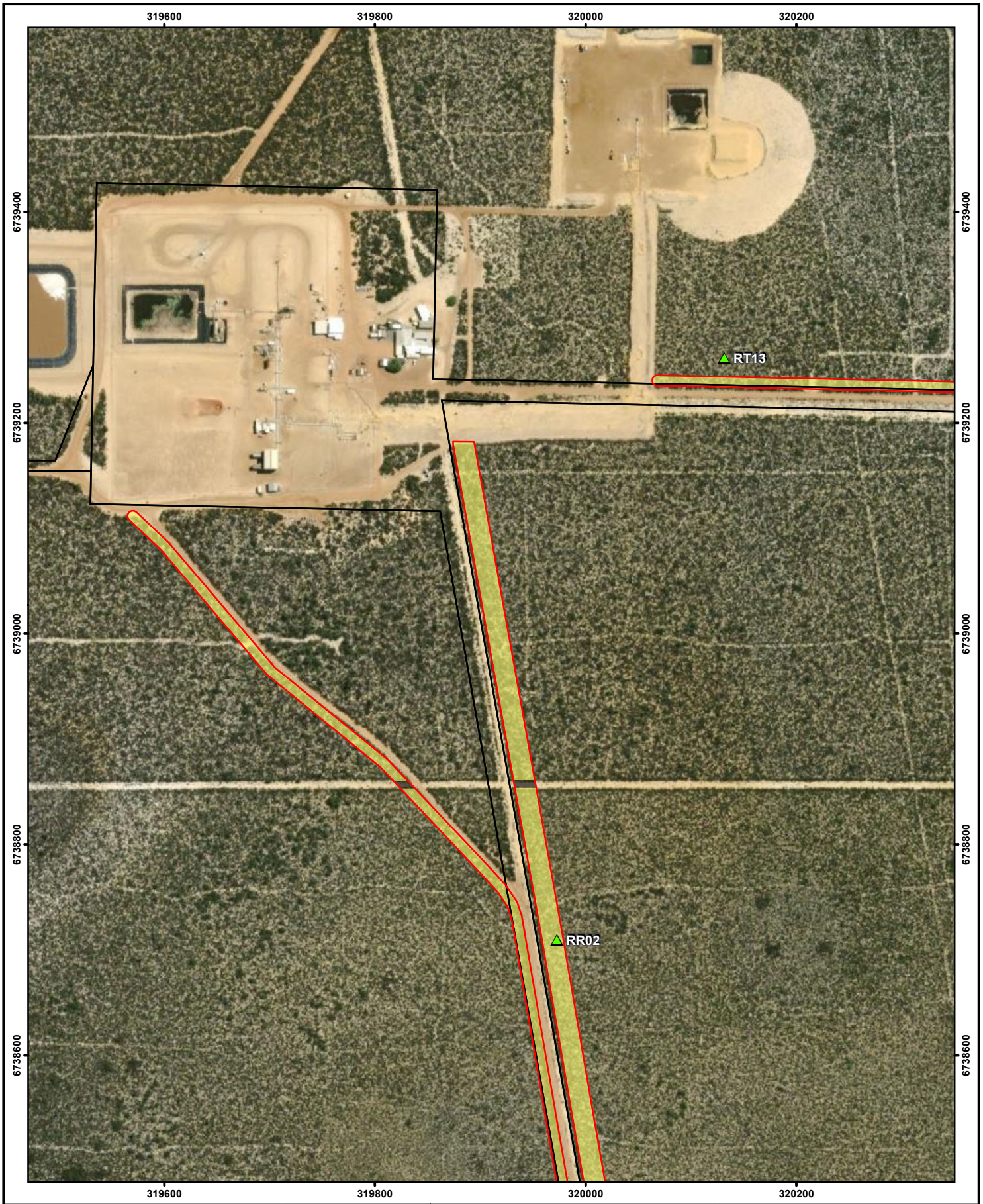
Perth Basin Ecological Studies

VEGETATION TYPES
REDBACK DEEP SOUTH 1

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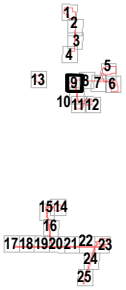
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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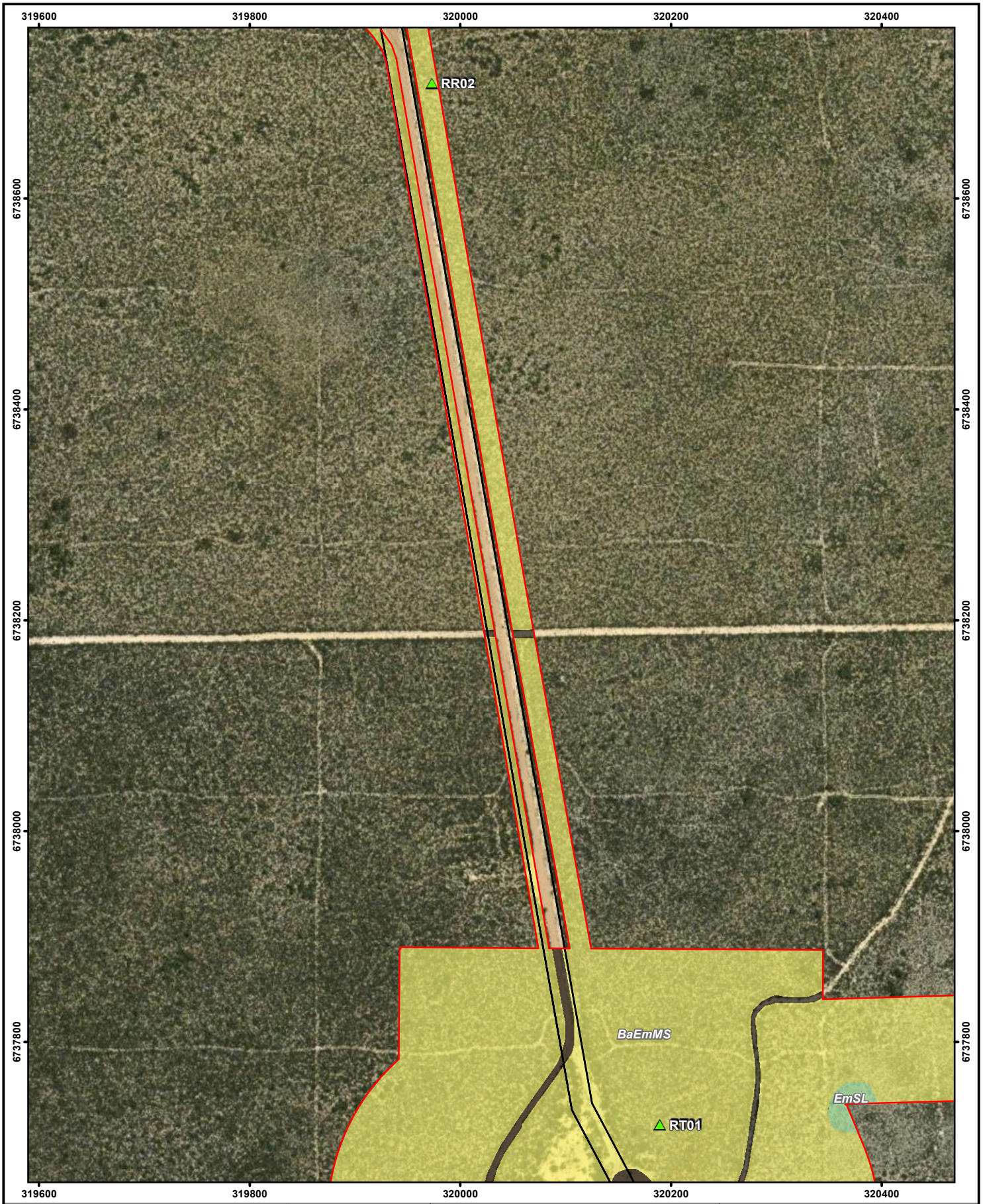
Perth Basin Ecological Studies

VEGETATION TYPES ACCESS TRACKS - REDBACK AND BEHARRA SPRINGS 2

Appendix G **Page 9 of 25**

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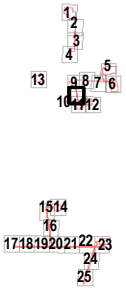
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- EmSL
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION TYPES
BEHARRA SPRINGS 2

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Image Reference: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- EmSL
- Cleared / Not vegetated
- Flora releve

Indicator Map

Scale 1:4,750 at A4

0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

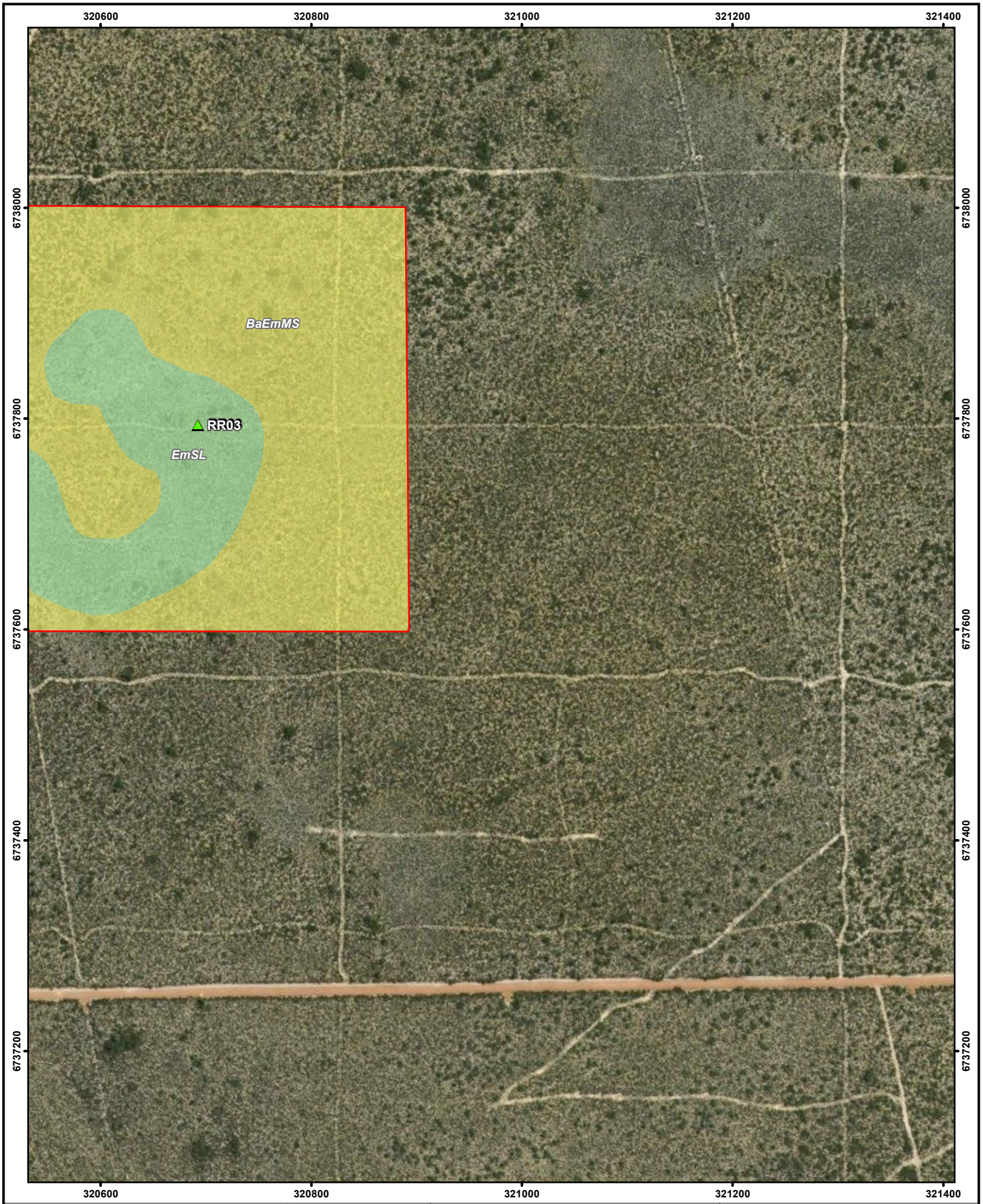
Perth Basin Ecological Studies

VEGETATION TYPES
BEHARRA SPRINGS 2

Appendix G **Page 11 of 25**

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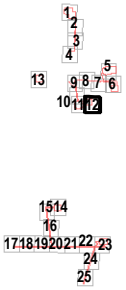
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- EmSL
- Flora releve

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

VEGETATION TYPES
BEHARRA SPRINGS DEEP 2

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strategen JBS&G

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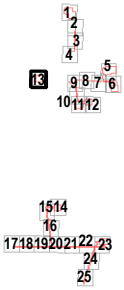
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BmBaLW
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

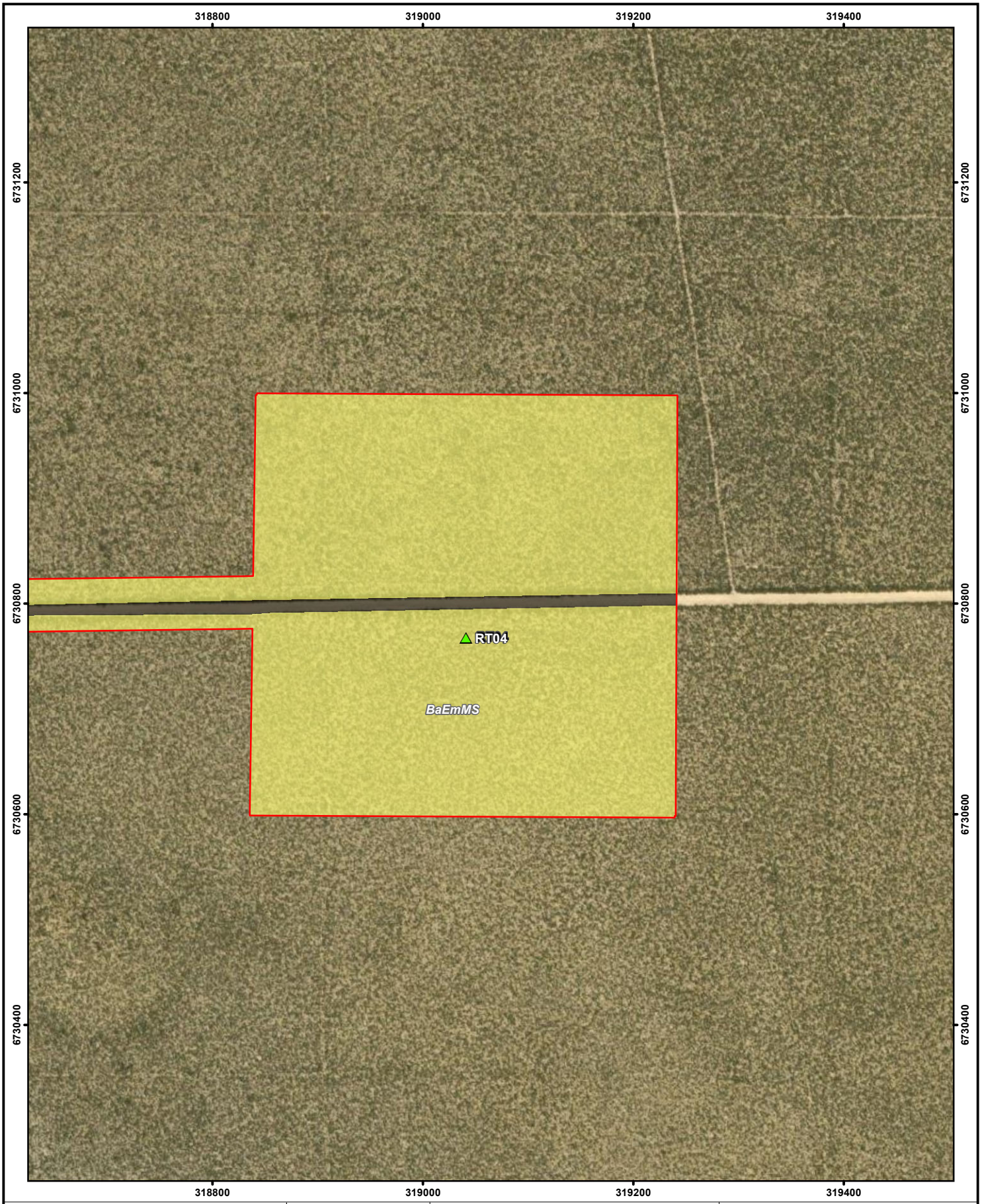
Perth Basin Ecological Studies

VEGETATION TYPES
BEHARRA SPRINGS DEEP 3

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strategen JBS&G

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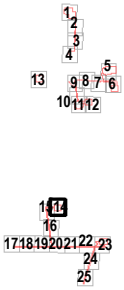
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

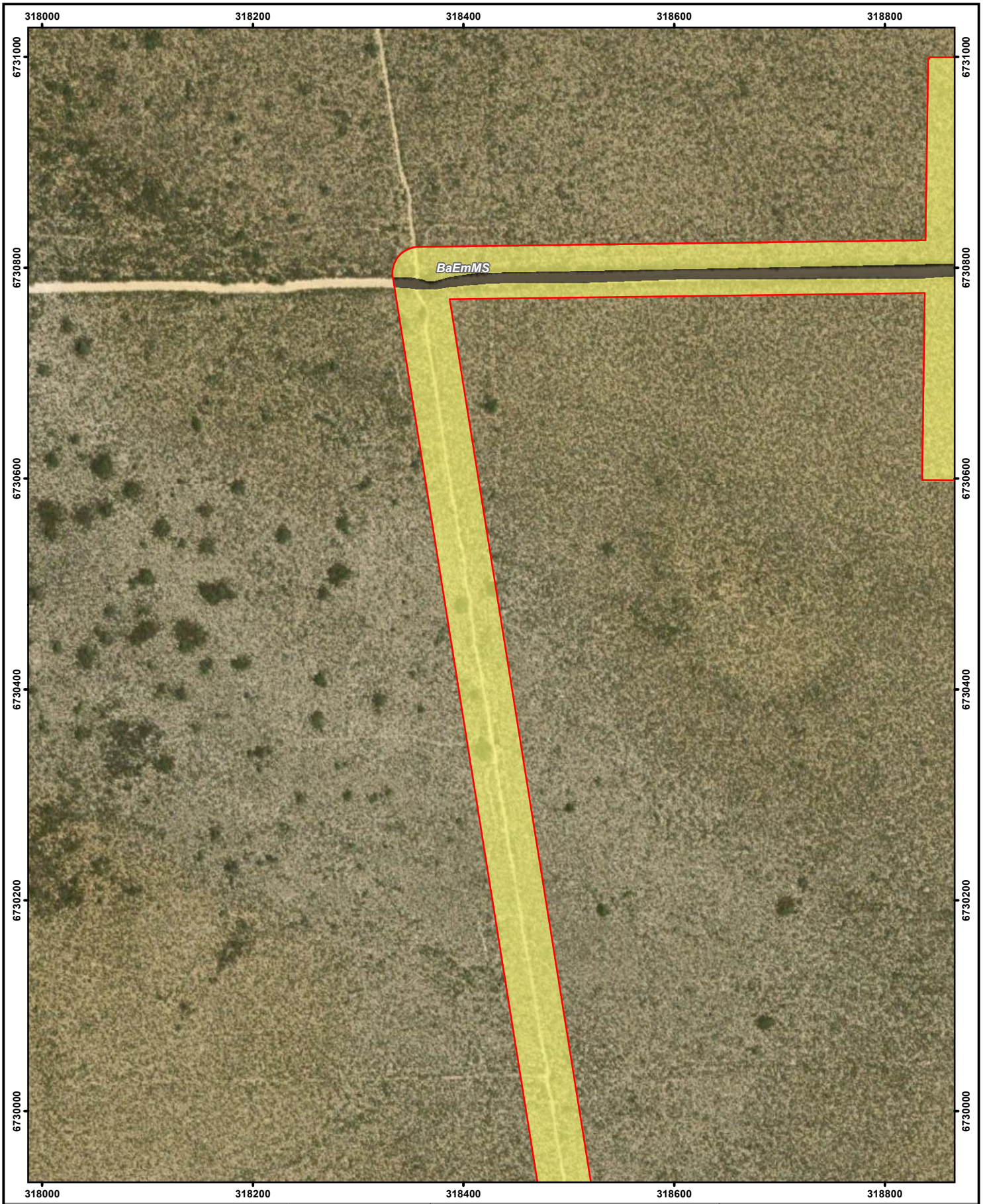
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VEGETATION TYPES FLOREAT 2

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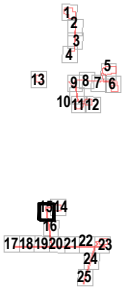
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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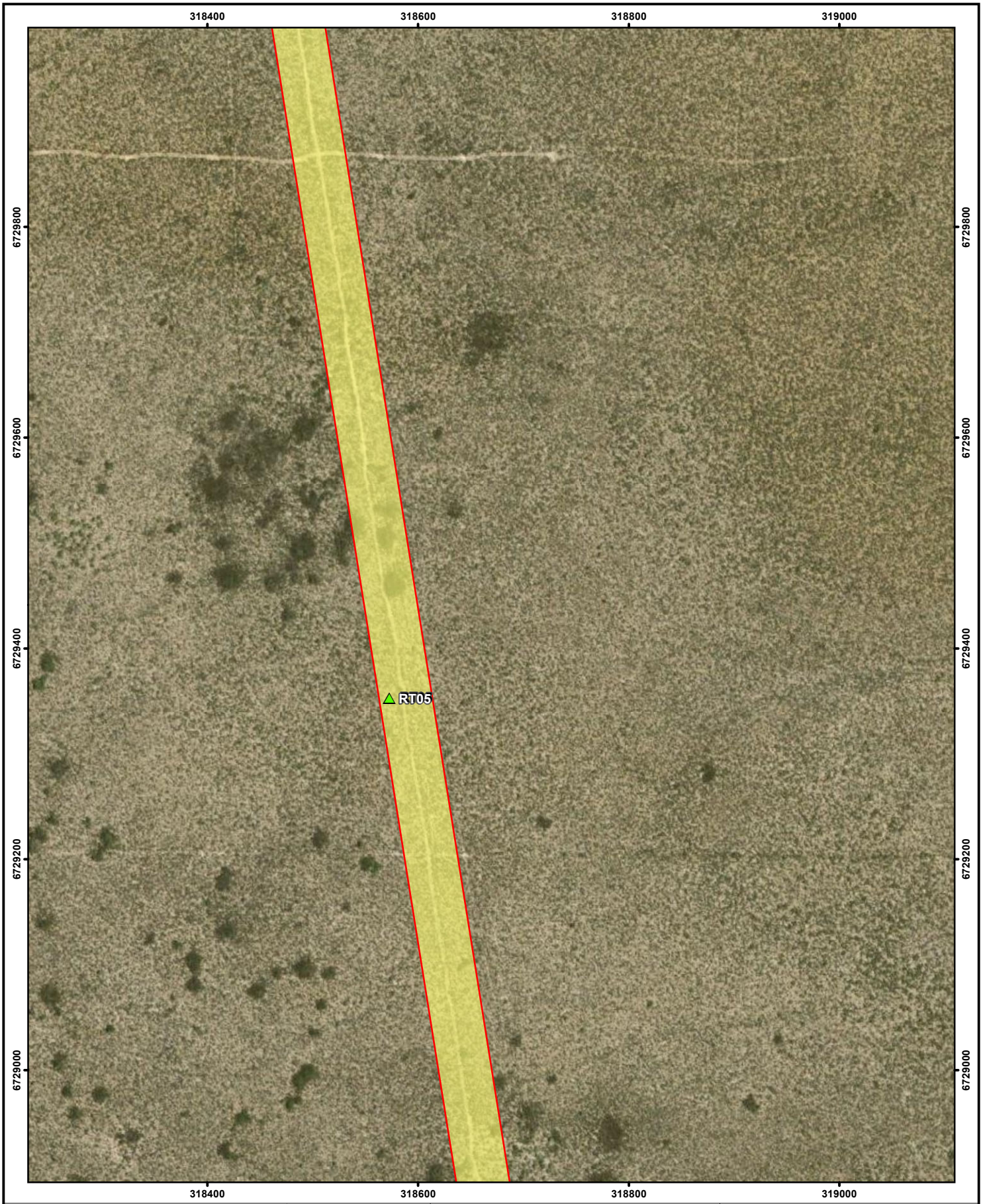
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VEGETATION TYPES FLOREAT 2

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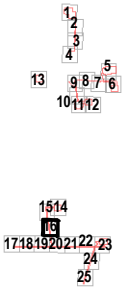
Legend

- Survey area
- Cadastral boundary

Vegetation type
- BaEmMS

- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

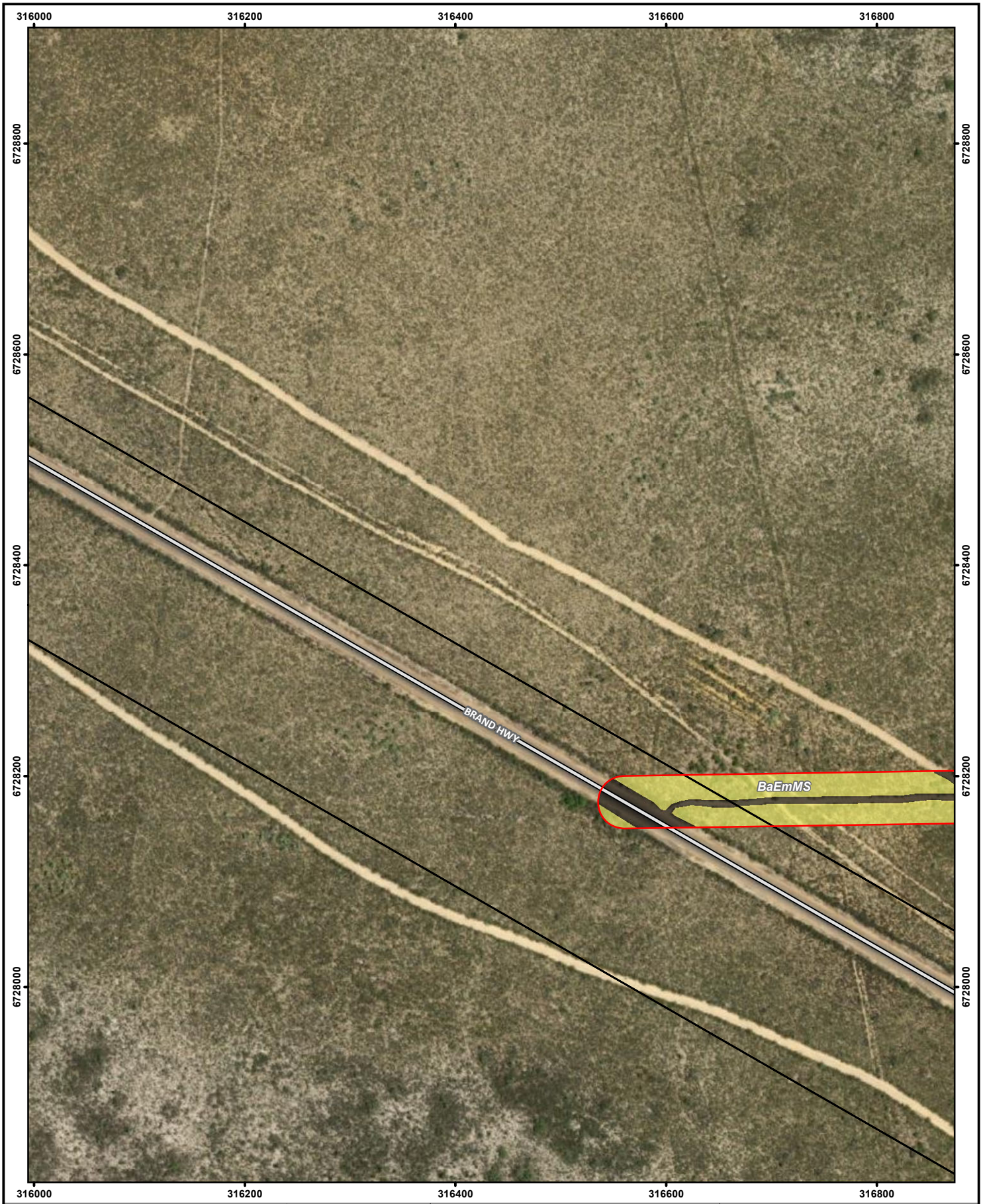
Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 2

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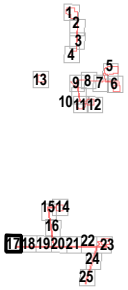
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated
- Highways

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

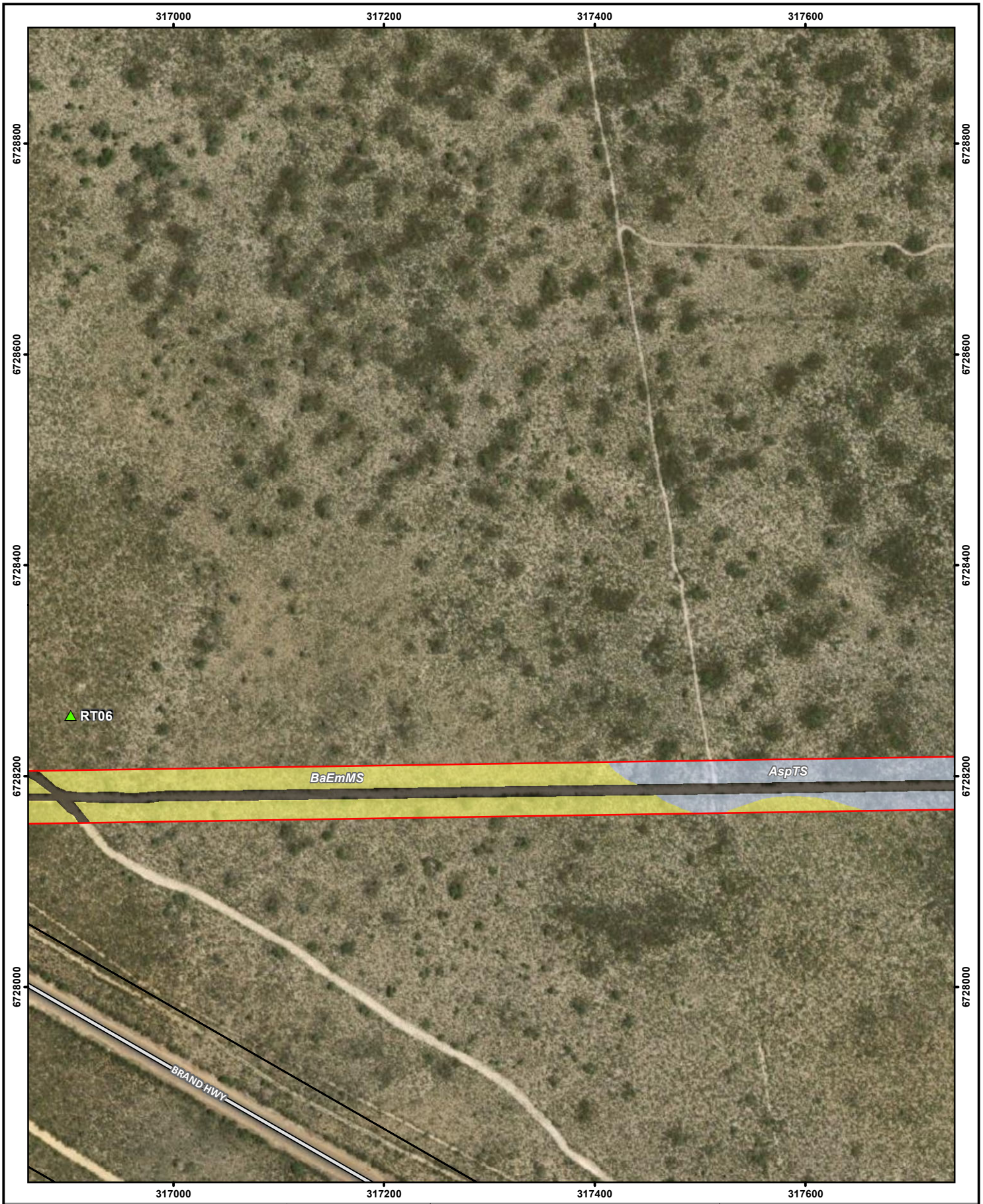
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VEGETATION TYPES FLOREAT 2

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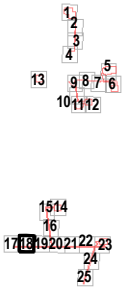
Legend

- Survey area
- Cadastral boundary

Vegetation type

- AspTS
- BaEmMS
- Cleared / Not vegetated
- Highways
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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VEGETATION TYPES FLOREAT 2

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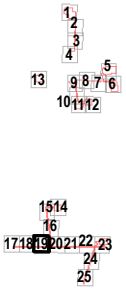
Legend

- Survey area
- Cadastral boundary

Vegetation type

- AspTS
- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 2

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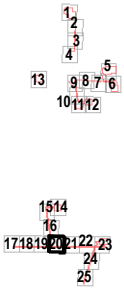
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 2

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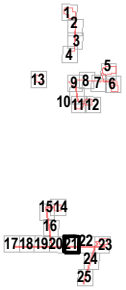
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

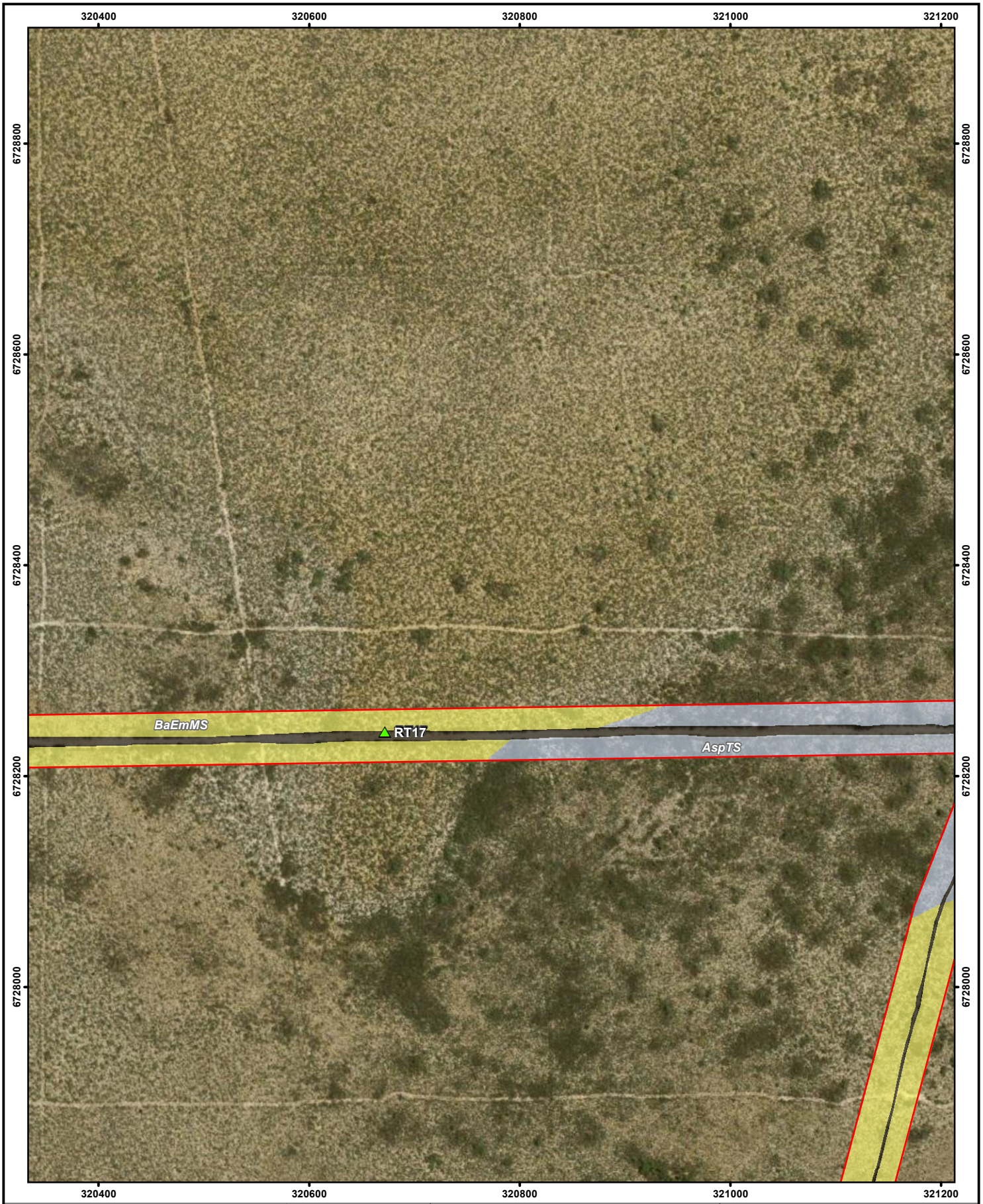
Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 2

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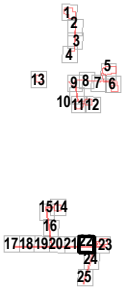
Legend

- Survey area
- Cadastral boundary

Vegetation type

- AspTS
- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

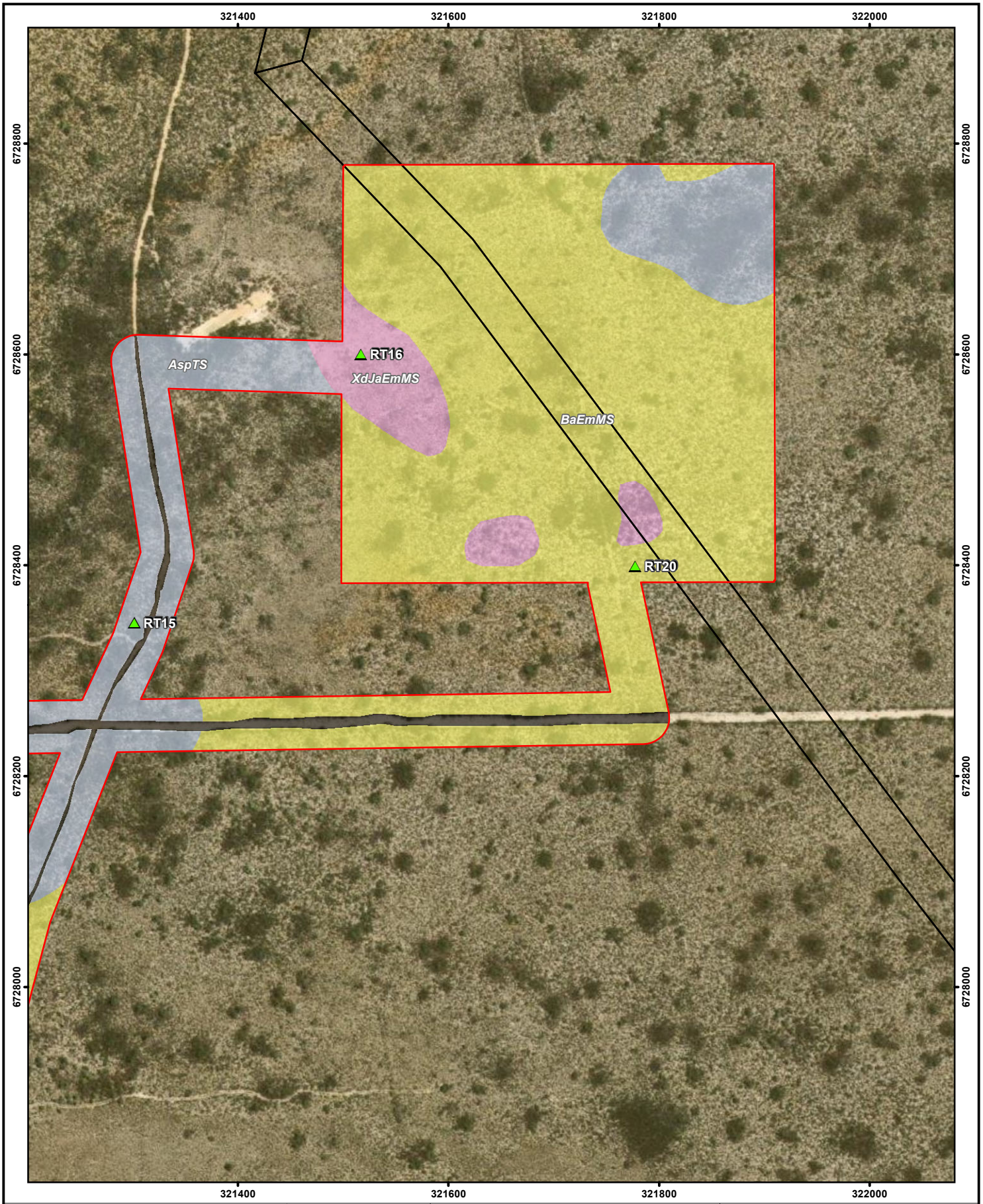
Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 2

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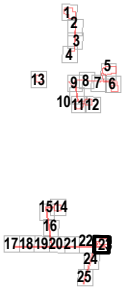
Legend

- Survey area
- Cadastral boundary

Vegetation type

- AspTS
- BaEmMS
- XdJaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 1

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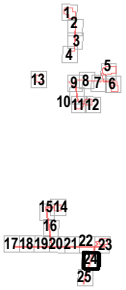
Legend

- Survey area
- Cadastral boundary

Vegetation type

- AspTS
- BaEmMS
- Cleared / Not vegetated
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100

metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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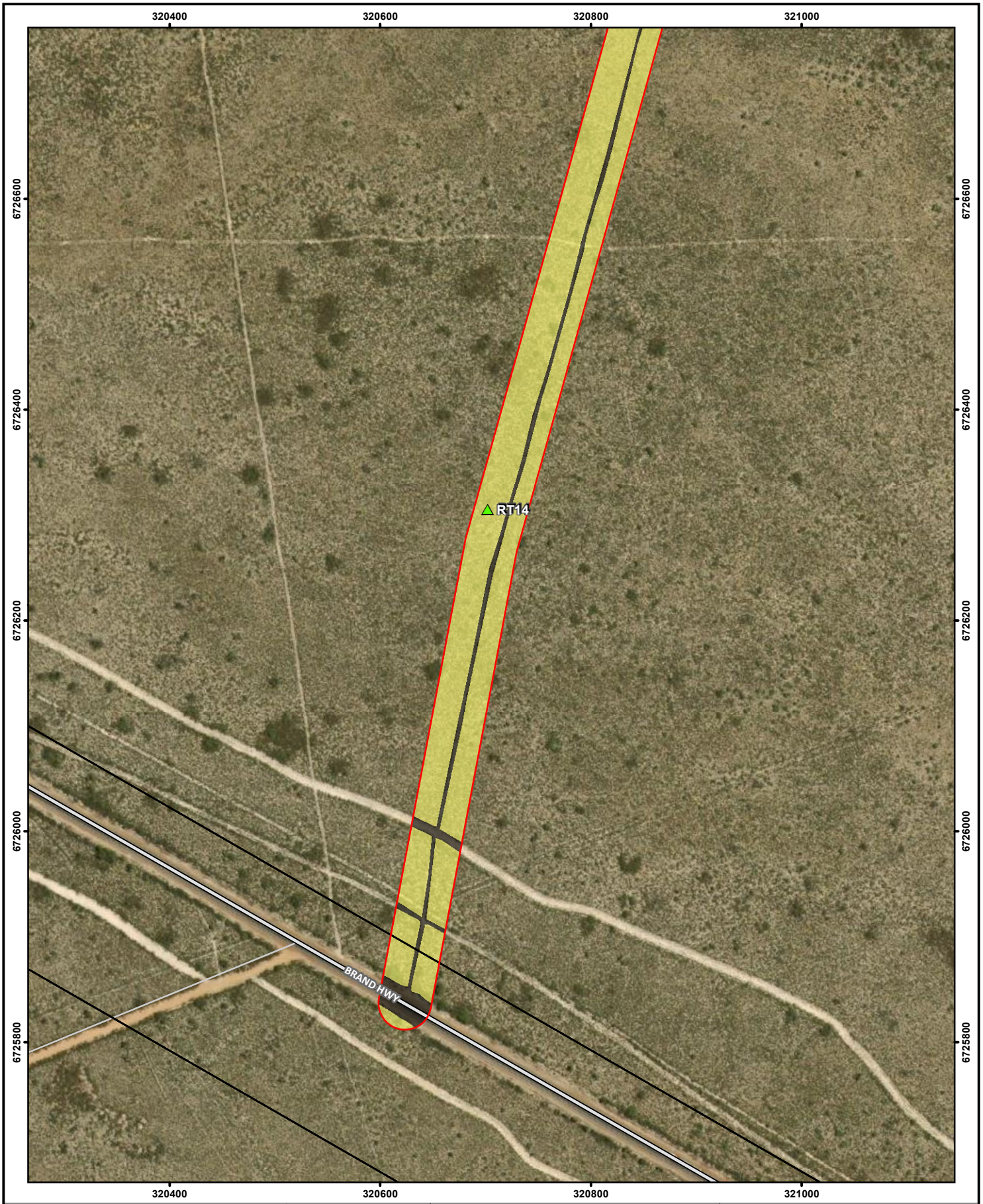
Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 1

