EPBC REF: 2022/09324
EXPANSION OF LIMESTONE EXTRACTION OPERATIONS
210 WESCO ROAD, NOWERGUP, WANNEROO

[redacted] OFFSET SITE MANAGEMENT PLAN

PREPARED FOR:

METEORSTONE
QUARRY and PROCESS NATURAL STONE

JUNE 2024

PREPARED BY:

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OFFSET SITE MANAGEMENT PLAN

Distribution List:

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Meteor Stone	[redacted]	[01]	07 June 2024
Stoneridge	[redacted]	[02]	07 June 2024
Complex Land Solutions	[redacted]	[03]	07 June 2024
DCCEEW	South WA Assessments Team	[04]	07 June 2024

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Report V1	Hayden Beltz	Sue Brand	16 April 2024
Revision 1	Hayden Beltz	Sue Brand	16 May 2024
Revision 2	Hayden Beltz	Sue Brand	07 June 2024

EXECUTIVE SUMMARY

Meteor Stone Pty Ltd propose to clear 6.495 ha of Carnaby's Cockatoo (*Zanda latirostris*) foraging habitat from a portion of Mining Tenement M70/138 in Neerabup (Proposed Action Area, PAA).

The longer-term but 'temporary' loss of 6.495 ha of quality Carnaby's Cockatoo foraging habitat means that an offset site is required to counterbalance the residual impacts associated with the proposed loss of habitat. This Offset Management Plan documents the various management actions that are proposed to enhance the quality of the Carnaby's Cockatoo habitat within the proposed offset Site, resulting in a net gain for the ongoing preservation of the species.

PROJECT OVERVIEW

It is Meteor Stone's intention to expand their current limestone extraction activities within the Sublease 1 area of mining lease M70/138 into the 6.495 ha Sublease 5 area as the current resource is close to being exhausted.

The proposed clearing location represents the area with the best limestone resource present within the Sublease 5 area of Lot 12737 (Landform Research, 2020). The PAA will be cleared on the granting of approvals, with extraction being undertaken according to product demand.

The Proposed Action (PA) will occur in 3 main phases over a minimum 10-year period up to a maximum 20 years according to product demand.

KEY PROJECT ELEMENTS

Key project elements can be categorised into three phases, namely:

- Pre-operational activities associated with preparing the site for extraction, including clearing of the 6.495 ha of Carnaby's Cockatoo foraging habitat over about a 4-week period.
- Operational activities associated with the extraction of the limestone, which is expected to occur over a minimum of 10 years and a maximum of 20 years, according to product demand.
- Post extraction (decommissioning) activities, including rehabilitation of the quarry site.

PRIMARY IMPACT TO THE CARNABY'S COCKATOO

The primary impacts of the clearing on Sublease 5 area are:

- Loss of 6.495 ha of quality foraging habitat as a result of land clearing.
- Injury or death of individual Carnaby's Cockatoo birds as a result of bird strike during land clearing or operations.

PRIMARY MANAGEMENT STRATEGIES

Management strategies to address injury and or death of birds during construction (land clearing) are detailed in a Project specific Construction Environmental Management Plan (CEMP).

As the clearing of the PAA will mean that foraging habitat for Carnaby's Cockatoo will be removed, an offset is required to counterbalance the residual impacts associated with this. The proposed [redacted] offset site represents a like-for-like direct offset. The proposed offset will ensure protection in perpetuity of existing Carnaby's Cockatoo foraging habitat and through implementation of a range of agreed land management measures,

enhancement of its current values as foraging habitat. It is also noted that the proposed offset site will also have several secondary conservation benefits including:

- Preservation and enhancement of [redacted] of Banksia Woodland that is likely to meet the key diagnostic features of the Banksia Woodlands of the Swan Coastal Plain ecological community listed as Threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) and Priority 3 under the *Biodiversity Conservation Act 2016* (WA) (BC Act).
- The likely protection of other State and/or Federal listed conservation significant flora and/or fauna that might be present within or utilise the site for some or all its habitat needs.

PROPOSED OFFSET

[redacted] will purchase a [redacted]. The Site will be subdivided from the larger [redacted] Lot, with the balance remaining in the ownership of the vendor. When subdivided, the Site will be zoned rural in the first instance to enable it to be used as an offset site.

A portion of [redacted] will provide the offset site required by Meteor Stone to counterbalance the residual impacts associated with clearing of 6.495 ha of Carnaby's Cockatoo foraging habitat from the PAA, with the actual area of the offset within [redacted] required as an offset to be finalised during the environmental assessment process. At present, it is envisaged that [redacted] of the Site will be required as Meteor Stone's offset, with this document being prepared on that basis. The remainder of the Site be banked for future offsetting. As each offset component is confirmed, a conservation covenant will be placed over it to ensure that, in time, the entire [redacted] site will be set aside for conservation purposes through offsetting, thus the value to the Carnaby's Cockatoo in the regional area will be greater than that provided by the Meteor Stone offset component.

The proposed Meteor Stone offset will be a direct offset in that it will:

- Ensure protection in perpetuity of existing Carnaby's Cockatoo foraging habitat. This will contribute to other regional measures to protect habitat for the species.
- Enhance current foraging habitat values of [redacted] through implementation of an agreed range of land management measures. The measures will specifically address listed Threatening Processes relevant to the species. This will result in a net environmental gain for the species.

The proposed offset site will exceed the offset requirements for the Meteor Stone project. In recognition of this, the remainder of the site will be made available to other proponents with need for an offset. Meteor Stone has developed a process whereby this can be managed: each proponent with an interest in [redacted] will purchase shares, with the number of shares equating to the area specified for their offset requirement. All parties will contribute to ongoing land management requirements as per their various approval conditions on a pro rata basis, according to the area they are 'responsible' for. As shareholdings in the site are confirmed, conservation covenants will be placed over each offset area with the eventual expectation the entire site will be subject to one or a collective of conservation covenants that will provide protection for an area of Carnaby's Cockatoo foraging habitat in perpetuity.

This Offset Site Management Plan (OMP) provides an overview of how the entire [redacted] site will be managed, with management activities being undertaken collectively by shareholders. Accordingly, this OMP outlines:

- An overview of the project that has led to the need for the offset.
- Main impacts to the Carnaby's Cockatoo at the Meteor Stone Proposed Action Site.
- Site characteristics of the offset site and its suitability for use as a direct, like-for-like offset for the PAA.
- Land management activities that will be carried out at the offset site over time.
- Completion criteria.

- Monitoring, reporting, and auditing requirements.

Going forward, when the area (ha) of Meteor Stone's offset requirement is confirmed, a portion of the [redacted] site will be allocated as the Meteor Stone offset site. Once the area to be protected is agreed, a conservation covenant will be placed over that area to ensure that it is set aside in perpetuity for conservation purposes.

Future site shareholders will similarly be allocated a portion of the site for offset purposes, the acquisition of which will also require the placement of a conservation covenant over that area.

It is expected that the conservation covenants will be created through the National Trust or via the provisions of the *Soil and Land Conservation Act 1945* (WA): both of which allow for the setting of conservation covenants in perpetuity.

DECLARATION OF ACCURACY:

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations* 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making [redacted]

[redacted] [redacted]

Full name (please print)	[redacted]
Organisation (please print)	Meteor Stone Pty Ltd
Date	07 / 06 / 2024
ABN	70 623 253 770

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APPENDICES

1. INTRODUCTION

Meteor Stone Pty Ltd are a limestone extraction and supply company that have been in operation for more than 20 years, supplying dimension stone blocks. At present, their current extraction site in part of mining lease M70/138 (known as Sublease 1) is coming to the end of its working life. The M70/138 tenement holder, Adelaide Brighton Cement Ltd, T/A Cockburn Cement, has provided Meteor Stone with approval to access the resource in that portion of the tenement that will be known as Sublease 5, with the plan to clear 6.495 ha of Banksia heathland (FCT 24) which provides foraging habitat for Carnaby's Cockatoo (*Zanda latirostris*).

The proposed clearing area is located within a portion of Lot 12737 (210) Wesco Road, Nowergup, within the City of Wanneroo (Figure 1). Lot 12737 on Plan 193226 is zoned as Crown Reserve 27590 for Quarry Purposes.

As the vegetation in the Proposed Action Area (PAA) includes flora species that are preferred foraging habitat species for Carnaby's Cockatoo (*Zanda latirostris*), which is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cwlth) (EPBC Act, the Act), a Referral was submitted to the Department of Climate Change, Energy, the Environment, and Water (DCCEEW) on 3 August 2022.

The referral decision received on 10 October 2022 stated that the proposed clearing was a 'Controlled Action' as defined by the Act, with the assessment approach being preliminary documentation (PD) with further information being required.

The request for further information (RFI) issued under Section 95 A (2) of the Act was received on 27 October 2022 to assist with the assessment process, with the RFI requiring an offset proposal to 'compensate' for the residual risks associated with the loss of 6.495 ha of Carnaby's Cockatoo foraging habitat. A component of that offset proposal is an Offset Management Plan (OMP) that will indicate how the offset will be managed to improve its condition and thus enhancing the Carnaby's Cockatoo habitat on the site with the aim of the site having a similar value to the foraging habitat that will be cleared from the PAA.

This document presents the OMP and has been prepared using the DCCEEW (2024) *Management Plan Checklist*.

1.1 PRIMARY IMPACTS

The primary impacts to the Carnaby's Cockatoo because of the clearing of the PAA are:

- Loss of 6.495 ha of quality foraging habitat as a result of land clearing.
- Injury or death of individual Carnaby's Cockatoo birds as a result of bird strike during land clearing or operations.

The clearing of foraging habitat is the subject of this Offset Management Plan, with the management of the bird presence and the potential for bird strike addressed in the Construction Environmental Management Plan (CEMP) (MBS, 2024a).

1.2 SECONDARY IMPACTS

Secondary impacts that could impact Carnaby's Cockatoo during clearing activities include dust, noise, weed encroachment and/or the introduction of plant pathogens, such as dieback. These impacts will be managed through implementation of the CEMP during the pre-operational phase of the project.

1.3 EPBC ACT APPROVAL CONDITIONS AND COMMITMENTS

The EPBC Act Approval was issued on (date to be inserted), with the conditions commitments provided in Table 1, noting that the table will be completed with the conditions become available and commitments are finalised.

Table 1: EPBC Act Approval Conditions

Item	Description
Approval Conditions	
Commitments	

381,500 382,200 382,900 383,600 384,300

6,498,800

6,498,100

6,497,400

N

Wesco Road

Hopkins Road

Sublease 1
Meteor Stone

Sublease 2

Sublease 3

Mining Tenement M70/138

Meteor Stone
Limestone
Processing

Lot 6

Proposed
Action
Area

Lot 7

Legend

Proposed Action Area (6.495 ha)

M70 138 Boundary (approx. 97 ha)

Scale: 1: 8,000
Original Size: A3
Imagery source: NearMap July 2023, MPP0.597
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 0.25 0.5 km

Meteor Stone Pty Ltd
EPBC Act Preliminary Documentation
Portion of Sublease 5 Area

Figure 1

M70/138 and Proposed Action Area (Sublease 5) Location

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\\mbssvr\working\Meteor Stone\GIS\Wesco Road Sublease 5.qgz 30/03/2024 F1 Location

2. OFFSET PACKAGE

2.1 SUMMARY OF OFFSET PROPOSAL

[redacted]. This portion will be excised and subdivided from a larger Lot of 1,343 ha, with the balance of the Lot remaining in the ownership of the Vendor (Figure 2). The location of the offset site in relation to the Proposed Action Area is provided in Figure 3.

The subdivided portion of [redacted] will be zoned Rural in the first instance, as per the parent Lot, noting that it is being purchased to serve conservation purposes as an offset site for the current proposed action (EPBC 2022/09324) for Meteor Stone, with the remainder of the site being banked to meet any future offset requirements under a 'share' arrangement. It is anticipated that [redacted] of the Site will meet the offset site required by Meteor Stone to counterbalance the residual impacts associated with clearing of 6.495 ha of Carnaby's Cockatoo foraging habitat, noting that the exact area of the offset to be confirmed during the environmental assessment process. Once the area of the Meteor Stone offset requirement is known, a portion of the [redacted] will be designated as the Meteor Stone offset and placed under a Conservation Covenant to ensure it is protected for conservation purposes in perpetuity, with an indicative location provided in Figure 4. Once the area required for the offset is finalised, Meteor Stone's land acquisition will form 100% of the offset requirement for impacts to Carnaby's Cockatoo foraging habitat.