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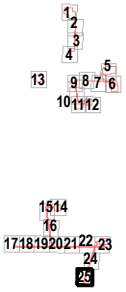
Legend

- Survey area
- Cadastral boundary

Vegetation type

- BaEmMS
- Cleared / Not vegetated
- Highways
- Minor road
- Flora releve

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION TYPES FLOREAT 1

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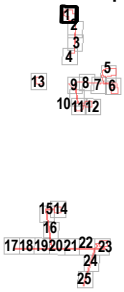
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION CONDITION
TARANTULA 1 AND TARANTULA DEEP 1

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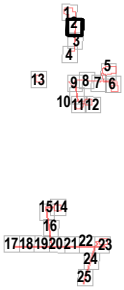
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

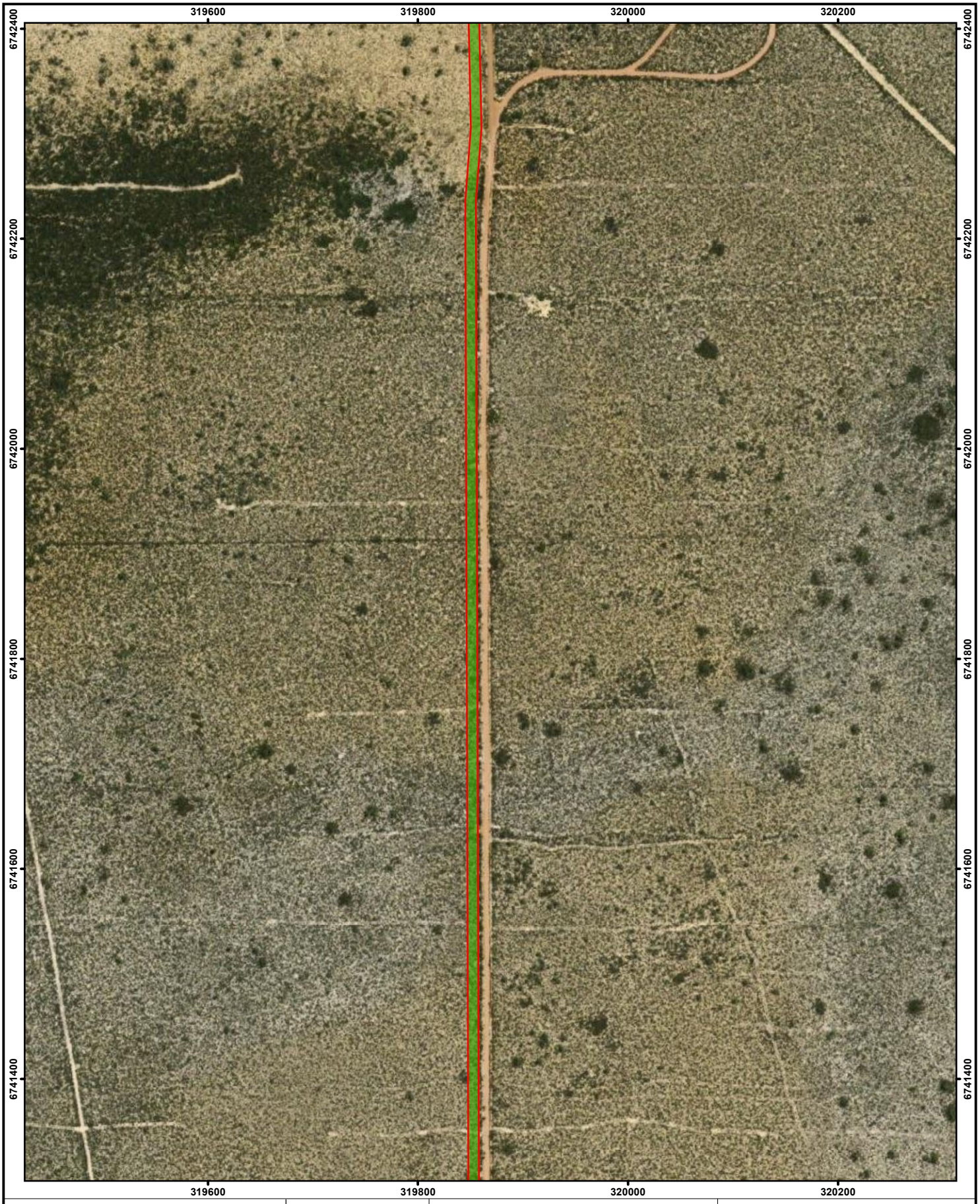
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VEGETATION CONDITION
TARANTULA 1 AND TARANTULA DEEP 1

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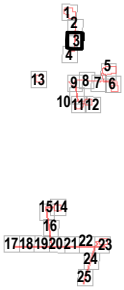
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION CONDITION
TARANTULA 1 AND TARANTULA DEEP 1

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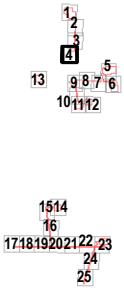
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

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Perth Basin Ecological Studies

VEGETATION CONDITION TARANTULA 1 AND TARANTULA DEEP 1

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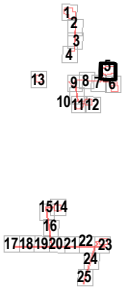
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Degraded
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

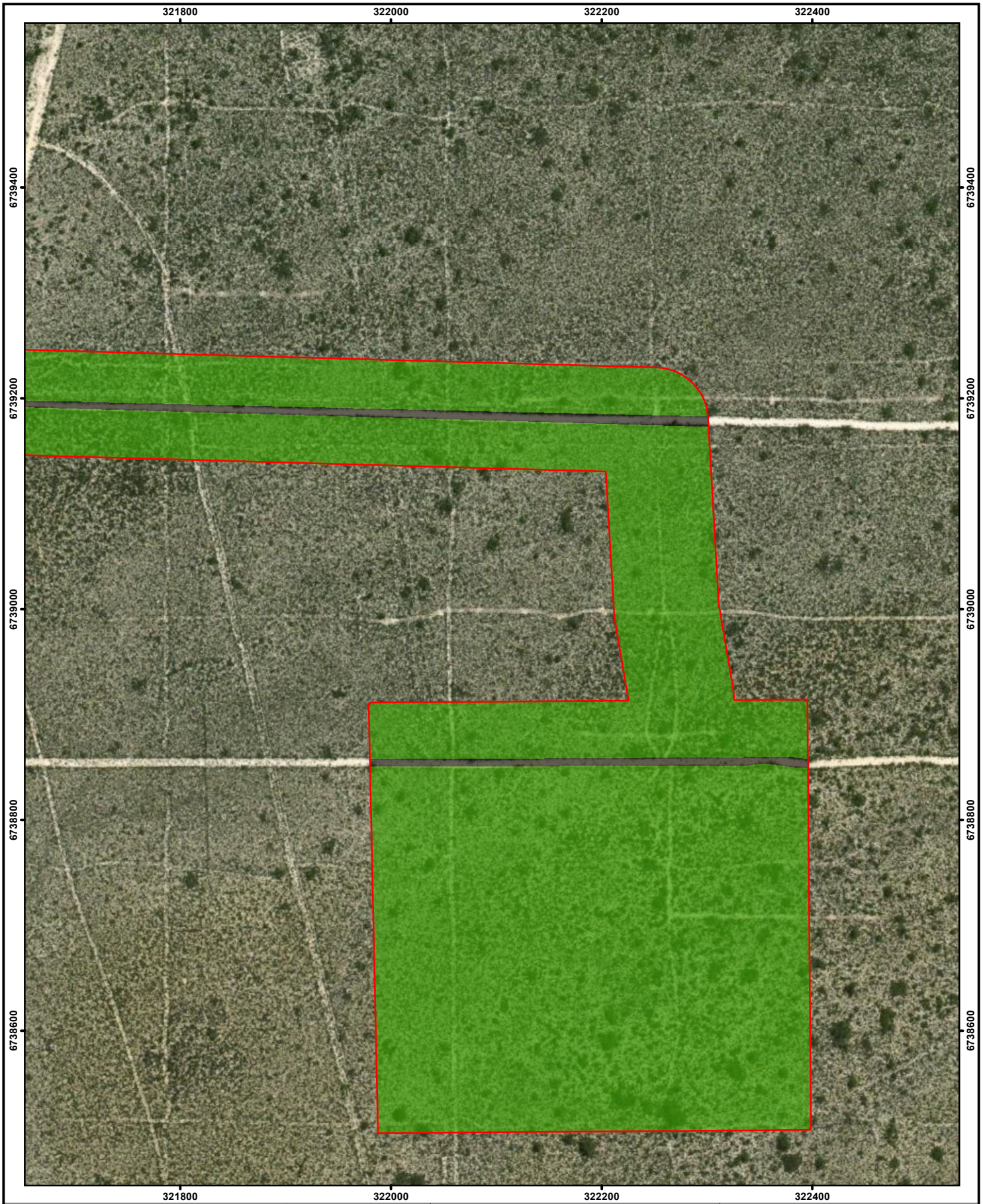
Perth Basin Ecological Studies

VEGETATION CONDITION
REDBACK 1 AND REDBACK DEEP 1

Appendix G **Page 5 of 25**

strategen JBS&G

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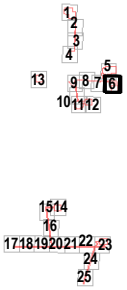
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

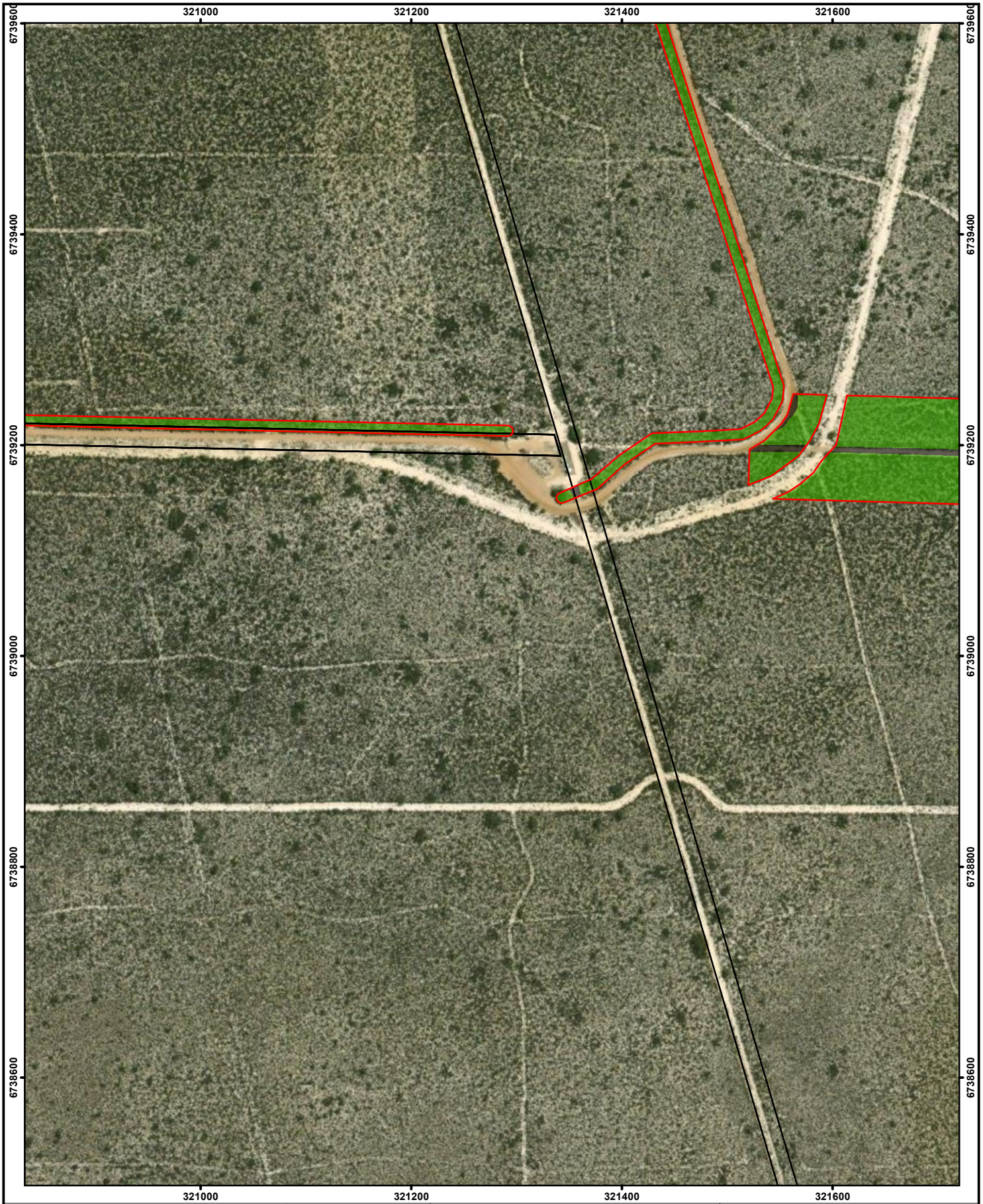
Perth Basin Ecological Studies

VEGETATION CONDITION REDBACK DEEP SOUTH 1

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strategen JBS&G

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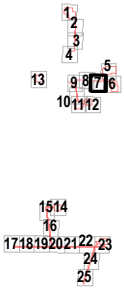
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

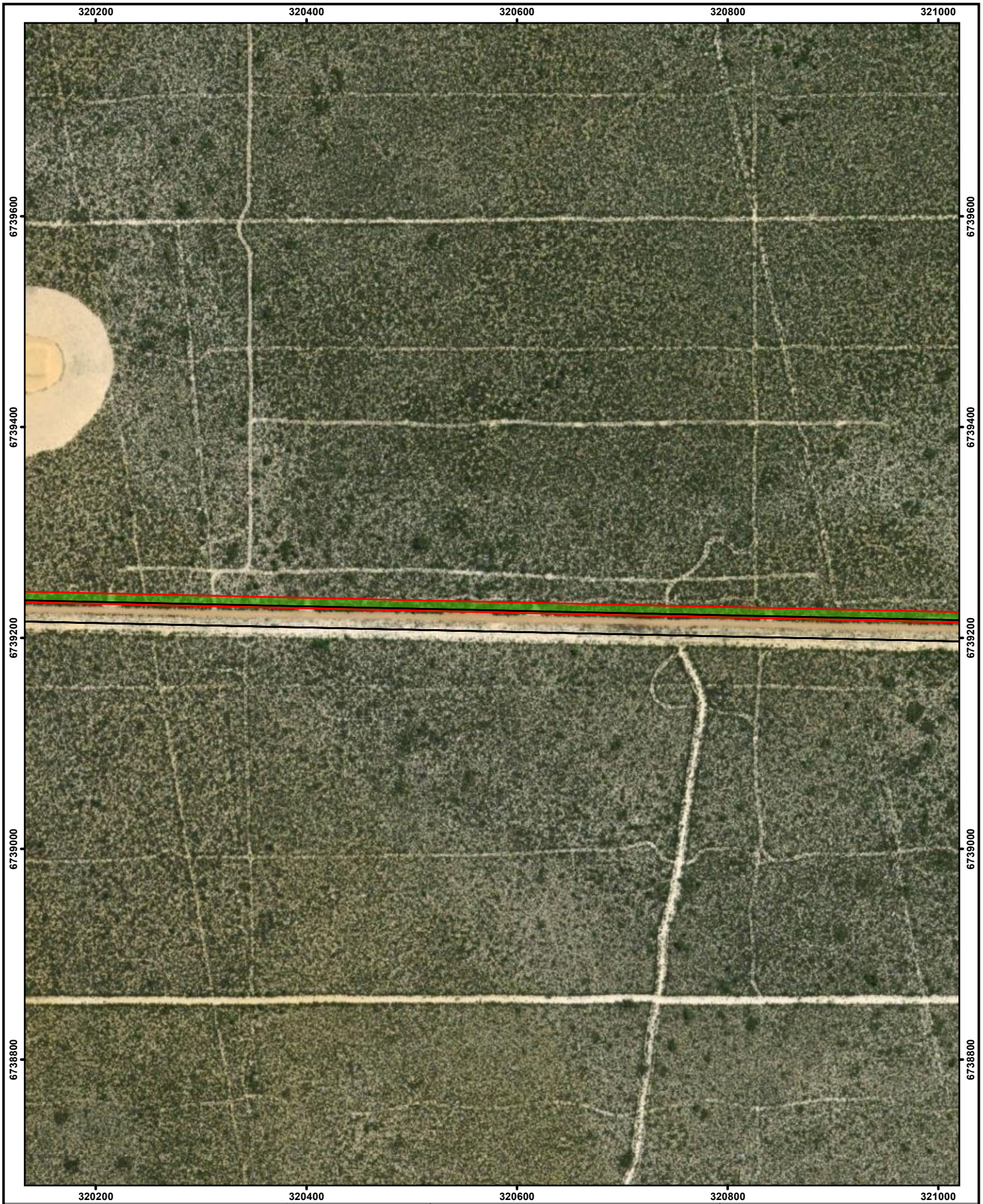
Perth Basin Ecological Studies

VEGETATION CONDITION REDBACK DEEP SOUTH 1

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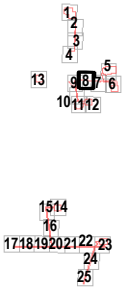
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

VEGETATION CONDITION REDBACK DEEP SOUTH 1

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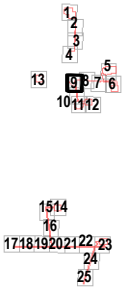
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

VEGETATION CONDITION ACCESS TRACKS - REDBACK AND BEHARRA SPRINGS 2

Appendix G

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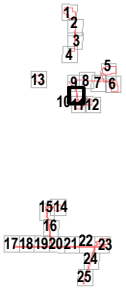
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Degraded
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

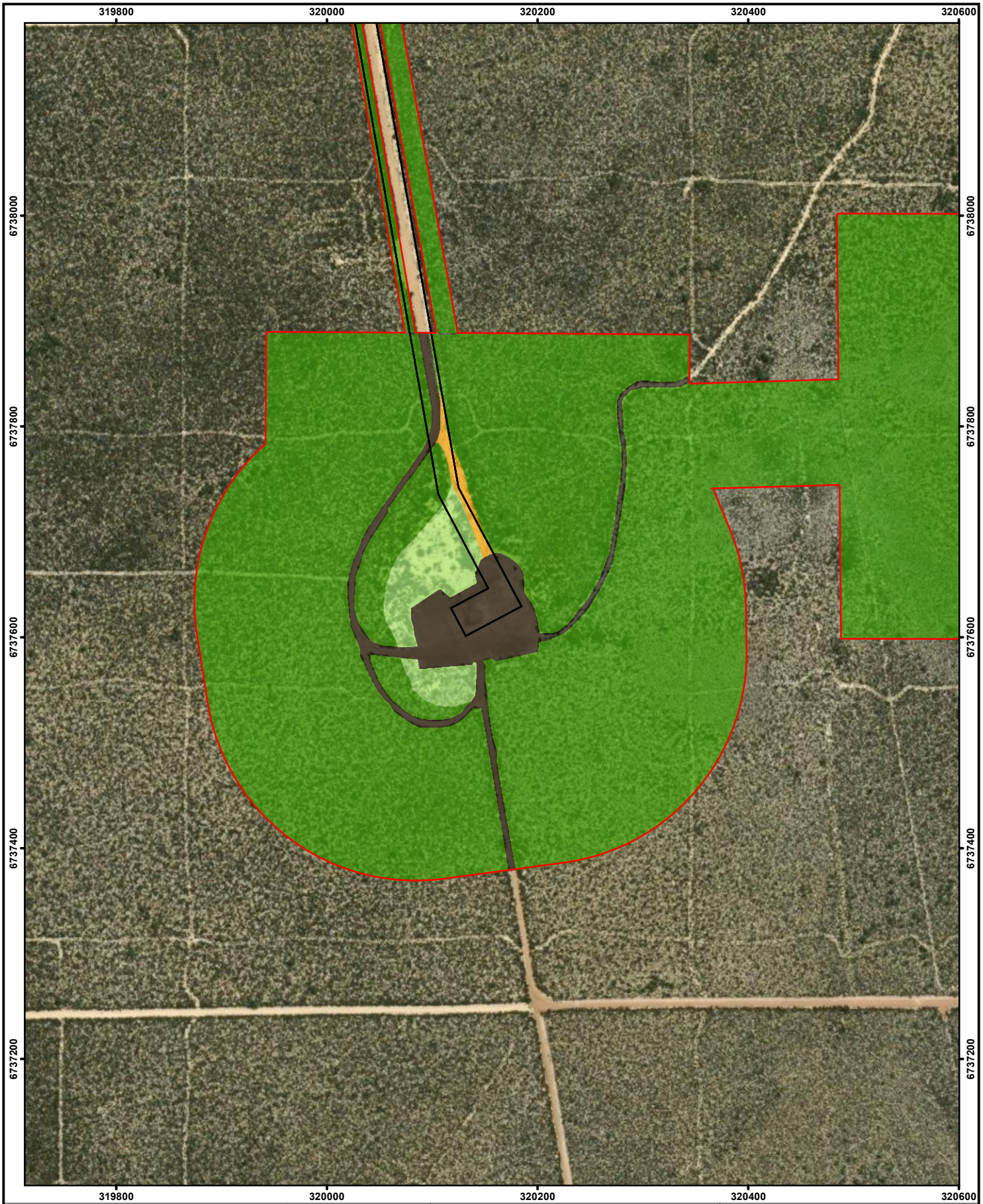
Perth Basin Ecological Studies

VEGETATION CONDITION BEHARRA SPRINGS 2

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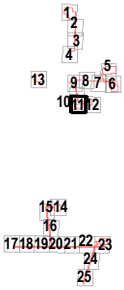
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Degraded
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION CONDITION BEHARRA SPRINGS 2

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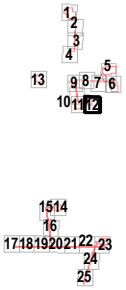
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

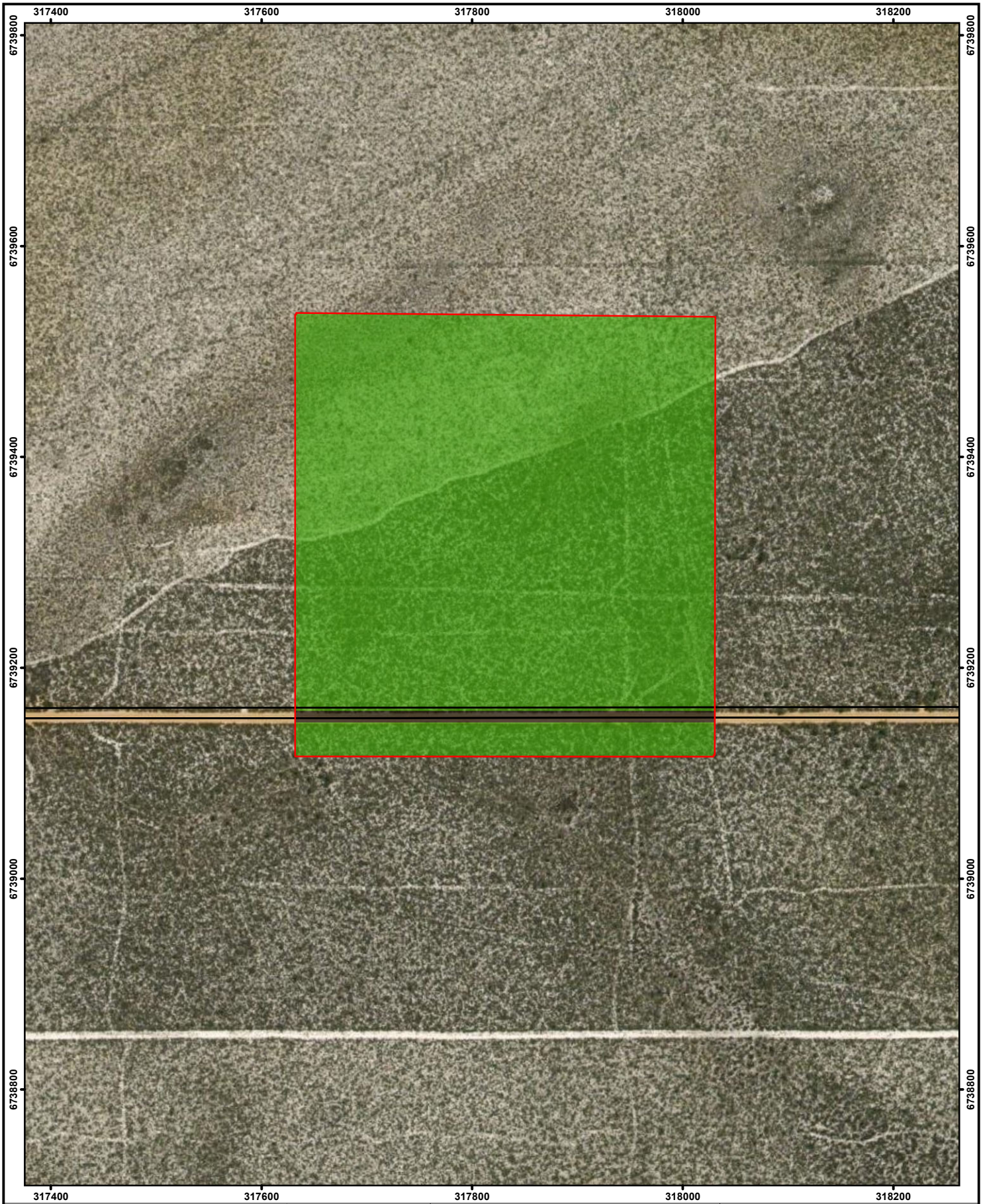
Perth Basin Ecological Studies

VEGETATION CONDITION BEHARRA SPRINGS DEEP 2

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strategen JBS&G

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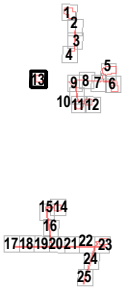
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

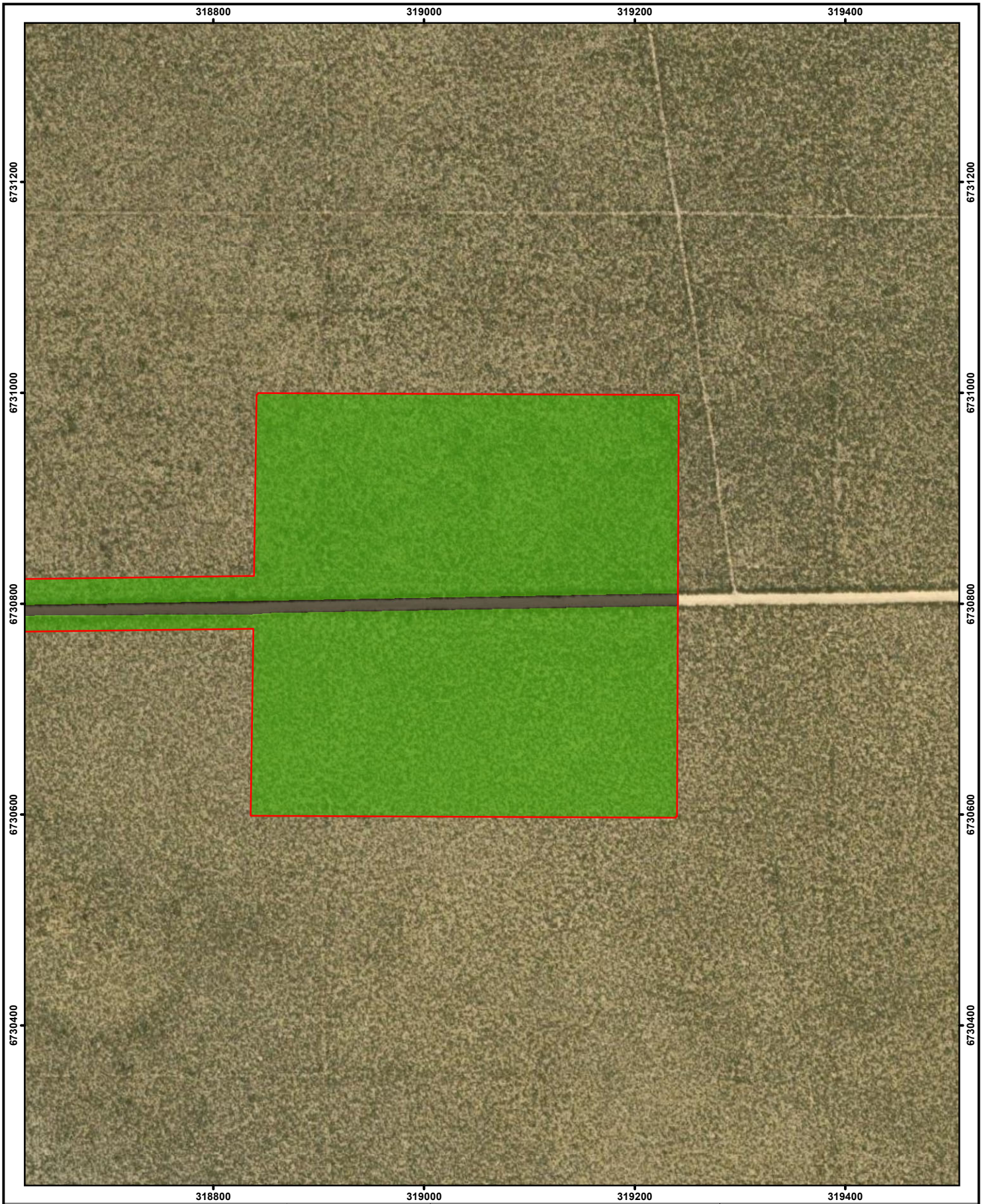
Perth Basin Ecological Studies

VEGETATION CONDITION
BEHARRA SPRINGS DEEP 3

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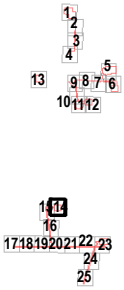
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

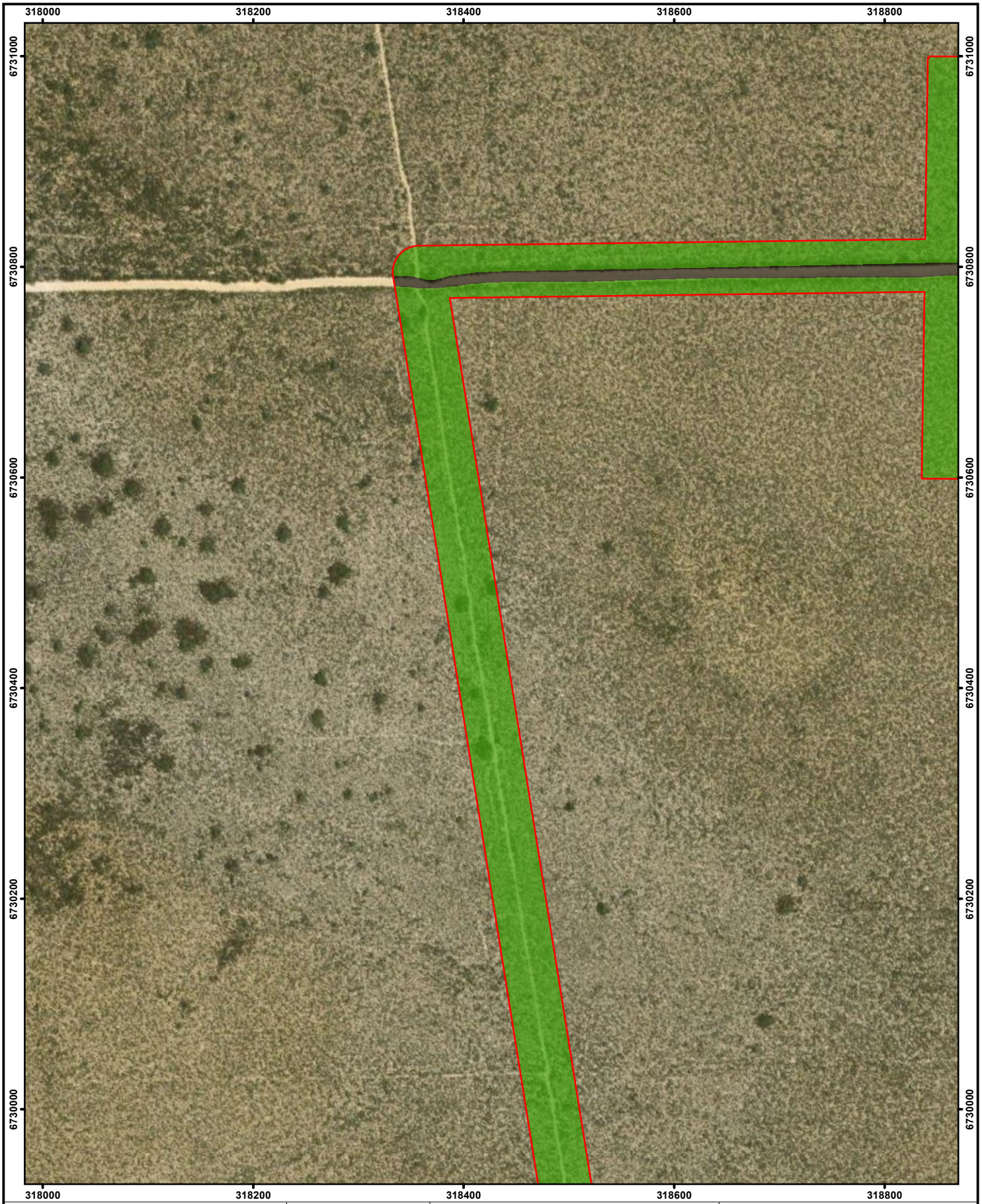
Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

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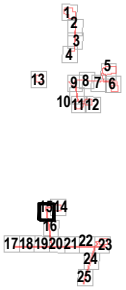
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

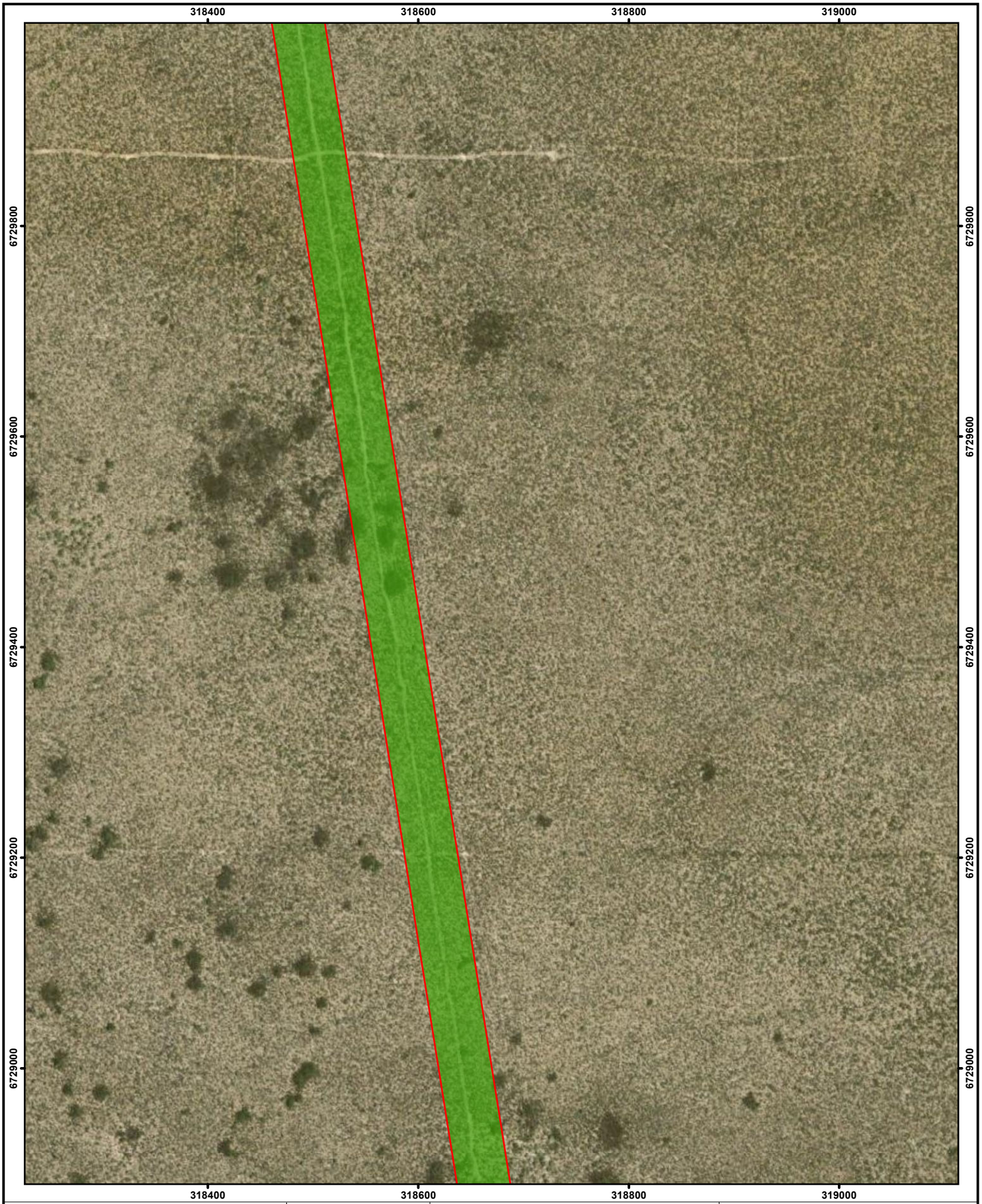
Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

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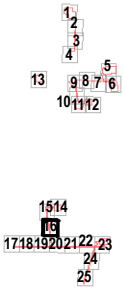
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

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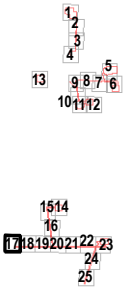
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Cleared/Not vegetated
- Highways

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

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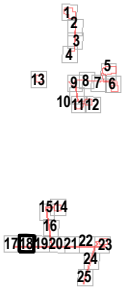
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Cleared/Not vegetated
- Highways

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

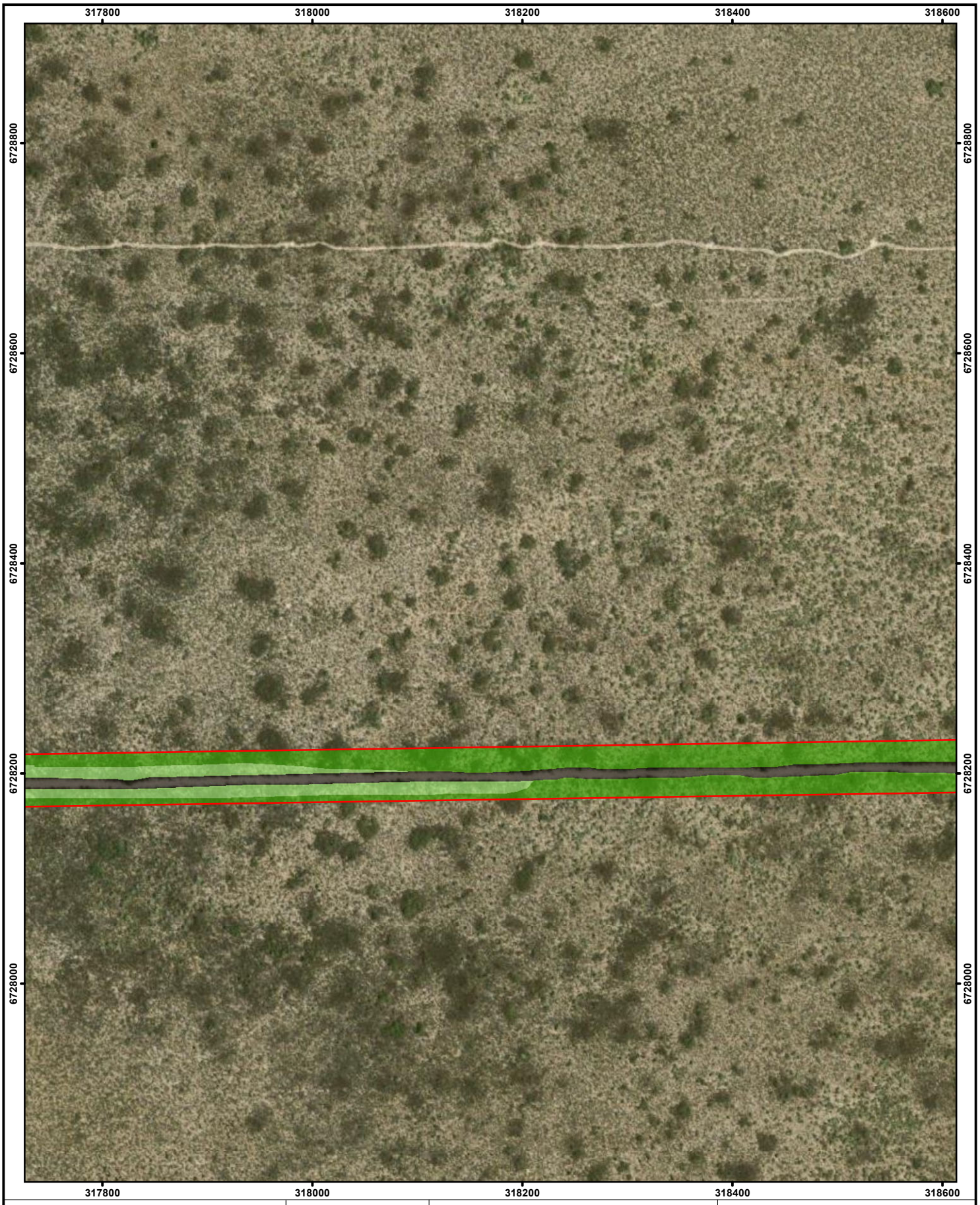
Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

Appendix G

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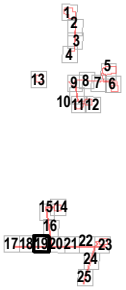
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

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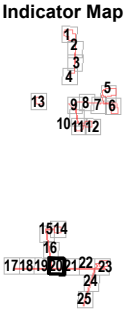
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

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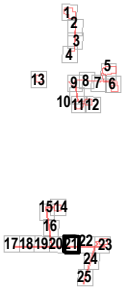
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

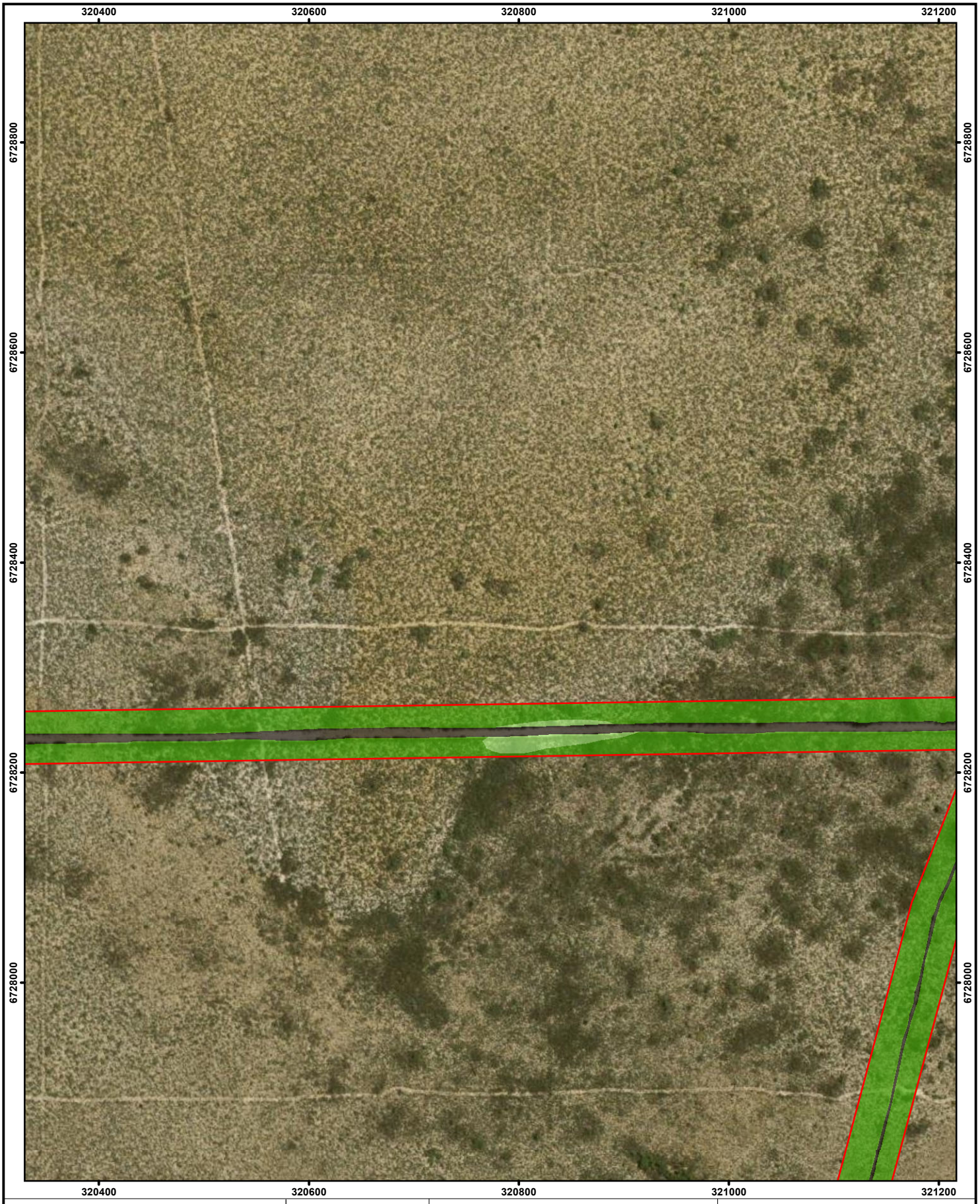
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VEGETATION CONDITION FLOREAT 2

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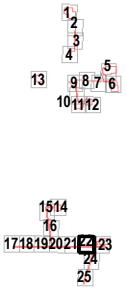
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

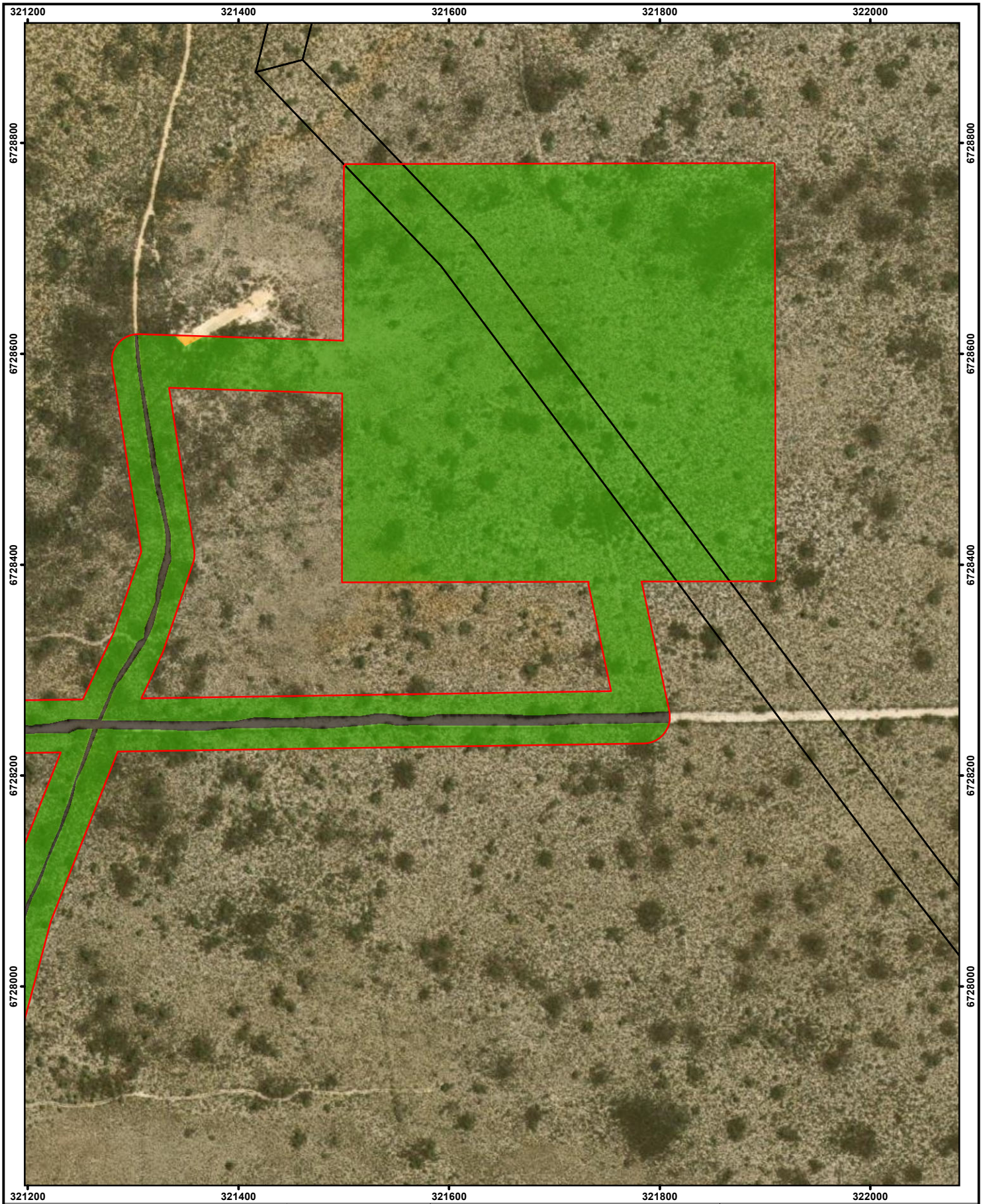
Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 2

Appendix G

strategen JBS&G

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Image Reference: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



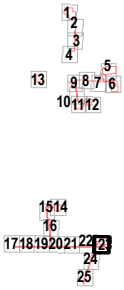
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Degraded
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

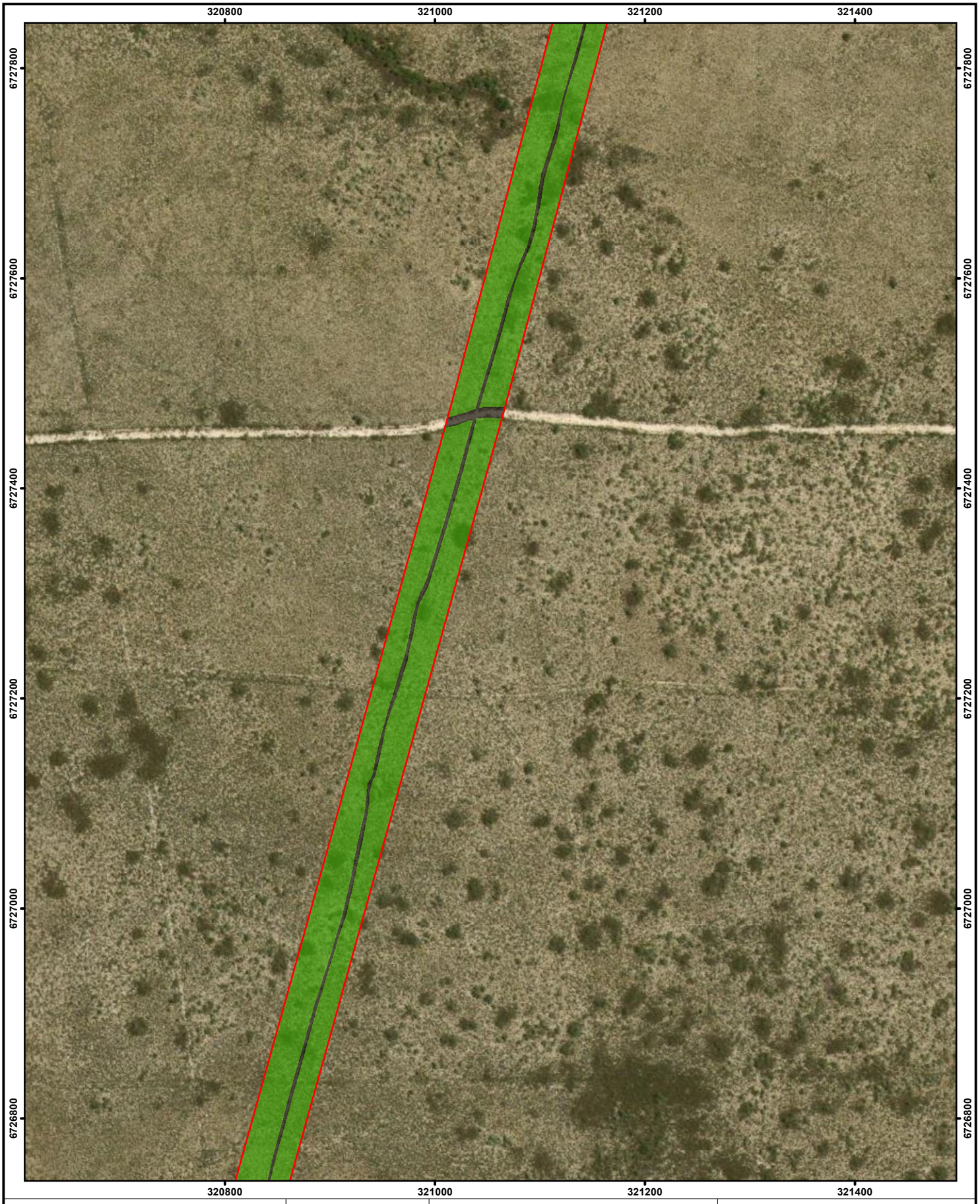
Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 1

Appendix G **Page 23 of 25**

strategen JBS&G

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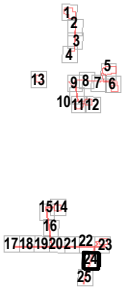
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Cleared/Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 1

Appendix G

strategen JBS&G

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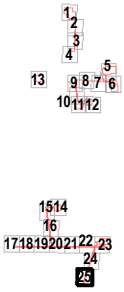
Legend

- Survey area
- Cadastral boundary

Vegetation condition

- Pristine
- Very good
- Cleared/Not vegetated
- Highways
- Minor road

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

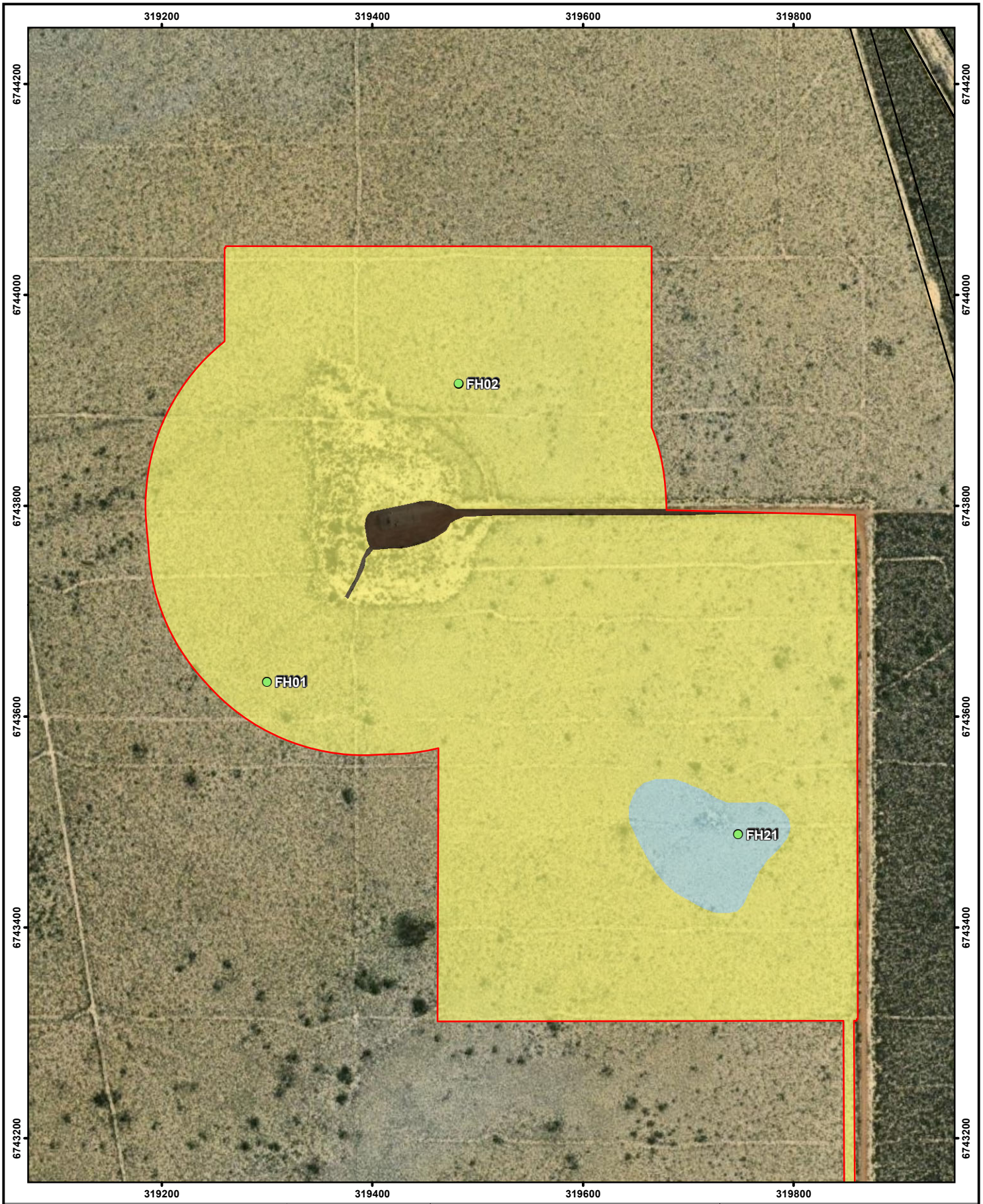
Perth Basin Ecological Studies

VEGETATION CONDITION FLOREAT 1

Appendix G **Page 25 of 25**

strategen JBS&G

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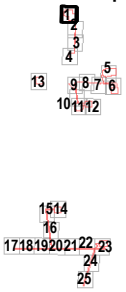
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Sedgeland
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA TARANTULA 1 AND TARANTULA DEEP 1

APPENDIX G **Page 1 of 25**

strategen JBS&G

File Name: \\008PMPMR004V001.jbsg.aust\JBS Perth\Projects\1)Open\Beach Energy\62676 Perth Basin Ecological Surveys\GIS\Maps\R01_Rev_A\62676_AppG_MB_FaunaHabitat.mxd
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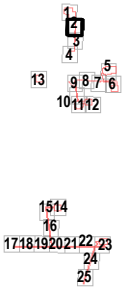
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Habitat assessment site
- Ornithological survey site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

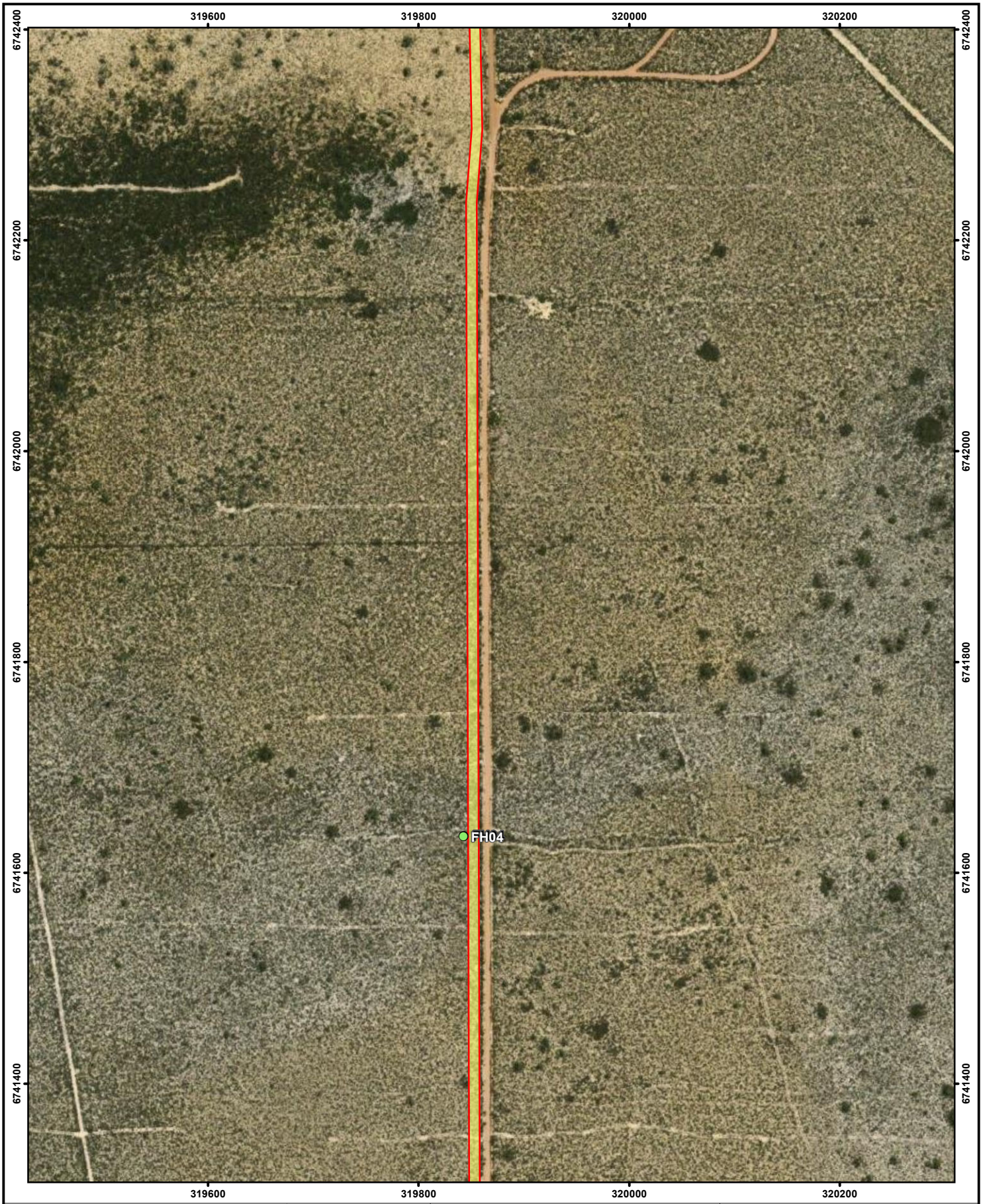
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA TARANTULA 1 AND TARANTULA DEEP 1

APPENDIX G **Page 2 of 25**

strategen JBS&G

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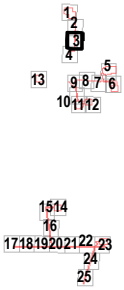
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA TARANTULA 1 AND TARANTULA DEEP 1

APPENDIX G **Page 3 of 25**

strategen JBS&G

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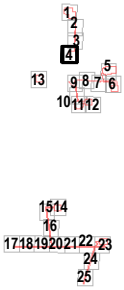
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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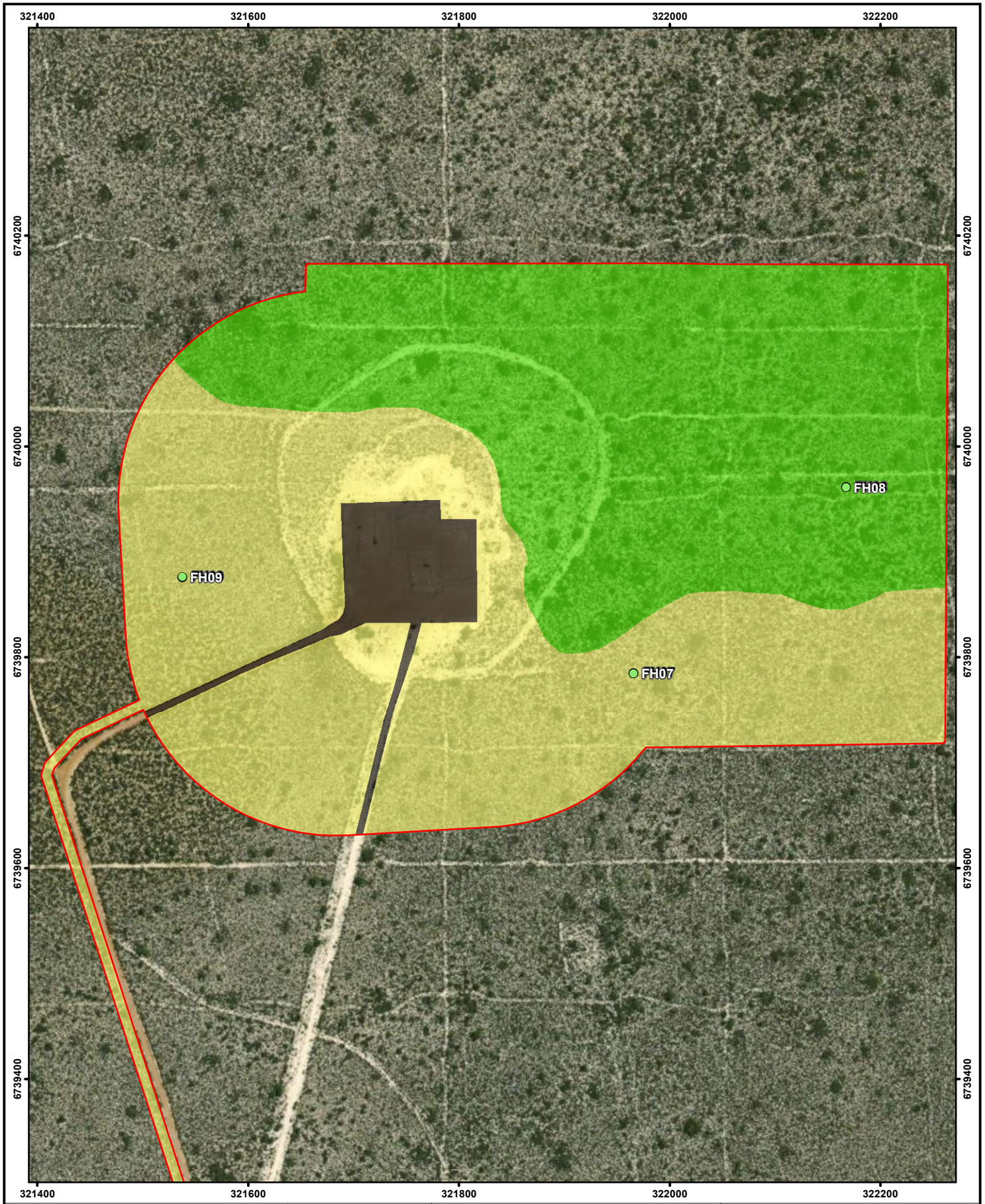
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA TARANTULA 1 AND TARANTULA DEEP 1

APPENDIX G

strategen JBS&G

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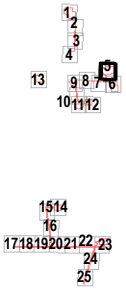
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Eucalypt woodland
- Kwongan
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

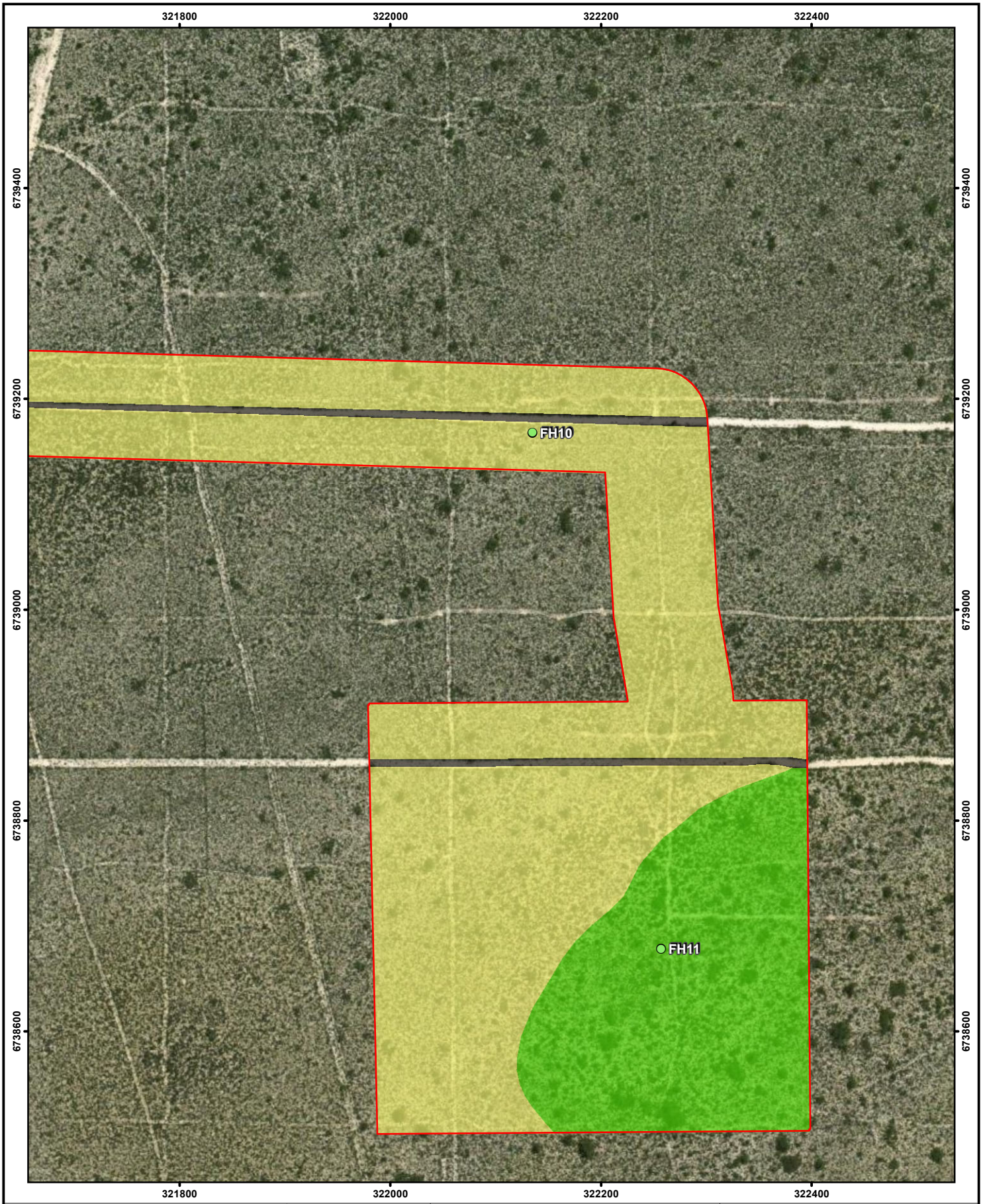
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA REDBACK 1 AND REDBACK DEEP 1

APPENDIX G **Page 5 of 25**

strategen JBS&G

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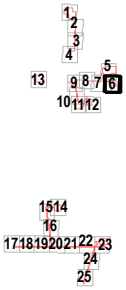
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Eucalypt woodland
- Kwongan
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA REDBACK DEEP SOUTH 1

APPENDIX G

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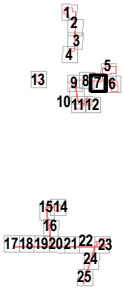
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

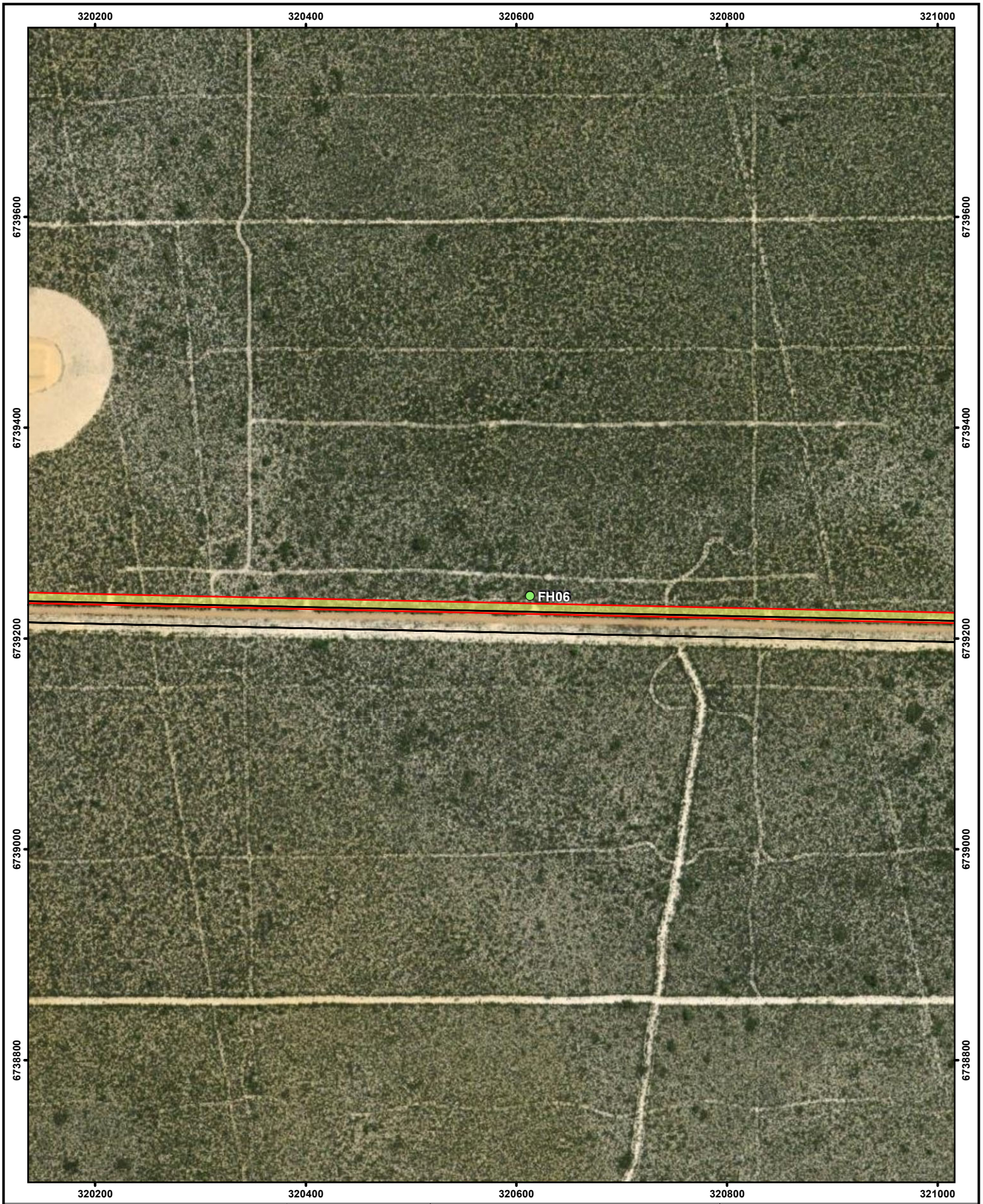
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA REDBACK DEEP SOUTH 1

APPENDIX G **Page 7 of 25**

strategen JBS&G

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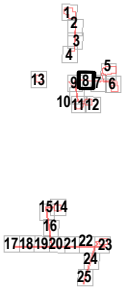
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA REDBACK DEEP SOUTH 1

APPENDIX G

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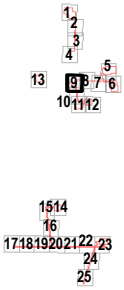
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

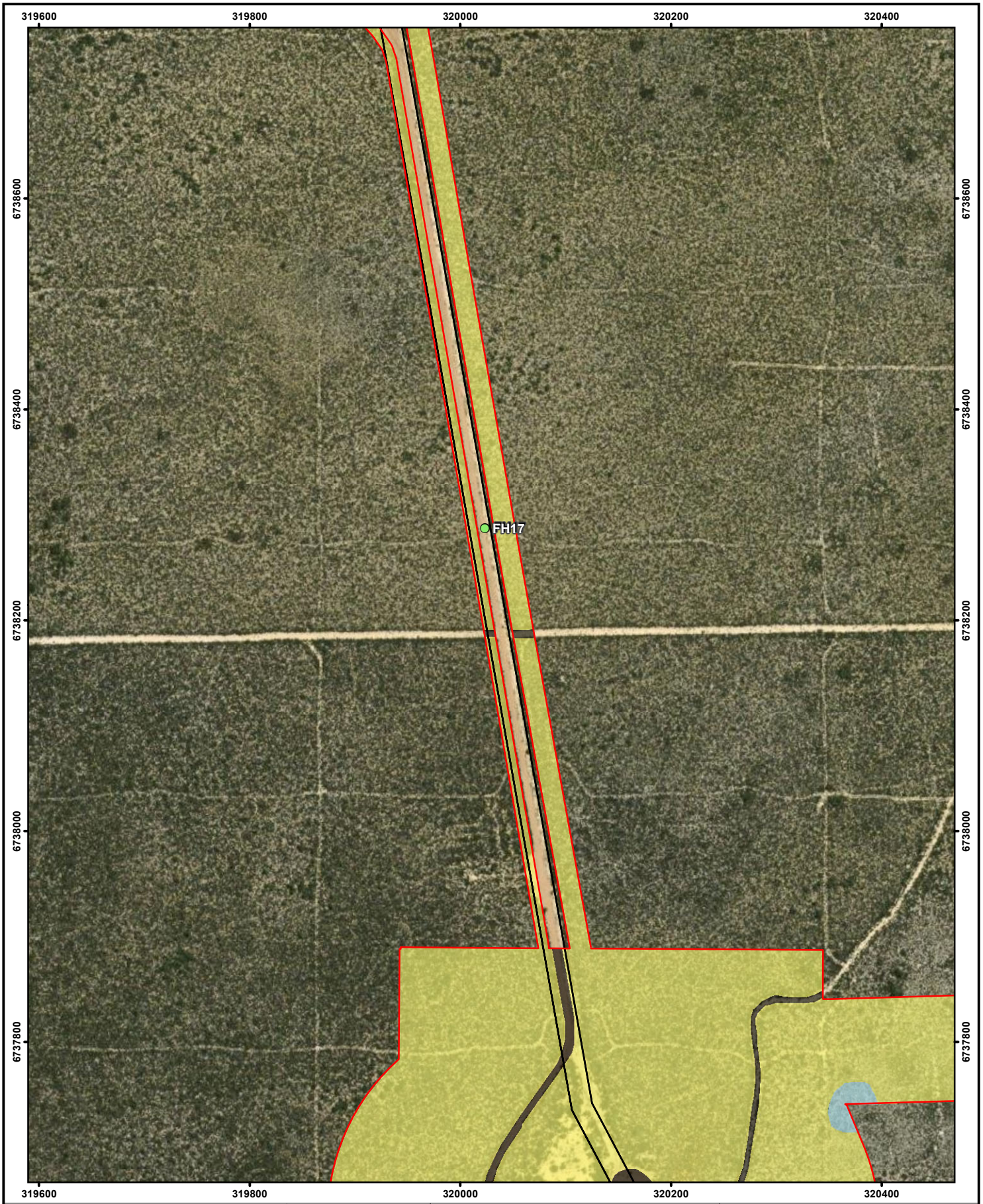
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA ACCESS TRACKS - REDBACK AND BEHARRA SPRINGS 2

APPENDIX G

strategen JBS&G

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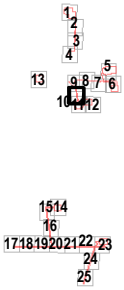
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Sedgeland
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA BEHARRA SPRINGS 2

APPENDIX G

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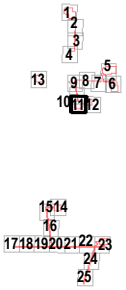
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Sedgeland
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

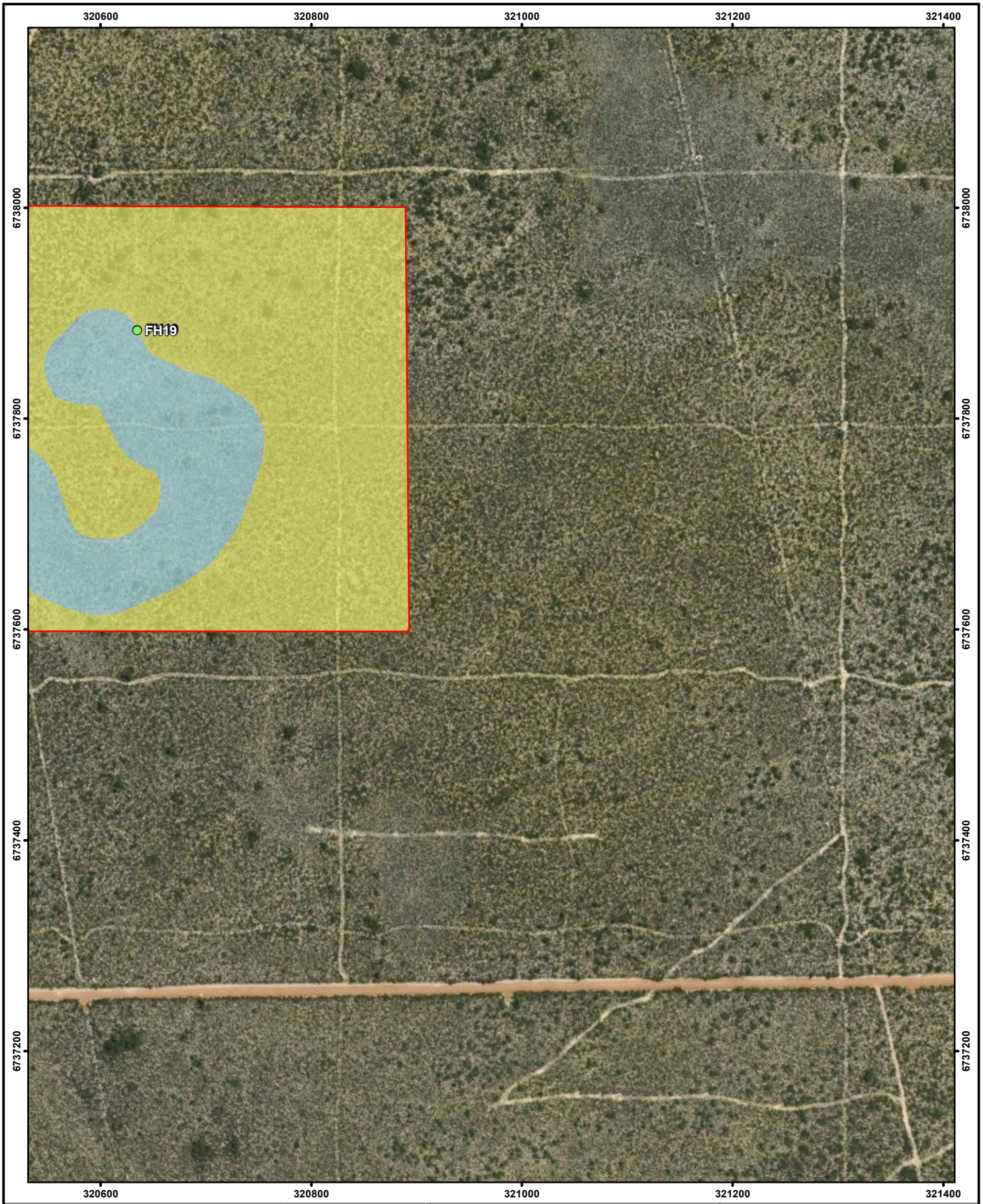
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA BEHARRA SPRINGS 2

APPENDIX G

strategen JBS&G

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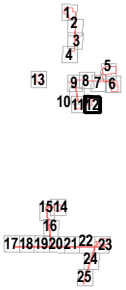
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Sedgeland
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA BEHARRA SPRINGS DEEP 2

APPENDIX G

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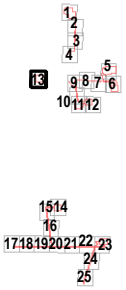
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Banksia woodland
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

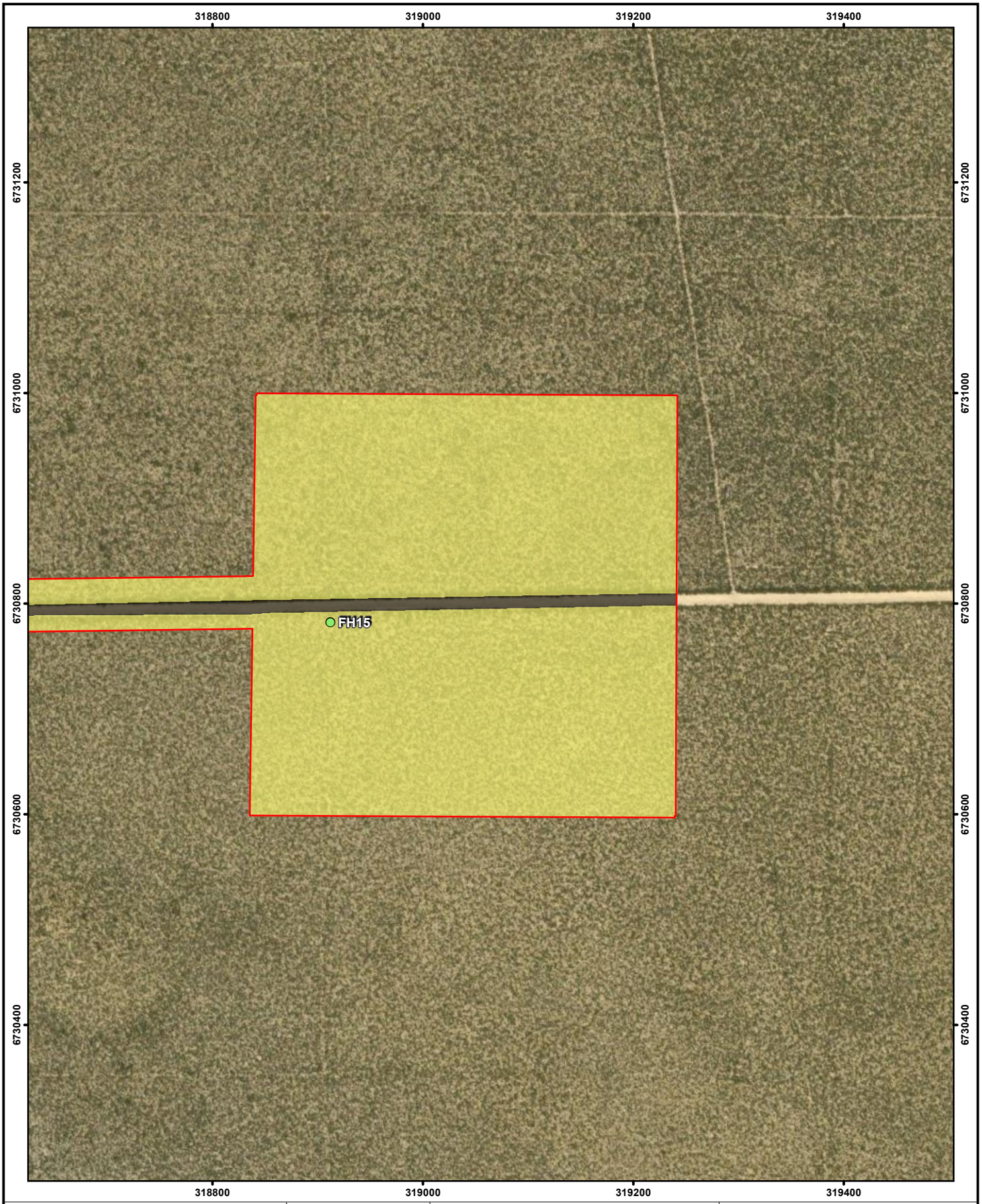
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA BEHARRA SPRINGS DEEP 3