The proposed Meteor Stone offset will be a direct offset in that it will:

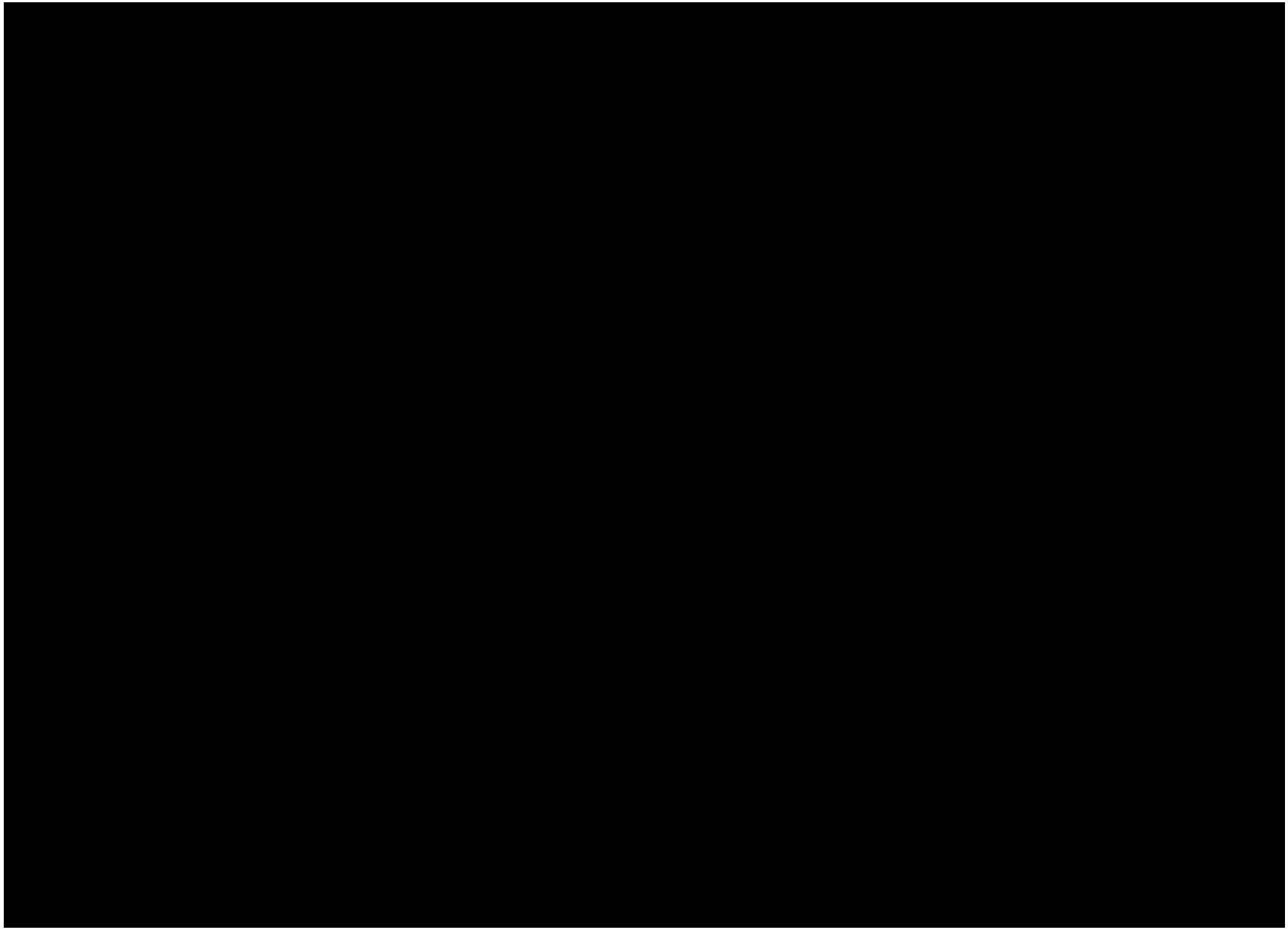
- Ensure protection in perpetuity of existing Carnaby's Cockatoo foraging habitat. This will contribute to other regional measures to protect habitat for the species, including contributing to increasing landscape connectivity within the region that goes beyond that required by the impacted protected matter.
- Enhance current foraging habitat values of [redacted] through implementation of an agreed range of land management measures. The measures will specifically address listed Threatening Processes relevant to the species, resulting in a net environmental gain for the species.

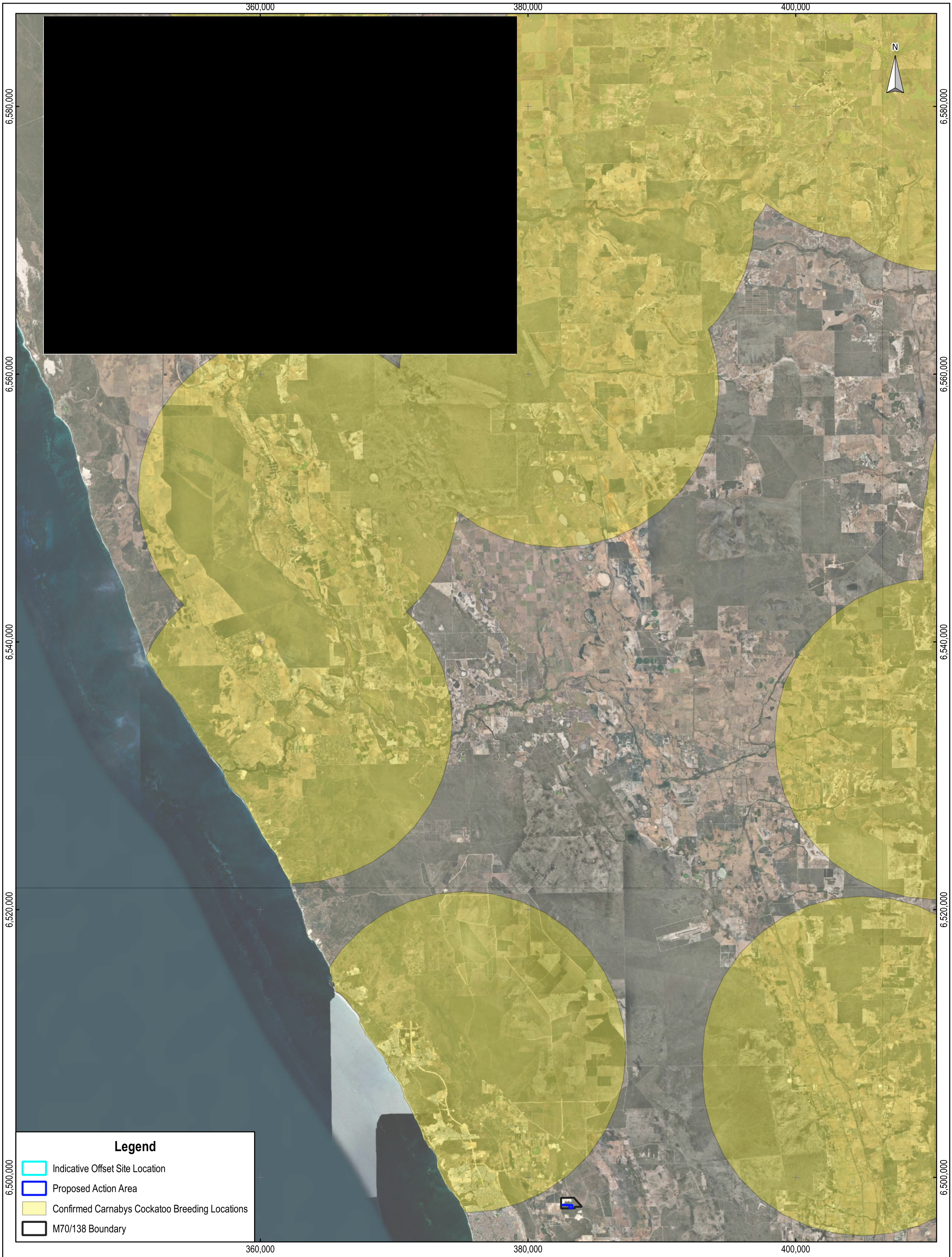
The habitat quality gain resulting from implementation of land management measures is expected to be achieved in a minimum of 5 years based on the establishment rate of Banksia Woodlands but could take up to 10 years depending on a range of variables that are more difficult to quantify, such as drought and fire.

Going forward, when the specific area (ha) of Meteor Stone's offset requirement is confirmed, a portion of the Site will be allocated as the Meteor Stone offset Site. A Conservation Covenant will be placed over that portion to ensure that it is set aside in perpetuity for conservation purposes.

The remainder of the Site will then be made available to other proponents with need for an offset. Future site shareholders will be allocated a portion of the site for offset purposes, the acquisition of which will also require the placement of a Conservation Covenant over their portion. It is expected that the Conservation Covenants will be created through the National Trust or via the provisions of the *Soil and Land Conservation Act 1945* (WA): both of which allow for the setting of Conservation Covenants in perpetuity.

Each proponent with an interest in [redacted] will purchase shares, with the number of shares equating to the area specified for their offset requirement. All parties will contribute to ongoing management requirements as per their various approval conditions on a pro rata basis, according to the area they are 'responsible' for. As shareholdings in the Site are confirmed, Conservation Covenants will be placed over each offset component. The eventual expectation is that the entire site will be subject to one or a collective of Conservation Covenants that will provide an area of Carnaby's Cockatoo foraging habitat in perpetuity — providing a larger conservation area than might otherwise have occurred, that will be enhanced to improve its condition and control several threatening processes, achieving a net environmental gain for the Carnaby's Cockatoo in terms of quality.





Scale: 1: 250,000
Original Size: A3
Aerial Imagery: Esri World Imagery
Grid: GDA94 / MGA zone 50 (EPSG:28350)
0 3 6 km

Meteor Stone Pty Ltd
EPBC Act
Offset Management Plan

Figure 3

Offset Site Location with Respect to Proposed Action Area and known Carnaby's Cockatoo Breeding Locations

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\\mbssvr\working\Meteor Stone\GIS\Wesco Road Sublease 5.qgz 14/05/2024 F3 OMP Offset

2.2 OMP PURPOSE AND STRUCTURE

This Offset Site Management Plan (OMP) has been prepared to facilitate implementation of the Offset Strategy described in Section 6 of the Preliminary Documentation (MBS Environmental, 2024b).

It provides an overview of how the entire [redacted] site will be managed, with management activities being undertaken collectively by shareholders. Accordingly, this OMP outlines:

- An overview of the project that has led to the need for the offset.
- Main impacts to Carnaby's Cockatoo at the Meteor Stone PAA (this action, EPBC 2022/09234).
- Site characteristics of the offset site and its suitability for use as a direct, like-for-like offset for clearing at the PAA.
- Identification of and management of key threatening processes that will be carried out at the site over time.
- Identification of management actions, performance indications and completion criteria to ensure that the offset site is achieving the desired conservation outcome for Carnaby's Cockatoo.
- Monitoring, reporting, and auditing requirements.

2.3 OFFSET SITE CHARACTERISTICS

The description of the environment of the proposed [redacted] offset site provides the context for the flora, vegetation, and associated fauna that comprise the various ecological communities present within an area. The features that comprise the physical characteristics of the proposed offset location and its surrounds are provided in this section. Bamford Consulting Ecologists (2024) indicated that most of the site does include suitable foraging habitat for the Carnaby's Cockatoo, as well as providing an indication of other conservation significant fauna species that are likely to be present.

2.4 BIOREGIONAL CONTEXT

The proposed [redacted] offset site is located within the Swan Coastal Plain Bioregion classified by the Interim Biogeographic Regionalisation for Australia (IBRA) and is described as a low lying coastal plain, mainly covered by Banksia or Tuart woodlands over sandy soils with paperbark prevalent in swampy areas (Thackway and Cresswell, 1995).

The Swan Coastal Plain Bioregion is divided into two subregions, the Dandaragan Plateau (SWA01) and Perth (SWA02). The [redacted] Site is located within the Perth subregion, which is the same subregion as the Proposed Action Area. The Perth subregion is comprised of colluvial and aeolian sands, alluvial river flats and coastal limestone. Native vegetation varies from Heath and/or Tuart woodlands on limestone, Banksia, and Jarrah woodlands on Quaternary marine dunes of various ages, and Marri on colluvial and alluvials. This subregion also includes a complex series of seasonal wetlands (Mitchell, Williams, and Desmond 2002). The primary land use associated with the subregion includes dry land agriculture, conservation, and crown reserve, as well as urban and rural residence (Mitchell, Williams, and Desmond 2002).

2.5 CLIMATE

The [redacted] Site experiences a Mediterranean climate characterised by hot, dry summers and cool, wet winters. The closest Bureau of Meteorology (BoM) weather station is the Badgingarra Research Station (Station ID 009037) located approximately 55 km to the north, with average statistics recorded between 1965 and 2024 (BoM, 2024) including:

- Average monthly maximum temperatures ranging from 17.6°C to 34.7°C, with the highest recorded maximum being 46.9°C and the lowest 26.0°C.

- Average monthly minimum temperatures ranging from 7.1°C to 17.9°C, with the highest average minimum being 7.8°C and the lowest -0.1°C.
- Average annual rainfall of 517°mm, with the majority falling between May and September.

2.6 LANDFORM AND TOPOGRAPHY

The Department of Primary Industries and Regional Development (DPIRD) dataset Soil Landscape Mapping — Systems (DPIRD-064) (2022) indicates that the [redacted] site is located on the Bassendean 1 Subsystem (212Bs_1) which is described as undulating to flat sandplain and minor swamps; pale-yellow deep sands.

The 2-m Contours dataset (DPIRD-072) (DPIRD, 2019) indicates that the [redacted] Site is largely flat at 56 m Australian Height Datum (AHD).

2.7 VEGETATION AND SUBSTRATE ASSOCIATIONS

Bamford Consulting Ecologists undertook a site-specific survey of the proposed offset site (Bamford, *Pers. comm.*, 2024). They identified three broad vegetation and substrate associations (VSAs) that consider the vegetation types, soils, and other substrates that they are associated with to describe the environment that provides habitat for fauna, in this case, Carnaby's Cockatoo. These are described in Table 2, with a copy of the report provided in Appendix 1.

Table 2: Offset Site Vegetation and Substrate Associations

Identifier	Name	Description	Photograph
VSA 1	Banksia Open, Low Woodland (76% of Site)	Open, low woodland of *Banksia* spp. (predominantly *Banksia attenuata* with c. 10% *B. menziesii* and occasional *B. prionotes* along the southern border and single *B. grandis* on margin of dampland) with scattered Coastal Blackbutt (*Eucalyptus todtiana*) over grass trees and mixed shrubs on sandplain.	
VSA 2	Banksia Low Woodland (13% of Site)	Low woodland of *Banksia* spp. (predominantly *Banksia attenuata* with c. 10% *B. menziesii*) over grass trees and mixed shrubs on sandplain, undulating in the southeast.	

Identifier	Name	Description	Photograph
VSA 3	Melaleuca Dampland (11% of Site)	Patchy woodland of *Melaleuca preissiana* over damp heath of mixed shrubs including *Hakea trifurcata*(?), on dark, peaty soil.	

3. OFFSET SITE MANAGEMENT FRAMEWORK

The owner of the Site, [redacted] will be the land manager. They will be responsible for implementing this management plan, drawing on experienced consultants and contractors to carry out works on their behalf when required. Management of the offset site needs to consider both the entirety of [redacted] and the subset of this that will be used to satisfy Meteor Stone's offset requirements under the EPBC Act.

The general aim for the entire [redacted] area will be the enhancement of Carnaby's Cockatoo foraging habitat that will assist with providing a food source for this species in perpetuity.

It is noted that this, and following sections, describe factors/considerations that will apply to the whole [redacted] Lot generally as well as the subsection of the Site that will form the Meteor Stone offset component (Figure 4).

3.1 METEOR STONE OFFSET SITE OBJECTIVE

The management objective of Meteor Stone's offset site will be the retention and enhancement of a self-sustaining ecosystem that provides Carnaby's Cockatoo foraging habitat in perpetuity.

3.2 THREATS TO OFFSET AREA VALUES

Key to determining the site management framework is to identify and consider the potential threats to the [redacted] site overall and Meteor Stone's offset site specifically. Likely threats are explained in the following sub sections.

3.2.1 Weed Invasion

The presence of weeds in an area can result in several impacts to an ecosystem, including:

- Competition for resources including space, nutrients, and water, as weeds species can out-competing native species due to more effective dispersal and establishment methods combined with and a lack of natural control methods such as predators or pathogens that would otherwise keep them in check.
- Inhibiting the germination and growth of seeds present within the topsoil, even when favourable growing conditions are present.
- Altering geomorphological processes, such as nutrient cycling.
- Altering the rate of infiltration and the presence of soil moisture.
- Increasing fire potential through the presence of additional fire fuel loads during warmer months when weeds often die off, leaving dry flammable material that is prone to ignition.
- Reducing habitat and food sources for native fauna, and thus potentially leading to reduced species and genetic diversity.

Weeds can be spread or introduced to an area via several mechanisms, such as wind-borne seed, vehicle movements, rain runoff, fauna activity movement of soil, dust, and introduction of materials, such as soil and mulch, from external sources. The presence of weeds at the offset site has been confirmed via:

- Desktop search of Dandjoo (DBCA 2024) using a 2 – 3-km search radius to gain an indication of those species that could be present. The Dandjoo search indicated the potential presence of 32 alien species that may occur within or in proximity to the offset site.
- Observation by MBS personnel during a site visit in December 2023. The site visit confirmed the presence of weeds, especially in areas lacking native vegetation cover or that had failed to full recover from the most recent fire.

At present, the weed burden at the offset site is limited, meaning that control methods are more likely to be effective and thus limiting the negative impacts associated with their presence. In turn, the limited weed coverage means that the confidence level associated with the planned site improvements is high and will lead to the desired enhancement of site and its value as a Carnaby's Cockatoo foraging location.

3.2.2 Dieback

Phytophthora cinnamomi (Dieback) is present in locations around the globe that have a Mediterranean climate, including the southwest of Western Australia. There are over 140 species of *Phytophthora* worldwide, with the most commonly found and damaging species in the southwest being *P. cinnamomi*.

Dieback is spread through infected soil that can be spread by fauna movement, surface water runoff, soil movement on sloping surfaces, and spores; however, the biggest spreader of dieback is human activity and movement. Infected soil can contaminate vehicles, footwear, and equipment that then moves to an uninfected area, introducing the pathogen. Additionally, the transport of infected soil as import or export material from a site can contribute to dieback spread.

A dieback assessment has not been undertaken on the offset site, however, using the Project Dieback and Southcoast NRM (2023) Dieback Public Map, the entire offset site is categorised as 'Moderate Confidence Uninfested to 2008'. Consequently, the entire property will be treated as dieback uninfected.

Management measures will be implemented at the site to prevent the introduction of dieback (Section 4). It is noted that the rural activities occurring on the adjacent properties have a risk of introducing and spreading dieback via human activity, but dieback may also be spread between properties by movement of local fauna such as kangaroos. The probable absence of dieback means that the risk of revegetation failing is reduced, thus providing a moderate to high confidence level in improving the habitat quality score at the site.

3.2.3 Fire

One of the main ongoing threats to Banksia dominated woodlands includes fire regime change, particularly increased fire frequency; prescribed burning during late autumn to late spring when plants are in active growth, flowering and seed development and animals are active (DPaW, 2014).

Native vegetation in the offset site shows evidence of burning in the past two – three years, and while appropriate fire regimes can benefit biodiversity, inappropriate regimes can lead to a loss of biodiversity in terms of both flora and fauna, and community structure. Fire intervals that are too frequent can result in changes to flora and fauna species, change the density of some species over others, and promote an increased weed presence, hence a short interval between fires can be a threat to the ongoing management of the Site.

A review of historical aerial imagery for 2012 available from Landgate (2024) shows indications of a controlled burn, as does the 2023 imagery. Given that the age of the current burn as 2 – 3 years, this suggests a period of around 8 – 10 years between burns. Earlier imagery is inconclusive in terms of providing indications of previous controlled burns due to the period between image collection.

Bamford Consulting Ecologists (2024) indicated there appears to be no current managed fire regime for the property with most of the project area having been burnt roughly 2 – 3 years prior to the fauna assessment. It was noted that the vegetation has substantially regenerated since this time. During the regeneration, the offset site may not have been able to support the usual fauna assemblage due to a lack of shelter and food resources. It is expected that due to the connectivity between the area and native vegetation to the east, this would have influenced the fauna assemblage in the short-term, while vegetation was regenerating.

A review of controlled burning practices at the offset site has the potential to improve ecosystem values by allowing plants to mature, set seed, and reach peak flowering age rather than burning at the minimum recommended burn period of eight years.

3.2.4 Kangaroos

A recent fauna assessment by Bamford Consulting Ecologists (2024) indicated the presence of western grey kangaroos (*Macropus fuliginosus*) within the offset site. Kangaroos are known to have a significant impact on conservation areas, with prevention of grazing specified as a priority management action in the Banksia Woodland TEC Approved Conservation Advice (Threatened Species and Scientific Committee, 2016) to enable the establishment of seedlings.

3.2.5 Feral Cats and Foxes

The recent fauna assessment by Bamford Consulting Ecologists (2024) indicated the presence of two feral species, namely the feral cat (*Felis catus*) and red fox (*Vulpes vulpes*) with tracks found within the offset site. Bamford Consulting Ecologists (2024) also indicated the likelihood of the European rabbit (*Oryctolagus cuniculus*) and house mouse (*Mus musculus*) in the offset site.

Introduced species are likely to be placing considerable pressure on the native fauna in the region, including the key conservation significant species supported by the offset site. Foxes and feral cats' impact native fauna via predation, and rabbits may compete with native fauna for resources and cause degradation of vegetation (Bamford Consulting Ecologists, 2024). Control of these species can lead to an improvement in the numbers of native fauna species and populations utilising the site, however, regular assessment is also likely to be required as new individuals could move into the site from surrounding areas.

3.2.6 Unauthorised Access

Unauthorised vehicle access to the offset site is effectively managed due to the use of gates and barriers. Access control will be used to prevent a range of detrimental impacts to bushland caused by unauthorised vehicle access.

Access restriction into the offset areas will be implemented to prevent unauthorised entry that will threaten the offset area in terms of the introduction and distribution of invasive weeds and spread of dieback. Fencing, and the maintenance of the fence, will be undertaken in consultation with the land manager, [redacted].

3.3 RISK MANAGEMENT

A risk assessment process that considers the likelihood and consequences of those potential threats to the proposed offset values has been applied as there are some that are more likely than others. The risk assessment included consideration of the nature and scale of the likely impacts, along with the level of confidence relating to the prediction of impacts.

The definition of likelihood and consequence definitions, and impact assessment matrix are provided in Tables 3, 4, and 5 respectively. The assessment outcome, including the raw and residual risk assessment and ranking, was carried out after considering the results of site visits, undertaking various desktop, and assessment outcomes of surveys carried out by other consultants to quantify where possible (e.g. the presence of feral and pest fauna) or otherwise qualitatively assess likely impacts based on the available data (e.g. impacts to the values of the offset site). Outcomes of the risk assessment process are provided in Table 6.

Table 3: Likelihood Definitions

Likelihood	Definition
Rare	May occur in exceptional circumstances
Unlikely	Could occur at the offset site but considered to be unlikely
Possible	Might occur at the offset site
Likely	Will probably occur at the offset site
Almost Certain	Is expected to occur at the offset site

Table 4: Consequence Definitions

Consequence	Definition
Minor	Minor environmental impact that can be reversed
Moderate	Isolated but substantial environmental impact that could be reversed with intensive efforts
High	Substantial environmental impact that could be reversed with intensive efforts
Major	Major loss of environmental value with real possibility that it could continue
Critical	Severe widespread loss of environmental value including irrecoverable environmental damage

Table 5: Impact Assessment Matrix

Likelihood	Consequence				
	Minor	Moderate	High	Major	Critical
Rare	Low	Low	Low	Medium	High
Unlikely	Low	Low	Medium	High	High
Possible	Low	Medium	Medium	High	Extreme
Likely	Low	Medium	High	High	Extreme
Almost Certain	Medium	High	High	Extreme	Extreme