APPENDIX G

strategen JBS&G

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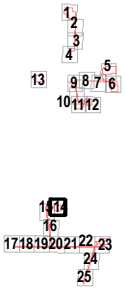
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

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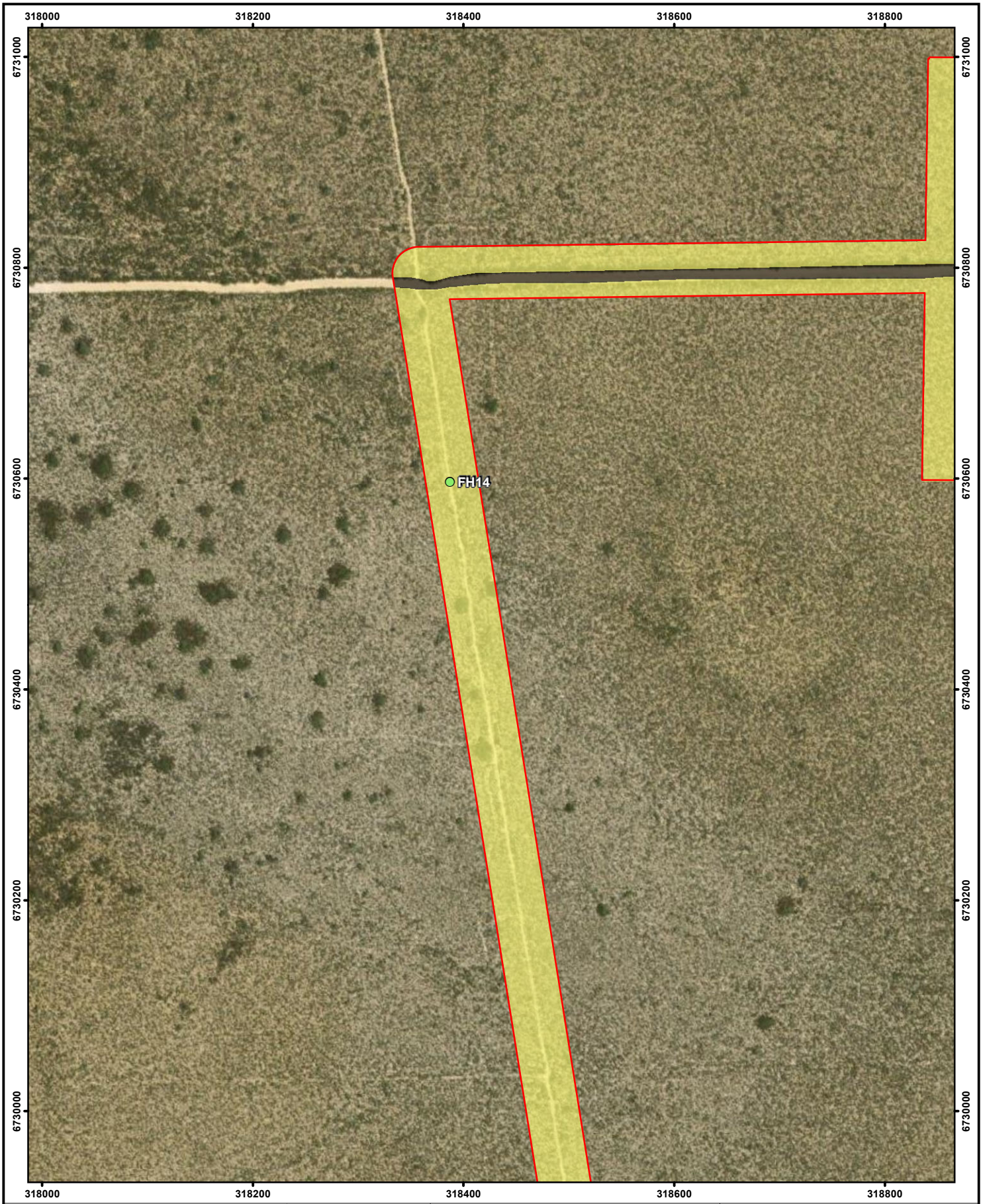
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FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA FLOREAT 2

APPENDIX G

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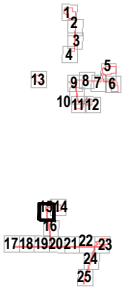
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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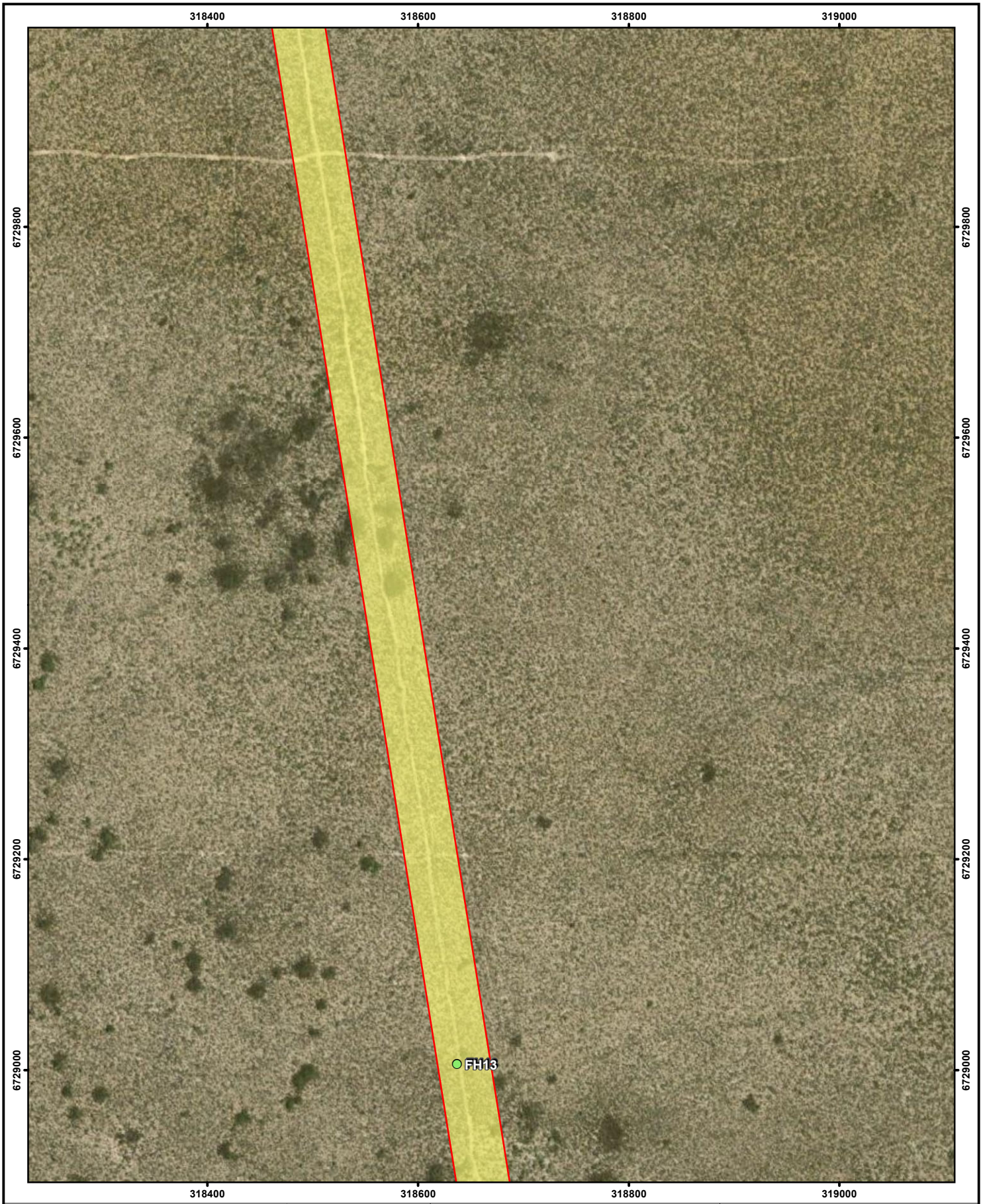
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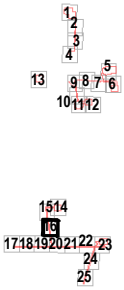
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

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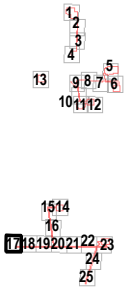
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated
- Highways

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

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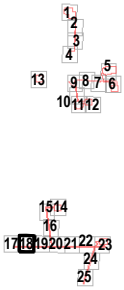
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Shrubland
- Cleared / Not vegetated
- Highways
- Habitat assessment site
- Ornithological survey site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

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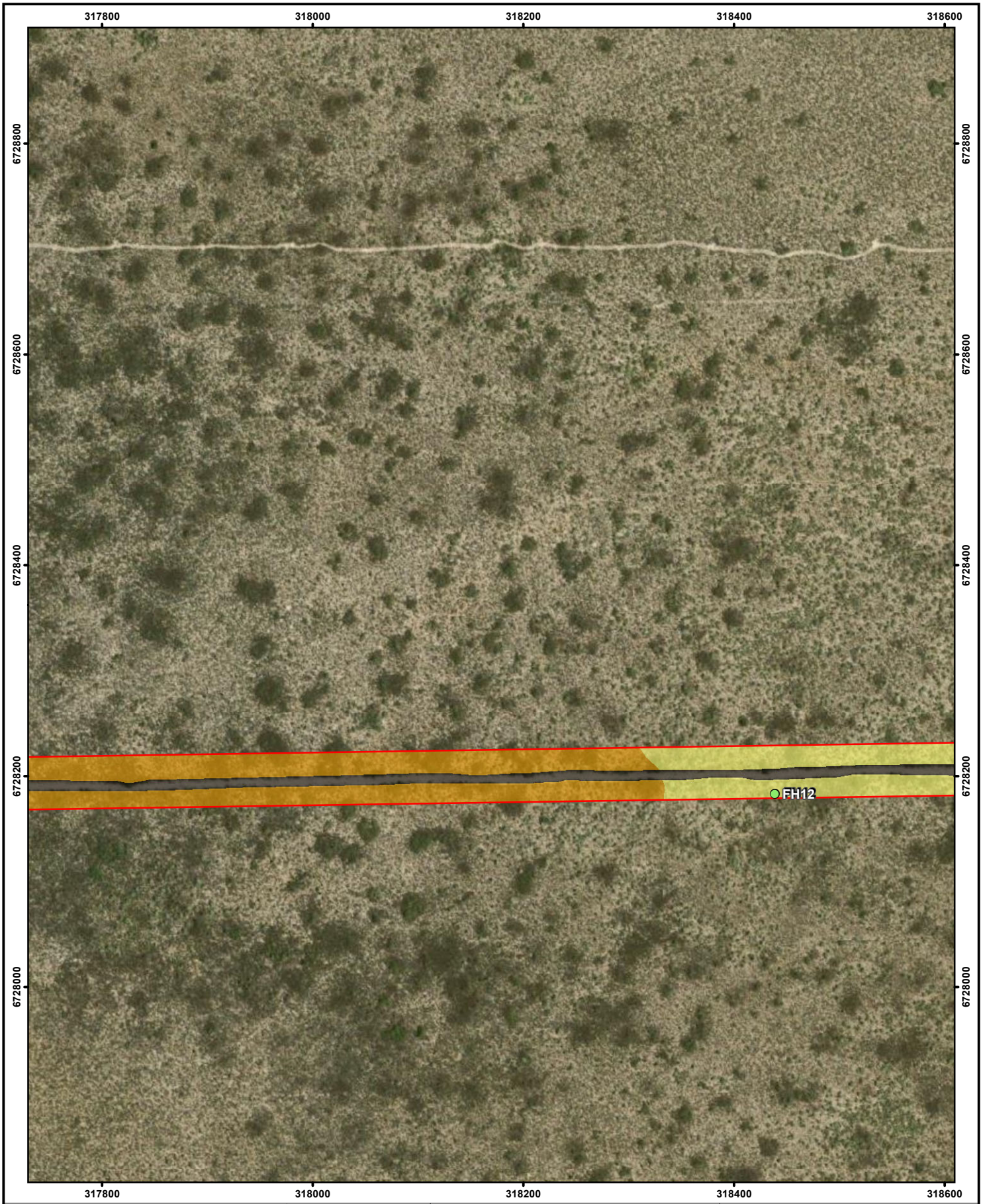
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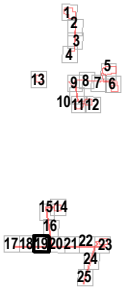
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Shrubland
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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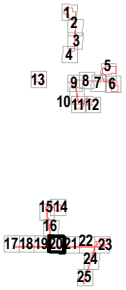
Legend

- Survey area
- Cadastral boundary

Fauna habitat
- Kwongan
- Cleared / Not vegetated

Conservation significant fauna
- *Calyptorhynchus latirostris*

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

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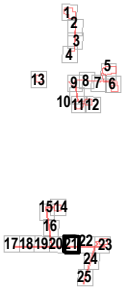
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

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Version: A | Date: 13-Feb-2023

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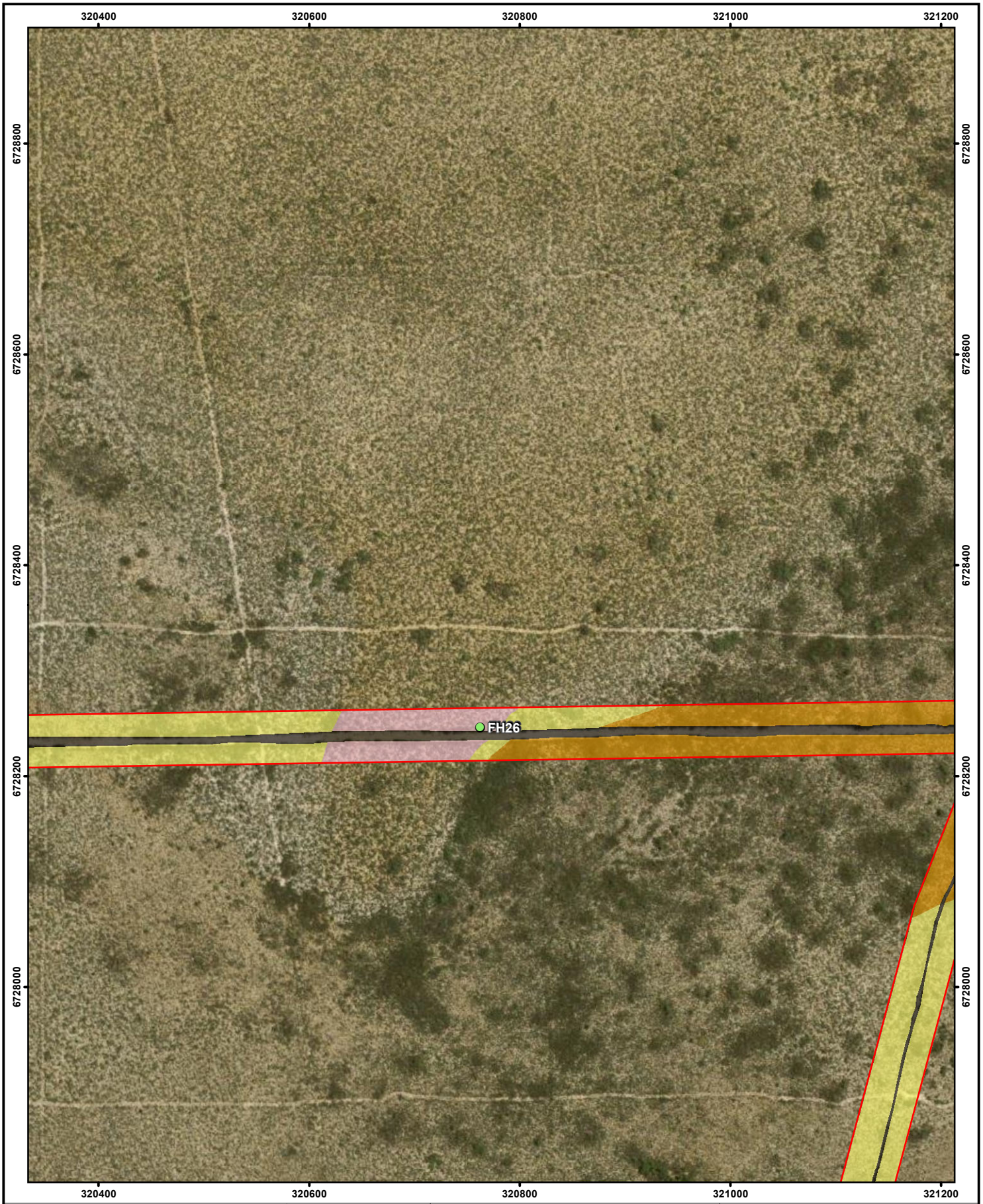
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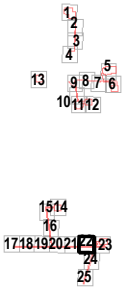
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Banksia scrub on yellow sand dune
- Kwongan
- Shrubland
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

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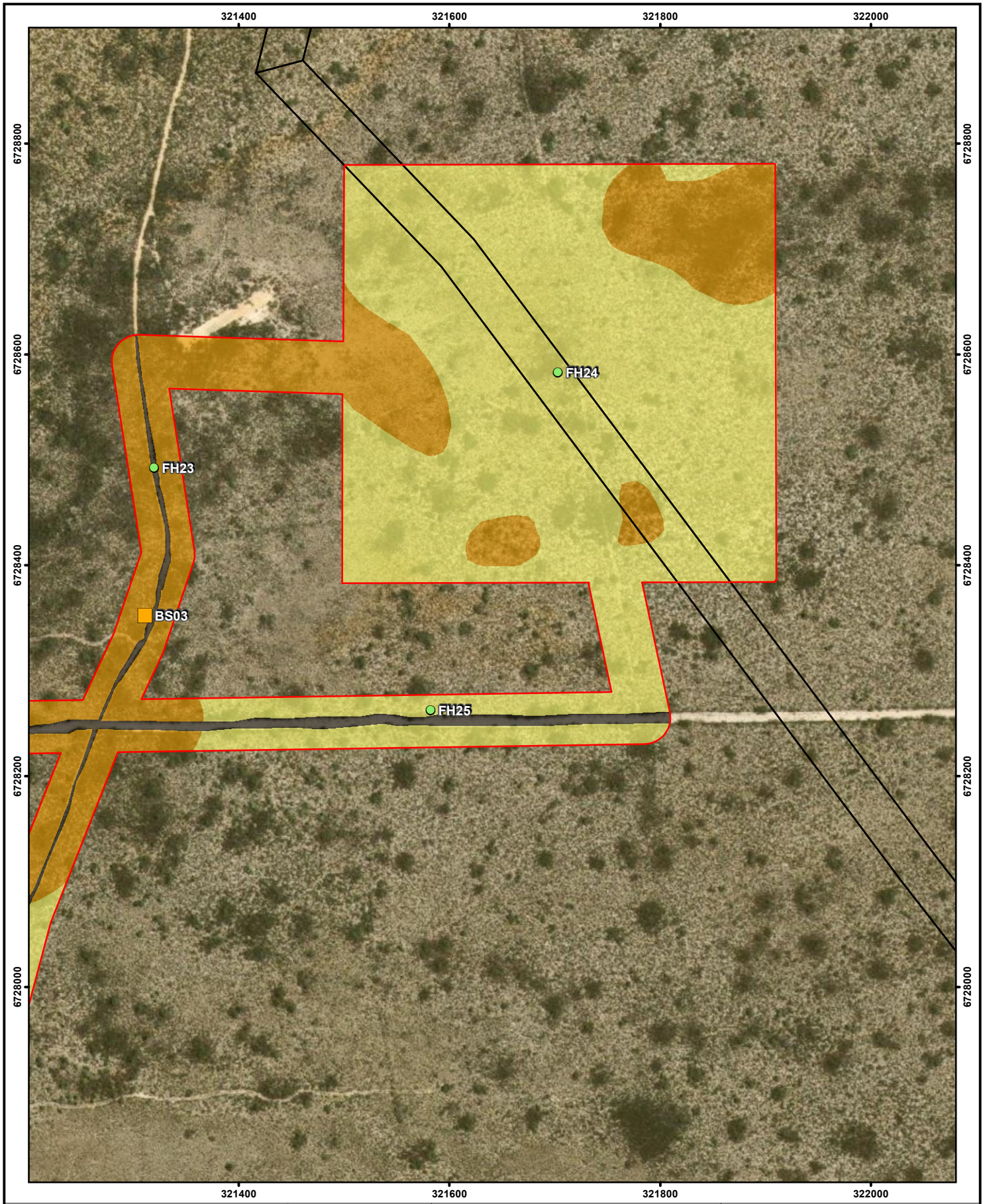
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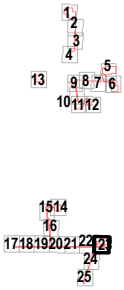
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Shrubland
- Cleared / Not vegetated
- Habitat assessment site
- Ornithological survey site

Indicator Map



Scale 1:4,750 at A4 — 0 50 100 metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

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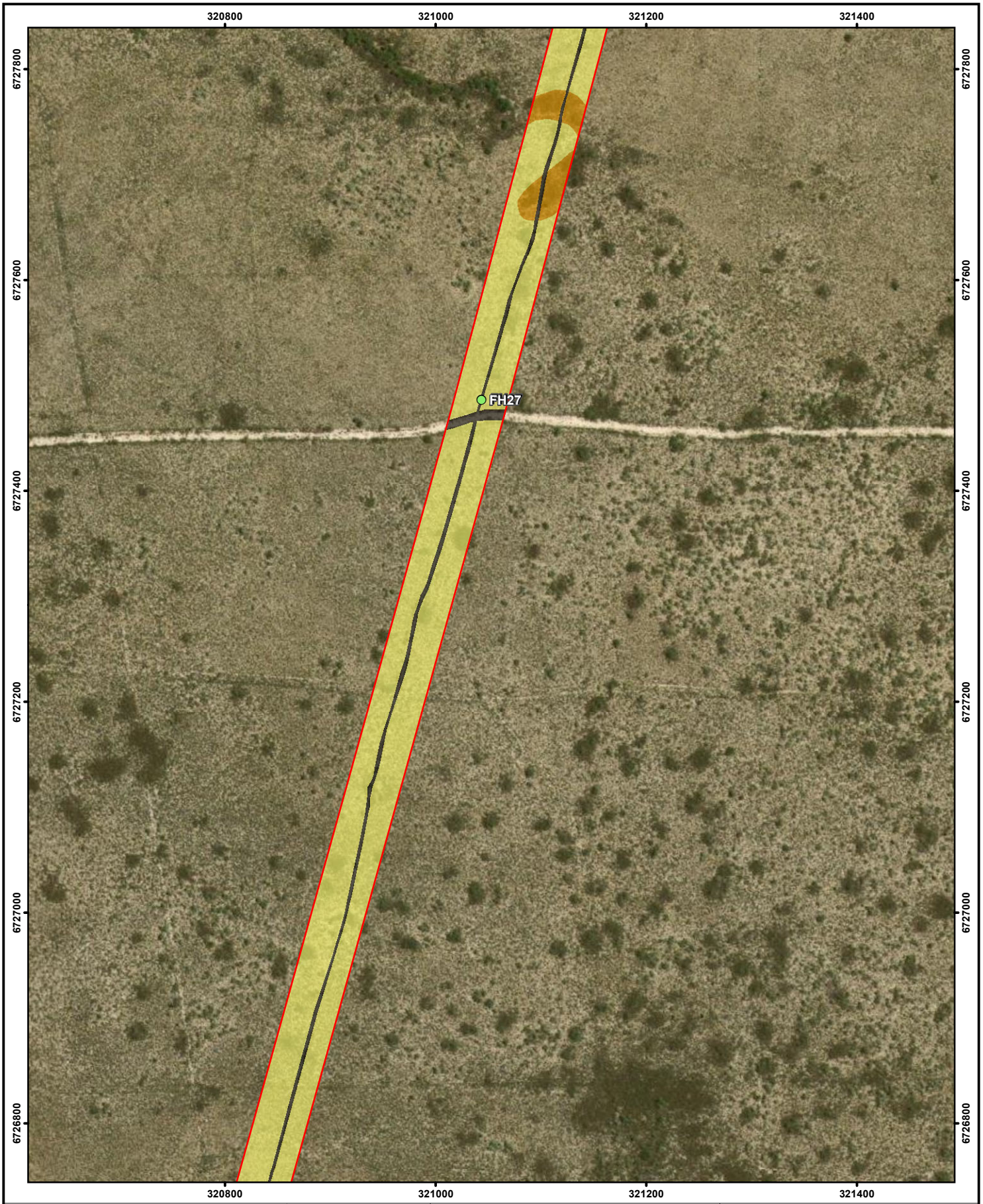
Perth Basin Ecological Studies

FAUNA HABITAT UNITS AND CONSERVATION SIGNIFICANT FAUNA FLOREAT 1

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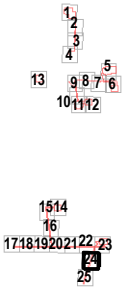
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Shrubland
- Cleared / Not vegetated
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

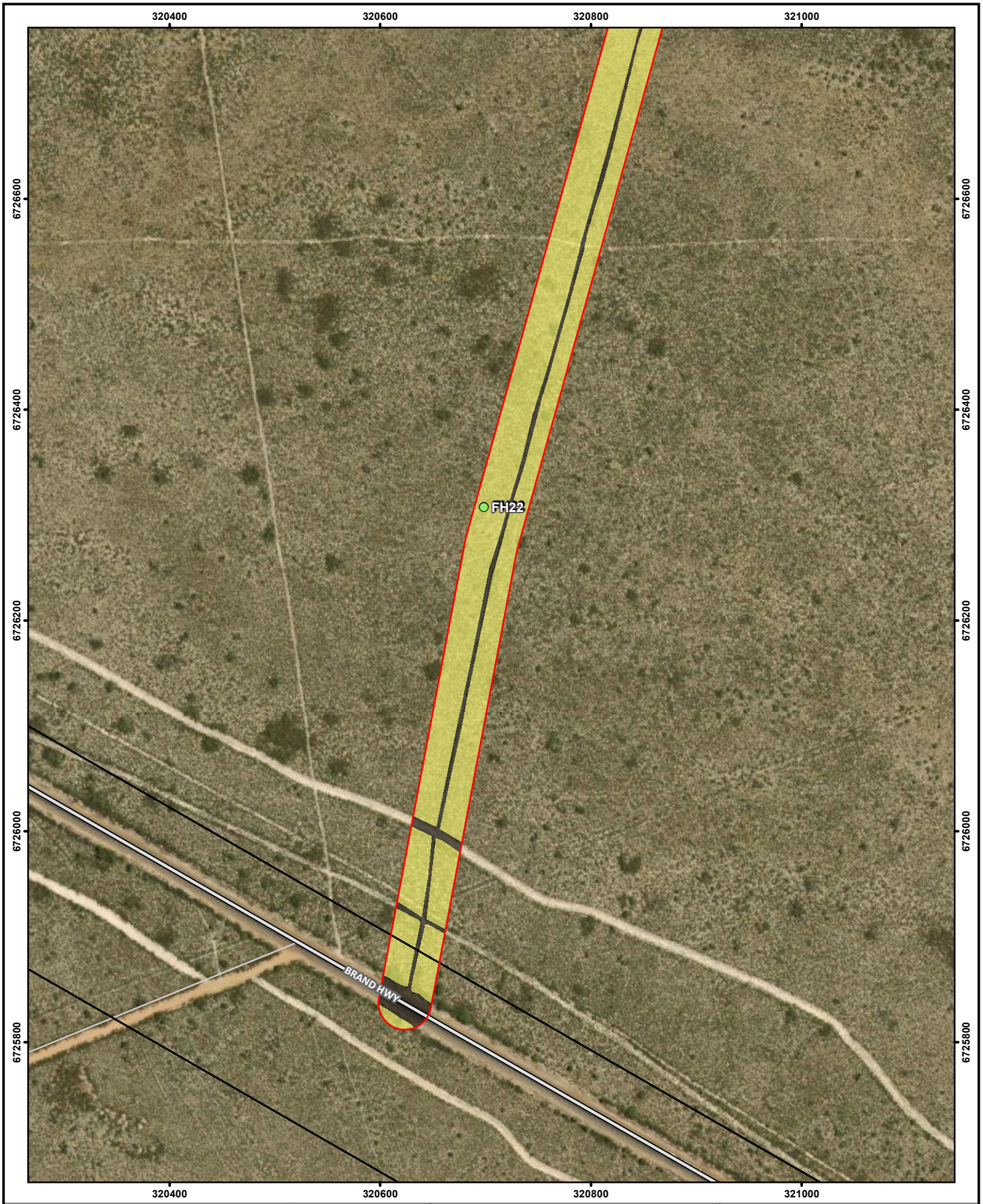
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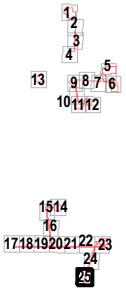
Legend

- Survey area
- Cadastral boundary

Fauna habitat

- Kwongan
- Cleared / Not vegetated
- Highways
- Minor road
- Habitat assessment site

Indicator Map



Scale 1:4,750 at A4

0 50 100
metres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 13-Feb-2023

Drawn By: ianandagoda | Checked By: BN

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Appendix B Targeted Flora Survey 2022 – Strategen-JBS&G 2022b – Beharra Springs Deep 2 Targeted Flora Survey Spring 2022

Beach Energy

Targeted Flora Searches, Beharra Springs 2, Beharra Springs 2 Deep and Associated Access Tracks

Mount Adams Road, Arrowsmith

13 December 2022

62676/149,050 (Rev 0)

JBS&G

www.jbsg.com.au

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Appendices

Appendix A Definitions and Classifications
Appendix B Likelihood of Occurrence Assessment

Abbreviations

Term	Definition
BC Act	*Western Australian Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DBCA	Western Australian Department of Biodiversity, Conservations and Attractions
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DEWHA	Commonwealth Department of Environment, Water, Heritage and the Arts (2007 – 2010)
DPIRD	Western Australian Department of Primary Industries and Regional Development
EN	Endangered (conservation status as listed under the Commonwealth EPBC Act and/or State BC Act)
EP Act	Western Australian Environmental Protection Act 1986
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre/kilometres
m	metre/metres
MNES	Matters of National Environmental Significance
P1, P2, P3, P4, P5	Priority Flora ranking (P1-P5) as per DBCA listings
PMST	Protected Matters Search Tool (hosted by DCCEEW, used to identify MNES)
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
var.	Variety (infrataxon)
VU	Vulnerable (conservation status as listed under the Commonwealth EPBC Act and/or State BC Act)
WAH	Western Australian Herbarium

1. Background

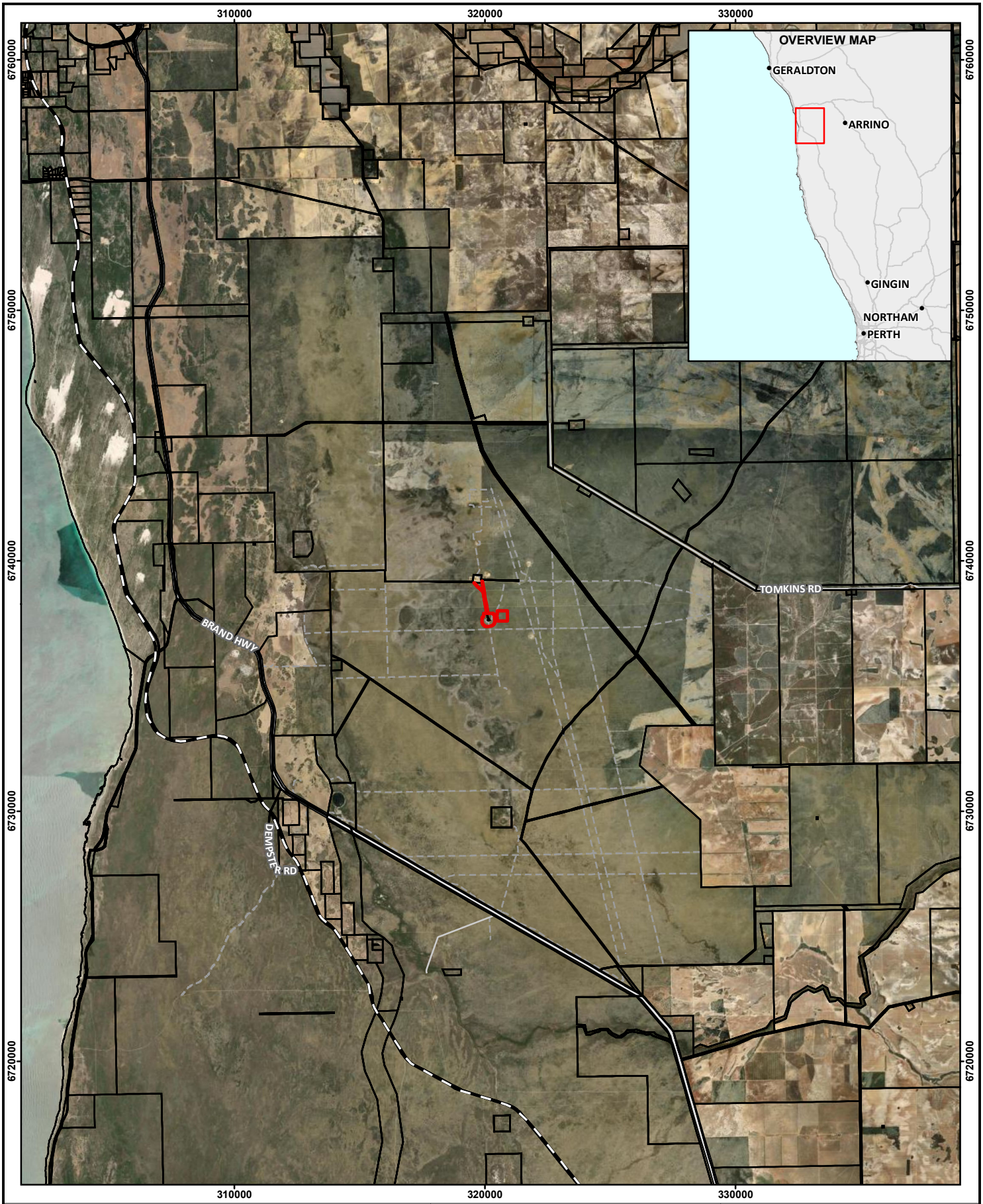
1.1 Scope

Beach Energy Resources (Perth Basin) Pty Ltd (Beach Energy) is the part owner and operator of the Beharra Springs Gas Facility. Project infrastructure is contained within Production Licences L11 and L22, Exploration Permit EP320 and Pipeline Licence PL18. Beach Energy are proposing to develop infrastructure and assets associated with the production of natural gas within their Beharra Springs Project at Beharra Springs 2, Beharra Springs 2 Deep and associated access tracks (Survey Area).

The Survey Area was subject to a Reconnaissance flora and vegetation survey conducted by ecologists from JBS&G in May and June, 2022. The Reconnaissance survey was conducted to broadly define ecological values associated with flora and vegetation within and adjacent to the Survey Area. Based on the findings during the Reconnaissance survey, it was determined that targeted searches were appropriate due to the high probability of flora of conservation value being present. Beach Energy engaged JBS&G to conduct these searches during spring of 2022.

1.2 Survey Area

The Survey Area was located in Arrowsmith, approximately 30 km southeast of Dongara, Western Australia in the Shire of Irwin. The Survey Area contained a footprint for two proposed well pads and an access track and covered an area of 44.72 ha (Figure 1.1).



Legend

- Survey Area
- Cadastral boundary
- Rail line
- Highways
- Minor road
- Track

Scale 1:200,000 at A4

0 2 4 Kilometres

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 09-Dec-2022

Drawn By: jcrute | Checked By: CT

Perth Basin Ecological Studies Targeted Flora Survey

Beharra Springs 2 and Beharra Springs 2 Deep

SURVEY AREA LOCATION

FIGURE 1.1

JBS&G

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1.3 Legislative Context

Flora in Western Australia (WA) are protected formally and informally by various legislative and non-legislative measures, including:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Commonwealth.
- *Biodiversity Conservation Act 2016* (BC Act) – State.
- *Environmental Protection Act 1986* (EP Act) – State; and
- WA Department of Biodiversity, Conservation and Attractions (DBCA) Priority lists for flora.

A short contextual description of each legislative measure is provided below. Other definitions, including species conservation categories, are provided in **Appendix A**.

1.3.1 Environment Protection and Biodiversity Conservation Act 1999

On lands that are not vested in the Federal Government, the EPBC Act aims to protect Matters of National Environmental Significance (MNES), which are detailed in Appendix A. Under the EPBC Act, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) lists protected species by criteria set out in the Act. Species are conservation significant if they are listed as Threatened (i.e., Critically Endangered, Endangered and Vulnerable), Migratory (as relates to international agreements) or Marine (when within Commonwealth waters jurisdiction).

1.3.2 Biodiversity Conservation Act 2016

DBCA lists taxa under the provisions of the BC Act as protected and are classified as according to their need for protection (see Appendix A). The BC Act makes it an offence to 'take' Threatened species without an appropriate licence. There are financial penalties for contravening the BC Act. Under the BC Act, DBCA lists species as Threatened (T) (Declared Rare) or Priority Flora (P1, P2, P3 or P4).

1.3.3 Environmental Protection Act 1986

Threatened flora are given special consideration in environmental impact assessments and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Exemptions for a clearing permit do not apply in, or within 50 m of, an ESA.

1.3.4 Relevant Guidelines

Additionally, the following factors, guidelines and government listings were taken into consideration when conducting ecological studies within the Survey Area:

- Department of Environment, Water, Heritage and the Arts (DEWHA) (2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 – Environment Protection and Biodiversity Conservation Act 1999.*
- EPA (2020) *Statement of Environmental Principles, Factors and Objectives.*
- EPA (2016a) *Environmental Factor Guideline – Flora and Vegetation.*
- EPA (2016b) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, referred to hereafter as the Flora and Vegetation Technical Guidance; and
- Locally significant populations recognised by the DBCA.

2. Methods

2.1 Desktop Review

A desktop review was conducted in accordance with current EPA guidance (EPA 2016b; 2020). The desktop review incorporated information on climate, biogeography, the results of a DBCA Threatened (Declared Rare) and Priority Flora database search and an EPBC Act Protected Matters Database search. In addition to this, relevant information from a Reconnaissance survey conducted by JBS&G (2022) was reviewed to provide information on vegetation within the Survey Area.

2.2 Targeted Flora Searches

2.2.1 Survey Methods

Targeted flora searches within the Beharra Springs 2, Beharra Springs 2 Deep and associated access track areas were conducted between 3rd – 16th November 2022. The searches were undertaken by the following JBS&G personnel:

- Terri Jones (Associate Ecologist, FB62000191).
- Brett Neasham (Senior Ecologist, FB62000483).
- Hannah Dlugi (Ecologist, FB62000448); and
- Logan Penman (Project Scientist).

The Survey Area was searched along parallel traverses spaced at approximately 10 m intervals. Where Priority flora were observed, the following was recorded in Fulcrum© (Spatial Networks, Inc.) on Samsung Tab A Tablets:

- Field name and sample collection number.
- Number of individuals present.
- Brief description of vegetation; and
- Notes in relation to the individual plants (condition, evidence of disturbances etc.).

When Threatened Flora were observed, the following additional information was recorded:

- Location of the individuals, recorded on a Garmin eTrex© GPS device; and
- Photographic record.

2.2.2 Flora Identification and Nomenclature

Where flora could not be identified confidently in the field, specimens were collected in accordance with procedures outlined by the Western Australian Herbarium (WAH) (DBCA 2020a). Plant specimens collected during the field surveys were identified by experienced independent taxonomist Bethea Loudon or Mike Hislop from the WAH. Nomenclature of species recorded was undertaken in accordance with WAH (1998-2022).

3. Desktop Assessment

3.1 Regional Context

3.1.1 Lesueur Bioregion

The Survey Area was located in the Lesueur Sandplain (GES02) subregion of the Geraldton Sandplains (GES) IBRA 7 bioregion (DAWE 2020). The Lesueur Sandplain is described as consisting of "coastal Aeolian and limestones, Jurassic siltstones and sandstones of Central Perth Basin" (Desmond and Chant 2002; pg. 293). Land use in the subregion is predominately dry-land agriculture (~69 %), with the balance in either conservation or UCL/Crown reserves (Desmond and Chant 2002). The Lesueur Sandplains subregion has a National Reserve System Protection Level of 15.01 – 30 % (DAWE 2020).

Flora endemism is high in the region, with over 250 sandplain species endemic to the region (Desmond and Chant 2001). Within this, there are a high number of Threatened and Priority flora and smaller number of fauna species at risk (Desmond and Chant 2002). Natural Resource Management is highly variable, with a number of species and ecosystems in need of detailed recovery and protection plans and improvements required for preservation of vegetation in and out of the reserve system (Desmond and Chant 2002).

The vegetation in the subregion is largely endemic rich proteaceous scrub-heaths with areas of York Gum and Jam woodlands on outwash plains (Desmond & Chant 2002). There are 10 ecosystems with over 85 % of their total extent within the Lesueur subregion. In addition to this, there are two rare communities – Lesueur floristic communities and stygofauna of cave communities in the Beekeepers Nature Reserve Area – located in the subregion (Desmond and Chant 2002).

3.1.2 Climate

The region has a dry warm Mediterranean climate with warm, dry summers and cool, wet winters (Beard 1990). Annual precipitation for the region is between 300 – 500 mm, the majority of which is concentrated in 4-5 months (Beard 1990). Recent rainfall data for the twelve months preceding the survey was reviewed for Green Grove (Station 008057), which is located 6.7 km away from the Beharra Springs Project (BoM 2022). In the three months prior to the site visit, above average rainfall was recorded at Green Grove (Station 008057) (Figure 3.1). Temperature data was reviewed for the now inactive Eneabba site (Station 008025) (BoM 2022). Highest average maxima of 36.4 °C and 36.5 °C were observed in January and February while lowest average maximum of 19.7 °C was recorded in June, with similar patterns for average minima.