Table 6: Risk Assessment Outcome

Impact	Cause	Nature and/or Scale Unknown, Unpredictable, or Irreversible	Confidence in Predictions	Mitigation Measures	Inherent Risk			Residual Risk		
					Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating
Direct loss of 6.495 ha of foraging habitat for Carnaby's Cockatoo at the PAA.	• Approved clearing of Proposed Action Area.	• Proposed Action Area boundary known. • Irreversible impact due to length of extraction period (10 – 20 years) and expected rehabilitation period.	High level of confidence in predictions.	• Delineation of clearing boundary. • Clearing of entire PAA will occur prior to extraction commencing due to the extraction method that will be implemented. • Offset site identified and secured. • Offset Management Plan prepared and implemented.	Almost certain	High	High	Almost certain	High	High (offset will be implemented)
Offset Completion Criteria not met (deterioration of foraging habitat condition).	• Fire. • Feral and pest animals. • Weeds. • Dieback. • Drought. • Unauthorised access to offset site.	• Monitoring activities indicate land management activities have not achieved completion criteria.	Moderate – high level of confidence in predictions.	• Offset Management Plan prepared and implemented. • Cause of unsuccessful rehabilitation investigated. • Infill planting initiated. • Other sources of lack of success treated as appropriate, such as presence of pest and feral animals, or weed presence.	Possible	High	Medium	Possible	Moderate	Medium
Loss of or reduction in condition of foraging habitat due to weed invasion.	• Frequent fire. • Animal and/or bird transport. • Introduced via personnel, vehicles, or equipment.	• Signs of weed invasion at offset site. • At present, scale of impact is low, however if management of current weeds and process that could lead to an increased weed presence is not undertaken, then the weed presence is likely to increase.	High level of confidence in predictions.	• Offset Management Plan prepared and implemented. • Potential processes that could lead to weed proliferation identified and management strategies identified. • Vehicles, personnel shoes, and equipment will be clean on entry to the site. • Implement weed monitoring and control programs. • Implement revegetation activities.	Almost certain	High	High	Possible	Moderate	Medium
Loss of or reduction in condition of foraging habitat due to dieback introduction.	• Introduction of infected soil material from vehicles, personnel footwear, or equipment.	• Public dieback map indicates site is likely to be uninfested. • No obvious indicators of Dieback infection currently present identified during MBS December 2023 visit.	Moderate level of confidence in predictions.	• Offset Management Plan prepared and implemented. • All personnel footwear, equipment, and vehicles will be clean on entry. • Disinfection of footwear, equipment, and vehicles will be undertaken prior to and on leaving the site using either Phytoclean or a 70% methanol:30% water mix.	Possible	Major	High	Possible	High	Medium
Loss of or reduction in condition of foraging habitat due to fire.	• Uncontrolled fire in surrounding areas. • Inappropriate controlled burn regime within the offset site.	• Changes to vegetation type and ecological community structure. • Increased proliferation of weeds. • Increased threat of fire due to increased presence of grassy weeds that dry out over summer.	High level of confidence in predictions.	• Offset Management Plan prepared and implemented. • Review of controlled burn frequency and adjust to more appropriate interval. • Undertake weed monitoring and control.	Almost certain	High	High	Possible	High	Medium
Loss of or reduction in condition of foraging habitat due to presence of Kangaroos.	• Population proliferation within offset site. • Population proliferation in surrounding areas.	• Current population is estimated to be low based on conversation with fauna consultant (Bamford, *Pers. comm.*, 2024). • Reduced success of revegetation. • Greater infill planting requirement.	Moderate – high level of confidence in predictions.	• Offset Management Plan prepared and implemented. • Monitoring of presence and numbers. • If required, implementation of appropriate controls.	Likely	High	High	Likely	Moderate	Medium

Impact	Cause	Nature and/or Scale Unknown, Unpredictable, or Irreversible	Confidence in Predictions	Mitigation Measures	Inherent Risk			Residual Risk		
					Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating
Loss of or reduction in condition of foraging habitat due to feral cats, foxes, rabbits, and mice.	• Population proliferation within PPA. • Population proliferation in surrounding areas.	• Changes to vegetative cover, type, and community composition. • Tracks were noted by Bamford Consulting Ecologists (2024), but numbers expected to be low.	High level of confidence in predictions.	• Offset Management Plan prepared and implemented. • Monitor indicators of presence such as tracks, scats, dens, warrens. • Implement control programs and den/warren destruction as required.	Likely	Moderate	Medium	Possible	Moderate	Medium
Loss of or reduction in condition of foraging habitat due to unauthorised access.	• Uncontrolled access to PPA.	• Increased weed presence. • Damage to vegetation that may need to be restored. • Introduction of dieback from infected footwear and/or vehicles. • Reduced success of revegetation.	Moderate – high level of confidence in predictions.	• Offset Management Plan prepared and implemented. • Monitor indicators of presence. • Site is fenced and fence condition maintained.	Possible	Moderate	Medium	Unlikely	Moderate	Low

4. MANAGEMENT ACTIONS

It is the intent that the offset site will provide an ongoing conservation gain for Carnaby's Cockatoo in perpetuity, with planned management actions at the site aimed at achieving that goal. Management strategies that will be implemented at the site to target specific threats are outlined in this Section, noting that these actions will be applied to that portion of the Meteor Stone's offset within the broader site, with those that will be applied to the sites of other shareholders being considered on a case-by-case basis and the expectation that they will be consistent with the overall aim of improving Carnaby's Cockatoo habitat values. A spring flora and vegetation survey will inform the management of the Site as a whole, as well as each offset component. It will also inform the management of the Meteor Stone offset patch, the aspirational revegetation species list, and confirm that the habitat quality score can reach and maintain a rating of 9 as it relates to the current action.

4.1 REVEGETATION

As one of the key aims will be to enhance of the current environmental values of the proposed offset site for the Carnaby's Cockatoo. Revegetation of degraded areas will be one of the strategies that will be implemented to achieve that aim.

Revegetation will focus on areas identified during the initial site inspection in 2023 and later assessment activities as having a lower density of vegetation as evidenced by bare patches and/or a weed presence. A subsequent review of aerial imagery indicates that a minimum of 2.5 ha of the proposed offset site has a lower plant density in patches across the site where revegetation works could potentially occur. Planting to achieve a minimum density of 1 – 2 plants per m^2 indicates the potential for 25,000 – 37,500 plants to be installed across the [redacted], noting that the actual will depend on the size and location of patches being targeted according to the area(s) that have formally been identified as offset patches for Meteor Stone and other, future, shareholders.

4.1.1 Revegetation Aims

Aims of the revegetation activities within the site will include:

- Increasing the density of flora species present.
- Enhance the presence of preferred Carnaby's Cockatoo preferred foraging species, including *Banksia attenuata*, *Banksia grandis*, *Banksia menziesii*, and *Banksia prionotes*, through to provide a greater number of plants across the site that that will provide a food source for the birds; note that 12 of the species listed in Appendix 2 are known to be preferred Carnaby's Cockatoo foraging species (Department of Environment and Conservation, 2011).
- Improve the habitat quality such that it is consistent with that which occurs in the Proposed Action Area.
- Control the various threatening processes that might otherwise result in further degradation of the site or reduce the effectiveness of planned revegetation/management activities.

4.1.2 Flora Species

A Dandjoo search (previously NatureMap) search for the site was carried in 2024 out using an approximate 2-km search radius to identify flora species known to be present within the immediate area. The search indicated the potential for 188 native plants (59 monocotyledons, 125 dicotyledons, 4 ferns),which represents the aspirational species list (Appendix 2). Note that the inclusion of all 188 species on the aspirational species list will maximise the potential plant diversity that will be installed in the various patches, but also recognises that not all species can be readily grown and thus available from specialist native plant nurseries, or that all varieties will be available as seed. Installation will favour Carnaby's Cockatoo preferred foraging species, including *Banksia attenuata*, *Banksia prionotes*, *Banksia grandis*, and *Banksia menziesii,* at a 2:1 of other species to enhance the presence of the Banksia Woodland.

Plants will need to be ordered by September the year prior to planting and meet the following requirements:

- Sourced from a NIASA accredited nursery.
- Tubestock needs to be suited to the offset site growing conditions (where possible, local provenance).
- Minimum pot size should be a forestry tube (50 mm x 50 mm x 120 mm tall).
- Plants shall be vigorous, established and hardened off.
- Have a good form consistent with species and variety.
- Free from disease and pests.
- Have large healthy root systems with no evidence of having been restricted or damaged (e.g. not root bound).
- Any pruning, budding, or grafting scars will be clean and well calloused.
- Trees will have a single leading shoot unless otherwise specified.
- Stock will be able to support their own weight, i.e. stand without staking.
- Containers will be free of weeds.
- The root ball of the plant shall remain intact with only a minor amount of loose soil present.

4.1.3 Planting Zones

The planting zone will be within that portion of the Banksia Woodland VSAs identified by Bamford Consulting Ecologists (2024) (Section 2.7) that will be the nominated Meteor Stone offset site (Figure 4).

Note that the wetland area will also be maintained as a component of the overall [redacted] site as it may act as a water source for the species during cooler months.

4.1.4 Planting Ratio

The nominated planting ratio is 1 – 2 trees (overstorey) per 10 m^2, two shrubs per 5 m^2 (middle storey) and one herb per 2 m^2 (understorey). This ratio will replicate the typical vegetation structure present within the Site (Section 2.7). Planting in excess of the final targets may be a strategy adopted to ensuring target completion criteria are achieved.

4.1.5 Pre-planting Activities

The success of revegetation activities can be closely linked to the effective management of other activities, particularly the presence of weeds and pests. Thus, pre-planting activities will be required ahead of tubestock planting that is anticipated to commence in 2025.

Each patch where infill planting will occur will be assessed individually to determine those pre-planting activities that will be required, and they may include:

- Ripping of the site.
- Weed control.
- Pest animal control.
- Rubbish removal.
- Fencing.

4.1.6 Revegetation Methodology

Revegetation activities will primarily involve infill planting at the site to restore the required species diversity. If seed is available, it will be used for direct seeding at the conclusion of weed control activities to prevent the non-target death of germinating seedlings. The lead time associated with seed collection and plant propagation will mean that planting will not occur until 2025 at the earliest.

Revegetation areas will be treated for weeds prior to planting as part the weed control program (Section 4.2). Plants will be installed as tubestock, rather than from smaller cells that mean less extensive root systems, with a native plant fertiliser tablet, such as Typhoon or similar, after the first major winter rains (May or June).

If required, seed collection may be undertaken by collectors licensed by DBCA from the proposed offset site, or other nearby locations where permission is granted for collection. Written permission will need to be obtained from the relevant landowners or managers to collect species included on the revegetation list from their land. The seed can then be provided to the specialist native plant nursery(ies) that will be used to propagate the tubestock for the offset site. Any seed left over after rehabilitation and the conclusion of weed control works may be direct seeded to provide additional variation in the age structure of species present. The seeding would occur at a rate of about 2 kg/ha. Seed will be treated according to the type collected, bulked, and blended prior to distribution. Seed will be broadcast manually using a hand seeder in locations where tubestock planting has occurred and throughout the broader site.

4.1.7 Watering

With a drying climate, it is increasingly common for plants to be watered on installation and, where possible to do so, over summer months to assist with plant establishment. The typical watering rate is 2 L per plant per visit, with visits scheduled according to the number of very hot days occurring in the area that could otherwise lead to plant stress and death. Due to the number of plants that may be installed in various patches across the site, along with the offset site location, direct watering is unlikely to be a feasible option: thus additional infill planting may be a more cost-effective method to achieve completion criteria for plant survival. The use of water retention gels, crystals, granules, or similar may also be an effective option.

4.1.8 Monitoring

Monitoring of revegetation activities within the offset site will occur twice annually (spring and autumn) for a minimum of three years after the last year plants were established i.e. if original planting is 2025 and infill planting 2026, assuming no large failure gaps and additional infill planting is not required beyond this, then monitoring would cover the years 2027, 2028, and 2029.

Monitoring will:

- Consider the survival of the preferred Carnaby's Cockatoo foraging species along with the mix of other native species and use this information to guide species choice for infill planting activities within the offset boundary.
- Include an assessment of weeds present and signs of pest animal species such as feral cats, foxes, rabbits, and kangaroos within and beyond the offset boundary.
- The potential for conditions/activities outside the offset boundaries to negatively influence the habitat quality, such as weed encroachment due to lack of management, damaged fencing, and similar.
- Consider the need for general maintenance in and around the Site.

Five monitoring methods will be implemented according to the area and location of the offset site, and patches where revegetation activities were carried out, namely:

- A series of photo monitoring points will be set up to enable a comparison of the area over time, with photos taken from the northwest corner towards the southeast.

- A series of transects will be set up within the revegetated areas that will be traversed on foot with plant survival, vegetation health, and community structure noted.
- As revegetation activities can be of varying success within a nominated site, a review of aerial imagery or data collection using drones showing change in vegetative coverage and condition over time will provide a broader measure of success.
- Identifying up to three reference sites within the offset boundary and using them as a comparison to measure change in the habitat quality score over time; the location of these will be informed by the botanist that carries out the planned spring flora survey in in spring 2024.
- Walking/traversing the offset site and surrounding area within the broader Lot that has been purchased for eventual use for offset purposes and, where possible, to observe conditions in neighbouring properties that could influence conditions within the offset boundary.

The proposed monitoring methods will enable change over time to be reviewed and assessed at both the detailed, quadrat level and the site level using drone imagery, thus enabling a more comprehensive assessment of management success and planned improvement/enhancement of the habit quality score. It will also inform the need for contingency measures to be implemented if there are indicators the completion and success criteria may not be met unless intervention occurs.

4.1.9 Contingency Measures

Monitoring activities will be carried out for a minimum of three years after initial planting to ensure completion criteria, particularly required numbers and planting densities are being met, with the aim being to achieve a robust, self-sustaining ecosystem with:

- A foliage cover of >60%.
- The dominant vegetation type is Banksia Woodland.
- Vegetation condition is Good or better.
- Low weed presence.
- Few tree deaths.
- Improvement in the Carnaby's Cockatoo foraging habitat quality score from a 7 – 9.

In the event monitoring indicates completion criteria have not been achieved, an assessment of potential reasons why seedlings have failed to survive as a means of informing appropriate solutions to ensure completion goals are met. Depending on outcomes of the assessment process, the following contingency will be implemented:

- Post-planting weed control, such as spot spraying or hand weeding.
- Infill planting at a sufficient density to account for current and any projected losses.
- Hand spreading of seed.
- Pest control if required if assessment activities indicate that pest animals such as rabbits or kangaroos are the cause of plant loss.
- Maintenance activities such as fence inspection and repair.
- If water stress is the likely cause of decline, the use of water gels or similar will be considered.

If Dieback (*P. cinnamomi* or some other species) is suspected as being the cause of the decline, discussions with DCCEEW will occur to review and refine the revegetation plan and completion criteria as appropriate.

As the Site being purchased by [redacted] is more than large enough to meet Meteor Stone's offset requirements, there is sufficient area to expand the area required in the event the completion criteria of increasing the habitat foraging quality score from a 7 to a 9 is not achieved in the life of the action.

4.2 WEEDS

The presence of weeds in a bushland area can lead to competition for resources, a reduction in flora and fauna diversity, and impact on revegetation success within bushland areas. With the [redacted] Site, there has been some encroachment of weeds that are more apparent after the controlled burn that was carried out approximately 2 – 3 years ago. Currently, the weeds appear to be grassy weeds and some annual species, rather than bulbs (geophytes) and shrubs ('woody weeds'), and are present primarily around boundary areas, particularly to the north and east. Benefits of weed control include:

- Improved ecosystem, species and genetic diversity through reduced competition and habitat restoration.
- Restoration of natural processes that occur in ecosystems, including the availability of key nutrients.
- Reduce fire fuel loading.
- Reduce ongoing site management costs.

Weed control activities will be carried out ahead of any direct seeding and/or tubestock planting to fill in bare areas of soil, with the main methods focussing on chemical control. Given the weed types/species present, chemical control via an appropriate herbicide is expected to be the most effective form of weed treatment rather than manual control methods.

The use of herbicides is the most common method of controlling many environmental weeds because it can be targeted at particular species or weed classes, with large areas being treated in a cost-effective manner. There are a range of herbicides in common usage, with differing active ingredient(s) that target different weed types . Common herbicides that may be used are described in Table 7.

Table 7: Common Environmental Weed Control Herbicides

Name	Description	Poison Schedule
2,2 DPA (dichloropropionic acid)	Pre- or post-emergent grass/monocot herbicide, residual up to 12 months, absorbed by the leaves and roots.	None allocated
2,4-D (dichlorophenoxyacetic acid)	Broad leaf annual and young perennial herbicide, little residual activity, absorbed by the leaves, plant hormone herbicide.	Schedule 5
Chlorsulfuron	Pre- or post-emergent herbicide for herbs, annual grasses and geophytic species, absorbed by the roots and leaves, residual for 1–12 months in soil depending on pH.	Schedule 5
Clopyralid (e.g. Lontrel®)	Selective herbicide for treatment of Asteraceae (Daisy) and some broad-leafed species, absorbed by the leaves with some residual action from days up to a few weeks on some species.	Schedule 5
Diflufenican (e.g. Brodal®)	Pre or post emergent broad-leafed herbicide, residual up to 12 months, absorbed by roots and leaves.	None allocated
Glyphosate (e.g. Nufarm® Glyphosate 360®)	Post-emergent herbicide affects most species at high rates but can be selective at low rates. Non-residual, absorbed by the leaves, and can be used as a wipe on stumps or stem injection.	Schedule 5

Name	Description	Poison Schedule
Halosulfuron (Sempra®)	Post emergent herbicide for the control of Nutgrass and Mullumbimby Couch, absorbed through the leaves, residual activity in the soil, related to Logran®.	Schedule 5
Metsulfuron methyl	Post-emergent herbicide used to treat ferns, geophytes, and some woody species, absorbed through the leaves, residual activity for up to a few weeks depending on soil pH.	None allocated
Picloram (e.g. Tordon®)	Systemic herbicide used to control woody weeds, usually applied to plant via cutting and painting of vascular tissues.	Schedule 6
Quizalofop (e.g. Targa®)	Selective, post-emergent grass herbicide, absorbed through the leaves, residual for a few days.	Schedule 6
Triasulfuron (e.g. Logran®)	Pre-emergent herbicide controls annual grasses and post-emergent control for broad leaf species or perennial seedlings, absorbed by the roots and leaves, with absorption enhanced with the addition of spray oil.	None allocated
Triclopyr (e.g. Garlon®)	Systemic herbicide used to control woody weeds, usually applied to plant via cutting and painting of vascular tissues.	Schedule 6

The herbicides listed in Table 7 have been formulated for agricultural applications, with dosage rates determined according to crop and/or target weed species, rather than weed control in bushland areas. Application in bushland reserves and natural areas has not been approved by the Australian Pesticides and Veterinary Medicines Authority (APVMA) and is an 'off-label' usage in that relevant information does not appear on the approved label (Australian Pesticides and Veterinary Medicines Authority, 2024). To overcome this situation, an off-label permit is necessary for use of nominated herbicides in bushland and other reserves and are applied for by appropriate agencies, such as permit PER13333 issued to the Forest Products Commission (WA) that covers the permitted application of a range of agricultural herbicides in a bushland setting to control environmental weeds.

Weed control within the [redacted] Site will be evaluated according to the weed type(s) present along with their density, and appropriate control method(s) applied.

4.3 DIEBACK

Given that the Public Dieback Map (Project Dieback and Southcoast NRM, 2023) mapping indicates that there is a moderate level of confidence that the site is uninfested, the main strategy for preventing the introduction of dieback will be a 'clean' when they leave base, requirement for all vehicles, people and equipment travelling to the site.

This will be achieved through the manual removal of excess soil from wheels, axles, and the underside of vehicles prior to leaving for the site, then the manual disinfection of vehicle tyres, rims, and axles, as well as shoes (including the underside) of personnel entering the site. After brushing to remove excess dirt from footwear and equipment, Phytoclean® or a manual spray of 70% methylated spirits and 30% water will be applied and allowed to dry before moving on.

Dieback protection requirements will be signposted at appropriate locations at the site.

4.4 FIRE

The calculated 8-year period represents the typical minimum period between controlled burns for Banksia Woodlands, and is associated with data reported by Burrows, Wardell-Johnson, and Ward (2008) that uses the time until the first flowering of species within a particular area to inform the period between controlled burns.

For B*anksia attenuata* (Slender Banksia), *Eucalyptus todtiana* (Coastal Blackbutt), and *Hakea trifurcata* (Two-leaf Hakea) that are present on the Site, the minimum time to flowering post-fire is four years, with a doubling of that figure to obtain the recommended minimum time between controlled burns of eight years.

Based on the minimum 8-year period between burns, it is expected that the trees have had sufficient time to recover from fire, flower, and set seed. Given the weed invasion, tree species that appear to have died because of fire, and the bare areas within the Site some 2 – 3 years post fire, it may be more appropriate for the burning period between fires to increase from 8 years. This will be investigated further through additional research, consultation with local Traditional Custodians, and the local fire brigade to determine the optimum burning frequency rather than the minimum burning frequency.

While active management of the site will occur, personnel will not be present at a high frequency, and if a fire commences in the site or moves into the site from another location, control will be limited to that which can be provided by the local fire brigade.

Firebreaks will be maintained in accordance with information issued by the local fire brigade.

4.5 KANGAROOS

Kangaroos are known to have deleterious impacts on conservation areas through overgrazing and targeting of juvenile plants. Western grey kangaroos (*Macropus fuliginosus*) and the western brush wallaby (*Notamacropus irma*) (Priority 4 listing at WA State level) were recorded during the Carnaby's Cockatoo habitat assessment carried out by Bamford Environmental Consultants (2024). The population numbers of these species are unknown, and thus their impact at the site cannot currently be quantified.

Population numbers will be monitored during various visits to the site by those carrying out management activities to quantify presence and impacts. Monitoring of numbers will include recording:

- Visual sightings of individuals and mobs.
- The presence of scats, tracks, loafing areas, and runs.
- Indications of where kangaroos and/or wallabies are entering the site.

Impacts of kangaroos and wallabies on habitat quality may also be managed by:

- Implementation of control programs in consultation with DBCA as a part of local and or regional programs.
- Use of tree guards as part of revegetation planting programs to minimise impacts of grazing.

4.6 PEST AND FERAL FAUNA

Bamford Consulting Ecologists (2024) confirmed the presence of feral cats (*Felis catus*) and foxes (*Vulpes vulpes*) and suggested that the house mouse (*Mus musculus*) and the European rabbit (*Oryctolagus cuniculus*) were likely to be present.

Control programs will be undertaken where monitoring indicates pest species are present in numbers that are compromising conservation objectives. This may include trapping, baiting, or shooting. Where control programs are required, these will be undertaken by licensed pest management companies.

4.6.1 Feral Cats and Foxes

The presence of feral cats and/or foxes will be monitored via signs of tracks, scats, dens, and evidence of predation. Active management will occur if monitoring activities the presence of these species are impacting on the

population(s) of Carnaby's Cockatoos foraging at the site. Direct impacts to Carnaby's Cockatoos from feral cats and foxes is possible, however, the threat is not considered likely to be major.

Feral cats are known to shy and cautious animals that mean baiting is likely to be the most effective control option. Baiting options include the use of Hisstory®, Curiosity®, and Eradicat®, with the latter also known to be effective for foxes as it is based on the 1080 toxin that is toxic to introduced fauna species while native species have developed a resistance to it. Other forms of 1080 baits are also effective in the control of fox numbers, as is the destruction of dens.

Management of these species is difficult in the sense that they will be present in the surrounding area and any eradication program will remove those utilising the site at the time, with the likelihood of other individuals 'moving in' over time.

Meteor Stone will consider participation in broader local and regional cat and fox control programs if these are being proposed by other land management entities.

4.6.2 European Rabbits

The presence of rabbits is readily identifiable and will be monitored via observing the presence of scats, warrens, and diggings.

The European rabbit is known to impact on habitat of native fauna through the creation of large, interconnected warrens and grazing of plants. They have potential to impact foraging habitat of Carnaby's Cockatoo and the planned habitat improvement of the site through grazing on seeds, seedlings and tubestock and promoting the presence of weed species that compete with native flora.

Baiting with Pindone or 1080 are both effective, however, care needs to be taken to prevent/minimise the potential for Pindone to impact on native fauna species. Fumigation and ripping of warrens in addition to baiting is likely to improve control results.

If required, rabbit control will be carried out through the use of 1080 baits, and through destruction of warrens where they are found.

Meteor Stone will consider participation in broader local and regional rabbit control programs if these are being proposed by other land management entities.

4.6.3 House Mouse

Given the location of the site, the house mouse is likely to be present in low numbers not likely to pose a significant risk to the presence of Carnaby's Cockatoos as it is vegetated bushland rather than an urban or other environment where there are likely to be multiple food sources available.

The control of mice within the site is likely via predation by snakes, cats, foxes, and raptors.

4.7 UNAUTHORISED ACCESS

The [redacted] Site is fenced around its perimeter, including along [redacted] to the south and east respectively, as part of the currently larger Lot.

Site visits by MBS personnel in 2023 and Bamford Consulting Ecologists (Bamford, *Pers. comm.*, 2024) noted indications of unauthorised access. At present, the current fencing is likely to be a sufficient deterrent against unauthorised access. However, the situation will be re-evaluated in the event that those carrying out various management activities observe indications of unauthorised access such as vehicle tracks, the presence of 'cubbies', campfires, and similar.

5. IMPLEMENTATION SCHEDULE

An implementation schedule relating to proposed management activities will be developed when Meteor Stone's offset site requirement is confirmed as a result during the environmental approval's process, its location within the Proposed offset site, and the works that need to be carried out to improve the environmental values of the Site such that they are consistent with those of the Proposed Action Area. It is expected that the implementation schedule will include information relating to the timing of:

- Pre-planting activities including seed collection.
- Weed control.
- Feral and pest animal control.
- Sourcing of tubestock for the following planting season.
- Seed installation.
- Planting activities.
- Monitoring activities.
- Submission of annual reports.

6. MONITORING

Preliminary assessment of required management/revegetation works will occur prior to works being implemented. Once rehabilitation works commence, regular monitoring of the offset site will occur to assist with assessing completion success and inform annual compliance reporting.