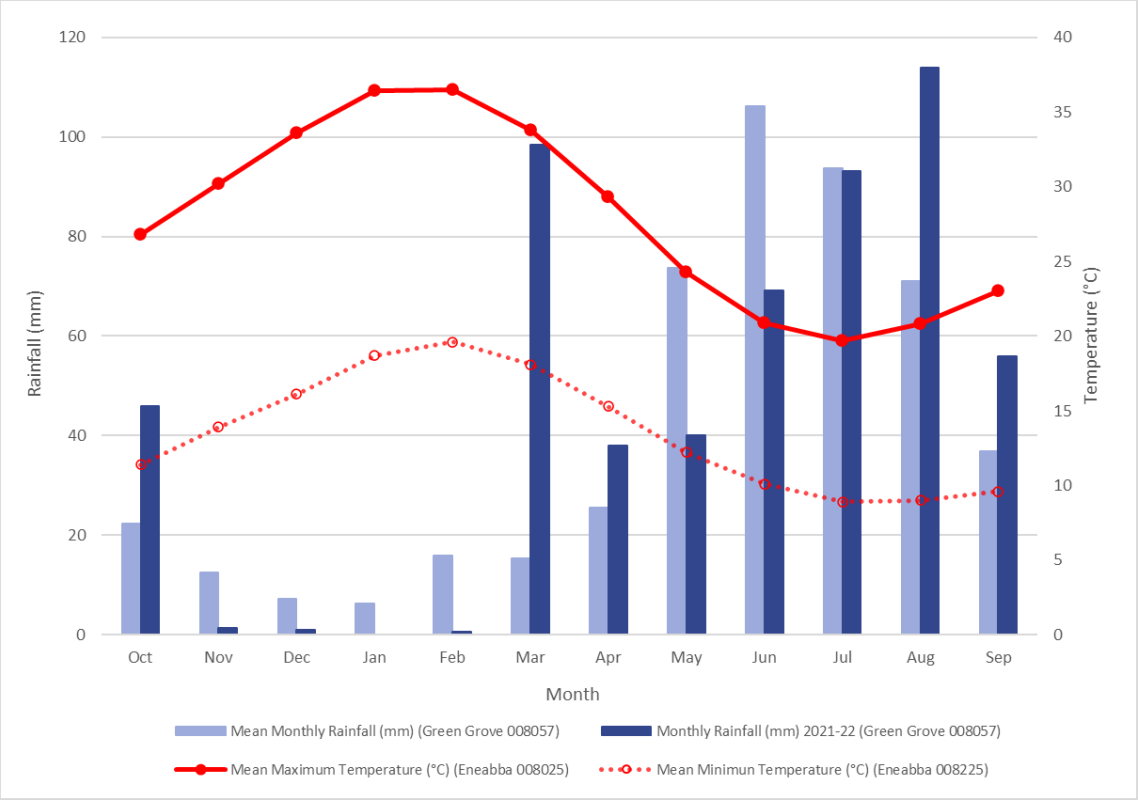


Figure 3.1: Local rainfall data and longer-term temperature data for Bureau of Meteorology stations close to the Survey Area.

3.1.3 Soils and Landforms

The Geraldton Sandplains are characterised by a series of old dunes which run parallel to the coast. The younger Quindalup dunes occur near the contemporary coastline, with the Spearwood dunes occurring further inland. The soils are typically sandy with some areas of exposed limestone, and a series of wetlands occurs along the plains. In the east lateritic rises occur.

Based on the 2017 soil and landform mapping dataset DPIRD-027 from the Department of Primary Industries and Regional Development (DPIRD 2017), the entire Survey Area was located on the Beharra 4 subsystem, which is characterised as level to gently undulating sandplain with numerous small playas and swampy depressions and yellow and pale deep sands with some swamp soils. The soil-land sub-systems have been used to inform potential presence of conservation significant flora and communities.

3.1.4 Pre-European Vegetation

Shephard *et al*. (2002) mapped the extent of pre-European vegetation across Western Australia, with recent updates reflecting the National Vegetation Information System (NVIS) Standards. One vegetation association corresponds with the Survey Area: Eridoon_378. The pre-European and current extent of this vegetation association is available from the DBCA Statewide Vegetation Statistics Dataset (DBCA 2019) and is provided in Table 3.1.

Table 3.1: Vegetation Associations

System	Association	Pre-European extent within IBRA region (ha)	Percent remaining within IBRA region (%)
Eridoon	378 – Scrub-Heath. Mixed heath with scattered tall Acacia spp., PROTEACEAE and MYRTACEAE.	93,523.98	65.04

3.1.5 Perth Basin Ecological Studies Interim Report (JBS&G, 2022)

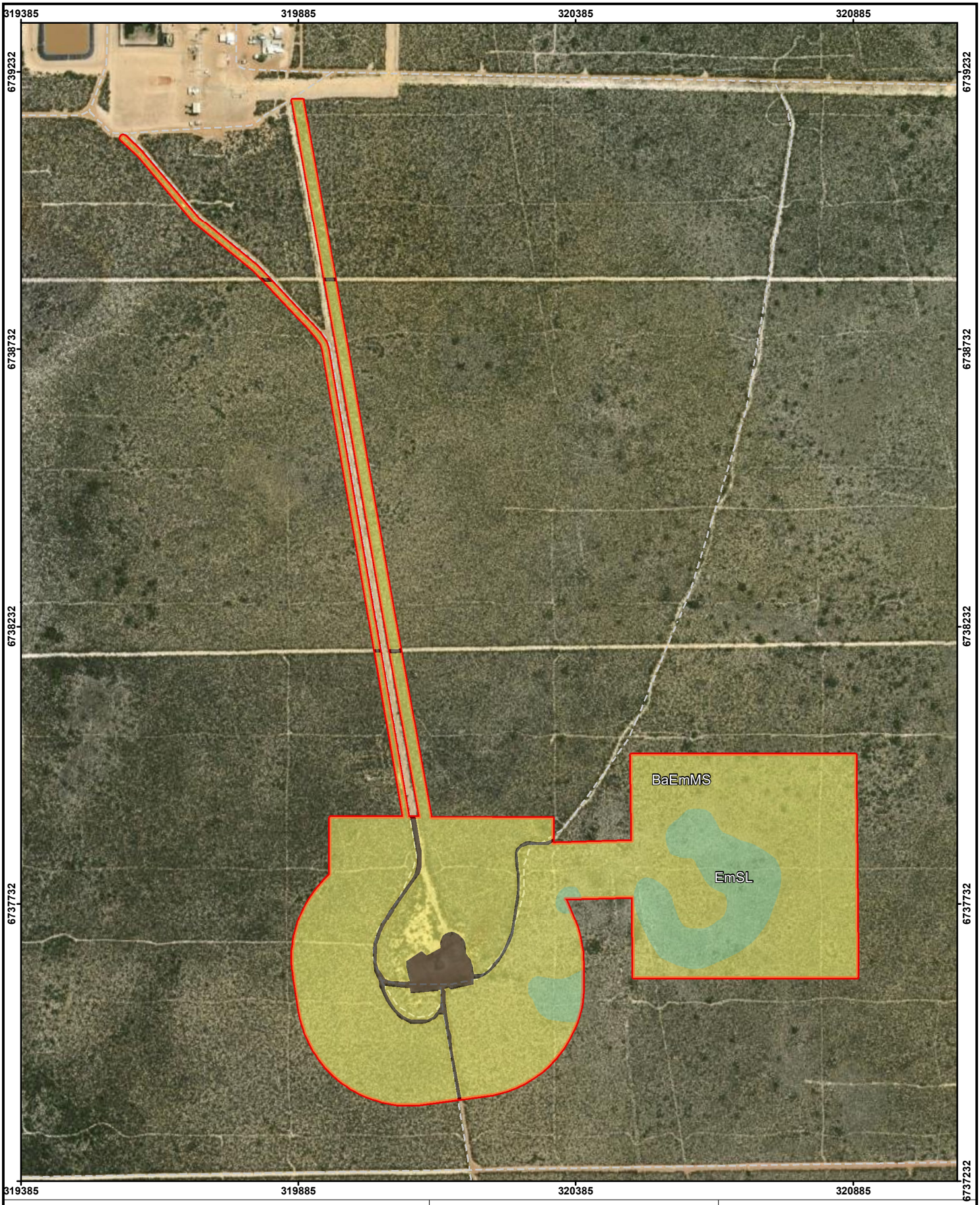
Vegetation in the Survey Area was mapped by JBS&G during the Reconnaissance survey conducted in May and June 2022. Two vegetation types were defined and delineated in the area:

- **BaEmMS** – Open mid shrubland of *Banksia attenuata,* with or without isolated emergent *Acacia* spp., *Eucalyptus todtiana* or *Xylomelum angustifolium*, over *Ecdeiocolea monostachya, Mesomelaena pseudostygia* and *Lepidobolus* sp. sparse sedgeland; and
- **EmSL** – Isolated low shrubs of *Banksia attenuata, Banksia shuttleworthiana* and *Calothamnus glaber,* over *Ecdeiocolea monostachya, Mesomelaena pseudostygia* and *Lepidobolus* sp. sedgeland.

The majority of the Survey Area was mapped as **BaEmMS** vegetation (Figure 3.2), dominated by open mid-shrubland of *Banksia attenuata* over sedges. This can also be characterised as Kwongan scrub or heath, which is a prominent vegetation type (VT) within the region. Most of the vegetation within the Survey Area was assessed as being in 'pristine' condition, with the exception of vegetation surrounding the existing cleared well pad, which was assessed as being in 'very good' condition.

Table 3.2: Vegetation Types within the Survey Area, based on JBS&G 2022.

Vegetation Types	Area (Ha)	Percentage (%)
BaEmMs	38.11	85.2
EmSL	4.94	11.1
Cleared	1.67	3.7



Legend

- Survey Area
- Track

Vegetation Type (Strategen-JBS&G 2022)

- BaEmMS
- EmSL
- Cleared / Not vegetated

Scale 1:9,000 at A4

0 100 200
Meters

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 09-Dec-2022

Drawn By: jcrute | Checked By: CT

Perth Basin Ecological Studies Targeted Flora Survey

Beharra Springs 2 and Beharra Springs 2 Deep

LOCAL VEGETATION

FIGURE 3.2

JBS&G

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Image Reference: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

3.2 DBCA Threatened and Priority Flora Database Search Results

A database search was conducted prior to the field survey (DBCA ref 14-0722FL), covering the Survey Area and a buffer of 18 km (search area). A total of 72 species were listed in the search (refer Appendix B for full listing). There were no previous records within the Survey Area. The nearest records were:

- *Hemiandra* sp. Eneabba (H. Demarz 3687) - ~1200 m southeast; and
- *Paracaleana dixonii* (T) - ~1500 m southeast.

To assist with determining which species may occur in the Survey Area, a likelihood assessment was conducted based on the criteria in Table 3.3. The results of the likelihood assessment for Threatened flora is presented in Table 3.4, with the findings for all flora listed in the database search results presented in Appendix B. Those flora species with known records proximal to the Survey Area, which are therefore considered to have a 'Possible' or 'Likely' potential for occurrence are shown in Figure 3.3.

Table 3.3: Criteria for Flora Likelihood Assessment

Likelihood	Criteria
Recorded	Species or community has been recorded previously and/or from the field survey.
Likely	Species or community likely to occur as suitable habitat is present and existing records are close to the Survey Area (within 4.5 km).
Possible	Species or community might occur as there are existing records in the vicinity (within 9 km) and suitable habitat is likely to be present. Species or community may also be present if there is insufficient information to exclude presence.
Unlikely	Species or community is unlikely to occur as habitat is not present, or habitat is present, but there are no records within the vicinity.

A total of 13 'Threatened' flora species as listed under Section 178 of the EPBC Act and Section 19(1) of the BC Act were identified in the search area (Table 3.4 and Appendix B).

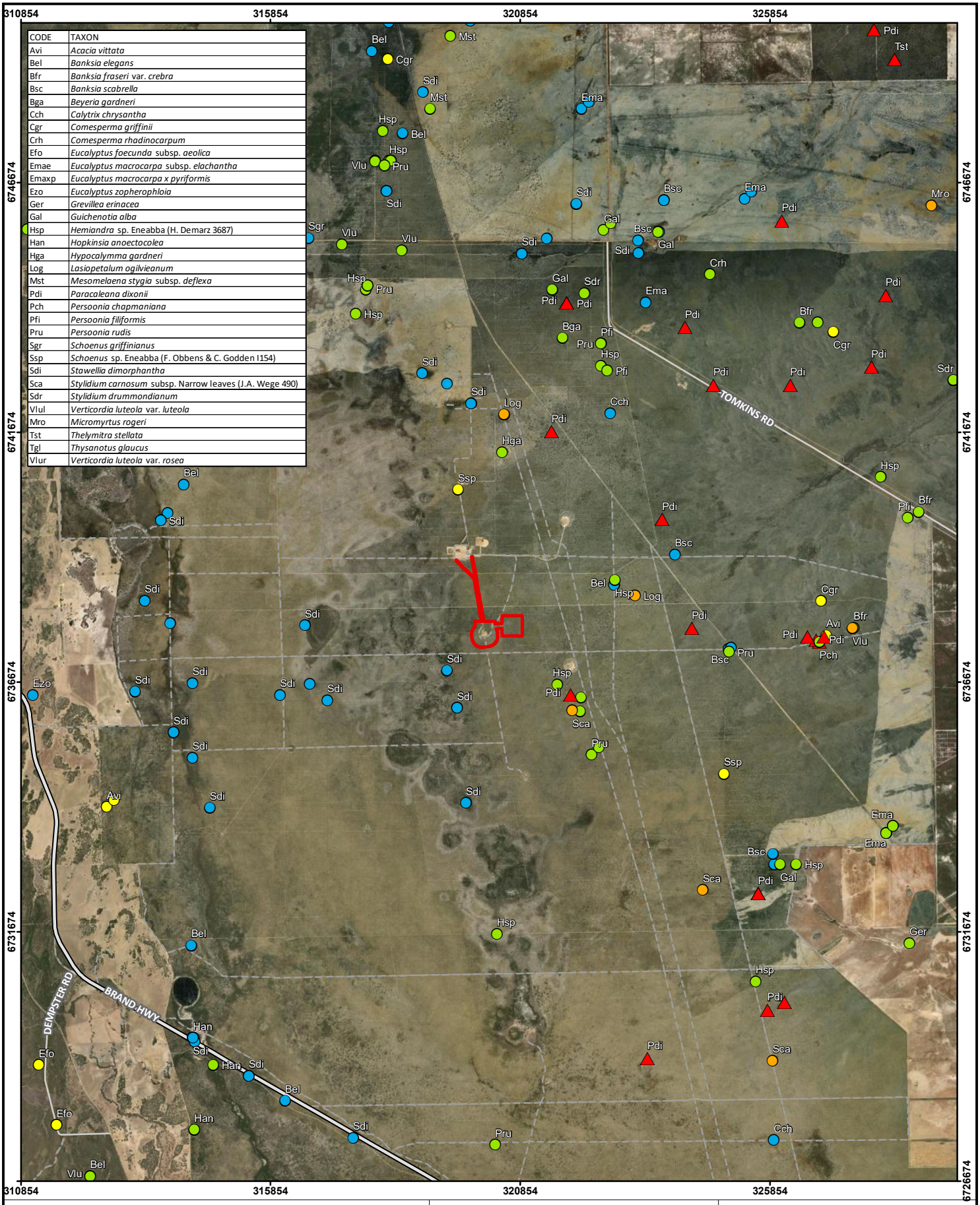
Table 3.4: Likelihood Assessment for Threatened Flora Species to Occur in Survey Area

Taxon	Conservation Status		Description	Likelihood of occurrence
	WA status	EPBC status		
Andersonia gracilis	VU	EN	A slender shrub up to 50 cm tall with few, spreading branches. Pink to pale mauve flowers are clustered in ovoid or oblong groups of 4 to 14 on terminal heads. Occurs on seasonally damp, black sandy clay flats near or on the margins of swamps, often on duplex soils supporting low open heath vegetation.	Unlikely (based on habitat preference)
Conostylis dielsii subsp. *teres*	VU	VU	A low, perennial monocot with terete leaves from 60-160 mm long and 0.5-1 mm wide. Short bristles of 0.8-1 mm long are present on the leaf margin and hairs on the leaf surface. Creamy yellow flowers appear from July to August. Occurs on sand/gravel.	Unlikely (based on lack of proximal records)
Conostylis micrantha	VU	VU	A low, perennial monocot with terete leaves from 70-145 mm long and 0.8-1 mm wide. Bristles of 8-10.5 mm length are present on the leaf margin, but the leaves are otherwise hairless. Yellow flowers appear from July to August. This species occurs in sandy areas.	Unlikely (based on lack of proximal records)
Daviesia speciosa	EN	EN	A low shrub with terete, pungent branchlets, that has a leafless appearance and red flowers that appear from April to May. Found in gravelly lateritic soils, undulating plains and rises.	Unlikely (based on lack of proximal records)
Eucalyptus crispata	EN	EN	A lignotuberous mallee from 3-7 m high, with rough bark on the trunk, in partly decorticated curls. Yellow-cream flowers appear from March to June. Prefers lateritic soils.	Unlikely (based on lack of proximal records)

Taxon	Conservation Status		Description	Likelihood of occurrence
	WA status	EPBC status		
Eucalyptus leprophloia	EN	EN	Lignotuberous mallee from 2-5(-8) m high with rough, loose & flaky bark to 1 m. Creamy white flowers appear from August to October. Occurs on a variety of soils.	Unlikely (based on lack of proximal records
Hakea megalosperma	VU	VU	A spreading, lignotuberous shrub from 1-2 m high. White-cream/pink flowers appear from May to June; nuts are retained year-round. Occurs on grey sand, loam, lateritic hills and rocks.	Unlikely (based on lack of proximal records)
Hemiandra gardneri	CR	EN	Prostrate, pungent shrub, 0.1-0.2 m high, to 1 m wide. Fl. Red/pink-red, Aug to Oct. Grey or yellow sand, clayey sand. Sandplains.	Unlikely (based on lack of proximal records)
Leucopogon obtectus (Styphelia obtecta (Benth.) F. Muell.)	EN	EN	A spindly erect shrub from 0.5-1.7 m high, with leaves which closely clasp the stem, obscuring the ends of branchlets. Tiny white to creamy yellow flowers appear in the leaf axils from August to October. Occurs on grey sands.	Unlikely (Habitat not present and no records within the vicinity <9km)
Paracaleana dixonii	VU	EN	A tuberous perennial orchid from 90-200 mm high, with a single, small basal leaf. Brown-yellow-green-red flowers in the shape of a duck appear from October to December or January. Found in shrubland under *Banksia* on deep sand, or in heath on shallow sand over laterite.	Likely (based on habitat preference and location of previous records)
Tetratheca nephelioides	EN	CR	Caespitose, dwarf shrub, to 0.3 m high. Fl. Purple, Sep. White-grey sand, yellow-brown clayey sand, gravel, laterite. Outcrops, undulating hills, ridges.	Unlikely (based on habitat preference)
Thelymitra stellata	EN	EN	A tuberous, perennial orchid from 150-250 mm high. Its yellow and brown flowers appear from October to November. Occurs on sand, gravel and lateritic loam.	Unlikely (based on lack of proximal records)
Wurmbea tubulosa	VU	VU	A cormous, perennial herb growing at ground level, from 10-30 mm tall with only three leaves, two of them larger. White-pink flowers appear from June to August. Found in clay and loam on riverbanks and seasonally-wet places.	Unlikely (based on lack of proximal records)

The remaining species were listed as Priority flora species by the DBCA as follows:

- Priority 1 flora (P1) – 5 taxa,
- Priority 2 flora (P2) – 12 taxa,
- Priority 3 flora (P3) – 29 taxa, and
- Priority 4 flora (P4) – 12 taxa.



CODE	TAXON
Avi	*Acacia vittata*
Bel	*Banksia elegans*
Bfr	*Banksia fraseri* var. *crebra*
Bsc	*Banksia scabrella*
Bga	*Beyeria gardneri*
Cch	*Calytrix chrysantha*
Cgr	*Comesperma griffinii*
Crh	*Comesperma rhadinocarpum*
Efo	*Eucalyptus foecunda* subsp. *aeolica*
Emae	*Eucalyptus macrocarpa* subsp. *elachantha*
Emaxp	*Eucalyptus macrocarpa x pyriformis*
Ezo	*Eucalyptus zopherophloia*
Ger	*Grevillea erinacea*
Gal	*Guichenotia alba*
Hsp	*Hemiandra* sp. Eneabba (H. Demarz 3687)
Han	*Hopkinsia anoectocolea*
Hga	*Hypocalymma gardneri*
Log	*Lasiopetalum ogilvieanum*
Mst	*Mesomelaena stygia* subsp. *deflexa*
Pdi	*Paracaleana dixonii*
Pch	*Persoonia chapmaniana*
Pfi	*Persoonia filiformis*
Pru	*Persoonia rudis*
Sgr	*Schoenus griffinianus*
Ssp	*Schoenus* sp. Eneabba (F. Obbens & C. Godden I154)
Sdi	*Stawellia dimorphantha*
Sca	*Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490)
Sdr	*Stylidium drummondianum*
Vlul	*Verticordia luteola* var. *luteola*
Mro	*Micromyrtus rogeri*
Tst	*Thelymitra stellata*
Tgl	*Thysanotus glaucus*
Vlur	*Verticordia luteola* var. *rosea*

Legend

- Survey Area
- Highways
- Minor road
- Track

Conservation Status

- T
- P1
- P2
- P3
- P4

Scale 1:100,000 at A4

0 1,000 2,000 Meters

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 09-Dec-2022

Drawn By: jcrute | Checked By: CT

Perth Basin Ecological Studies Targeted Flora Survey

Beharra Springs 2 and Beharra Springs 2 Deep

DATABASE SEARCH RESULTS

FIGURE 3.3

JBS&G

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Image Reference: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

3.3 EPBC Act Protected Matters Database Search Results

One EPBC Act listed species, *Paracaleana dixonii* (the Sandplain Duck Orchid [VU; EN]), was considered as being relevant to the Survey Area. Numerous records of this taxon are known from the vicinity, particularly in areas of unfragmented native vegetation to the immediate east of the Survey Area. Conservation Advice published in 2008 (DEWHA 2008) estimated that there were 57 plants occurring within eight extant populations, distributed across an approximately 540 km^2 range between Gingin and Dongara.

This diminutive plant is most detectable when flowering in November to January, or after summer fires when flowers proliferate, however, vegetative structures are absent for much of the year. This means there is a very specific and narrow survey period within which to assess presence of the Sandplain Duck Orchid.

Following significant surveys for the species south-east of Dongara, Woodman Environmental Consulting (2013) described the key local habitats for the taxon as:

- Low open woodland of Pricklybark (*Eucalyptus todtiana*) over mid to low shrubland of mixed species dominated by Dwarf Sheoak (*Allocasuarina humilis*), Burma Road Banksia (*Banksia scabrella*), *Calothamnus sanguineus, Eremaea beaufortioides* var. *microphylla, Melaleuca* aff. *Leuropoma* and *Hibbertia hypericoides* over low shrubland and sedgeland of mixed species including *Banksia dallanneyi* subsp. *media, Conostylis canteriata, Mesomelaena pseudostygia* and *Caustis dioica* on grey or brown sand on lower and mid slopes.
- Mid sparse to open shrubland of mixed species including *Calothamnus quadrifidus* subsp. *angustifolius, Grevillea biformis* subsp. *biformis* and Coast Banksia (*Banksia attenuata*) over low shrubland and sedgeland of mixed species dominated by *Ecdeiocolea monostachya*, *Melaleuca leuropoma, Daviesia divaricata* subsp. *divaricata, Mesomelaena pseudostygia* and *Banksia shuttleworthiana* on yellow-brown or occasionally grey sand on slopes and valley floors.
- Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* or mid open shrubland of *Allocasuarina campestris* over low shrubland and sedgeland of mixed species dominated by Pink Dryandra (*Banksia carlinoides*), *Ecdeiocolea monostachya, Hakea 12enticulat, Hibbertia hypericoides* and *Melaleuca aspalathoides* on gravelly grey or brown clay loams or sands, usually with laterite on or near the surface, on slopes and crests.

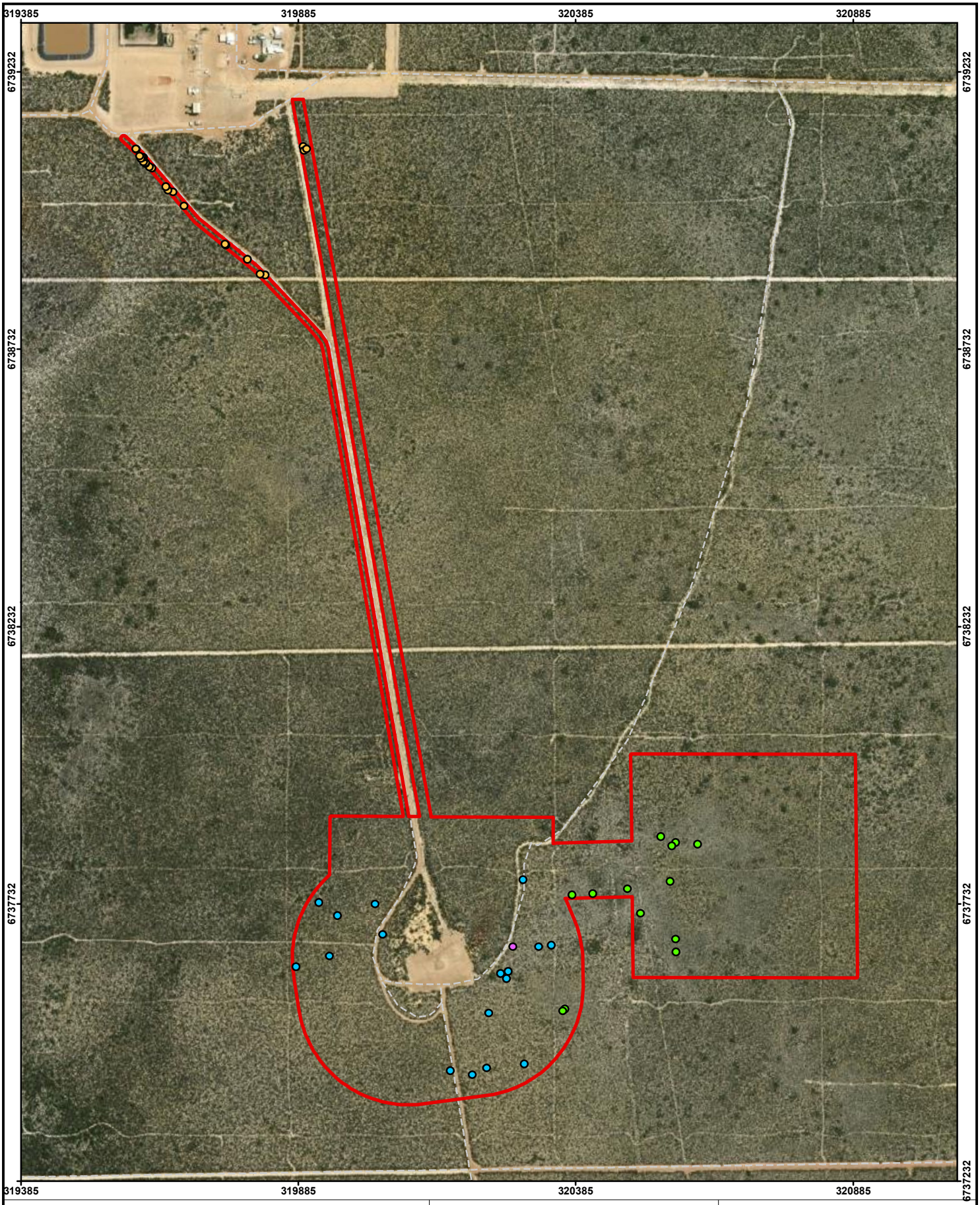
4. Survey Results

4.1 Summary of findings

During targeted searches over the Survey Area, a total of four Priority taxa were recorded. No Threatened flora were recorded. A summary of the flora recorded, the number of locations at which they were found and abundance is presented in Table 4.1. The distribution of the records within the Survey Area is presented in Figure 4.1.

Table 4.1: Priority Flora Recorded in the Survey Area During Targeted Searches Conducted in Spring 2022.

Species	Conservation code	Recorded locations	Plant count
Banksia elegans	P4	23	26
Beyeria gardneri	P3	13	15
Schoenus griffinianus	P4	1	1
Tricoryne sp. Wongan Hills (B.H. Smith 794)	P2	17	43



Legend

- Survey Area
- Track

Conservation-listed Flora

- *Banksia elegans* (P4)
- *Beyeria gardneri* (P3)
- *Schoenus griffinianus* (P4)
- *Tricoryne* sp. Wongan Hills (B.H. Smith 794) (P2)

Scale 1:9,000 at A4

0 100 200
Meters

Coord. Sys. GDA2020 MGA Zone 50

Job No: 62676

Client: Beach Energy Limited

Version: A | Date: 09-Dec-2022

Drawn By: jcrute | Checked By: CT

Perth Basin Ecological Studies Targeted Flora Survey

Beharra Springs 2 and Beharra Springs 2 Deep

CONSERVATION-LISTED FLORA

FIGURE 4.1

JBS&G

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Image Reference: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

4.2 Limitations

Potential or actual limitations of surveys need to be assessed to meet the requirements of the EPA (2016b). An assessment of the potential limitations associated with the targeted flora searches over the Survey Area is presented in Table 4.2.

Table 4.2: Survey constraints analysis.

Potential limitation	Constraint (yes/no, significant, moderate or negligible)	Comments
Availability of contextual information at a local and regional scale	No	The Survey Area was in an area that has been subject to extensive surveying.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The survey team was led by a botanist with over five years of experience specific to the bioregion and included a botanist with over three years of experience in the region and two botanists with less than two years of experience in the region.
Proportion of the flora recorded and/or collected, and any identification issues	No	Potential species that could occur in the Survey Area had been clearly identified. Samples of flora that could not be confidently identified in the field were taken and provided to expert taxonomists for confirmation.
Was the appropriate area fully surveyed (effort and extent)	No	The area was surveyed using parallel traverses spaced approximately 10 m from each other. All areas were surveyed on foot.
Access restrictions within the survey area	No	All areas that needed to be surveyed were able to be accessed by foot.
Survey timing, rainfall, season of survey	No	The survey was timed to coincide with flowering and emergence times of key flora of conservation significance that had the potential to occur in the area and was conducted after a period in which above average rainfall had been received.
Disturbances that may have affected the results of the survey e.g., fire, flood, clearing	Negligible	The survey incorporated some areas that were adjacent to access tracks and an out of service well pad and thus had been subject to some degree of disturbance.

5. Discussion

The distribution of Priority flora recorded during the survey separates into two distinct groupings. All records of *Banksia elegans* (P4) were in the northern sections of the access track corridor near the existing Beharra Springs processing plant and administration area. This location and the vegetation to the north and northwest of the current administration and operations sites has been observed as hosting numerous individuals of this species. DBCA records contain 12 distinct populations of *B. elegans* within a 10 km radius of the Survey Area, with six of these in conservation reserves. This species has a known range from east of Jurien Bay to east of Geraldton (WAH 1998-2022). The scale of impacts associated with this species are considered to be moderate on a local scale but low on a regional scale.

The remaining records of Priority flora were all made in the Beharra 2 and Deep survey areas. *Tricoryne* sp. Wongan Hills (B.H. Smith 794) (P2) was recorded in the Beharra 2 survey area. There was only one record of this species in the DBCA database search results. This species is known from a small number of populations; however, these are distributed between the Perth hills and Mingenew (WAH 1998-2022). There is the potential that there are populations of this species that have not been recorded, but based on current information, the scale of impacts associated with the proposed activities should be considered significant on both a local and regional scale.

Most records of *Beyeria gardneri* (P3) were in the proposed Beharra 2 Deep lease area. There were three records of this species in the DBCA database search results, with two of these in conservation reserves. While the database search records were limited, it is noted that this species is recorded from east of Cervantes to northeast of Kalbarri (WAH 1998-2022). With local populations in the conservation estate and a wide distribution, it is proposed that the scale of impacts to this species are moderate on a local level but low on a regional level.

The single record of *Schoenus griffinianus* (P4) made during the survey was in the Beharra 2 survey area. There were three records of this species recorded in the DBCA database search result, all of which were located outside of conservation reserves. This species has a distribution from east of Perth to southeast of Geraldton (WAH 1998-2022). Based on the distribution of this *S. griffinianus,* it is proposed that the scale of impacts to this species is low on both a local and regional scale.

The likelihood assessment for species listed in the DBCA database search for the area has been updated based on data collected during the targeted searches. This summary is presented in Appendix B (Table B1). The species for which an assessment of 'possible' has been made are mostly small herbaceous species. While not observed during the survey, there is a residual potential for these to be present. The results of this study provide an overall estimate of Priority flora within the Survey Area; however, it should be noted that the actual numbers of smaller species such as *Schoenus griffinianus* and *Tricoryne* sp. Wongan Hills (B.H. Smith 794) may be higher than those recorded during the targeted searches.

6. Recommendations

It is recommended that, as far as is practicable, the disturbance associated with the vegetation in the Survey Area is minimised, and, where possible, populations of flora of conservation significance are avoided.

7. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

8. References

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Appendix A Definitions and Classifications

Table A.1: EPBC Act categories for threatened species

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

Table A.2: Conservation codes for Western Australian flora and fauna (DBCA 2020b)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. *The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species[3] 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 the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species. Threatened flora is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species. The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline (Number 1) and Ministerial Guideline (Number 2) that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria[4], and is based on the national distribution of the species.
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.
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.
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)I of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.
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).
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 fauna or flora species listed as extinct in the wild.
P	**Priority species** Priority is not a listing category under the BC Act. All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land). Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey 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 prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened. Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of priority status is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	**Priority 1: Poorly-known species - known from few locations, none on conservation lands** 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, for example, 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 for threatened listing and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.

Conservation Codes for Western Australian Flora and Fauna	
2	**Priority 2: Poorly-known speci–s - known from few locations, some on conservation lands** 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, for example, 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 for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.
3	**Priority 3: Poorly-known speci–s - known from several locations** 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. These species need further survey.
4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as a conservation dependent specially protected speciel(c) Species that have been removed from the list of threatened species or lists of conservation dependent or other specially protected species, during the past five years for reasons other than taxonomy. (d) Other species in need of monitoring.

[1] The definition of flora includes algae, fungi, and lichens.

[2] Species includes all taxa (plural of –axon - 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).

[3] Schedules are not referred to when stating the listing status of threatened, extinct or specially protected species under the BC Act. See the examples provided under each listing category.

[4] Western Australia has assigned species to threat categories using the IUCN Red List of Threatened Species Categories and Criteria since 1996 (referencing all criteria). At the national level, threatened species listings under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) reference only some of the IUCN criteria (http://www.environment.gov.au/biodiversity/threatened/nominations/forms-and-guidelines).

Appendix B Likelihood of Occurrence Assessment

Table B.1: Flora Likelihood of Occurrence

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence within Beharra Gas Facility project area	Post-field Likelihood of occurrence within Beharra Springs 2, Beharra Springs 2 Deep and access tracks
	BC Act	EPBC Act				
Acacia latipes subsp. *licina*	P3		Pungent shrub, 0.4-1.2 m high. Fl. yellow, Jun to Sep. White sand, granitic soils. Limestone hills, sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Acacia vittata	P2		Dense, rounded shrub, 1-4 m high. Fl. yellow, Aug. Grey sand, sandy clay. Margins of seasonal lakes.		Possible Habitat present and records within the vicinity	Unlikely
Andersonia gracilis	VU	EN	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Species or species habitat likely to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Anthocercis intricata	P3		Dense, spinescent shrub, 0.9-3 m high. Fl. white-cream, Jun to Sep. Sand or loam over limestone. Consolidated sand dunes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Baeckea sp. Walkaway (A.S. George 11249)	P3		Dense, multi-stemmed shrub, 0.5-2 m high. Fl. white, Dec or Jan. Yellow/brown or white sand. Undulating plains, hillslopes.		Possible Habitat present and records within the vicinity	Unlikely
Banksia cypholoba	P3		Prostrate, dwarf, lignotuberous shrub, to 0.3 m high. Fl. yellow-brown, Aug. Sand & gravelly loam.		Possible Habitat present but no records within the vicinity (<9km)	Possible
Banksia elegans	P4		Shrub (with fire-tolerant rootstock, often suckering), 1-4 m high. Fl. yellow/green-yellow, Oct to Nov. Yellow, white or red sand. Sandplains, low consolidated dunes.		Likely Habitat present and existing close records	Recorded
Banksia fraseri var. *crebra*	P3		Shrub usually less than 50 cm high. Leaf lobes linear, glaucous. Sandy loam or sandy clay over laterite, in kwongan. Fl. July and August.		Likely Habitat present and records within the vicinity	Unlikely
Banksia scabrella	P4		Much-branched, lignotuberous shrub, 0.6-2 m high. Fl. yellow & cream & purple, Sep to Dec or Jan. White, grey or yellow sand, sometimes with lateritic gravel. Sandplains, lateritic ridges.		Likely Habitat present and existing close records	Unlikely
Beyeria cinerea subsp. *cinerea*	P3		A spreading, erect or prostrate succulent shrub to 70cm, with both male and female, inconspicuous flowers that1enticulaticable petals, with flowers consisting of a yellow-green calyx. Flowers appear in July and from September to November. Subspecies cinerea has leaf blades with truncate to cuneate bases rather than cordate bases. It grows in coastal heath and shrubland on sandy soils over limestone.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence within Beharra Gas Facility project area	Post-field Likelihood of occurrence within Beharra Springs 2, Beharra Springs 2 Deep and access tracks
	BC Act	EPBC Act				
Beyeria gardneri	P3		Shrub, 0.25-0.5 m high. Fl. yellow, Aug to Sep. Yellow sand.		Likely Habitat present and existing close records	Recorded
Cala2enticulateculata subsp. *albicans*	P1		15-35 cm height. Flowers dull white or cream. Labellum white with red stripes, spots and blotches. Column opaque cream with red stripes, spots and blotches. Grows in a variety of habitats as well as moist, calcareous sand under Eucalyptus camaldulensis and Acacia species. Also known as Cala2enticulateculata subsp. Arrowsmith. Flowers 7-10cm long x 5-9 cm wide.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Calytrix chrysantha	P4		Shrub, 0.3-1.3 m high. Fl. yellow, Dec or Jan to Feb. White, grey or yellow/brown sand. Flats.		Likely Habitat present and existing close records	Unlikely
Calytrix eneabbensis	P4		Shrub, 0.3-1 m high. Fl. purple & pink & yellow, Jul to Oct. White, grey or yellow sand over laterite. Sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Calytrix superba	P4		Shrub, 0.2-1 m high. Fl. pink-red, Dec or Jan to Feb. Sand over laterite. Flats.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Centrolepis milleri	P3		Specimens of C. milleri grow with their leaves mostly buried by sand. Centrolepis milleri superficially resembles C. drummondiana, but differs from it in the presence of two to five cataphylls at the base of a scape, in the absence of a spikelet in the axil of the lower primary bract, in the dimorphic morphology of the primary bracts and in the presence of one long and one short tepal-like phyllome associated with each flower. The absence of a spikelet in the axil of the lower primary bract and the dimorphic nature of the primary bracts are shared with species such as C. polygyna and C. glabra, to which C. milleri is apparently related. Spring flowering.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Comesperma griffinii	P2		Annual or perennial, herb, to 0.15 m high. Fl. white, Oct. Yellow or grey sand. Plains.		Possible Habitat present and records within the vicinity	Unlikely
Comesperma rhadinocarpum	P3		Perennial, herb. Fl. blue, Oct to Nov. Sandy soils.		Possible Habitat present and records within the vicinity	Unlikely
Conostylis dielsii subsp. *teres*	VU	EN	Shortly rhizomatous, tufted perennial, grass-like or herb, 0.13-0.33 m high, leaves terete. Fl. cream-yellow, Jul to Aug. White, grey or yellow sand, gravel. Low open woodland.	Species or species habitat likely to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Conostylis micrantha	VU	EN	Rhizomatous, tufted perennial, grass-like or herb, 0.13-0.24 m high. Fl. yellow-cream/red, Jul to Aug. White or grey sand. Sandplains.	Species or species habitat known to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence within Beharra Gas Facility project area	Post-field Likelihood of occurrence within Beharra Springs 2, Beharra Springs 2 Deep and access tracks
	BC Act	EPBC Act				
Dampiera tephrea			Ascending to erect perennial, herb or shrub, 0.3-0.6 m high, with grey or yellowish hairs on abaxial surface of leaves. Fl. blue, Jul. Sand, gravelly loam.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Daviesia speciosa	EN	EN	Many-stemmed shrub, 0.3-0.8 m high. Fl. red, Apr to May. Gravelly lateritic soils. Undulating plains, rises.	Species or species habitat known to occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Eucalyptus crispata	EN	EN	A lignotuberous mallee from 3-7 m high, with rough bark on the trunk, in partly decorticated curls. Yellow-cream flowers appear from March to June. Prefers lateritic soils.	Species or species habitat likely to occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Eucalyptus foecunda subsp. *aeolica*	P2		Distinguished from E. foecunda subsp. foecunda by its consistently dull, grey-green seedling leaves that are pruinose, at least on the new growth.White, yellowish or pale brown coastal sands overlying limestone, often on limestony dunes, in mallee shrubland or low open woodland. Associated eucalypts include Eucalyptus erythrocorys, E. obtusiflora subsp. dongarrensis, E. petrensis and E. zopherophloia.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Eucalyptus leprophloia	EN	EN	(Mallee), 2-5(-8) m high, bark rough loose & flaky to 1 m. Fl. cream-white, Aug to Oct. White or grey sand over laterite. Valley slopes.	Species or species habitat known to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Eucalyptus macrocarpa subsp. *elachantha*	P4		(Spreading or sprawling mallee), 0.8-4 m high, bark smooth, grey over salmon pink. Fl. red-pink, Aug to Sep or Nov to Dec. White or grey sand over laterite. Hillslopes, ridges, sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Eucalyptus macrocarpa x pyriformis	P3		Erect, open mallee tree, 1.2-6 m high. Fl. red, Apr or Aug to Oct. Sand, lateritic sandy soils. Hills, rocky ironstone ridges, sandplains.		Likely Habitat present and existing close records	Unlikely
Eucalyptus zopherophloia	P4		(Spreading mallee), 2.5-4(-6) m high, bark rough, fibrous. Fl. cream-white, Oct to Dec or Jan. Grey/white sand with limestone rubble. Coastal areas.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Grevillea erinacea	P3		Spindly, prickly, sparingly branched shrub, (0.3-)0.6-1.8 m high. Fl. green-white-cream, Jul to Dec. White, grey or yellow sand, often with lateritic gravel.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Guichenotia alba	P3		Slender, lax, few-branched shrub, 0.1-0.45 m high. Fl. white, Jul to Aug. Sandy & gravelly soils. Low-lying flats, depressions.		Likely Habitat present and existing close records	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence within Beharra Gas Facility project area	Post-field Likelihood of occurrence within Beharra Springs 2, Beharra Springs 2 Deep and access tracks
	BC Act	EPBC Act				
Guichenotia quasicalva	P2		Erect, compact shrub, to 0.5 m high. Fl. blue-purple, Sep to Oct. Sandy clay over laterite. Drainage line.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Hakea megalosperma	VU	VU	Spreading, lignotuberous shrub, 1-2 m high. Fl. white-cream/pink, May to Jun. Grey sand, loam. Lateritic hills & rocks.	Species or species habitat may occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Haloragis foliosa	P3		Perennial, herb or shrub, 0.2-0.5 m high. White/grey sand over limestone.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Hemiandra garderni	CR	EN	Prostrate, pungent shrub, 0.1-0.2 m high, to 1 m wide. Fl. red/pink-red, Aug to Oct. Grey or yellow sand, clayey sand. Sandplains.	Species or species habitat may occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Hemiandra sp. Eneabba (H. Demarz 3687)	P3		Straggly, erect shrub, 0.5-0.9 m high, to 0.4 m wide. Fl. blue/violet, Feb. Sand. Disturbed sites.		Likely Habitat present and existing close records	Unlikely
Hemigenia saligna	P3		Shrub, 0.3-1 m high. Fl. blue-purple/violet, Jul to Oct. Lateritic & sandy soils.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Hopkinsia anoectocolea	P3		Rhizomatous, tufted perennial, herb, 0.5-1 m high, to 1 m in diameter. Fl. brown, Sep to Dec. White or grey sand, often saline. Winter-wet depressions, floodplains, salt lakes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Hypocalymma gardneri	P3		Shrub, to 0.3 m high. Fl. yellow, Aug to Sep. Grey-brown sand, laterite. Sandplains, upper slopes, heathland.		Likely Habitat present and existing close records	Unlikely
Hypocalymma tetrapterum	P3		Shrub, 0.4-0.9 m high. Fl. white, Aug. Grey sand, loam, lateritic gravel. Riverbanks, breakaways.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Lasiopetalum ogilvieanum	P1		Shrub, 0.45-1.5 m high. Fl. pink-white, Jul to Oct. White/grey or yellow sand, stony loam. Undulating plains, lateritic rises.		Likely Habitat present and existing close records	Unlikely
Leucopogon obtectus (*Styphelia obtecta* (Benth.) F.Muell.)	EN	EN	A spindly erect shrub from 0.5-1.7 m high, with leaves which closely clasp the stem, obscuring the ends of branchlets. Tiny white to creamy yellow flowers appear in the leaf axils from August to October. Occurs on grey sands.	Species or species habitat likely to occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence within Beharra Gas Facility project area	Post-field Likelihood of occurrence within Beharra Springs 2, Beharra Springs 2 Deep and access tracks
	BC Act	EPBC Act				
Mesomelaena stygia subsp. *deflexa*	P3		Tufted perennial, grass-like or herb (sedge), 0.1-0.5 m high. Fl. brown-black, Mar to Oct. White, grey or lateritic sand, clay, gravel.		Likely Habitat present and existing close records	Unlikely
Micromyrtus rogeri	P1		Shrub, 0.2-0.4 m high. Fl. white, Jul to Oct. Yellow-brown sandy soils, gravel, laterite. Breakaways.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Paracaleana dixonii	VU	EN	A tuberous perennial orchid from 90-200 mm high, with a single, small basal leaf. Brown-yellow-green-red flowers in the shape of a duck appear from October to December or January. Found in shrubland under Banksia on deep sand, or in heath on shallow sand over laterite.	Species or species habitat known to occur within area	Likely Habitat present and existing close records	Unlikely
Persoonia chapmaniana	P3		Erect, spreading shrub, 1-2 m high. Fl. yellow, Sep to Nov. White sandy clay, yellow sand. Vicinity of salt lakes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Persoonia filiformis	P3		Erect, spreading, lignotuberous shrub, 0.07-0.4 m high. Fl. yellow, Nov to Dec. Yellow or white sand over laterite.		Likely Habitat present and existing close records	Unlikely
Persoonia rudis	P3		Erect, often spreading shrub, 0.2-1 m high. Fl. yellow, Sep to Dec or Jan. White, grey or yellow sand, often over laterite.		Likely Habitat present and existing close records	Unlikely
Pityrodia viscida	P4		Viscid shrub, 0.3-0.6(-1) m high. Fl. white, Sep to Dec or Jan to Feb. Lateritic sand.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Schoenus badius	P2		Slender annual, grass-like or herb (sedge), 0.05-0.12 m high. Fl. brown-green, Sep to Oct. Grey sand. Moist areas.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Schoenus griffinianus	P4		Small, tufted perennial, grass-like or herb (sedge), to 0.1 m high. Fl. Sep to Oct. White sand.		Likely Habitat present and existing close records	Recorded
Schoenus sp. Eneabba (F. Obbens & C. Godden I154)	P2		Erect, clumped rhizomatous, perennial, grass-like or herb (sedge), to 0.75 m high. Grey, yellow or white sand. Undulatiing sandplains, mid slopes, tops of rises.		Likely Habitat present and existing close records	Possible
Scholtzia calcicola	P2		Erect, dense shrub to 2 m high, with tiny, pale pink flowers in a raceme-like arrangement and a wrinkled hypanthium. It has the smallest flowers in the genus at 2.5-3.5 mm diameter and with petals 1-1.2 mm long. Commonly has 5 stamens, with 0-2 opposite each sepal. Recorded from near Dongara south to Drovers Cave National Park in heath on shallow sand over limestone.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Stawellia dimorphantha	P4		Stilt-rooted perennial, herb, 0.05-0.2 m high. Fl. purple/cream, Jun to Nov. White, grey, yellow sand.		Likely Habitat present and existing close records	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence within Beharra Gas Facility project area	Post-field Likelihood of occurrence within Beharra Springs 2, Beharra Springs 2 Deep and access tracks
	BC Act	EPBC Act				
Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490)	P1		Cormaceous herb to 1m with white flowers between Oct – Nov.		Likely Habitat present and existing close records	Possible
Stylidium drummondianum	P3		Rosetted perennial, herb, 0.05-0.22 m high, Leaves narrowly oblanceolate, 0.5-3 cm long, 0.8-2 mm wide, apex mucronate, margin hyaline and serrulate, glabrous. Scape hoary. Inflorescence paniculate. Fl. pink, Aug to Oct. Sand or clayey sand over laterite. Upper hillslopes, breakaways. Low heath, mallee shrubland.		Likely Habitat present and existing close records	Possible
Stylidium longitubum	P4		Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Stylidium pseudocaespitosum	P2		Rosetted perennial, herb, 0.1-0.3 m high, leaves tufted, linear, 2-7 cm long, 0.5-2 mm wide, apex subacute, margin entire, scabrous. Scape glabrous. Inflorescence racemose. Fl. yellow, Sep to Nov. White, grey or yellow sand over laterite. Breakaways and hillslopes.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Stylidium sp. Three Springs (J.A. Wege & C. Wilkins JAW 600)	P2		Occurs in yellow-brown clayey sand over laterite, yellow-brown clayey loam over granite, ironstone breakaway, loamy soils over granite, clay loams with scattered gravel, rocky hill with lateritic stones.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Stylidium torticarpum	P3		Caespitose perennial, herb, 0.12-0.27 m high, Leaves tufted, broadly linear, (2-) 5-13 cm long, 0.6-1.5 mm wide, apex mucronate, margin hyaline and serrulate, glabrous. Scape glandular throughout. Inflorescence paniculate. Capsule twisted. Fl. pink, Sep to Nov. Sandy clay and clay loam over laterite. Adjacent to creeklines, depressions, and beneath breakaways. Heath or mallee shrubland.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Synaphea oulopha	P3		Compact shrub, ca 0.2 m high. Fl. yellow, Jul to Oct. Grey sand, gravelly loam, clay. Lateritic breakaways & rises.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Synaphea sparsiflora	P2		Shrub, to 0.6 m high, to 1 m wide. Fl. yellow, Aug to Sep. Sandy loam over laterite.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Tetratheca nephelioides	EN	CR	Caespitose, dwarf shrub, to 0.3 m high. Fl. purple, Sep. White-grey sand, yellow-brown clayey sand, gravel, laterite. Outcrops, undulating hills, ridges,.	Species or species habitat may occur within area	Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Thelymitra stellata	EN	EN	A tuberous, perennial orchid from 150-250 mm high. Its yellow and brown flowers appear from October to November. Occurs on sand, gravel and lateritic loam.	Species or species habitat likely to occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely

Taxon	Conservation Status		Description	PMST Attribution	Desktop Likelihood of occurrence within Beharra Gas Facility project area	Post-field Likelihood of occurrence within Beharra Springs 2, Beharra Springs 2 Deep and access tracks
	BC Act	EPBC Act				
Thryptomene sp. Lancelin (M.E. Trudgen 14000)	P3		Shrub, ca 0.5 m high. Fl. pink, Sep. Calcareous sand.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Thysanotus glaucus	P4		Caespitose, glaucose perennial, herb, 0.1-0.2 m high. Fl. purple, Oct to Dec or Jan to Mar. White, grey or yellow sand, sandy gravel.		Likely Habitat present and existing close records	Possible
Tricoryne sp. Wongan Hills (B.H. Smith 794)	P2		Multi-stemmed, open, caespitose rhizomatous, perennial, herb, to 0.2 m high. Yellow to grey sand, gravelly clay quartz, laterite, limestone. Midslopes and uplands.		Unlikely Habitat present but no records within the vicinity (<9km)	Recorded
Triglochin protuberans	P3		Annual, herb, 0.03-0.13 m high. Red loam, grey mud over clay. Winter-wet sites, claypans, near salt lakes, margins of pools.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Verticordia argentea	P2		Erect, open shrub, 0.9-2 m high. Fl. pink & white, Nov to Dec or Jan to Apr. White, grey or yellow sand. Sand ridges, undulating plains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Verticordia dasystylis subsp. *oestopoia*	P1		Spreading shrub, 0.1-0.4 m high. Fl. cream-yellow, Oct. Gritty soils over granite. Outcrops.		Unlikely Habitat not present and no records within the vicinity (<9km)	Unlikely
Verticordia fragrans	P3		Openly branched shrub, 1-3 m high. Fl. pink-white, Sep to Nov. White, grey or yellow sand, clay loam. Low-lying areas, sandplains.		Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely
Verticordia luteola var. *luteola*	P3		Slender shrub, 0.5-1.4 m high. Fl. white-yellow, Nov to Dec. Grey sand over gravel. Flats.		Likely Habitat present and existing close records	Unlikely
Wurmbea tubulosa	VU	EN	Cormous, perennial, herb, 0.01-0.03 m high, dioecious or sometimes andromonoecious. Fl. white-pink, Jun to Aug. Clay, loam. River banks, seasonally-wet places.	Species or species habitat may occur within area	Unlikely Habitat present but no records within the vicinity (<9km)	Unlikely

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Appendix C Black-Cockatoo Habitat Survey 2022 – Assessment of Values for Black-Cockatoos for Beach Energy in the Beharra Springs Project Area

Assessment of Values for Black-Cockatoos for Beach Energy in the Beharra Springs Project Area



Kwongan heath surrounding one of the existing gas facilities at Beharra Springs. Photo: Wes Bancroft.

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7th January 2023

Executive Summary

Beach Energy is proposing to expand operations at its Beharra Springs Gas Facility (BSGF) at Mount Adams, Western Australia. Six project areas are currently being considered:

(i) Tarantula 1 and Tarantula Deep 1 ('Tarantula Deep 1')
(ii) Beharra Springs Deep 3
(iii) Beharra Springs Gas Facility Proposed Workers Accommodation Camp ('BSGF Proposed Camp')
(iv) Redback 2 and Redback Deep 1 ('Redback Deep 1')
(v) Beharra Springs 2 and Beharra Springs Deep 2 ('Beharra Springs Deep 2')
(vi) Trigg Northwest 1B

All sites, other than the BSGF Proposed Camp, are options for future drilling campaigns and the development envelopes range between c. 9.9 ha and 40.7 ha in size.

One taxon of threatened black-cockatoo may make use of the project sites (for breeding, foraging and/or roosting): *Zanda latirostris* (Carnaby's Black-Cockatoo). Bamford Consulting Ecologists (BCE) was commissioned to conduct a targeted desktop assessment and site inspection to better understand the use, and potential use, of the survey area by black-cockatoos.

Vegetation and substrate associations (VSAs)

Eight major vegetation and substrate associations (VSAs) were identified in relation to fauna in the survey areas:

- VSA01: Banksia shrubland
- VSA02: Banksia woodland
- VSA03: Mixed shrubland
- VSA04: Sedgeland
- VSA05: Melaleuca thicket
- VSA06: Coastal Blackbutt/Woody Pear woodland
- VSA07: Dampland
- VSA08: Cleared or disturbed

Black-cockatoo habitat analysis

No species of black-cockatoo was recorded within the survey areas during the site inspection, and there was very scant indirect (foraging) evidence observed. Despite this, BCE has regular records of Carnaby's Black-Cockatoo in the general area, suggesting that it is a regular visitor over this region, but may visit small locations, such as the Beach Energy project areas, irregularly.

All the survey areas are unsuited to breeding by black-cockatoos; there were no hollow-bearing trees present.

Foraging habitat for the Carnaby's Black-Cockatoo was present throughout the survey areas. A detailed BCE foraging habitat assessment was conducted (including mapping), and these data are presented within the report. The quality of potential foraging habitat varied considerably within the

boundaries of most areas but a relatively small proportion of the total area surveyed was considered to have 'high' value vegetation scores.

Despite extensive searching, there was only one (old) record of foraging by Carnaby's Black-Cockatoo recorded (within the Beharra Springs Deep 3 survey area).

The survey areas are therefore, generally, of moderate value for potential foraging by the Carnaby's Black-Cockatoo and there was only very limited evidence to show that this species has previously used the sites for feeding.

The DCCEEW foraging quality scoring tool was also used to assess the survey areas and these data are presented within.

No black-cockatoo night-roosts are known from within the survey areas and there was a complete absence of suitable roosting habitat. Night roosts are, however, known from the region (the nearest of these is within c. 12 km of the Tarantula Deep 1 survey area boundary).

No potential water sources for black-cockatoos were observed within the survey areas.

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1 Introduction

Beach Energy is proposing to expand operations at its Beharra Springs Gas Facility at Mount Adams, c. 30 km south-east of Dongara and c. 40 km north of Eneabba, Western Australia (see Figure 1). Six project areas are currently being considered (listed below from north to south, and shown on Figure 1):

(i) Tarantula 1 and Tarantula Deep 1 (hereafter 'Tarantula Deep 1')
(ii) Beharra Springs Deep 3
(iii) Beharra Springs Production Facility Proposed Camp (hereafter 'BSGF Proposed Camp')
(iv) Redback 2 and Redback Deep 1 (hereafter 'Redback Deep 1')
(v) Beharra Springs 2 and Beharra Springs Deep 2 (hereafter 'Beharra Springs Deep 2')
(vi) Trigg Northwest 1B

All sites, other than the BSGF Proposed Camp, are options for future drilling campaigns.

It is possible that one taxon of threatened black-cockatoo may make use of the project sites (for breeding, foraging and/or roosting):

- *Zanda* (previously *Calyptorhynchus) latirostris* (Carnaby's Black-Cockatoo) – listed as Endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999* and also as Endangered under the Western Australian *Biodiversity Conservation Act 2016* (see Appendix 1 for more details).

Bamford Consulting Ecologists (BCE) was commissioned to conduct a targeted desktop assessment and site inspection to better understand the use, and potential use, of the survey area by black-cockatoos. This report presents the findings of that survey.

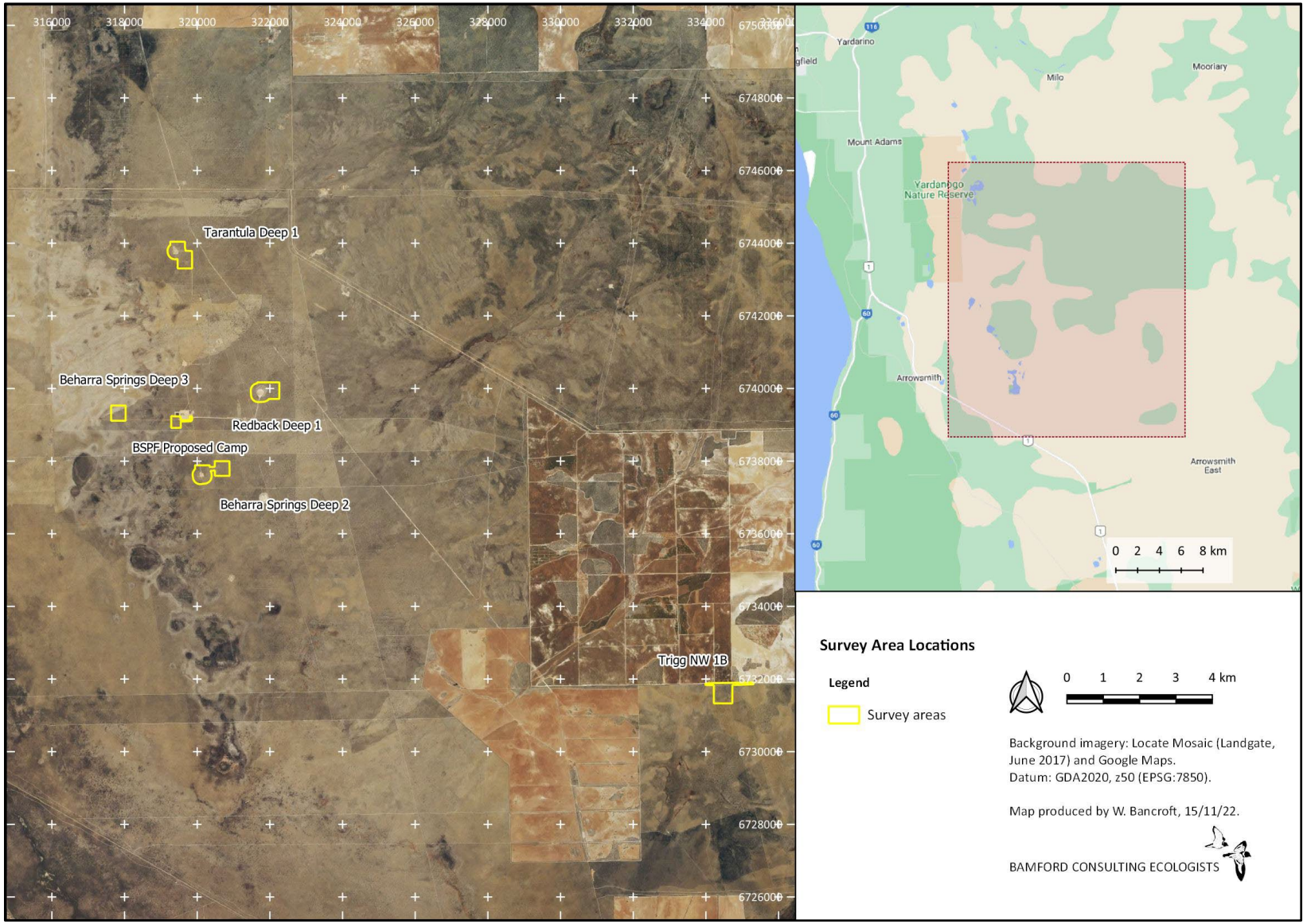


Figure 1. Location of the survey areas.

1.1 Background: black-cockatoo ecology

There is considerable published information on the ecology of, and threats to, Carnaby's, Baudin's and Forest Red-tailed Black-Cockatoos. Key references include:

- Action plans (Garnett and Baker 2021);
- Recovery plans (DEC 2008; DPaW 2013);
- EPBC Act referral guidelines (DSEWPaC 2012; DAWE 2022b);
- Commonwealth listing and conservation advice (DEWHA 2009a, b; TSSC 2018);
- The federal Department of Climate Change, Energy, the Environment and Water's (DCCEEW) Species Profile and Threats (SPRAT) Database (DCCEEW 2022a, b, c);
- Scientific literature (Davies 1966; Saunders 1974, 1979a, b, 1980; Saunders *et al.* 1982; Saunders 1986; Johnstone and Storr 1998; Higgins 1999; Johnstone and Kirkby 1999, 2008; Johnstone *et al.* 2013a, b; Whitford *et al.* 2015; Johnston *et al.* 2016; Williams *et al.* 2016; Williams *et al.* 2017); and
- Major reports (Johnstone *et al.* 2011; Kabat *et al.* 2012; Peck *et al.* 2016).

Much of this information has been compiled by DCCEEW (2022a, b, c). Summarising this work further, there are several salient points for assessing the potential value of the site for black-cockatoos:

Key ecology

- All species are long-lived with low annual reproduction rates and cannot, therefore, rapidly increase their population size.
- Carnaby's and Baudin's Black-Cockatoos undergo regular, seasonal migration between breeding and non-breeding areas.
- Forest Red-tailed Black-Cockatoos are not currently considered to undergo regular migration. In recent years there appears to have been a distinct expansion of the range of this species on to the Swan Coastal Plain, including many suburbs within the Perth metropolitan area.
- It is possible that Baudin's Black-Cockatoo is also beginning a similar expansion of its range on to the Swan Coastal Plain.
- In recent years there have been considerable shifts in the breeding ecology, distribution and movement patterns of Forest Red-tailed and Carnaby's Black-Cockatoos. These may be a response to habitat degradation/clearing and/or climatic factors.

Key habitat requirements

- All species are reliant on large tree-hollows in eucalypts, in which they breed. Each species has its own preference for nesting tree species and its own geographical breeding range (although these overlap between species). There is a solid understanding of these preferences (see Appendix 2 for summary).
- All species primarily feed on plant seeds and flowers, but also consume wood-boring insect larvae when available. Each species has its own preference for food plant species (with considerable overlap). There is a solid understanding of these preferences (see Appendix 2 for summary).

Key threats

- Key threatening processes include illegal shooting, habitat loss, habitat degradation, nest hollow shortage, competition for available nest hollows from other parrots and feral Honeybees (*Apis mellifera*), and illegal trade.

1.2 Description of survey area and background environmental information

1.2.1 Survey area

For spatial terminology (i.e. definitions of project, survey and study areas) see Section 2.1.1 below.

The Beharra Springs Gas Facility site and proposed project areas ('survey areas') are in the locality of Mount Adams (Shire of Irwin), c. 30 km south-east of Dongara and c. 40 km north of Eneabba, Western Australia, as shown in Figure 1. The six survey areas vary in size: Tarantula Deep 1 (35.8 ha), Beharra Springs Deep 3 (16.7 ha), BSGF Proposed Camp (9.9 ha), Redback Deep 1 (37.3 ha), Beharra Springs Deep 2 (40.7 ha), and Trigg Northwest 1B (33.2 ha). It is expected that the development footprints within these areas will be much less than this total area (e.g. initial drilling may require 3 to 5 ha of clearing).

1.2.2 Interim Biogeographic Regionalisation of Australia (IBRA) and landscape characteristics

The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia which are further divided into subregions (DAWE 2022a). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA 2016). The survey area lies within the Lesueur Sandplain subregion (GES02) of the Geraldton Sandplains bioregion, comprising coastal Aeolian and limestones of the central Perth basin overlain with shrub-heaths and rich in endemic plants.

The Geraldton Sandplains bioregion falls within the Bioregion Group 1 classification (EPA 2004). Bioregions within Group 1 (South-West Botanical Province) are "extensively cleared for agriculture" and include sites of major urban developments. The bioregion has a high degree of species loss. The Lesueur subregion, however, is much less affected by clearing and habitat loss than the broader bioregion.

1.2.3 Land systems and vegetation complexes

George and Gibson (2015) revised Beard's pre-European vegetation categories, and have defined and described broad vegetation complexes for Western Australia. The mapping of these is provided by (DPIRD 2022b). The survey areas fall within two of these vegetation complexes:

- Eridoon System: flat coastal plain with various small rivers and creeks with numerous small lakes and swamps and some limited alluvial flats of heavier soil on the lower Arrowsmith River. Vegetation consists of scattered small trees with an open layer of tall shrubs over a closed layer of small heath-like shrubs, which experiences frequent fire. [Survey areas: Tarantula

Deep 1, Beharra Springs Deep 3, BSGF Proposed Camp, Redback Deep 1 and Beharra Springs Deep 2.]

- Tathra System: shrublands; scrub-heath on lateritic sandplain in the central Geraldton Sandplain Region. [Survey area Trigg Northwest 1B.]

Complex definitions were sourced from Mattiske (2021) and Strategen-JBS&G (2021).

The pre-European vegetation complexes within the survey areas are mapped in Figure 2 (data provided by DPIRD 2022b).

1.2.4 Recognised sensitive sites

There are no known Ramsar Sites (DBCA 2022c), Important Wetlands (DBCA 2022b), Threatened Ecological Communities (DBCA 2022d, e), Bush Forever sites (Dell and Banyard 2000; DPLH 2022), Key Biodiversity Areas (KBA 2022) or Environmentally Sensitive Areas (DWER 2022a, b) within the survey area.

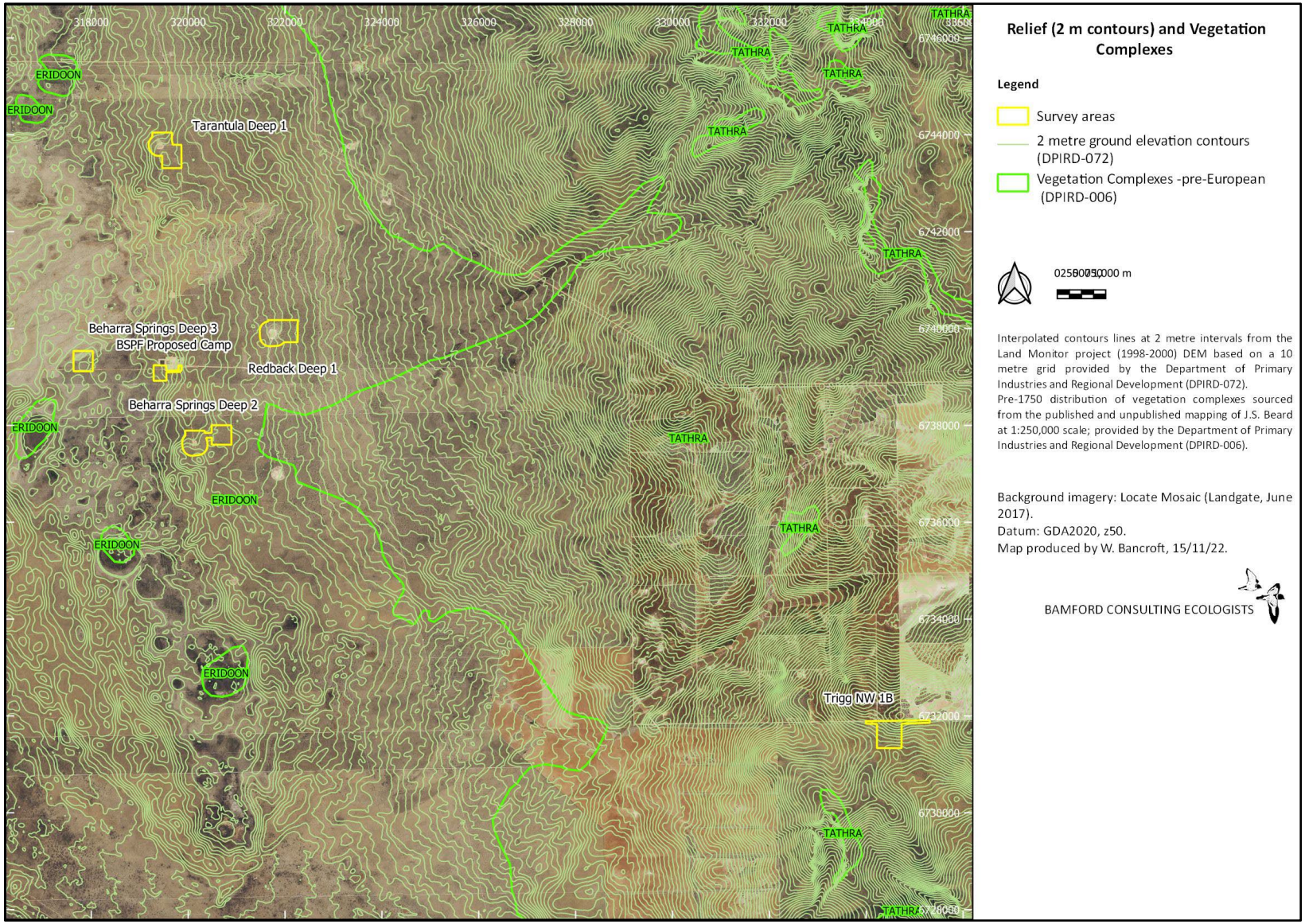


Figure 2. Relief (2 m contours) and vegetation complexes (DPIRD 2022b) within the survey areas.

2 Methods

2.1 Overview

2.1.1 Spatial terminology

A range of terms are used through the report to refer to the spatial environment around the proposed project, and these are defined below:

- Study area – the outermost boundary of the desktop assessment that is almost always a specified buffer distance around the *survey area*. The study area thus encompasses the *survey area* but includes the area from which databases are sourced.
- Survey area – the *survey area* is the area to which the results of the desktop analysis are directed and/or the area within which field investigations are conducted. Note that while the term '*survey area*' is used throughout the guidance provided by EPA (2020), it does not appear to be explicitly defined and, therefore, the above definition has been developed with interpretation of both the guidance and BCE report structure.
- Project area – this may be equivalent to the *survey area* but is strictly the land over which the proponent has tenure or some control and within which on-site impacts may occur. For this project, there are six project areas.
- Development footprint – the expected extent of land clearing and/or development.

Where available, these spatial boundaries are mapped in Figure 1.

2.2 Identification of vegetation and substrate associations (VSAs)

Vegetation and substrate associations (VSAs) combine vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna.

BCE deliberately makes the distinction between 'habitat' (a species-specific term that may encompass the whole or part of one or more VSAs and is the physical subset of an ecosystem that a given species, or species group, utilises) and 'VSA' (a general, discrete and mutually exclusive spatial division of a target area, based on soil, vegetation and topography). It is recognised, however, that, within the broader EIA literature/guidance, the former term is used more or less synonymously to indicate the latter (e.g.' habitat assessment' used by EPA 2020). Further discussion is provided in Appendix 3.

For the current assessment, VSAs were identified based on the consultant's previous experience in the area and on observations made during the field investigations.

2.3 Desktop methods

2.3.1 Nomenclature and taxonomy

As per the recommendations of the EPA (2020), the nomenclature and taxonomic order presented in this report are generally based on the Western Australian Museum's (WAM) Checklist of the Fauna of Western Australia 2022. The authorities used for each vertebrate group were: fish (Morgan *et al.* 2014), frogs (Doughty 2022a), reptiles (Doughty 2022b), birds (BirdLife Australia 2022; Gill *et al.* 2022), and mammals (Travouillon 2022). In some cases, more widely-recognised names and naming

conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds, and the International Ornithological Congress' 'World Bird List'). Similarly, the group name 'black-cockatoo' is consistently used for all three taxa in the South-West. English common names of species, where available, are used throughout the text; Latin names are presented with corresponding English names in tables in the appendices. The use of subspecies is limited to situations where there is an important (and relevant) geographically distinct population, or where the taxonomic distinction has direct relevance to the conservation status or listing of a taxon.

2.4 Field investigations

2.4.1 Overview

Field investigations were focussed on black-cockatoo habitat analysis (comprising breeding, foraging and roosting assessments), with the major focus on identification of foraging habitat suited to Carnaby's Black-Cockatoo. Methods are detailed below.

2.4.2 Dates

The survey areas were visited on the 4th and 5th of October 2022.

2.4.3 Black-cockatoo habitat analysis

2.4.3.1 Guidelines

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) provides guidelines for the referral of actions that may result in impact to black-cockatoos (for assessment under the EPBC Act). The survey and analysis reported here have been conducted with strong reference to both the existing guidelines (DAWE 2022b) as well as the previous guidelines (DEE 2017). This includes application of the 'foraging quality scoring tool' in DAWE (2022b). In addition, survey methodology followed the recommendations listed on the DCCEEW's Species Profile and Threats Database (DCCEEW 2022a, b, c). Ecological values for black-cockatoos within the site were based on the definitions of breeding, foraging and roosting habitat as per the EPBC Act referral guidelines for black-cockatoos (DAWE 2022b).

The DBCA has also indicated that the methodology developed and applied previously by BCE (e.g. Bancroft and Bamford 2021), and as described below, is an acceptable approach to score nesting value and foraging habitat.

2.4.3.2 Breeding

The aim of the breeding surveys was to sample the survey area for potential hollow-bearing trees (suitable for black-cockatoo nesting). All survey areas (see Figure 1) were examined for the presence of these trees. The following information was recorded for every suitable tree[1] with a diameter at breast height (DBH) equal to or greater than 500 mm (or equal to or greater than 300 mm for *Eucalyptus accedens* and *E. wandoo*):

- tree location;
- tree species;
- life status;
- DBH; and
- nest-tree rank: trees were assessed (from the ground) for the potential presence/quality of nest-hollows and allocated a nesting rank (developed by BCE) as described in Table 1.

The BirdLife Australia database of black-cockatoo breeding surveys was also searched for relevant local records (see Peck 2019).

[1] the revised EPBC Act referral guidelines (DAWE 2022) note that "any species of tree may develop suitable hollows for breeding" however there are some species that are much more likely to provide breeding sites. These species are listed on the DCCEEW SPRAT database and were the focus of the field investigations here.

Table 1. Ranking system for the assessment of potential nest-trees for black-cockatoos (revised 08/01/2021).

As per DCCEEW (2022a, b, c) guidance, a potential nest-tree is any tree with a diameter at breast height >500 mm (or >300 mm for *Eucalyptus accedens, E. salmonophloia* and *E. wandoo*). Note that black-cockatoos favour vertical hollows for the nest chamber, but the hollow entrance may be vertical (a chimney hollow), have a side entrance or have a horizontal spout entrance.

Rank	Description of tree and hollows/activity
1	Activity at hollow observed; adult (or immature) bird seen entering or emerging from hollow. Can also be used for a known nest tree active in the previous 12 months (although this should be noted in the description). Note that activity at a hollow does not absolutely mean that breeding is occurring unless a young bird in hollow is observed.
2	Hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old.
3	Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present - as suggested by structure of tree, such as large, vertical trunk broken off at a height of >8 m; but note that hollow height is contextual. Carnaby's Black-Cockatoo will nest in hollows <5 m so in a Wheatbelt breeding site a lower criterion may be more appropriate.
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows (nest chamber) are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos. Trees with low but otherwise suitable hollows can also be assigned a rank or 4, depending on the species of black-cockatoo likely to be present.
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.

2.4.3.3 Foraging

The foraging value of the study area was assessed by calculating a foraging score for areas of similar vegetation type/condition (see Appendix 4). The foraging score provides a numerical value that reflects the significance of vegetation as foraging habitat for black-cockatoos, and this numerical value is designed to provide the sort of information needed by DCCEEW, Department of Water and Environmental Regulation (DWER) and the Environmental Protection Authority (EPA) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area, and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed in Appendix 4. These three components are drawn from the DCCEEW offset calculator but with the scoring approach developed by BCE:

- A score out of six for the vegetation composition, condition and structure.
- A score out of three for the context of the site.
- A score out of one for species density.

Foraging value can thus be assigned a score out of six, based upon site vegetation characteristics, or a score out of 10 if context and species density are also considered. A higher score represents better foraging value. A score out of 10 is presented for the purposes of aiding offset calculations. The approach to assigning scores for vegetation, context and species density are outlined in Appendix 4. Foraging value scores are calculated differently for the three black-cockatoo species (Appendix 4) depending upon the vegetation present; thus a separate score is given for each VSA for each species.

For comparison, the foraging quality scoring tool of DAWE (2022b) was also used to assess the foraging value of the site to black-cockatoos. The template for this tool is provided in Appendix 5.

Black-cockatoo foraging signs were also recorded in conjunction with the breeding tree surveys (see Section 2.4.3.2) and general site inspections. When observed, the location, tree species and approximate age of the foraging evidence were recorded. Black-cockatoo foraging evidence may persist for some months or years after the foraging event. There is currently no published evidence documenting the deterioration process of forage. Factors that help to establish the time since foraging include: the colour of nuts/foliage, the degree of weathering or decay of debris, the presence of small fragments of nut debris, the position/compression of the foraging debris relative to surrounding vegetation and leaf litter, and the strength of the eucalypt smell emitted. Despite the absence of empirical data, four categories of foraging activity were recognised, based on the time since foraging:

(i) Active – where birds were observed in the act of foraging;
(ii) Recent – foraging signs (e.g. chewed nuts or vegetation) were 'fresh' (i.e. foraging was likely to have occurred within days to weeks). Recent foraging signs were typically green and/or with very little sign of weathering. Approximately less than four weeks old;
(iii) Intermediate – foraging was likely to have occurred within weeks to months previously. Approximately one to six months old; and
(iv) Old – foraging was likely to have occurred months to years previously. Approximately more than six months old.

As an indication, Appendix 6 shows examples of Forest Red-tailed Black-Cockatoo foraging signs across the range of these categories (note that it is uncertain as to the exact time frame for each stage).

2.4.3.4 Night roosting

As the breeding and foraging surveys were conducted, areas likely to be used as night roosting sites (e.g. sites adjacent to watercourses with large trees) or areas that had cockatoo activity in the late-afternoon were noted.

It is usual for the BirdLife Australia Great Cocky Count (GCC) database of roost sites to be directly searched for relevant local records (see Peck *et al.* 2019) but for this report the data from the GCC that is provided by DBCA (2022a).

2.4.4 Opportunistic observations

At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site. These included such casual observations as reptiles, birds or mammals seen while travelling through and near the site.

2.5 Personnel

Personnel involved in the field investigations and report preparation are listed in Table 2. Note that both personnel have had extensive previous field experience in the Beharra area over the period 2005 to 2021.

Table 2. Personnel involved in the field investigations and report preparation.

Personnel	Consulting Experience	Field Investigations	Report Preparation
Dr Mike Bamford *BSc (Biol.), Hons (Biol.), PhD (Biol.)*	42 years		+
Dr Wes Bancroft *BSc (Zool./Microbiol.), Hons (Zool.), PhD (Zool.)*	25 years	+	+

2.6 Mapping and spatial data

Low resolution maps have been provided within the body this report. Higher resolution maps and GIS files can be supplied if required. While the recommendation of the EPA (2020) was that maps use the GDA94 datum (and are projected into the appropriate Map Grid of Australia (MGA94) zone), this has been superseded by the GDA2020 (projected to MGA2020) datum used here (and recommended by DWER 2022c).

3 Results and Discussion

3.1 Vegetation and substrate associations (VSAs) ['Habitat assessment']

Vegetation and substrate associations within the survey area are a mosaic, largely reflecting soil types and topography. Broad-scale vegetation descriptions for the region were provided by Bamford and Bancroft (2022). From these and observations made during the field investigations here, eight major vegetation and substrate associations (VSAs) were identified in relation to fauna in the survey areas. These are listed in Table 3.

Table 3. Vegetation and substrate associations (VSAs) within the survey areas.

VSA	Variant Description
VSA01: Banksia shrubland	*Banksia attenuata* shrubland over moderately diverse shrubland on white and/or pale grey sands.
	Banksia attenuata shrubland with occasional *Eucalyptus todtiana* over moderately diverse shrubland on pale yellow sands.
	Banksia attenuata shrubland with occasional *Eucalyptus todtiana* over moderately diverse shrubland on white and/or pale grey sands.
	Banksia attenuata shrubland with occasional *Eucalyptus todtiana* over very diverse heath on white and/or pale grey sands.
	Banksia sessilis shrubland over very diverse heath on white and/or pale grey sands.
	Mixed tall Banksia shrubland, including *B. sessilis* on yellow sands.
VSA02: Banksia woodland	*Banksia menziesii* woodland with *B. attenuata* shrubland (and occasional low trees) over moderately diverse shrubland on white and/or pale grey sands.
	Open to very open *Banksia menziesii* woodland with B. attenuata shrubland (and occasional low trees) over moderately diverse shrubland on white and/or pale grey sands.
VSA03: Mixed shrubland	Diverse mixed shrubland dominated by *Conospernum* spp. with occasional stunted *Eucalyptus todtiana* on pale yellow sands.
	Diverse mixed shrubland dominated by *Conospernum* spp. with some *Banksia* spp. on pale yellow sands.
	Mixed shrubland on pale orange sands.
	Mixed shrubland on white sands.

VSA	Variant Description
	Mixed, very diverse heath with occasional *Eucalyptus todtiana* and *Nuytsia floribunda* on white and/or pale grey sands.
VSA04: Sedgeland	Sedgeland with *Calothamnus* and other sparse shrubs on white sands.
VSA05: Melaleuca thicket	Thicket of Melaleuca sp. with overstorey of *Xylomelum* sp. over lower diversity mixed shrubland on white sands
VSA06: Coastal Blackbutt/Woody Pear woodland	Very open *Eucalyptus todtiana* woodland with mixed shrubs and sedgeland elements on pale yellow sands.
	Xylomelum sp. and *Eucalyptus todtiana* woodland over lower diversity shrubland on white sands.
VSA07: Dampland	Seasonal dampland area with mixed shrubland on grey clays and/or loams.
VSA08: Cleared or disturbed	Cleared, disturbed or developed.

The extent of the VSAs in each of the survey areas is mapped in Figure 3 to Figure 8.

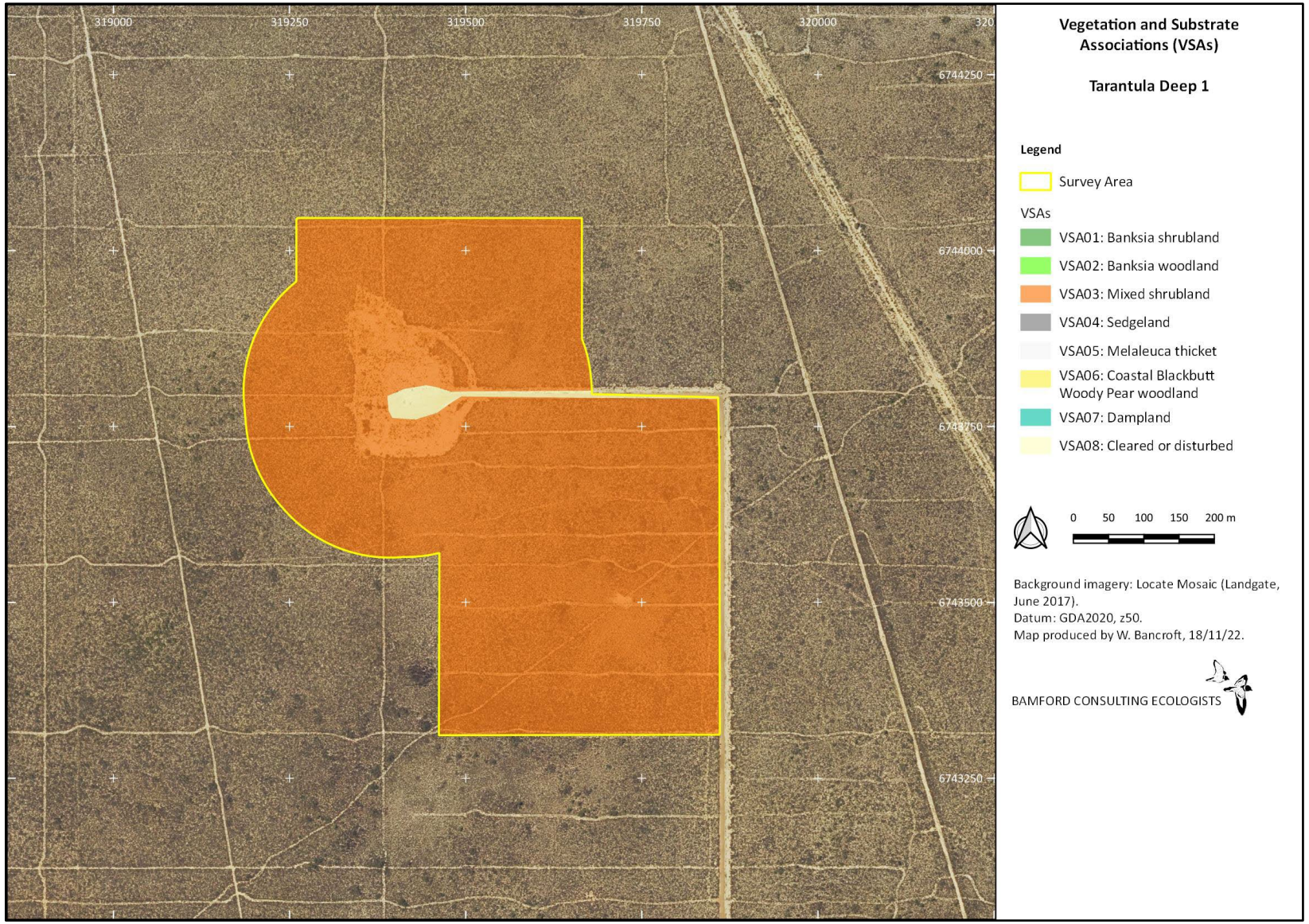


Figure 3. Vegetation and substrate associations at Tarantula Deep 1.