Example monitoring recording forms are provided in Appendix 3, with monitoring activities including:

- Assessment of native and non-native plant species present.
- Review of quadrats and photo monitoring points.
- Evidence of threatening processes and the need for management action.
- Assessment against completion criteria and the need for corrective action.

Monitoring forms will be kept, with outcomes of the monitoring process reported in annual compliance reports.

7. COMPLETION CRITERIA

To confirm when the desired revegetation outcomes have been achieved, it is necessary to formulate completion criteria and monitor those over time. Completion criteria for the rehabilitation of the offset site three years post planting are:

- An overall 70% survival rate for all plants (i.e. if 35,000 plants are installed, then 24,500 surviving), noting the criteria for individual strata are:
  - 75% of trees (overstorey).
  - 55% of shrubs (middle storey).
  - 75% of herbs (understorey).
- Canopy cover of >60%.
- The maximum patch size of bare ground is 30 m^2.
- A weed reduction target for infested areas is more than 70% in the affected area, with each location being assessed prior to weed control activities being implemented.
- A maximum of 5% of plants affected by rabbit and/or kangaroo herbivory.
- Gates and boundary fences are to be in good condition with no obvious damage.

8. EVALUATION, CONTINGENCY MANAGEMENT AND REPORTING

8.1 EVALUATION

Evaluation of the progress towards achieving the offset objective of improving/enhancing the environmental values of the site for Carnaby's Cockatoo will be informed by regular monitoring activities at the site as described in Sections 4.1.8 and 6. The key measure will be assessment against the completion criteria nominated in Section 4.1.9 along with observations of Carnaby's Cockatoo utilising the site. .

8.2 CONTINGENCY MANAGEMENT

In the event monitoring and evaluation activities indicate that compliance with completion criteria is lower than expected, the contingency management measures outlined in Section 4.1.9 will be implemented. These will include an assessment of potential causes for the lower-than-expected outcomes and determining which management activities will be implemented to ensure the site objectives will be achieved.

Records of contingency management activities will be kept and outcomes of the process documented in annual compliance reports.

8.3 ANNUAL REPORTING

The outcomes of revegetation activities will be reported to DCCEEW as a component of its annual compliance reporting requirement and will include:

- Weed control.
- Pest animal control.
- Revegetation activities carried out, including planting and seeding.
- Survival rates, including progress towards completion criteria.
- Recommendations on the need for infill planting.
- Recommendations on the need for pest animal control.

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APPENDICES

APPENDIX 1: BAMFORD CONSULTING ECOLOGISTS REPORT 2024

[redacted] Potential Offset Site, Fauna Assessment

Banksia menziesii cones chewed by Carnaby's Black-Cockatoo. Photo: Mike Bamford.

Prepared for: MBS Environmental
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27th March 2024

Executive Summary

Bamford Consulting Ecologists (BCE) was commissioned by MBS Environmental on behalf of Meteor Stone to conduct a black-cockatoo habitat assessment, as well as a brief assessment regarding other conservation significant fauna, of a potential offset site (the project area) in [redacted]. The assessment includes a brief desktop component and field investigations. The primary purpose of these field investigations is to provide information on the foraging value (for black-cockatoos) of the potential offset sites to help determine the suitability of the site as an offset for Carnaby's Black-Cockatoo. This includes identifying Vegetation and Substate Associations (VSAs; provide habitat for fauna), which also informs a discussion of the conservation significant fauna likely to be present and how they are expected to use the project area. This report presents the results of the targeted black-cockatoo assessment for the project area, along with a discussion of other conservation significant fauna likely to use the project area, patterns of biodiversity across the landscape, and key ecological processes influencing fauna. The project area was visited on 17th March 2024.

Description of project area

The project area is c. [redacted] in size and is comprised primarily of banksia woodland. It is located approximately [redacted] north of Perth, in the Perth (SWA02) subregion of the Swan Coastal Plain bioregion. This bioregion can broadly be defined as a low lying coastal plain, mainly covered with woodlands, dominated by *Banksia* or Tuart on sandy soils, *Allocasuarina obesa* on outwash plains, and paperbark in swampy areas. It has a warm Mediterranean climate.

Carnaby's Black-Cockatoo

The project area is not within the range of the Forest Red-tailed Black-Cockatoo, *Calyptorhynchus banksii naso*) or Baudin's Black-Cockatoo (*Zanda baudinii*). Carnaby's Black-Cockatoo (*Zanda latirostris*) is likely to be a regular visitor to the project area and is known to breed in the region (c. 16 km from the project area). Carnaby's Black-Cockatoo is listed as Endangered under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and Schedule 2, Division 2 (Endangered) under the *WA Biodiversity Conservation (BC) Act 2016.*

Vegetation and Substrate Associations (VSAs)

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. Three VSAs were identified in relation to fauna in the project area. The majority of the project area is made up of Banksia Open, Low Woodland (VSA 1), comprised of *Banksia* spp. with scattered Coastal Blackbutt (*Eucalyptus todtiana*) over grass trees and mixed shrubs on sandplain. The remainder of the project area comprises two small areas of Banksia Low Woodland (VSA 2) which is similar to VSA 1 but less open and slightly taller, and an area of Melaleuca dampland (VSA 3), which comprises a patchy woodland of *Melaleuca preissiana* over damp heath of mixed shrubs including *Hakea trifurcata*(?), on dark, peaty soil. The majority of the project area was burnt c. 3 years prior to the current site inspection but has substantially regenerated.

Key species of conservation significance

The project area is expected to support four key conservation significant vertebrate species: the Jewelled Ctenotus (CS2 (P3)), Black-striped Burrowing Snake (CS2 (P3), Carnaby's Black-Cockatoo (CS1 (EN, S2D2)) and the Brush Wallaby (CS2 (P4)). The targeted black-cockatoo assessment is summarised below.

It is likely that the Banksia woodlands of the project area will support a variety of conservation significant invertebrates, including species listed under federal and/or state publications, as well as a suite of short-range endemic (SRE) or potential SRE species.

Black-cockatoo assessment

Carnaby's Black-Cockatoo was not observed in the project area during the site inspection, but old and recent foraging evidence and a feather from this species were found. Suitable foraging habitat for Carnaby's Black-Cockatoo is present throughout the project area, in the form of *Banksia* spp. in VSA 1 and VSA 2, and *Hakea* shrubs in VSA 3.

Summary of black-cockatoo assessment

- Foraging value – overall the project area is of moderate foraging value for Carnaby's Black-Cockatoo, with a (rounded) weight average foraging score of 7/10. Foraging scores ranged from 8/10 for small areas with the highest density of *Banksia* trees (VSA 2), to 7/10 for areas with a lower density of *Banksia* trees (VSA 1) and 3/10 for areas with no *Banksia*, but which contained palatable *Hakea* shrubs (VSA 3).
- Breeding value – no trees were large enough to be assessed as potential nesting trees. The closest known breeding sites are within the Cataby Important Bird Area, c. 16 km from the boundary of the project area.
- Roosting value – No suitable areas for roosting sites were apparent within the project area. The closest known and confirmed roost is c. 10 km from the project area and was last confirmed used in 2022, when 1510 birds were counted. It is expected that this roost site would also have been confirmed used in 2023; the dataset available does not extend past 2022.

Patterns of biodiversity

The project area is relatively uniform, with the two *Banksia* woodland VSAs only differing slightly in the height and density of *Banksia* trees but having a similar understorey in terms of structure and composition. The loose sand and leaf litter of these VSAs is likely to support the conservation significant Black-striped Burrowing Snake and Jewelled Ctenotus. Both have been recorded at Cooljarloo, about [redacted] north-east, in similar VSAs (BCE database). The *Banksia* trees of these VSAs provide the highest foraging value for Carnaby's Black-Cockatoo (of all VSAs present). The *Melaleuca* dampland of VSA 3 is expected to support a high abundance and variety of fauna species; the assemblage supported may vary seasonally depending on inundation of this area. The plant species present provide low value foraging habitat for Carnaby's Black-Cockatoo, in the form of *Hakea* shrubs. It is likely that the Brush Wallaby will utilise all VSAs of the project area, so long as the understorey is dense enough to provide sufficient shelter.

Key ecological processes.

The ecological processes that are expected to influence the fauna assemblage include existing habitat loss, landscape connectivity and the presence of feral species. Local hydrology may impact fauna as there is a small area of damplands that appears to be seasonally inundated and which may support certain fauna species. The bushfire c. 3 years prior to the current site inspection may have had a short-term impact on the fauna assemblage but it is expected that being part of a large, continuous patch of native vegetation would have buffered the project area against any long-term impacts.

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1 Introduction

Bamford Consulting Ecologists (BCE) was commissioned by MBS Environmental on behalf of Meteor Stone to conduct a black-cockatoo habitat assessment, as well as a brief assessment regarding other conservation significant fauna, of a potential offset site (the project area) in [redacted]. The project area is comprised primarily of Banksia woodland. The assessment includes a brief desktop component (regarding nearby black-cockatoo records and other species of conservation significance), and field investigations. The primary purpose of these field investigations is to provide information on the foraging value (for black-cockatoos) of the potential offset sites to help determine the suitability of the site as an offset for Carnaby's Black-Cockatoo. This includes identifying Vegetation and Substate Associations (VSAs; habitats for fauna), which also informs a discussion of the conservation significant fauna likely to be present and how they are expected to use the project area. During field investigations, information regarding black-cockatoo nesting and roosting habitat was obtained opportunistically.

This report presents the results of the black-cockatoo habitat assessment for the project area, along with a discussion of conservation significant fauna likely to use the project area, patterns of biodiversity across the landscape, and key ecological processes influencing fauna.

Figure 1-1. Location of the project area.

1.1 Carnaby's Black-Cockatoo

The project area is out of range for the Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo and, as such, Carnaby's Black-Cockatoo is the only black-cockatoo expected to occur in the project area. The project area is within the species' range, and the species is known from within 15 km of the project area (see Section 3.2.1.1). Carnaby's Black-Cockatoo is listed as Endangered under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999* (EPBC Act) and falls under Schedule 2 Division 2 (Endangered) of the Western Australian *Biodiversity Conservation Act 2016* (BC Act). See Appendix 1 and 2 for conservation significance categories and descriptions. The species is expected to occur as a regular visitor in the project area.

1.2 Project area

The project area is c. [redacted] in size and located approximately [redacted] north of Perth in the very south of the Midwest region (DBCA, 2023b). The Interim Biogeographic Regionalisation of Australia (IBRA v7) has identified 27 bioregions in Western Australia which are further divided into subregions (DCCEEW, 2023a). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway & Cresswell, 1995). The project area is in the north of the Perth subregion (SWA02) of the Swan Coastal Plain bioregion. The Perth (SWA02) subregion was described by Mitchell *et al.*(2003) and a summary of their work follows here. The Swan Coastal Plain bioregion is a low lying coastal plain, with woodlands the predominant vegetation type, and dominant species comprising *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. The Perth subregion is made up of colluvial sands and alluvial river flats (dominated by Marri vegetation), aeolian sands/dunes (dominated by Banksia and Jarrah-Banksia woodlands), and coastal limestone (with heath and/or Tuart woodlands). This subregion also includes a complex series of seasonal wetlands and several offshore islands (including Garden Island). The Swan Coastal Plain bioregion falls into the Southern Climatic Region (EPA, 2020) and the climate of the Perth subregion is Mediterranean (Mitchell *et al*., 2003). Average rainfall for the station closest to the project area is 588 mm (Station: Lancelin, Number 009114, BOM, 2023).

The dominant land uses within the Perth (SWA02) subregion are Cultivation (both dry land agriculture, and irrigated horticulture, agriculture and plantations), Conservation, UCL and Crown reserves, Urban, Rural residential, Forestry plantations, Roads and other easements and Grazing (improved pastures), with smaller areas of Mining and Defence lands (Mitchell *et al*., 2003). The project area is comprised of intact remnant vegetation surrounded by areas cleared for agriculture (mostly to the west) and large areas of native vegetation. Existing development within 15 km consists of cleared agricultural land and a network of sealed and unsealed roads.

Within 15 km of the project area, the landscape comprises 39 soil subsystems, from six systems within four zones (details from Schoknecht *et al.*(2004):

1. Perth Coastal Zone (characterised by calcareous and siliceous sands and calcarenite (a type of limestone)): Quindalup and Spearwood systems
2. Bassendean Zone (fixed dunes inland from coastal dune zone, characterised by non-calcareous sands and podsolised soils with low-lying wet areas): Bassendean system
3. Dandaragan Plateau Zone (characterised by areas of sandplain and some laterite on a gently undulating plateau): Capitella and Rowes systems
4. Arrowsmith Zone (sandy and gravelly soils on a lateritic sandplain): Boothendarra system

The project area itself lies entirely within the Bassendean 1 subsystem of the Bassendean system (DPIRD, 2023c), described as an undulating to flat sandplain with minor swamps, and pale to yellow deep sands (Schoknecht et al., 2004). Pre-European vegetation (Beard *et al*., 2013; DPIRD, 2023b) within 15 km of the project area is thought to have consisted of six vegetation types (3, 9, 14, 18, 107 and 108) as well as areas of salt lake and exposed dune sand. The majority of the 15 km buffer, including the entirety of the project area, was thought to have consisted of vegetation type 9: Low woodland or open low woodland, dominated by *Acacia* spp., *Banksia* spp., *Agonis flexuosa* (Peppermint), *Callitris* spp., *Allocasuarina* spp. and *Eucalyptus loxophleba* (York Gum).