Figure 4. Vegetation and substrate associations at Beharra Springs Deep 3.

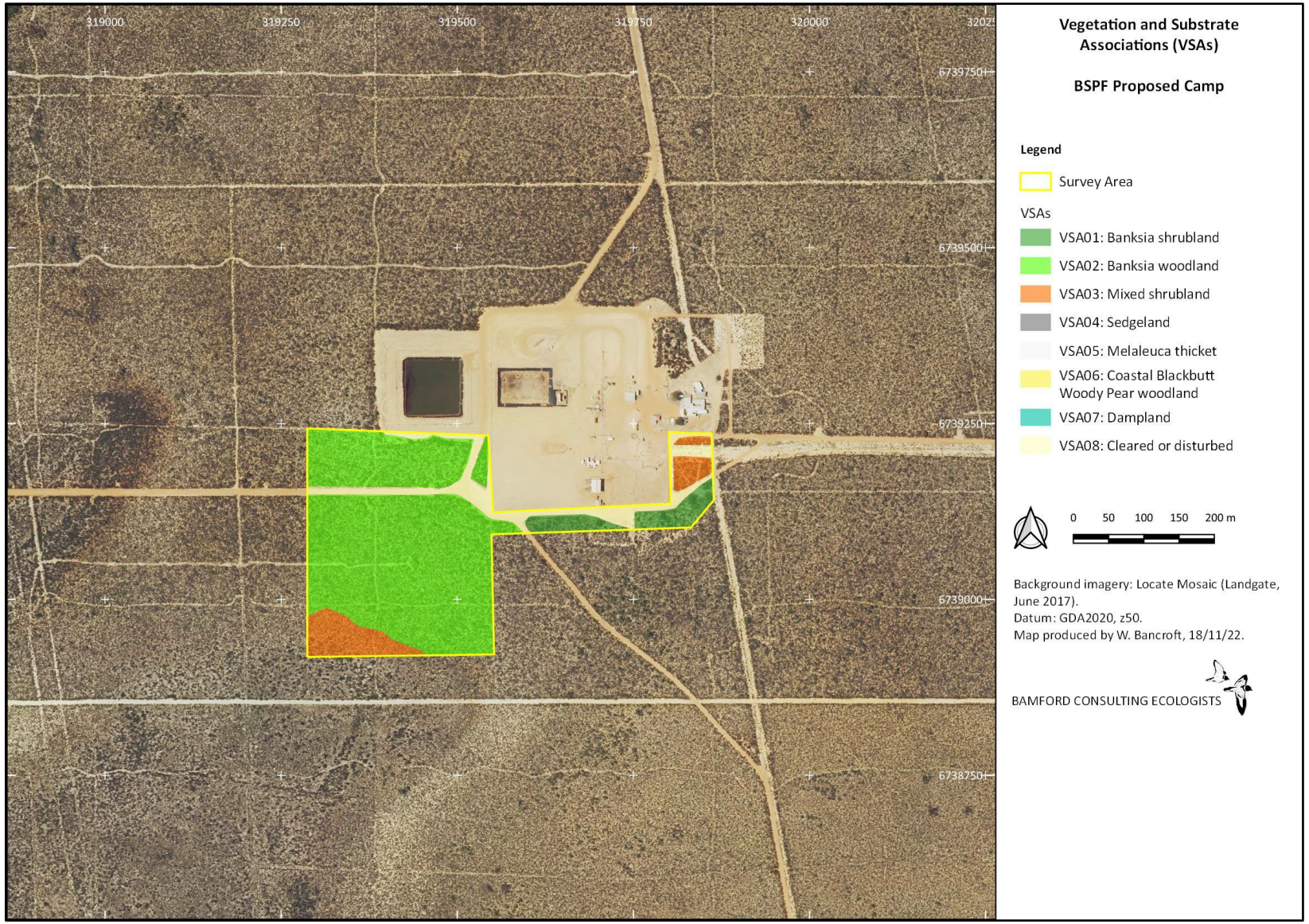


Figure 5. Vegetation and substrate associations at BSGF Proposed Camp.

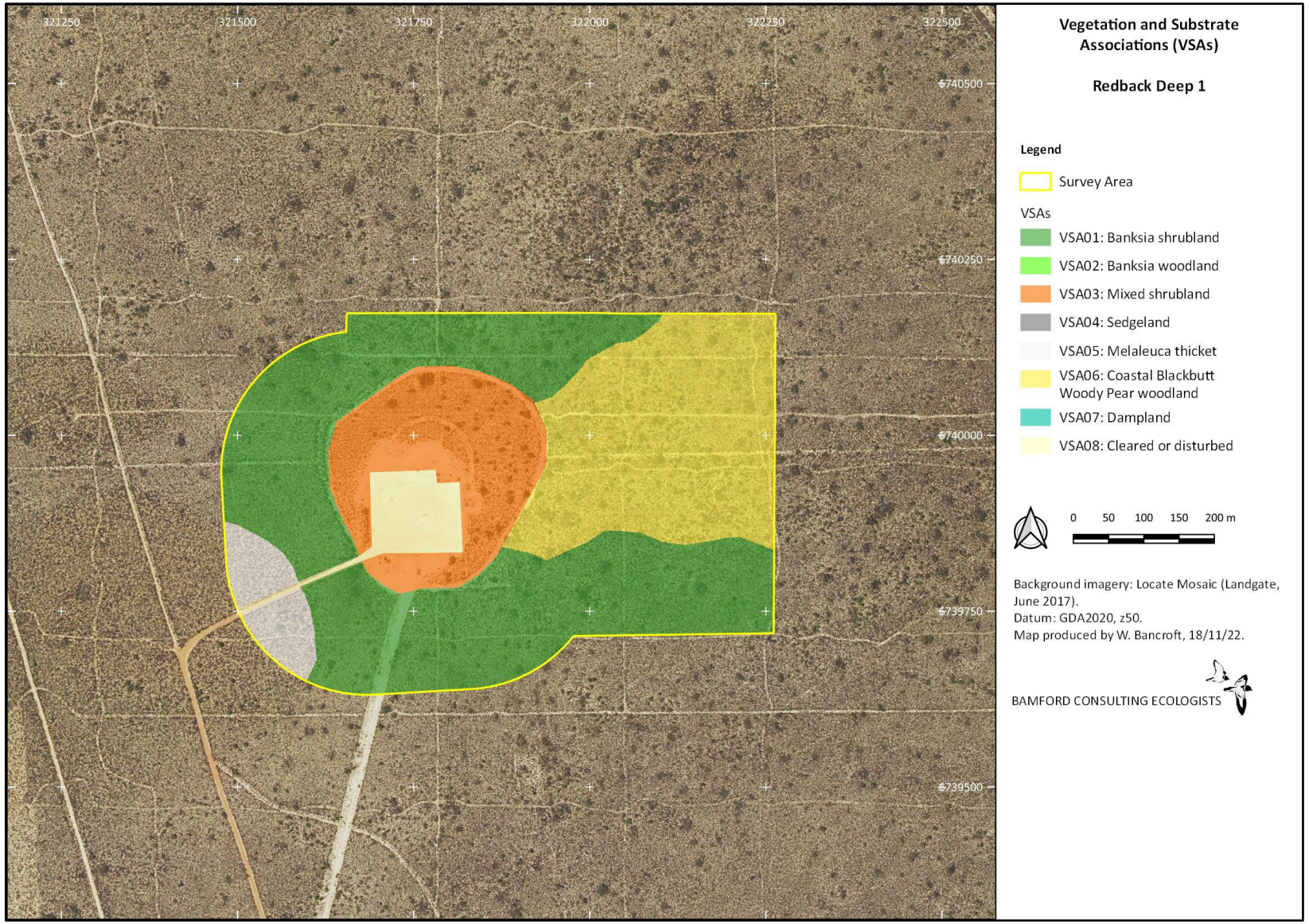


Figure 6. Vegetation and substrate associations at Redback Deep 1.

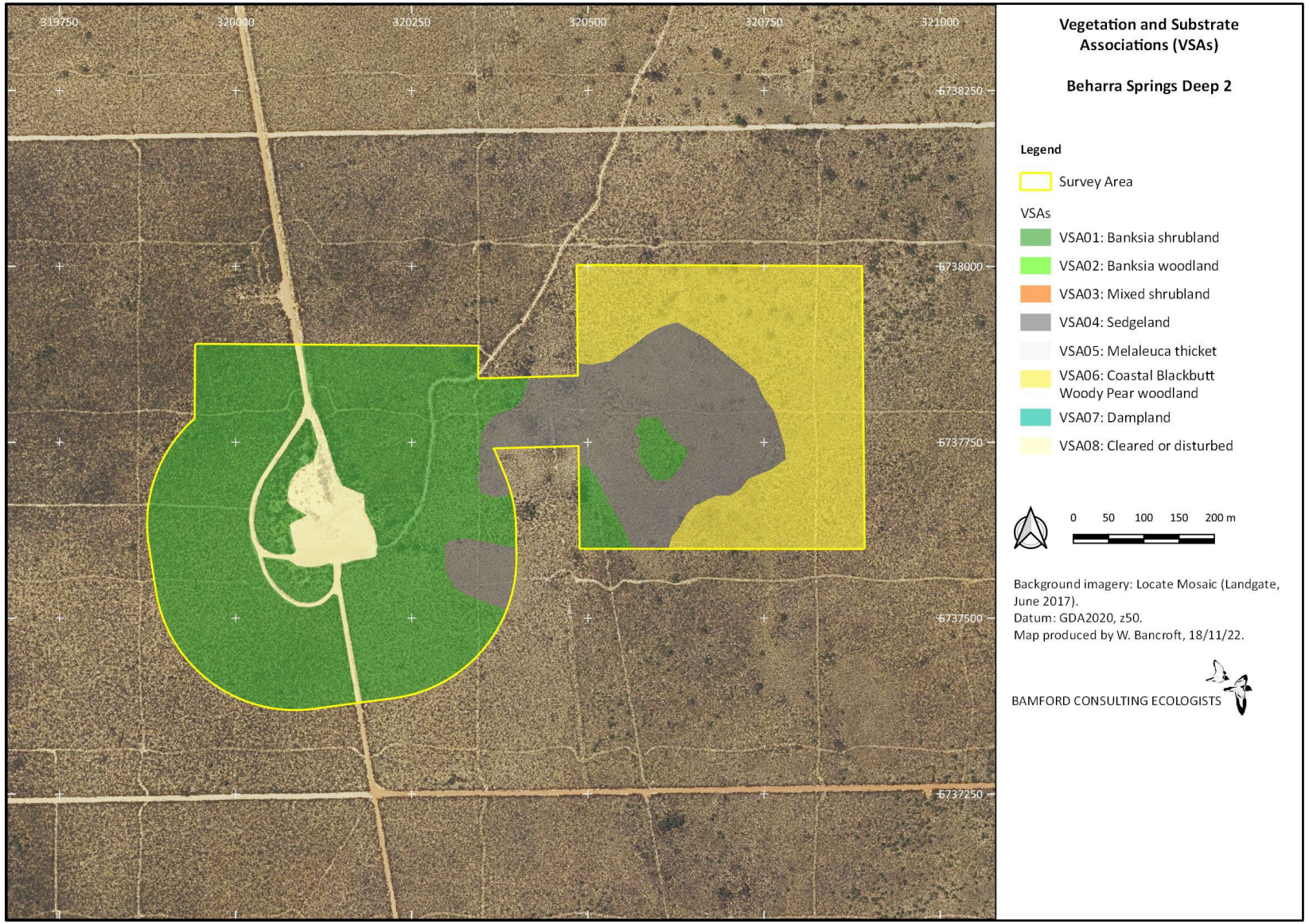


Figure 7. Vegetation and substrate associations at Beharra Springs Deep 2.

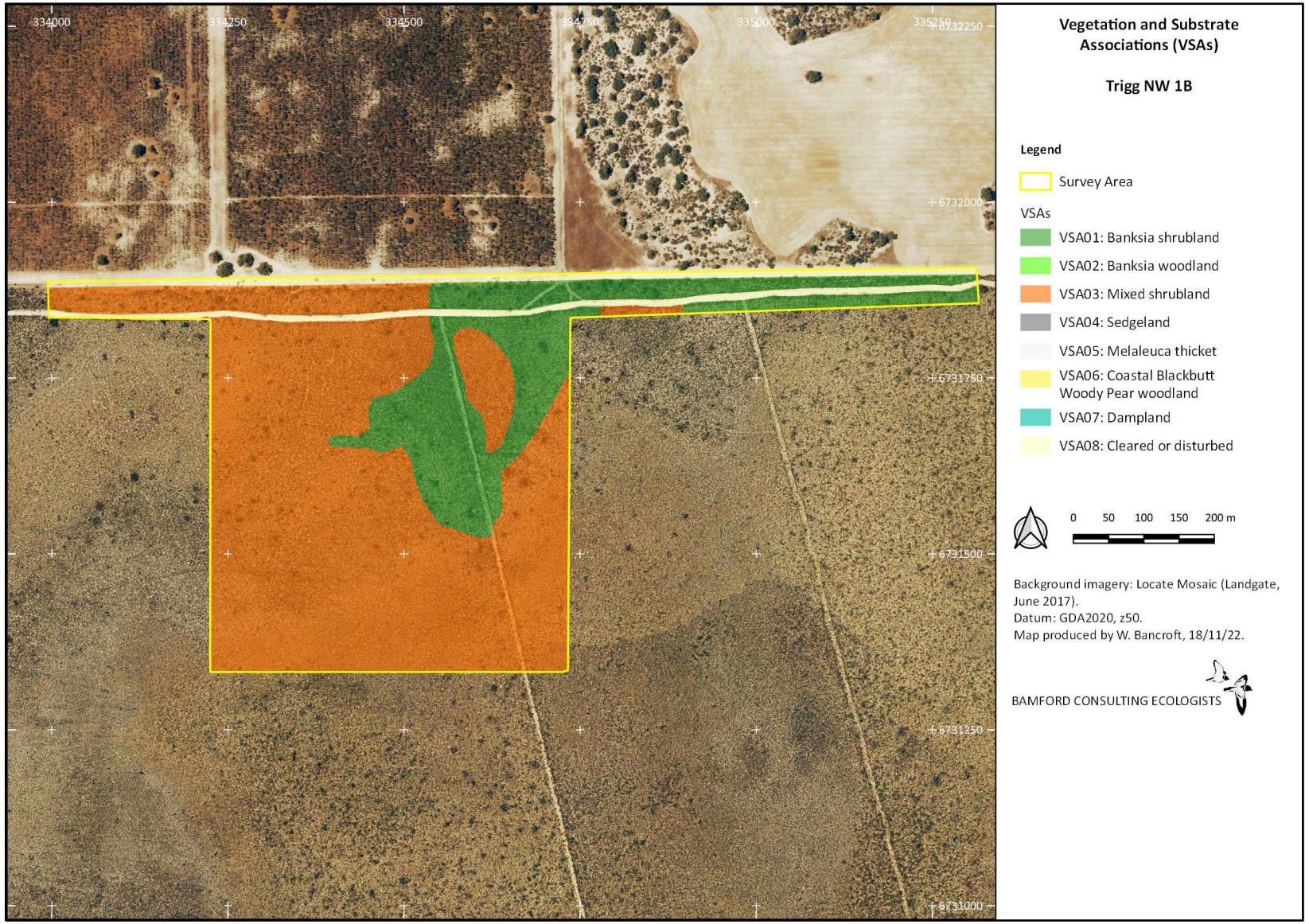


Figure 8. Vegetation and substrate associations at Trigg NW 1B.

3.2 Black-cockatoo habitat analysis

3.2.1 Black-cockatoo presence

Only one of the three species of black-cockatoos known to occur in the south-west of Western Australia is expected to occur regularly in the vicinity of the survey areas (Carnaby's Black-Cockatoo) but this was not directly recorded on the site during the site inspection. Anecdotal evidence suggested that Carnaby's Black-Cockatoos are likely to occur irregularly and infrequently within the survey areas and this is supported by very scant indirect (foraging) evidence presented in Section 0 below. In studies carried out in the Beharra to Arrowsmith area to the west of the current study area, Carnaby's Black-Cockatoo was seen occasionally and in small numbers, except around a roost west of the Brand Highway, and a single Red-tailed Black-Cockatoo (inland subspecies *Calyptorhynchus banksia escondidus* which is not threatened) was observed near this roost (M. Bamford pers. obs.).

Given these direct observations, indirect (foraging) records (see Section 0 below), roosting data (see Section 3.2.3.2 below) and the literature review (including current species distributions), it is considered that, currently:

- Carnaby's Black-Cockatoo is a regular visitor to the broader region but an irregular visitor to small sites such as the Beach Energy project areas.

3.2.2 Black-cockatoo breeding habitat

All of the survey areas are unsuited to breeding by black-cockatoos; there were no hollow-bearing trees that met the potential nest-tree criteria of DCCEEW (2022a, b, c) and DAWE (2022b) present at any of the sites.

3.2.3 Black-cockatoo foraging habitat

3.2.3.1 Carnaby's Black-Cockatoo

Foraging habitat for the Carnaby's Black-Cockatoo was present throughout the survey areas. This is predominantly due to the presence of several *Banksia* species (in either tree and/or shrub form; *B. attenuta, B. menziesii, B. sessilis*) known to be mainstays of the Carnaby's Black-Cockatoo diet (Groom 2011). The most widespread of these was *B. attenuta* and, where it occurred, it was generally in moderate density. *B. menziesii* and *B. sessilis* were more irregular in their occurrence but, when present, were in moderate to high densities. The areas (and percentages) of each vegetation score in each survey area are shown for the Carnaby's Black-Cockatoo in Table 4.

There are between c. 35,660 and 58,703 ha of remnant native vegetation (as assessed by DPIRD 2022a) within 15 km of each of the survey areas, which themselves have between c. 9.9 and 40.7 ha of native vegetation (individual site data are presented in Table 5). Therefore, the sites comprise between c. 0.02 and 0.09% of the native vegetation in the 'local area' (as per the methods outlined in Appendix 4). It is likely that the Carnaby's Black-Cockatoo breeds within the local area, given the proximity to areas of hollow-bearing eucalypts in the region. Thus, a 'context' score of 1 (out of 3) has been assigned to the survey area for this species (see Appendix 4).

There was very limited evidence of foraging by Carnaby's Black-Cockatoo within the survey areas. Despite extensive searching, only one (old) record of foraging by Carnaby's Black-Cockatoo was noted. This was on *B. attenuata* cones within the Beharra Springs Deep 3 survey area (317982E, 6739370N). It is expected that Carnaby's Black-Cockatoo will occur irregularly (only for foraging) within the survey areas. Therefore, the survey areas were assigned a species 'density' score for Carnaby's Black-Cockatoo of 1 (out of 1; see Appendix 4).

The context and density values have been added on to the vegetation scores to yield the overall foraging value scores (with areas and percentages) that are also presented in Table 4. A map of foraging scores for Carnaby's Black-Cockatoo foraging within each survey area is presented in Figure 9 to Figure 14.

By considering the area of each foraging score[2] and the size of the site, it is possible to calculate an overall foraging score for each of the six sites. These average foraging scores are presented in Table 6.

The survey areas are, generally, of moderate value for foraging by the Carnaby's Black-Cockatoo, with the Beharra Springs Deep 3 area, and the Proposed Camp are, have the highest average values.

[2] For a foraging score <3, a value of 3 is assumed for the calculation of these averages

Table 4. Areas (ha) and proportions (%) of each category (vegetation score, combined foraging score) of foraging habitat in each survey area for Carnaby's Black-Cockatoo.

See Section 2.4.3.3 and Appendix 4 for explanation of vegetation, context, species density and (combined) foraging scores.

	Tarantula Deep 1		Beharra Springs Deep 3		BSGF Proposed Camp		Redback Deep 1		Beharra Springs Deep 2		Trigg Northwest 1B	
Vegetation Score	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**
6: High	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5: Moderate to High	0.0	0.0	0.0	0.0	2.1	21.2	0.0	0.0	0.0	0.0	0.0	0.0
4: Moderate	0.0	0.0	15.5	92.8	5.4	54.5	0.0	0.0	0.5	1.2	7.6	22.9
3: Low to Moderate	7.6	21.2	0.0	0.0	0.4	4.0	18.0	48.3	19.3	47.4	0.0	0.0
2: Low	27.6	77.1	0.0	0.0	0.9	9.1	17.7	47.5	11.0	27.0	23.2	69.9
1: Negligible	0.0	0.0	0.7	4.2	0.0	0.0	0.0	0.0	0.6	1.5	0.0	0.0
0: Nil	0.6	1.7	0.4	2.4	1.2	12.1	1.6	4.3	9.3	22.9	2.5	7.5
Total	***35.8***	***100.0***	***16.7***	***100.0***	***9.9***	***100.0***	***37.3***	***100.0***	***40.7***	***100.0***	***33.2***	***100.0***
Context Score	1		1		1		1		1		1	
Species Density Score	1		1		1		1		1		1	
Foraging Score												
10	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
7	0.0	0.0	0.0	0.0	2.1	21.2	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	15.5	92.8	5.4	54.5	0.0	0.0	0.5	1.2	7.6	22.9
5	7.6	21.2	0.0	0.0	0.4	4.0	18.0	48.3	19.3	47.4	0.0	0.0
NA (Vegetation Score < 3)	28.2	78.8	1.2	7.2	2.1	21.2	19.3	51.7	20.9	51.4	25.6	77.1
Total	***35.8***	***100.0***	***16.7***	***100.0***	***9.9***	***100.0***	***37.3***	***100.0***	***40.7***	***100.0***	***33.2***	***100.0***

Table 5. Area (ha) of remnant native vegetation within 15 km of each survey area, and the percentage of this value that the survey area represents.

Survey Area	Area (ha)	Local Native Vegetation (ha)	% of Local Native Vegetation
Tarantula Deep 1	35.8	51,931.0	0.07
Beharra Springs Deep 3	16.7	58,075.4	0.03
BSGF Proposed Camp	9.9	58,150.9	0.02
Redback Deep 1	37.3	55,659.4	0.07
Beharra Springs Deep 2	40.7	58,703.0	0.07
Trigg Northwest 1B	33.2	35,659.7	0.09

Table 6. Average (overall) Carnaby's Black-Cockatoo foraging scores at each survey area.

Survey Area	Overall Foraging Score (out of 10)
Tarantula Deep 1	3.4
Beharra Springs Deep 3	5.8
BSGF Proposed Camp	5.6
Redback Deep 1	4.0
Beharra Springs Deep 2	4.0
Trigg Northwest 1B	3.7

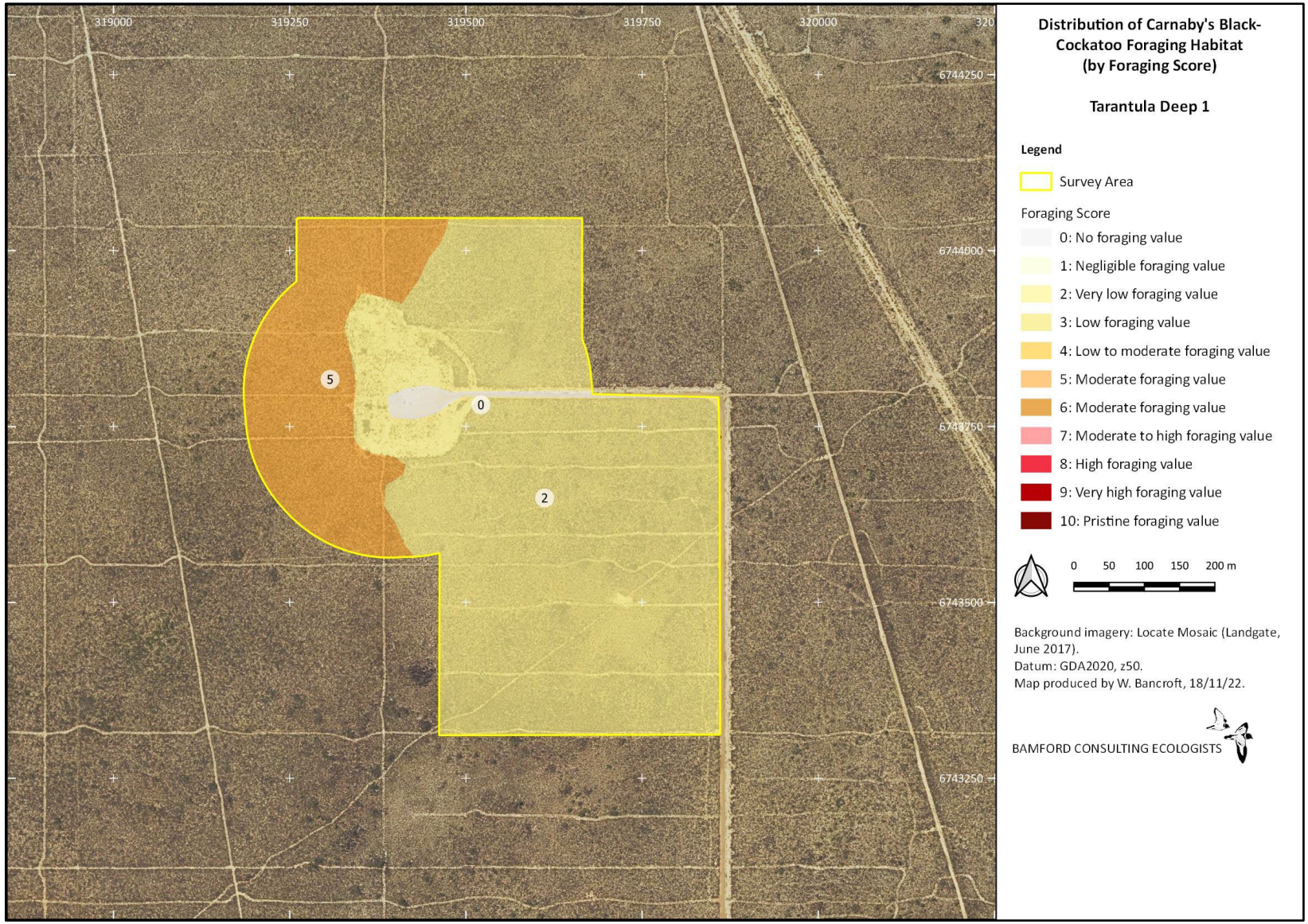


Figure 9. Distribution of Carnaby's Black-Cockatoo foraging scores at Tarantula Deep 1.

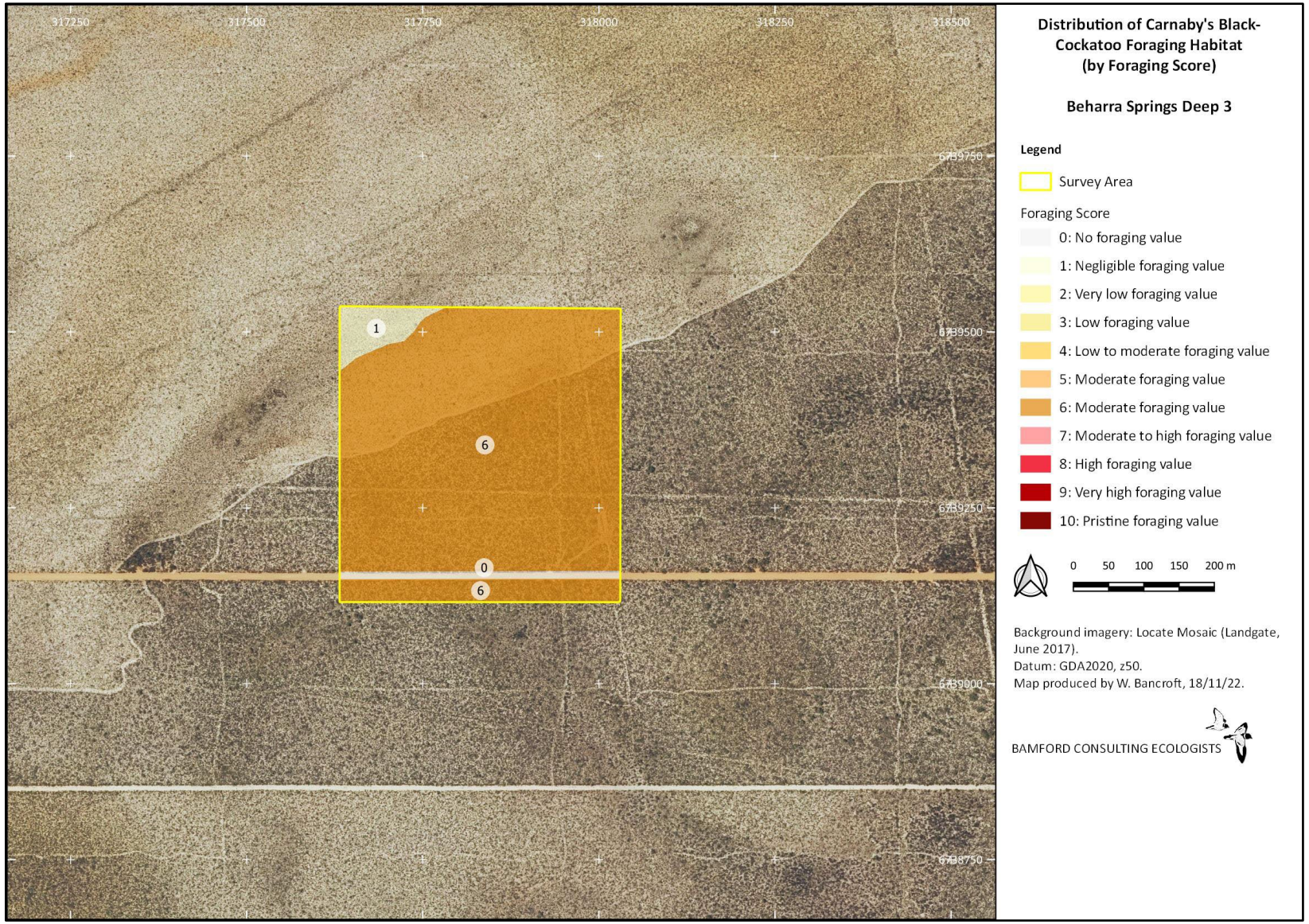


Figure 10. Distribution of Carnaby's Black-Cockatoo foraging scores at Beharra Springs Deep 3.

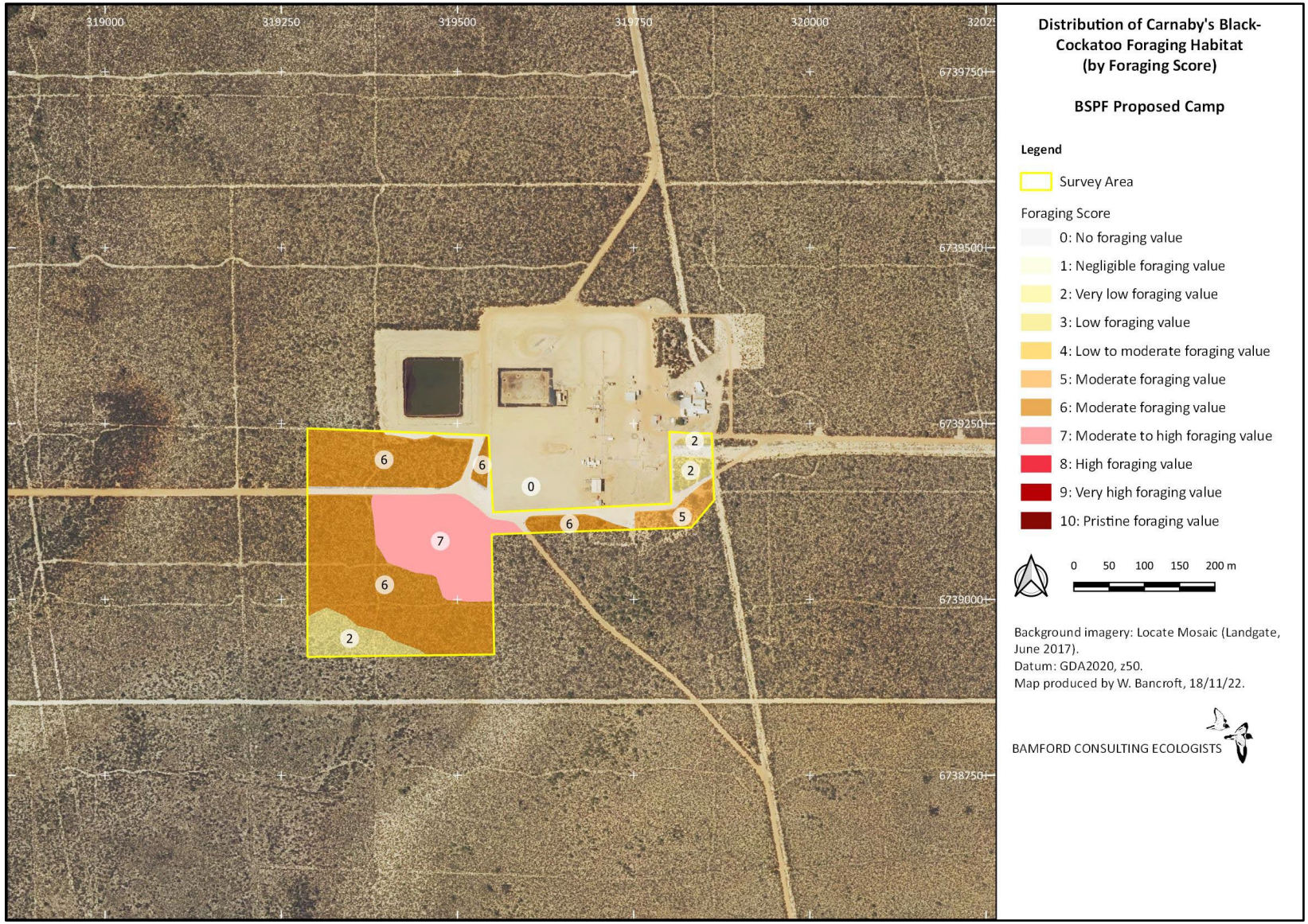


Figure 11. Distribution of Carnaby's Black-Cockatoo foraging scores at BSGF Proposed Camp.

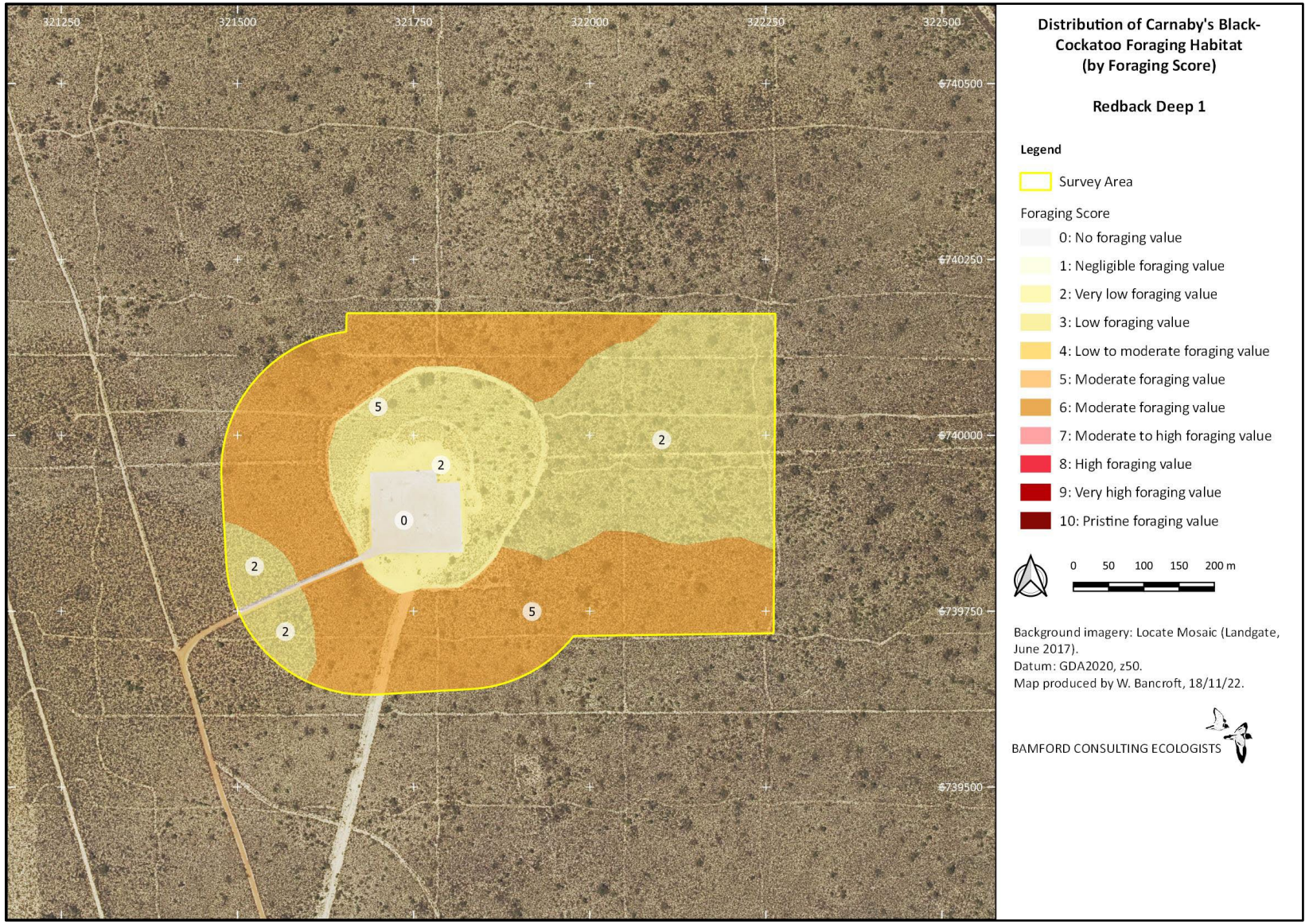


Figure 12. Distribution of Carnaby's Black-Cockatoo foraging scores at Redback Deep 1.

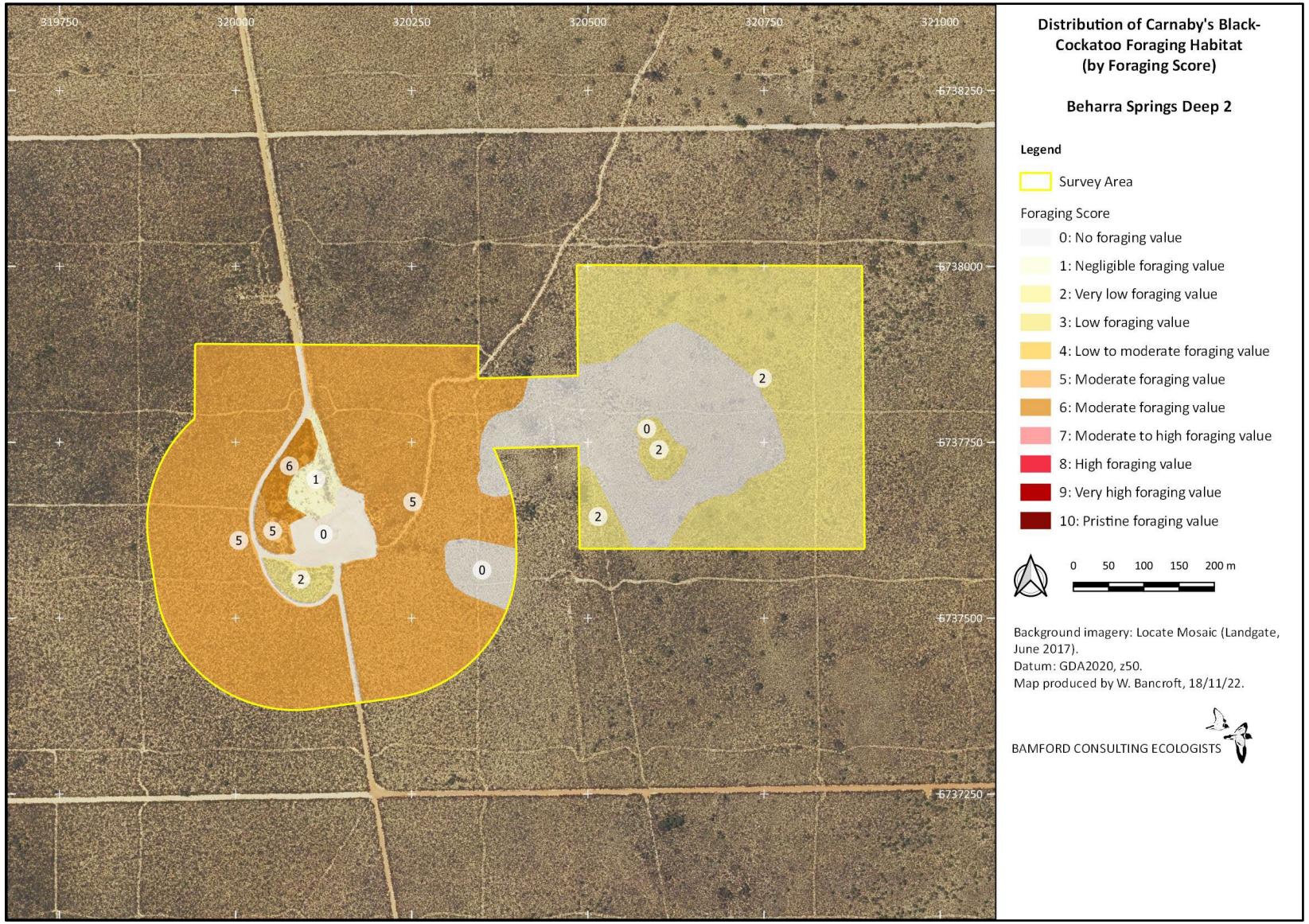


Figure 13. Distribution of Carnaby's Black-Cockatoo foraging scores at Beharra Springs Deep 2.

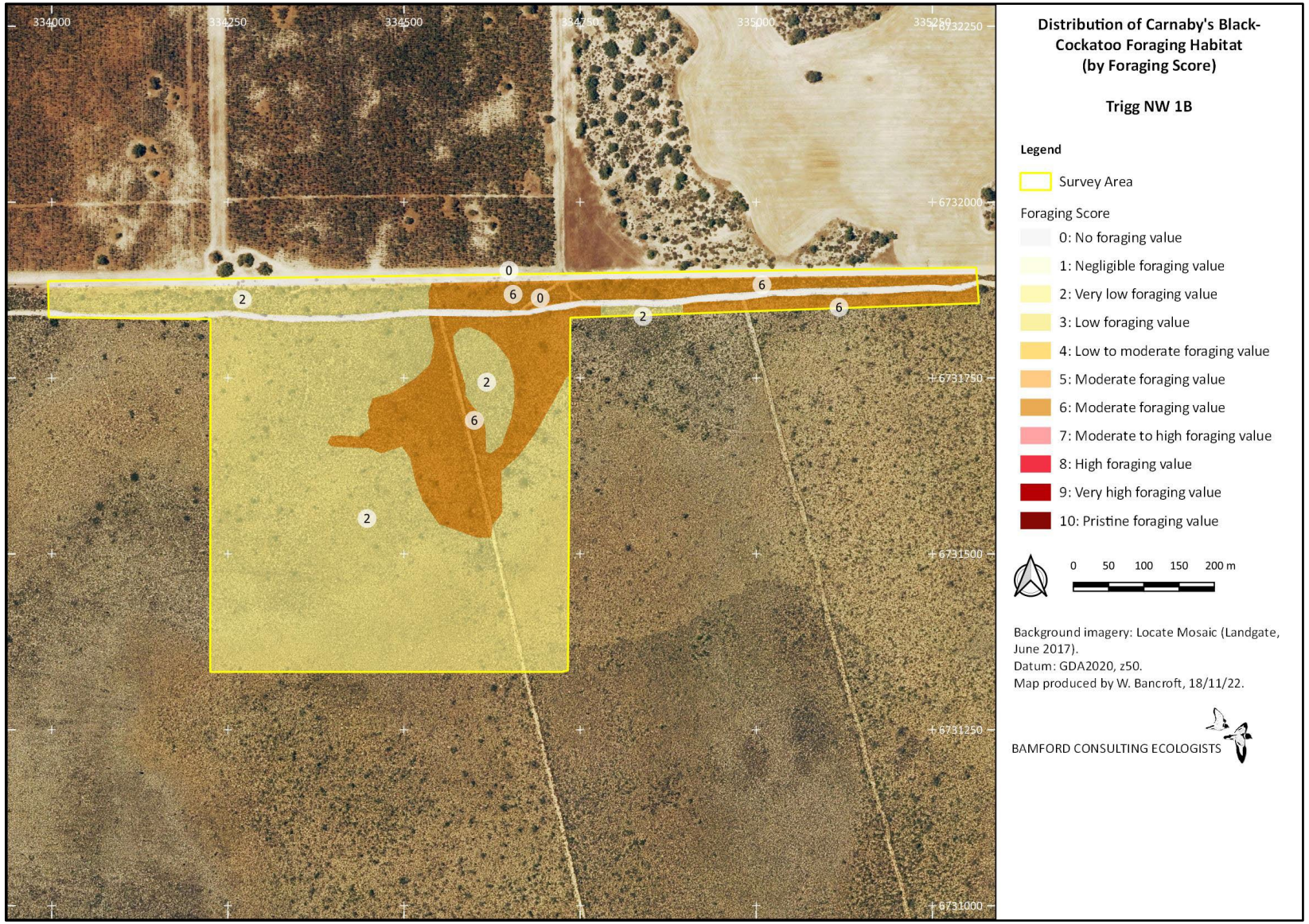


Figure 14. Distribution of Carnaby's Black-Cockatoo foraging scores at Trigg NW 1B.