1.3 Recognised sensitive sites

A number of recognised sensitive sites occur within 15 km of the project area, including Important Wetlands (DBCA, 2023c), Environmentally Sensitive Areas (ESAs) (DWER, 2023b, 2023a) and several protected terrestrial reserves (DCCEEW, 2020, 2023e). The project area is part of a large, continuous area of native vegetation, which includes the protected areas of [redacted]

A large proportion of the 15 km buffer, including the entire project area, overlaps with Threatened Ecological Communities (TECs) (DBCA, 2023d, 2023g). Based on cross-referencing with the Protected Matters Search Tool (DCCEEW, 2023e), the TEC that overlaps with the project area is likely to be Banksia Woodlands of the Swan Coastal Plain ecological community, which is Endangered. Two other TECs may occur in the project area (DCCEEW, 2023e) but were not observed: Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion (Critically Endangered) and Tuart Woodlands and Forests of the Swan Coastal Plain ecological community (Critically Endangered). One other TEC occurs within 15 km but does not overlap with the project area (DCCEEW, 2023e): Clay pans of the Swan Coastal Plain.

The Key Biodiversity Area (KBA, 2023) of the [redacted]. This area is significant because it supports more than 1% of the breeding population of Carnaby's Black-Cockatoo, with nesting trees and foraging habitat distributed throughout remnant vegetation and isolated paddock trees (Key Biodiversity Areas Partnership, 2024). There are no Ramsar Sites (DBCA, 2023e) within 15 km.

Sensitive sites and protected areas within [redacted] are shown on Figure 1-2.

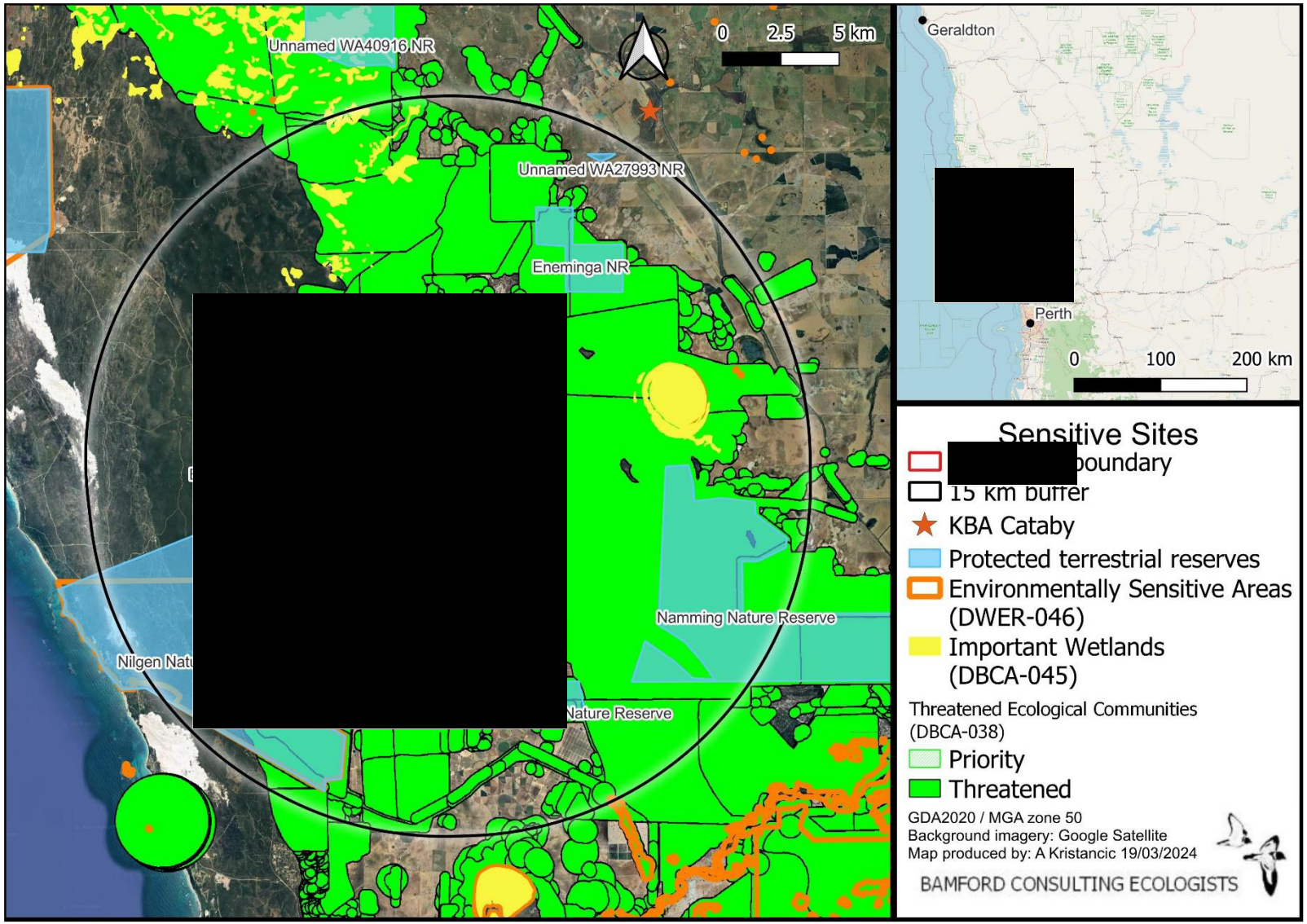

Figure 1-2. Recognised sensitive sites and protected areas within [redacted] of the project area.

2 Methods

2.1 Overview

The primary objective when assessing the value of offset properties for black-cockatoos is to assess the foraging value of existing vegetation. As a score is given for each 'type' of vegetation present, this first requires identification of the broad Vegetation and Substrate Associations (VSAs) present at the site. The foraging preferences of each species of black-cockatoo differ, therefore the foraging value is calculated separately for each black-cockatoo species under consideration. These methods are described in detail in Section 2.5 below and in Appendix 3. Identification of the VSAs in the project area also informs the discussion of conservation significant fauna likely to be present, and how they are expected to use the project area.

2.2 Dates and personnel

Personnel involved in the field investigations and report preparation (including desktop review) are listed in Table 2-1. The potential offset site was visited on the 17th March 2024. The purpose of the field investigations was to provide the following information:

- Identification of Vegetation and Substrate Associations (VSAs) for which foraging value is calculated (a separate score is calculated for each VSA for each black-cockatoo species) and which informs a discussion of conservation significant species likely to be present;
- Assessment of foraging value across the site (described in Section 2.5.2.2); and
- Opportunistic assessment of potential nesting trees, if present, and opportunistic observations of potential roosting sites. Field personnel stayed on high ground adjacent to the site until sunset to check for any flocks of Carnaby's Black-cockatoos moving towards roosting site within or close to the project area.

Table 2-1. Personnel involved in the field investigations and report preparation.

Personnel	EIA Experience	Field Investigations	Report Preparation
Dr Mike Bamford *BSc (Biology), Hons (Biology), PhD (Biology)*	40 years	+	+
Natalia Huang *BEnvSc (Zoology), Hons (Conservation Biology), MBA*	16 years		+
Dr Amanda Kristancic *BSc (Zoology/Biochemistry), Hons (Zoology), PhD (Parasitology)*	3 years		+

2.3 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.

For the current assessment, VSAs were identified based on observations made during the field investigations and are described in Section 3.1 below. These VSAs were mapped using aerial imagery as a guide, and this formed the basis for the mapping of foraging scores presented in Section 0.

2.4 Opportunistic observations

At all times, observations of fauna or fauna signs were noted when they contributed to the accumulation of information on the fauna of the site.

2.5 Black-cockatoo habitat analysis

2.5.1 Desktop review

Databases were queried for information regarding black-cockatoos, including records of individuals or flocks, known roosting sites and known breeding sites. Previous reports including black-cockatoo habitat assessment within 15 km were obtained and summarised to supplement information available in databases. These sources of information are summarised in Table 2-2 and Table 2-3.

Table 2-2. Databases searched for records relating to black-cockatoos.

Database	Type of records obtained	Area searched
Atlas of Living Australia (ALA, 2023)	Observations of black-cockatoos	15 km buffer around boundary of project area.
DBCA breeding sites publicly available (DBCA, 2023b)	Known breeding sites for Carnaby's Black-Cockatoo	Broad region.
Roosting sites dataset (BirdLife Australia, 2023)	Records of known roosting sites from the Great Cocky Count (Bird Life Western Australia).	Broad region.
EPBC Protected Matters Search Tool (DCCEEW, 2023e)	Records on MNES protected under the EPBC Act.	15 km buffer around boundary of project area.
Index of Biodiversity Surveys for Assessment (IBSA) (DWER, 2023c)	Previous reports relating to black-cockatoo habitat assessment.	15 km buffer around boundary of project area.

Table 2-3. Reports relating to black-cockatoo habitat assessment, returned from IBSA search during desktop review. Reports that are in italics did not have any resources publicly available and are not included in reference list.

Author	Title	Distance to project area
Eco Logical Australia (2020)	Black Cockatoo Habitat Assessment of Part of [redacted]. Prepared for Public Transport Authority.	10 km
360 Environmental	Flora, Vegetation and Black Cockatoo Assessment. Prepared for: ACOR MCE Consultants Pty Ltd. December 2017	12 km

2.5.2 Field investigations

2.5.2.1 Guidelines

The Department of Climate Change, Energy, the Environment and Water (DCCEEW, formerly DAWE) provides guidelines for the referral of actions that may result in impacts to black-cockatoos (for assessment under the EPBC Act). The survey and analysis reported here have been conducted with strong reference to both the referral guidelines provided by DSEWPaC (2012) and DAWE (2022). This includes application of the foraging habitat scoring tool in DEE (2017). In addition, survey methodology followed the recommendations listed on the DCCEEW's Species Profile and Threats Database (DCCEEW, 2023b, 2023d, 2023c). 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 (DSEWPaC, 2012).

Actual scoring of foraging value and assessment of potential breeding habitat was based on systems developed by BCE that are outlined below and in Appendix 3. The DBCA has indicated that the methodology developed and applied previously by BCE (e.g. Bancroft & Bamford, 2021), and as described below, to score nesting value and foraging habitat, is an acceptable approach. BCE has used this system previously in reports and it has been accepted by the regulator.

2.5.2.2 *Assessment of foraging value*

The foraging value of the study area was assessed by calculating a foraging score for each VSA (areas of similar vegetation type/condition, see Appendix 3). 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 federal DCCEEW, the state Department of Water and Environmental Regulation (DWER) and Department of Energy, Mines, Industry Regulation and Safety (DMIRS), and the WA Environmental Protection Authority (EPA) to assess impact significance and offset requirements. The foraging value (also referred to as 'habitat quality score ' (HQS)) 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 3. These three components are drawn from the DCCEEW offset calculator (DCCEEW, undated) but with the scoring approach developed by BCE:

- A score out of six for the vegetation composition, condition and structure.
  This is based on the presence, abundance and condition of vegetation that is used for foraging by the black-cockatoo under consideration (as described in Appendix 3).

- A score out of three for the context of the site.
  The context score is a function of the proportion of native vegetation within the local area that lies within the offset area, and is also affected by the vegetation condition score (as described in Appendix 3. The local area for site context is considered to be a 15km radius around the offset area. Native vegetation within the local area (15 km radius) is based on the Department of Primary Industry and Regional Development's online shapefile of native remnant vegetation polygons in Western Australia (DPIRD, 2023a).
- A score out of one for species density.
  As described in Appendix 3, the species density score (out of 1) is assigned on the basis of observed or predicted regular presence of foraging birds. For example, birds may not be observed and foraging evidence may not be found during a short site visit, but if there are birds and/or foraging evidence nearby, and the habitat has a moderate to high vegetation condition score, then it is certain to be visited regularly by foraging birds and is given a density score of 1 accordingly. If birds or foraging evidence are not observed, and the regular presence of foraging birds is not expected, then the area is given a stocking rate score of 0.