3.2.3.2 DCCEEW foraging quality scoring tool

The DCCEEW foraging quality scoring tool (provided by DAWE 2022b) was used to assess the whole of each survey area for Carnaby's Black-Cockatoo. The calculations are presented in Table 7 and these generated a total score (out of 10) for each survey area. These give very high foraging value scores compared with the scores determined using the BCE assessment method. This is because the DCCEEW approach does not differentiate on the basis of vegetation condition and assumes that any vegetation that may provide foraging habitat is of equal starting value, and adjusts only on the basis of a range of other site characteristics, such as foraging evidence and proximity to breeding and roosting areas.

Table 7. DCCEEW foraging quality scoring tool calculations for Carnaby's Black-Cockatoo in each of the survey areas.

Attribute	Tarantula Deep 1	Beharra Springs Deep 3	BSGF Proposed Camp	Redback Deep 1	Beharra Springs Deep 2	Trigg Northwest 1B
Starting score	10	10	10	10	10	10
Foraging potential	-2 (No evidence of foraging debris.)	0 (Foraging debris present.)	-2 (No evidence of foraging debris.)	-2 (No evidence of foraging debris.)	-2 (No evidence of foraging debris.)	-2 (No evidence of foraging debris.)
Connectivity	0 (Foraging habitat within 12 km.)	0 (Foraging habitat within 12 km.)	0 (Foraging habitat within 12 km.)	0 (Foraging habitat within 12 km.)	0 (Foraging habitat within 12 km.)	0 (Foraging habitat within 12 km.)
Proximity to breeding	0 (Breeding habitat within 12 km.)	0 (Breeding habitat within 12 km.)	0 (Breeding habitat within 12 km.)	0 (Breeding habitat within 12 km.)	0 (Breeding habitat within 12 km.)	0 (Breeding habitat within 12 km.)
Proximity to roosting	0 (Known night roosting habitat within 20 km.)	0 (Known night roosting habitat within 20 km.)	0 (Known night roosting habitat within 20 km.)	0 (Known night roosting habitat within 20 km.)	0 (Known night roosting habitat within 20 km.)	0 (Known night roosting habitat within 20 km.)
Impact from significant plant disease	0 (*Phytophthora* spp. Or Marri canker affects less than 50% of preferred food plants.)	0 (*Phytophthora* spp. Or Marri canker affects less than 50% of preferred food plants.)	0 (*Phytophthora* spp. Or Marri canker affects less than 50% of preferred food plants.)	0 (*Phytophthora* spp. Or Marri canker affects less than 50% of preferred food plants.)	0 (*Phytophthora* spp. Or Marri canker affects less than 50% of preferred food plants.)	0 (*Phytophthora* spp. Or Marri canker affects less than 50% of preferred food plants.)
Total Score	**8**	**10**	**8**	**8**	**8**	**8**

3.2.4 Black-cockatoo night roosting habitat

No night roosts were located during the site inspections.

The region around the survey areas has been known to support black-cockatoo roosting, however there are no known records of roost sites within the survey areas themselves. Previously known roost locations (provided by DBCA 2022a and that reflect data collected in BirdLife Australia's Great Cocky Counts) within 15 km of the survey area are mapped in Figure 15. The nearest of these known roosts is within c. 12 km of the Tarantula Deep 1 survey area boundary. Further details on these roosts can be provided, if required, by requesting data from BirdLife Australia. In addition, BCE also has a number of known night-roost locations in its database that occur in the vicinity of the survey areas. These are also plotted in Figure 15, with the nearest c. 8 km from the Beharra Springs Deep 3.

The absence of roosts within the survey areas is very reasonable; there is a complete absence of taller trees (e.g. eucalypts, pines) preferred by black-cockatoos as roost locations. It is almost certain that black-cockatoos do not depend on any of the survey areas for roosting habitat.

3.2.5 Black-cockatoo watering points

No potential water sources for black-cockatoos were observed within the survey areas.



Figure 15. Known black-cockatoo roost locations within the region.

3.3 Other Fauna

At least 28 vertebrate species were recorded during the site inspection. A list of these species is provided in Appendix 7.

3.4 Conclusion; value of project areas for black-cockatoos

Carnaby's Black-Cockatoo is the only black-cockatoo of conservation significance present in the general region where it is a regular visitor, several roost sites are known and breeding is likely to occur. Within the six project areas, however, the species is probably only an irregular visitor, while there is no breeding or roosting habitat. The project areas provide foraging habitat of moderate value, being slightly higher in the Beharra Springs Deep 3 and BSGF Proposed camp areas than elsewhere. These are very small areas within a region that provides extensive foraging habitat of similar value.

4 References

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5 Appendices

Appendix 1. Categories used in the assessment of conservation status.

IUCN (International Union for the Conservation of Nature) categories, as outlined by IUCN (2012), and as used for the *Environment Protection and Biodiversity Conservation Act 1999*:

EX	Extinct	Taxa not definitely located in the wild during the past 50 years.
EW	Extinct in the Wild	Taxa known to survive only in captivity.
CR	Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
EN	Endangered	Taxa facing a very high risk of extinction in the wild in the near future.
VU	Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term future.
NT	Near Threatened	Taxa that risk becoming Vulnerable in the wild.
CD	Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
DD	Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
LC	Least Concern	Taxa that are not Threatened.

Categories used in the WA *Biodiversity Conservation Act 2016:*

THREATENED SPECIES		
CR	Critically Endangered	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".
EN	Endangered	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".
VU	Vulnerable	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".
EXTINCT SPECIES		
EX	Extinct	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).
EW	Extinct in the Wild	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).

SPECIALLY PROTECTED SPECIES		
MI	Migratory	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).
CD	Conservation Dependent	Species of special conservation need that are 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).
OS	Other Specially Protected	Species 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).

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

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, for example, 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 for threatened listing and appear to be under immediate threat from known threatening processes. These 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, for example, 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 for threatened listing and appear to be under threat from known threatening processes. These 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. These species need further survey.

		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 a conservation dependent specially protected species. (c) Species that have been removed from the list of threatened species or lists of conservation dependent or other specially protected species, during the past five years for reasons other than taxonomy. (d) Other species in need of monitoring.
P4	Priority 4	

Appendix 2. Plants known to be used for foraging, roosting and nesting by black-cockatoos in south-western Western Australia.

Data compiled from the literature (Davies 1966; Saunders 1974, 1979a, b, 1980; Saunders *et al.* 1982; Saunders 1986; Johnstone and Storr 1998; Higgins 1999; Johnstone and Kirkby 1999, 2008; Groom 2011; Johnstone *et al.* 2011; DotE 2017a, b, c).

FRTBC = Forest Red-tailed Black-Cockatoo, CBC = Carnaby's Black-Cockatoo, BBC = Baudin's Black-Cockatoo.

Plant status: blank = Western Australian native, AN = Australian native (but not naturally occurring in Western Australia), E = exotic (i.e. not native to Australia).

F = foraging, R = roosting, N or n = nesting (main and less commonly used species, respectively).

Plant Species	Plant Status	FRTBC	CBC	BBC
Acacia baileyana (Cootamundra Wattle)	AN		F	
Acacia pentadenia (Karri Wattle)			F	
Acacia saligna (Orange Wattle)			F	
Agonis flexuosa (Peppermint Tree)			F	
Allocasuarina fraseriana (Sheoak)		F		F
Anigozanthos flavidus (Tall Kangaroo Paw)				F
Araucaria heterophylla (Norfolk Island Pine)	E		F	
Banksia ashbyi (Ashby's Banksia)			F	
Banksia attenuata (Slender Banksia)			F	
Banksia baxteri (Baxter's Banksia)			F	
Banksia carlinoides (Pink Dryandra)			F	
Banksia coccinea (Scarlet Banksia)			F	
Banksia dallanneyi (Couch Honeypot Dryandra)			F	
Banksia ericifolia (Heath-leaved Banksia)	AN		F	
Banksia fraseri (Dryandra)			F	
Banksia gardneri (Prostrate Banksia)			F	
Banksia grandis (Bull Banksia)			F	F
Banksia hookeriana (Hooker's Banksia)			F	
Banksia ilicifolia (Holly Banksia)			F	F
Banksia kippistiana (Dryandra)			F	
Banksia leptophylla			F	
Banksia lindleyana (Porcupine Banksia)				F
Banksia littoralis (Swamp Banksia)			F	F
Banksia menziesii (Firewood or Menzie's Banksia)			F	
Banksia mucronulata (Swordfish Dryandra)			F	
Banksia nivea (Honeypot Dryandra)			F	
Banksia nobilis (Golden Dryandra)			F	
Banksia praemorsa (Cut-leaf Banksia)			F	F
Banksia prionotes (Acorn Banksia)			F	
Banksia quercifolia (Oak-leaved Banksia)			F	F
Banksia sessilis (Parrot Bush)			F	F
Banksia speciosa (Showy Banksia)			F	
Banksia squarrosa (Pingle)			F	F
Banksia tricuspis (Lesueur Banskia or Pine Banksia)			F	
Banksia undata (Urchin or Cut-leaf Dryandra)			F	

Plant Species	Plant Status	FRTBC	CBC	BBC
Banksia verticillata (Granite Banksia)			F	
Brassica campestris (Canola, Rape)	E		F	
Callistemon spp.				F
Callistemon viminalis (Captain Cook Bottlebrush)	AN		F	
Callitris sp.			F	
Carya illnoinensis (Pecan)	E		F	F
Casuarina cunninghamiana (River Sheoak)	AN		F	
Citrullus lanatus (Pie or Afghan Melon)	E		F	
Corymbia calophylla (Marri)		F,N	F,n,R	F,n
Corymbia ficifolia (Red Flowering Gum)			F	
Corymbia haematoxylon (Mountain Marri)			F	
Corymbia maculata (Spotted Gum)			R	
Darwinia citriodora (Lemon-scented Darwinia)	AN		F	F
Diospryros sp. (Sweet Persimmon)	E		F	F
Eremophila glabra (Tarbush)			F	
Erodium aureum (Corkscrew Grass or Storksbill)	E		F	
Erodium botrys (Corkscrew Grass or Storksbill)	E		F	F
Eucalyptus caesia (Silver Princess)			F	
Eucalyptus camaldulensis (River Red Gum)	AN		R	
Eucalyptus citriodora (Lemon Scented Gum)	AN	F	F,R	F
Eucalyptus diversicolor (Karri)		n	n	N
Eucalyptus globulus (Tasmaniam Blue Gum)	AN		R	
Eucalyptus gomphocephala (Tuart)		n	F,n,R	
Eucalyptus grandis (Flooded Gum, Rose Gum)	AN		R	
Eucalyptus longicornis (Red Morrell)			n	
Eucalyptus loxophleba (York Gum)			F,n	
Eucalyptus marginata (Jarrah)		F,N	F,n,R	F
Eucalyptus megacapa (Bullich)		n		n
Eucalyptus occidentalis (Swamp Yate)			n	
Eucalyptus patens (Blackbutt)		F	F,R	
Eucalyptus pleurocarpa (Tallerack)			F	
Eucalyptus preissiana (Bell-fruited Mallee)			F	
Eucalyptus robusta (Swamp Mahogany)			F,R	
Eucalyptus rudis (Flooded Gum)			R	
Eucalyptus salmonophloia (Salmon Gum)			F,N	
Eucalyptus salubris (Gimlet)			n	
Eucalyptus todtiana (Coastal Blackbutt or Prickley Bark)			F	
Eucalyptus wandoo (Wandoo)			F,N,R	F,n
Ficus sp. (Fig)			F	
Grevillea armigera (Prickly Toothbrushes)			F	
Grevillea bipinnatifida (Fuschia Grevillea)			F	
Grevillea hookeriana (Red Toothbrushes)			F	
Grevillea hookeriana subsp. *apiciloba* (Black Toothbrushes)			F	

Plant Species	Plant Status	FRTBC	CBC	BBC
Grevillea paniculata (Kerosene Bush)			F	
Grevillea paradoxa (Bottlebrush Grevillea)			F	
Grevillea petrophiloides (Pink Poker)			F	
Grevillea robusta (Silky Oak)			F	
Grevillea wilsonii (Native Fuchsia)				F
Hakea auriculata			F	
Hakea candolleana			F	
Hakea circumalata (Coastal Hakea)			F	
Hakea commutata			F	
Hakea conchifolia			F	
Hakea costata (Ribbed Hakea)			F	
Hakea cristata (Snail Hakea)			F	F
Hakea cucullata (Snail Hakea)			F	
Hakea cyclocarpa (Ramshorn)			F	
Hakea eneabba			F	
Hakea erinacea (Hedgehog Hakea)			F	F
Hakea falcata (Sickle Hakea)			F	
Hakea flabellifolia (Fan-leaved Hakea)			F	
Hakea gilbertii			F	
Hakea incrassata (Golfball or Marble Hakea)			F	
Hakea lasiantha (Woolly Flowered Hakea)			F	
Hakea lasianthoides			F	F
Hakea laurina (Pin-cushion hakea)			F	
Hakea lissocarpha (Honeybush)			F	F
Hakea marginata				F
Hakea megalosperma (Lesueur Hakea)			F	
Hakea multilineata (Grass Leaf Hakea)			F	
Hakea obliqua (Needles and Corks)			F	
Hakea oleifolia (Dungyn or Olive-leaved Hakea)			F	
Hakea pandanicarpa subsp. *crassifolia* (Thick-leaved Hakea)			F	
Hakea petiolaris (Sea Urchin Hakea)			F	
Hakea polyanthema			F	
Hakea preissii (Needle Tree)			F	
Hakea prostrata (Harsh Hakea)			F	F
Hakea psilorrhyncha			F	
Hakea ruscifolia (Candle Hakea)			F	F
Hakea scoparia (Kangaroo Bush)			F	
Hakea smilacifolia			F	
Hakea spathulata			F	
Hakea stenocarpa (Narrow-fruited Hakea)			F	F
Hakea sulcata (Furrowed Hakea)			F	
Hakea trifurcata (Two-leaved Hakea)			F	F
Hakea undulata (Wavy-leaved Hakea)			F	

Plant Species	Plant Status	FRTBC	CBC	BBC
Hakea varia (Variable-leaved Hakea)			F	F
Helianthus annuus (Sunflower)	E		F	
Hibiscus sp. (Hibiscus)	E		F	
Isopogon scabriusculus			F	
Jacaranda mimosifolia (Jacaranda)	E		F	F
Jacksonia furcellata (Grey Stinkwood)			F	
Kingia australis (Kingia)				F
Lambertia inermis (Chittick)			F	
Lambertia multiflora (Many-flowered Honeysuckle)			F	
Liquidamber styraciflua (Liquid Amber)	E		F	
Lupinus sp. (Lupin)	E		F	
Macadamia integrifolia (Macadamia)	E		F	F
Malus domestica (Apple)	E		F	F
Melaleuca leuropoma			F	
Melia azedarach (Cape Lilac or White Cedar)	E	F	F	
Mesomeleana sp.			F	
Persoonia longifolia (Snottygobble)		F		
Pinus canariensis (Canary Island Pine)	E		F	
Pinus caribea (Caribbean Pine)	E		F	
Pinus pinaster (Pinaster or Maritime Pine)	E		F,R	
Pinus radiata (Radiata Pine)	E		F,R	F
Protea 'Pink Ice'	E		F	
Protea repens	E		F	
Prunus amygdalus (Almond Tree)	E		F	
Pyrus communis (European Pear)	E			F
Quercus spp. (Oak spp.)	E			F
Raphanus raphanistrum (Wild Radish)	E		F	
Reedia spathacea				F
Tipuana tipu (Tipu or Rosewood Tree)	E		F	
Xanthorrhoea preissii (Grass Tree)			F	F

Appendix 3. Extended rationale for chosen methodology.

Vegetation and substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

VSA assessment was made with reference to the key attributes provided by (EPA 2020):

- soil type and characteristics
- extent and type of ground surfaces and landforms
- height, cover and dominant flora within each vegetation stratum
- presence of specific flora or vegetation of known importance to fauna
- evidence of fire history including, where possible, estimates of time since fire
- evidence and degree of other disturbance or threats, e.g. feral species
- presence of microhabitats and significant habitat features, such as coarse woody debris, rocky
- outcrops, tree hollows, water sources and caves
- evidence of potential to support significant fauna
- function of the habitat as a fauna refuge or part of an ecological linkage.

Appendix 4. Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos.

Bamford Consulting Ecologists
Revised 4th April 2021

Introduction

Application of the Offset Assessment Guide (offsets guide) developed by the federal environment department for assessing Black-Cockatoo foraging habitat requires the calculation of a score out of 10. The following system has been developed by Bamford Consulting Ecologists (BCE) with assistance from Quessentia Consulting to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species.

The foraging value score provides a numerical value that reflects the significance of vegetation as foraging habitat for Black-Cockatoos, and this numerical value is designed to provide the information needed by the Federal Department of Agriculture, Water and the Environment (DAWE) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed above. These three components are drawn from the DAWE offsets guide but the scoring approach was developed by BCE and includes a fourth (moderation) component. Note that the scoring system can only be applied within the range of the species or at least where the species could reasonably be expected to occur based upon existing information.

Calculating the total score (out of 10) requires the following steps:

A. Site condition. Determining a score out of six for the vegetation composition, condition and structure; plus
B. Site context. Determining a score out of three for the context of the site; plus
C. Species stocking rate. Determining a score out of one for species density.
D. Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value.

The BCE scoring system places the greatest weight on site condition (scale of 0 to 6) because this has the highest influence on the foraging values of a site, which in turn is the fundamental driver in meeting ecological requirements for continued survival.

Site context has a lower weight (scale of 0 to 3) in recognition of the mobility of the species, which means they can access good foraging habitat even in fragmented landscapes, but allowing for recognition of the extent of available habitat in a region and context in relation to activity (such as breeding and roosting). The application of scoring site context is further discussed below.

Species stocking rate is given a low weight (0 to 1) as it is a means only of recognising that a species may or may not be abundant at a site, but that abundance is dependent upon site condition and context and is thus not an independent variable. The abundance of a species is also sensitive to

sampling effort, and to seasonal and annual variation, and is therefore an unreliable indicator of actual importance of a site to a species.

Calculation of scores and the moderation process are described in detail below.

A. Site condition. Vegetation composition, condition and structure scoring

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples: • Water bodies (e.g. salt lakes, dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits) or with vegetation of no food value, such as some suburban landscapes. • Mown grass	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).
1	Negligible to low foraging value. Examples: • Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; • Paddocks that are lightly vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source; • Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual).	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have < 10% projected foliage cover; • Woodland with tree banksias 2-5% projected foliage cover; • Woodland with tree banksias (of key species *B. attenuata* and *B. menziesii*) with <10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Open eucalypt woodland/mallee of small-fruited species; • Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Marri-Jarrah Woodland with <10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants <10% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants <10% projected foliage cover (establishing food sources with good long-term viability); • Urban areas with scattered foraging trees.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah) 1-5% projected foliage cover; • Marri-Jarrah Woodland with <10% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Woodland with <10% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants <10% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants <10% projected foliage cover (establishing food sources with good long-term viability); • Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; • Woodland with tree banksias 5-20% projected foliage cover; • Woodland with tree banksias (of key species *B. attenuata* and *B. menziesii*) with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Eucalypt Woodland/Mallee of small-fruited species; • Eucalypt Woodland with Marri < 10% projected foliage cover.	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover; • Marri-Jarrah Woodland with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; • Marri-Jarrah Woodland with 10-40% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 10-40% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
4	Moderate foraging value. Examples: • Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) 20-40% projected foliage cover; • Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover; • Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 40-60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 40-60% projected foliage cover (establishing food sources with good long-term viability); • Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 40-60% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 40-60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 40-60% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
5	Moderate to High foraging value. Examples: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover; • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 40-60% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term). • Pine plantations with trees more than 10 years old (but see pine note below in moderation section).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Parkland-cleared Eucalypt Woodland/Forest with known food plants >60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants >60% projected foliage cover (establishing food sources with good long-term viability).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with > 60% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants >60% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants >60% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
6	High foraging value. Example: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term). • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have >60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Vegetation structural class terminology follows Keighery (1994).

B. Site context.

Site Context is a function of site size, availability of nearby habitat and the availability of nearby breeding areas. Site context includes consideration of connectivity, although Black-Cockatoos are very mobile and will fly across paddocks to access foraging sites. Based on BCE observations, Black-Cockatoos are unlikely to regularly go over open ground for a distance of more than a few kilometres and prefer to follow tree-lines.

The maximum score for site context is 3, and because it is effectively a function of presence/absence of nearby breeding and the distribution of foraging habitat across the landscape, the following table, developed by Bamford Consulting in conjunction with the Department of the Environment and Energy (DEE), provides a *guide* to the assignation of site context scores. Note that 'local area' is defined as within a 15 km radius of the centre point of the study site. This is greater than the maximum distance of 12km known to be flown by Carnaby's Black-Cockatoo when feeding chicks in the nest.

Site Context Score	Percentage of the existing native vegetation within the 'local' area that the study site represents.	
	'Local' breeding known/likely	'Local' breeding unlikely
3	> 5%	> 10%
2	1 - 5%	5 - 10%
1	0.1 - 1%	1 - 5%
0	< 0.1%	< 1%

The table above provides weighting for where nearby breeding is known (or suspected) and for the proportion of foraging habitat within 15 km represented by the site being assessed. Some adjustments may be needed based on the judgement of the assessor and in relation to the likely function of the site. For example, a small area of foraging habitat (e.g. 0.5% of such habitat within 15 km) could be upgraded to a context of 2 if it formed part of a critical movement corridor. In contrast, the same sized area of habitat, of the same local proportion, could be downgraded if it were so isolated that birds could never access it.

C. Species density (stocking rate).

Species stocking rate is described as "the usage and/or density of a species at a particular site" in the offsets guide. The description also implies that a site supports a discrete population, which is unlikely in the case of very mobile black-cockatoos. Assignation of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence. Where information on actual presence of birds is lacking, a species density score can be assigned by interpreting the landscape and the site context. For example, a site with a moderate condition score that is part of a network of such habitat where a black-cockatoo species is

known would get a species density score of 1 even without clear presence data, while a species density score of 0 can be assigned to a site where the level of usage can confidently be predicted to be low.

D. Moderation of scores for the calculation of a value out of 10.

The calculation out of 10 requires the vegetation characteristics (out of 6) to be combined with the scores given for context and species density. It is considered that the context and density scores are not independent of vegetation characteristics; otherwise habitat of absolutely no value for black-cockatoo foraging (such as concrete or a wetland) could get a foraging score out of 10 as high as 4 if it occurred in an area where the species breed (context score of 3) and are abundant (species density score of 1). Similarly, vegetation of negligible or low characteristics which could not support black-cockatoos could be assigned a score as high as 6 out of 10. In that case, the score of 6 would be more a reflection of nearby vegetation of high characteristics than of the foraging value of the negligible to low scoring vegetation. The Black-Cockatoos would only be present because of vegetation of high characteristics, so applying the context and species density scores to vegetation of low characteristics would not give a true reflection of their foraging value.

For this reason, the context and species density scores need to be moderated for the vegetation characteristic score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. A simple approach is to assign a context and species density score of zero to sites with a Condition score of low (2), negligible (1) or none (0), on the basis that birds will not use such areas unless they are adjacent to at least low-moderate quality foraging habitat ($\geq$3). The approach to calculating a score out of 10 can be summarised as follows:

Vegetation composition, condition and structure score	Context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C above
0-2 (no to low value)	0	0

Note that this moderation approach may require interpretation depending on the context. For example, vegetation with a condition score of 2 could be given a context score of 1 under special circumstances. Such as when very close to a major breeding area or if strategically located along a movement corridor.

Pine plantations

Pine plantations are an important foraging resource for Carnaby's Black-Cockatoo (only) but are not directly comparable with native vegetation. In comparing native vegetation with pine plantations for the purpose of calculating offsets, the following should be noted:

- Pine plantations are a commercial crop established with the intention of being harvested and thus have short-term availability (30-50 years), whereas native vegetation is available indefinitely if protected. Due to the temporary nature of pines as a food source, site condition and context differs between pines and native vegetation.
- Although pines provide a high abundance of food in the form of seeds, they are a limited food resource compared with native vegetation which provides seeds, insect larvae, flowers and nectar. The value of insect larvae in the diet of Carnaby's Black-Cockatoo has not been quantified, but in the vicinity of Perth, the birds forage very heavily on insect larvae in young cones of *Banksia attenuata* in winter, ignoring the seeds in these cones and seeds in older cones on the same trees (Scott and Black 1981; M. Bamford pers. obs.). This suggests that insect larvae are of high nutritional importance immediately prior to the breeding season.
- Pine plantations have very little biodiversity value other than their importance as a food source for Carnaby's Black-Cockatoos. They inhibit growth of other flora. While this is not a factor for direct consideration with respect to Carnaby's Black-Cockatoo, it is a factor in regional conservation planning of which offsets for the cockatoos are a part.

Taking the above points into consideration, it is possible to assign pine plantations a foraging value as follows:

- Site condition. The actual foraging value of pines is high. Stock *et al.* (2013) report that it takes nearly twice as many seeds of *Pinus pinaster* to meet the daily energy requirements for Carnaby's Black-Cockatoo compared with Marri, and three times as many *P. pinaster* seeds compared with Slender Banksia. However, pines are planted at a high density so the food supply per hectare can be high. Taking account of the lack of variety of food from pines, this suggests a site condition score of 4 or 5 out of 6 (5 is used in Section A above). As a source of food, pines are thus comparable to the best banksia woodland. This site condition score then needs to be adjusted to take account of the short-term nature of the food supply (for pine plantations to be harvested. Where pines are 'ornamental, such as in some urban contexts, they can be treated as with other trees in urban landscapes). The foraging value of a site after pines are harvested will effectively be 0, or possibly 1 if there is some retention. It is proposed that this should approximately halve the site condition score; young pine plantations could be redacted slightly less than old plantations on the basis that a young plantation provides a slightly longer term food supply. If a maximum site condition score of 5 is given, then a young plantation (>10 but <30 years old) could be assigned a score of 3, and an old plantation (>30 years old) could be assigned a score of 2. Plantations <10 years old and thus not producing large quantities of cones could also get a score of 2, but recognising they may increase in value.
- Site context. Although a temporary food source, pines can be very important for Carnaby's Black-Cockatoo in some contexts; they could be said to carry populations in areas where there is little native vegetation. The system for assigning a context score as outlined above (Section B) also applies to pines. Thus, a context score of 3 can be given where pines are a significant

proportion of foraging habitat (>5% if breeding occurs; >10% if no breeding), but where pines are a small part of the foraging landscape they will receive a context score of less than this.

- Species density. As outlined above (Section C), pines will receive a species density score of 1 where Carnaby's Black-Cockatoo are regular visitors. This is irrespective of an old plantation having a moderated condition score of 2.

Based on the above, pine plantations that represent a substantial part of the foraging landscape, such as in the region immediately north of Perth, would receive a total score (out of 10) of 6; young plantations in this area would receive a score of 7. In contrast, isolated and small plantations in rural landscapes could receive a score of just 2 if they are only a small proportion of foraging habitat and Carnaby's Black-Cockatoos are not regularly present.

Appendix 5. The foraging quality scoring tool template from DAWE (2022b).

Table A1 Foraging quality scoring tool template

Starting score		Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black-Cockatoo
10		**Start at a score of 10** if your site is native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly Marri, within the range of the species, including along roadsides and parkland cleared areas. Can include planted vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size.**	**Start at a score of 10** if your site is native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size.**	**Start at a score of 10** if your site is Jarrah or Marri woodland and/or forest, or if it is on the edge of Karri forest, or if Wandoo and Blackbutt occur on the site, within the range of the subspecies, including along roadsides and parkland cleared areas. **This tool only applies to sites equal to or larger than 1 hectare in size.**
Attribute	Sub-tractions	Context adjustor (attributes reducing functionality of foraging habitat)		
Foraging potential	-2	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.
Connectivity	-2	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.
Proximity to breeding	-2	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.
Proximity to roosting	-1	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.
Impact from significant plant disease	-1	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.
Total score		*Enter score*	*Enter score*	*Enter score*
Appraisal		To support your habitat score, you should provide an overall appraisal of the habitat on the impact site and within 20km of the impact area to clearly explain and justify the score. It should include discussion on the foraging habitat's proximity to other resources (e.g. exact distance to proximate resources), frequency of use of proximate sites, the degree of evidence and description of vegetation type and condition.		

Appendix 6. Examples of Forest Red-tailed Black-Cockatoo foraging signs across the range of age categories used in this study.

Active/Recent ↔ Intermediate ↔ Old

Jarrah nuts



Jarrah leaves



Marri nuts



Appendix 7. Species recorded in the field investigations.

+ = species recorded directly; D = diggings, S = scats, T = tracks

Note that because of the spatial separation and VSA differences, separate inventories were taken for the 'Existing Facility Area' (comprising the Tarantula Deep 1, Beharra Springs Deep 3, BSGF Proposed Camp, Redback Deep 1 and Beharra Springs Deep 2 survey areas) and the 'Trigg Area' (Trigg Northwest 1B survey area).

Species		Existing Facility Area	Trigg Area
Agamidae (Dragons)			
Ctenophorus maculatus		+	
Scincidae (Skinks)			
Tiliqua rugosa	Bobtail	+	
Casuariidae (Emus and Cassowaries)			
Dromaius novaehollandiae	Emu	S	+
Cuculidae (Cuckoos)			
Chalcites basalis	Horsfield's Bronze-Cuckoo		+
Accipitridae (Eagles, Kites, Goshawks)			
Aquila audax	Wedge-tailed Eagle		+
Falconidae (Falcons)			
Falco cenchroides	Nankeen Kestrel	+	
Falco berigora	Brown Falcon		+
Maluridae (Fairy-wrens, Emu-wrens and Grasswrens)			
Malurus splendens	Splendid Fairy-wren		+
Malurus leucopterus	White-winged Fairy-wren	+	+
Meliphagidae (Honeyeaters and Chats)			
Lichmera indistincta	Brown Honeyeater	+	+
Phylidonyris niger	White-cheeked Honeyeater	+	+
Melithreptus brevirostris	Brown-headed Honeyeater		+
Glyciphila melanops	Tawny-crowned Honeyeater	+	+
Gavicalis virescens	Singing Honeyeater		+
Acanthizidae (Thornbills and Gerygones)			
Calamanthus campestris	Rufous Fieldwren	+	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		+
Pachycephalidae (Whistlers, Shrike-thrushes and allies)			
Pachycephala rufiventris	Rufous Whistler		+
Artamidae (Woodswallows, Currawongs, Butcherbirds and Magpie)			
Artamus cinereus	Black-faced Woodswallow	+	
Rhipiduridae (Fantails)			
Rhipidura leucophrys	Willie Wagtail		+

Species		Existing Facility Area	Trigg Area
Corvidae (Crows and Ravens)			
Corvus coronoides	Australian Raven	+	
Dicaeidae (Flowerpeckers)			
Dicaeum hirundinaceum	Mistletoebird		+
Estrildidae (Weaver Finches)			
Taeniopygia guttata	Zebra Finch	+	
Motacillidae (Pipits and Wagtails)			
Anthus novaeseelandiae	Australasian Pipit	+	+
Zosteropidae (White-eyes)			
Zosterops lateralis	Silvereye		+
Tachyglossidae (Echidnas)			
Tachyglossus aculeatus	Short-beaked Echidna	D	
Macropodidae (Kangaroos)			
Macropus fuliginosus	Western Grey Kangaroo	+	S,T
Leporidae (Rabbits and hares)			
Oryctolagus cuniculus	Rabbit	S	
Canidae (Dogs)			
Vulpes vulpes	Red Fox	T	

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Appendix D Petroleum Licence

STATE OF WESTERN AUSTRALIA

PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967

RENEWAL OF PRODUCTION LICENCE L 11

I, ANTHONY THOMAS BULLEN, General Manager Resource Tenure of the Department of Mines, Industry Regulation and Safety for the State of Western Australia, the delegate of the Minister for Mines and Petroleum, pursuant to the provisions of Section 65 of the *Petroleum and Geothermal Energy Resources Act 1967*, grant a renewal of the production licence L 11 in respect of the block described hereunder to:

AWE (BEHARRA SPRINGS) PTY LTD [ACN: 009 362 645]

And

BEACH ENERGY (PERTH BASIN) PTY LIMITED [ACN: 008 432 479]

(hereinafter collectively referred to as "the Licensee")

The petroleum production licence will remain in force for an indefinite period commencing on the day on which the renewal comes into force.

The grant of the renewal is subject to the conditions set out hereunder and to the permittee at all times complying with the provisions of the Act and of any Regulations for the time being in force under the Act and all Directions given to him under the Act.

INTERPRETATION

In this petroleum production licence:

Act means the *Petroleum and Geothermal Energy Resources Act 1967* and includes all subsidiary legislation and any Act with which that Act is incorporated and words used in this notice have the same respective meanings as in the Act;

Department means the department assisting the Minister in the administration of the Act from time to time; and

Minister means the Minister of the State to whom the administration of the Act is for the time being committed by the Governor or his duly appointed delegate in accordance with an instrument of delegation under section 25 of the Act.

DESCRIPTIONS OF BLOCKS

(The references hereunder are to the names of map sheets of the 1:1,000,000 series published by the Minister and to the numbers of graticular sections shown thereon.)

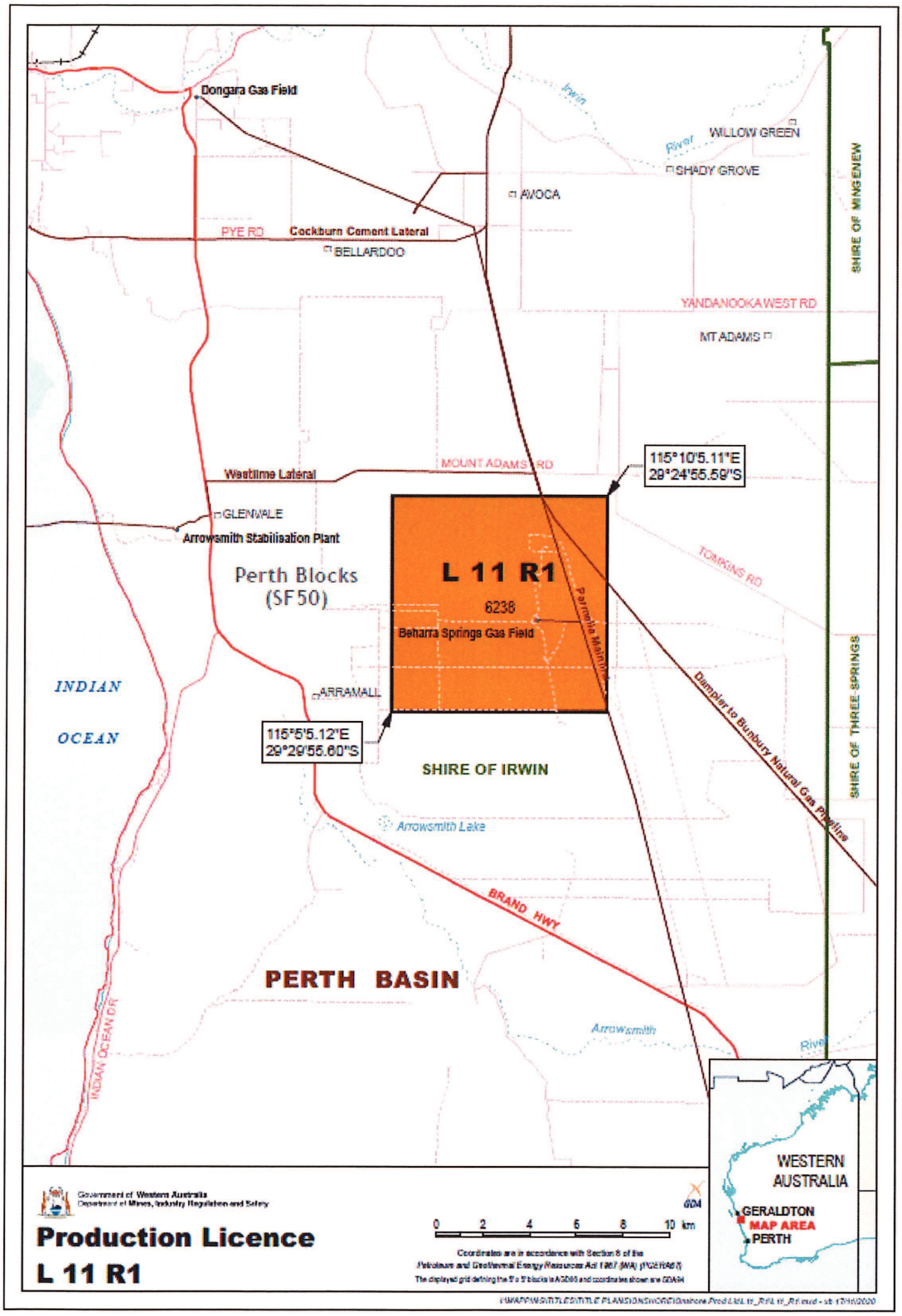
PERTH MAP SHEET (SH50)

Block No.

6238

The area is assessed to contain **1 block** to the extent only that the area is within the State as defined in section 26 of the Act.

MAP PAGE


Dongara Gas Field
Irwin River
WILLOW GREEN
SHADY GROVE
AVOCA
PYE RD
Cockburn Cement Lateral
BELLARDOO
SHIRE OF MINGENEW
YANDANOOKA WEST RD
MT ADAMS
115°10'5.11"E
29°24'55.59"S
Westlime Lateral
MOUNT ADAMS RD
GLENWALE
Arrowsmith Stabilisation Plant
Perth Blocks
(SF50)
L 11 R1
6238
Beharra Springs Gas Field
Parmelia Pipeline
TOMKINS RD
INDIAN
OCEAN
ARRAMALL
115°5'5.12"E
29°29'55.60"S
SHIRE OF IRWIN
Dampier to Bunbury Natural Gas Pipeline
SHIRE OF THREE SPRINGS
Arrowsmith Lake
BRAND HWY
PERTH BASIN
INDIAN OCEAN DR
Arrowsmith River
WESTERN AUSTRALIA
GERALDTON
MAP AREA
PERTH
Government of Western Australia
Department of Mines, Industry Regulation and Safety
Production Licence
L 11 R1
GDA
0 2 4 6 8 10 km
Coordinates are in accordance with Section 8 of the
Petroleum and Geothermal Energy Resources Act 1967 (WA) ("PGERA67")
The displayed grid defining the 5' x 5' blocks is AGD66 and coordinates shown are GDA94

CONDITIONS

1. The Licensee shall continue to appraise and explore the licence area to determine whether additional recoverable petroleum exists in the area and exploit such petroleum where commercially viable.

2. On the discovery of petroleum in the petroleum production licence area, the Licensee shall provide the Department a report of the discovery in writing within the period of 90 days after the date of the discovery providing the following particulars of the discovery:

    a. the title area in which the discovery was made;
    b. a preliminary estimate of the location and areal extent of the petroleum pool;
    c. details of the geological structure or underground formation in which the petroleum is located;
    d. the results of all assessments of the discovery;
    e. if the rate or quantity of production of petroleum and water from the well that resulted in the discovery has been determined — that rate or quantity;
    f. the data used to estimate the quantity of petroleum in the petroleum pool;
    g. a preliminary estimate of the quantity of recoverable petroleum in the petroleum pool; and
    h. details of the Licensee's plans for further evaluation of the discovery, including the work that the Licensee proposes to carry out in the licence area in the next 12 months from the date of the report.

3. The Licensee shall permit a person authorised in writing for the purpose by the Minister or an inspector, to test or examine any measuring device installed within the licence area that has been, is being, or is to be used by the Licensee to measure for royalty purposes the quantity of any petroleum recovered in the licence area.

4. Prior to the Licensee submitting an application pursuant to section 98 of the Act, the Licensee shall:

    a.

        i. remove all structures, equipment, flowlines, and other property associated with the Beharra Springs Gas Plant; or

        ii. make arrangements that are satisfactory to the Minister for any structures, equipment, flowlines, and other property required to be removed pursuant to subparagraph 4(a)(i).

    b.

        i. plug or close off (with a permanent well barrier element), the following wells Beharra Springs 1, Beharra Springs 2, Beharra Springs 3, Beharra Springs 4, Beharra Springs Deep 1, Beharra Springs North 1, Redback 2, Redback South 1, Tarantula 1 ST1, Wolf 1; or

        ii. make arrangements that are satisfactory to the Minister for any of the wells required to be plugged or closed off pursuant to subparagraph 4(b)(i).

    c.

        i. restore the land, soil and vegetation comparable with the surrounding land use and make good any damage to the Earth's crust, including any access tracks, well pads, sumps, and laydown areas associated with:
            1. the Facilities listed in subparagraph 4(a)(i)(1); and
            2. the wells listed in subparagraph 4(b)(i)(1); and
            3. the plugged and/or closed off wells being North Yardanogo 1 and South Yardanogo 1; or

        ii. make arrangements that are satisfactory to the Minister for any damage to the Earth's crust required to be made good pursuant to subparagraph 4(c)(i)(3).

    d. Clean up and remove waste, including remediating of the effects of the escape of petroleum which is associated with:
        i. the Facilities listed in subparagraph 4(a)(i); and

ii. the wells listed in subparagraph 4(b)(i); and the plugged and/or closed off wells listed in subparagraph 4(c)(i)(3).

Dated at Perth this 15th day of June 2021.

Made under the *Petroleum and Geothermal Energy Resources Act 1967* of the State of Western Australia.

ANTHONY THOMAS BULLEN
GENERAL MANAGER RESOURCE TENURE
RESOURCE TENURE DIVISION
DEPARTMENT OF MINES, INDUSTRY REGULATION AND SAFETY

ENDORSEMENTS

1. In addition to any specific conditions that are endorsed on this instrument, the holder in exercising the rights granted herein must first ensure that all necessary consents and permissions have been obtained and applicable compensation has been agreed to or determined and that consultation has occurred where the lawful rights of other land users and occupiers are concerned so that the activities of those other land users and occupiers are not interfered with to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the holder of this petroleum production licence.

2. The Licensee's attention is drawn to the provisions of Division 3A of the Act which provides for petroleum and geothermal titles to subsist in respect to the same blocks.

3. The Licensee's attention is drawn to the provisions of the *Aboriginal Heritage Act 1972*.

4. The Royalty Rate, determined by the Minister, for this petroleum production licence has been set at 10% at well-head value and has been determined for the term of the licence.