The combination of the vegetation condition score, the context score and the species density score provides an overall foraging value score (the overall HQS) out of 10. 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 3. Foraging value scores are calculated separately for the two black-cockatoo species (Appendix 3) depending upon the vegetation present; thus a separate score is given for each VSA for each species.

An overall foraging score for the project area was calculated based on the individual HQS of each VSA and the proportion of the project area made up of each VSA. This provides an average weighted habitat quality score (HQS) for the project area as a whole, which is always rounded up for comparative purposes; conventional rounding rules could lead to very different sites being considered to be similar.

Black-cockatoo foraging signs were also recorded in conjunction with the foraging value assessments. When foraging signs were observed, the location and tree species were recorded. Black-cockatoo foraging evidence may persist for some months or years after the foraging event. 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.

2.5.2.3 *Black-cockatoo breeding*

The aim of the breeding surveys was to opportunistically record presence of potential hollow-bearing trees (suitable for black-cockatoo nesting) within the project area. A potential nesting tree is considered any tree with a diameter at breast height (DBH) equal to or greater than 500 mm (or 300 mm for Wandoo/Salmon Gum) (DCCEEW, 2023d, 2023c, 2023b). The following information was recorded for suitable trees:

- 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 2-4.

Table 2-4. Ranking system for the assessment of potential nest-trees for black-cockatoos (revised 21/08/2023).

As per information from DCCEEW (2023d, 2023c, 2023b), a potential nest-tree is any tree with a diameter at breast height >500 mm (or >300 mm for *Eucalyptus 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 >8m; but note that hollow height is contextual. Carnaby's Black-Cockatoo will nest in hollows <5m 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.

2.5.2.4 Black-cockatoo night roosting

As per the guidance of DAWE (2022), areas likely to be used as night roosting sites were noted during field investigations, based on the topographical, physical and vegetation characteristics present (such as sites adjacent to watercourses with large trees) and/or indirect evidence of roosting (e.g. guano deposits, discarded feathers).

2.5.2.5 Potential watering points

During the desktop review and site inspection, any potential watering points for black-cockatoos were noted and details are presented in the relevant sections below.

2.6 Conservation significant fauna

A list of conservation significant vertebrate and invertebrate fauna expected in the project was compiled based on previous BCE surveys nearby, general literature regarding expected distributions of species, and the consultants' extensive previous experience and familiarity with the fauna of this region. This list is provided in Appendix 4 and key conservation significant species are discussed in Section 3.3 below. Several conservation significant species are considered locally extinct in this region; these are detailed in Appendix 4.

2.7 Mapping

Low resolution maps (300-400dpi) have been provided within the body this report. As per the recommendation of EPA (2020), maps use the GDA2020 datum and are projected into the appropriate Map Grid of Australia (MGA94) zone.

2.8 Survey Limitations

The EPA Guidance Statement 56 (EPA, 2004) and the EPA (2020) outline a number of limitations that may arise during field investigations for Environmental Impact Assessment. These survey limitations are discussed in the context of the BCE investigation of the project area in Table 2-5. No limitations were identified.

Table 2-5. Survey limitations as outlined by EPA (2020).

EPA Survey Limitations	BCE Comment
Availability of data and information	Sufficient information from databases and previous studies. Not a limitation.
Competency/experience of the survey team, including experience in the bioregion surveyed	The ecologists have had extensive experience in conducting field surveys for environmental impact assessment fauna studies, particularly for black-cockatoo habitat assessments and have undertaken a number of studies within the region. Not a limitation.
Scope of the survey (e.g. were faunal groups were excluded from the survey)	The scope of the assessment was a targeted survey for black-cockatoo foraging habitat, and identification of fauna habitats. The latter informs a discussion of conservation significant fauna likely to be present. Not a limitation.
Timing, weather and season	Seasonality is not of great importance for this type of assessment. Not a limitation.
Disturbance that may have affected results	None. Not a limitation.
The proportion of fauna identified, recorded or collected	All fauna observed were identified. Not a limitation.
Adequacy of the survey intensity and proportion of survey achieved (e.g. the extent to which the area was surveyed)	The project area was adequately surveyed to the level appropriate for a black-cockatoo foraging values assessment. Not a limitation.
Access problems	No access problems were encountered. Not a limitation.
Problems with data and analysis, including sampling biases	There were no data problems. Not a limitation.

3 Results

3.1 Vegetation and Substrate Associations

Almost the entire project area was burnt c. 3 years prior to the site inspection but has substantially regenerated. Both key Banksia species (*B. attenuata* and *B. menziesii*) have flowered since the fire. It appears that some small areas in the south-west and north-east of the project area, as well as the dampland area in the north-west, were not burnt. Based on observations made during the site inspection, three broad VSAs were identified in relation to fauna in the project area:

VSA 1: Banksia Open, Low Woodland. Open, low woodland of *Banksia* spp. (predominantly *Banksia attenuata* with c. 10% *B. menziesii* and occasional *B. prionotes* along southern border and single *B. grandis* on margin of dampland) with scattered Coastal Blackbutt (*Eucalyptus todtiana*) over grass trees and mixed shrubs on sandplain. The projected foliage cover was temporarily reduced by the recent fire, with canopies still regenerating. This VSA makes up c. 76 % of the project area. See Plate 1.

VSA 2: Banksia Low Woodland. Low woodland of *Banksia* spp. (predominantly *Banksia attenuata* with c. 10% *B. menziesii*) over grass trees and mixed shrubs on sandplain, undulating in south-east. Trees slightly taller than in VSA 1 as well as at a higher density. This VSA makes up c. 13 % of the project area. See Plate 2.

VSA 3: Melaleuca Dampland. Patchy woodland of *Melaleuca preissiana* over damp heath of mixed shrubs including *Hakea trifurcata*(?), on dark, peaty soil. A slight depression retains water but was dry at the time of the site inspection. This VSA makes up c. 11 % of the project area. See Plate 3.

The distribution of VSAs across the project area is shown in Figure 3-1.

Plate 1. Representative photograph of VSA 1 (Banksia Open, Low Woodland). This photograph is from the south-west corner and is approximately 3 years post fire.

Plate 2. Example of VSA 2 (Banksia Low Woodland). This photograph is from the north-east corner of project area (unburnt).

Plate 3. Examples of VSA 3 (Melaleuca Dampland) within the project area.

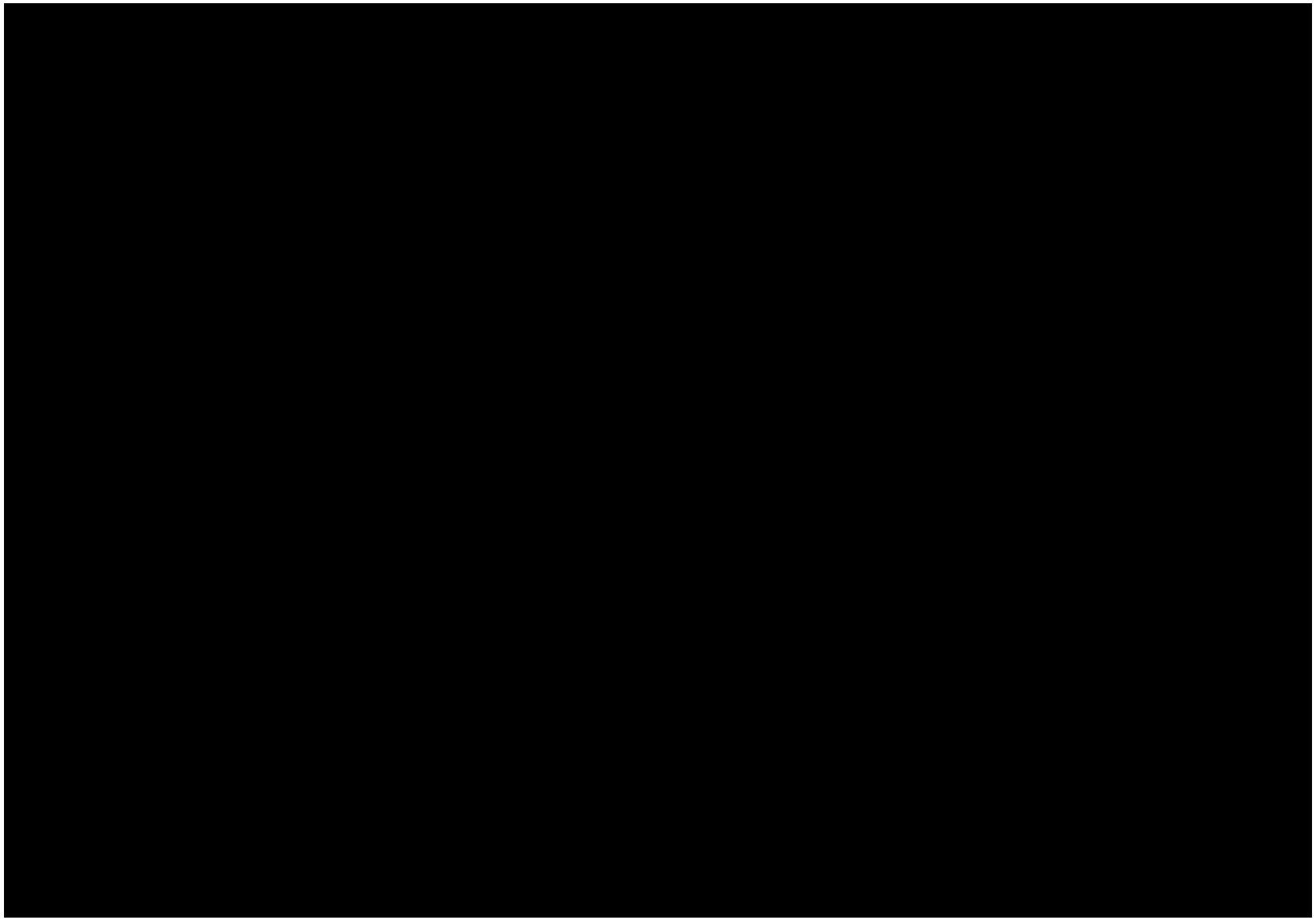

Figure 3-1. Distribution of VSAs within the project area.

3.2 Black-cockatoo habitat assessment

3.2.1 Black-cockatoo presence

3.2.1.1 Observations of black-cockatoos

Carnaby's Black-Cockatoo is known from the area, with 23 records of individuals or flocks (of up to 230 birds) within 15 km of the project area (ALA, 2024) and species or species habitat known to occur within this 15 km buffer (DCCEEW, 2023e). Breeding is known to occur in the Cataby Important Bird Area (Johnstone et al., 2015), which is [redacted] around the project area. No Carnaby's Black-Cockatoos were observed during the site inspection either in the project area or nearby, but the birds are highly mobile and cannot be expected to be present at all times.

3.2.1.2 Black-cockatoo foraging evidence

Evidence of foraging by Carnaby's Black-Cockatoo was found during the site inspection, on *Banksia attenuata* and *B. menziesii* cones. Plate 4 shows an example of the foraging evidence observed. The foraging evidence on *B. menziesii* was recent (probably weeks old) but was old (possibly around a year old) on *B. attenuata*.

Plate 4. Firewood Banksia (*Banksia menziesii*) cones chewed by Carnaby's Black-Cockatoo

3.2.2 Foraging value (Habitat Quality Score (HQS))

Foraging habitat for Carnaby's Black-Cockatoo was present throughout the project area, predominantly due to the presence of *Banksia* tree species and proteaceous shrubs such as *Hakea* spp. that are known to be palatable to the species. For Carnaby's Black-Cockatoo, the majority of the site consists of VSA 2 (Banksia Open Low Woodland) with a moderate to high foraging value of 7/10. The remaining VSAs were small and had low (VSA 3) or moderate to high (VSA 2) foraging value for Carnaby's Black-Cockatoo. The foraging scores for Carnaby's Black-Cockatoo for each VSA are presented in Table 3-1 and Figure 3-2, and details regarding the different elements (vegetation condition, context and stocking rate) are described in detail in Sections 3.2.2.1, 3.2.2.2 and 3.2.2.3.

The overall (rounded) weighted habitat quality score (HQS) for the project area is 6/10.

Table 3-1. Foraging scores for each VSA for Carnaby's Black-Cockatoo

Vegetation and Substrate Association (VSA)	Area (ha)	% of total area	Veg'n (/6)	Context (/3)	Density (/1)	HQS (/10)
VSA 1 – Banksia Open, Low Woodland	104	76	4	2	1	**7**
VSA 2 – Banksia Low Woodland	17	13	5	2	1	**8**
VSA 3 – Melaleuca Dampland	15	11	2	0	1	**3**
Total	136	100.0	Rounded weighted average HQS			**7/10**

3.2.2.1 Vegetation condition score

The project area consists primarily of VSA 1 (Banksia Low Open Woodland), with a projected foliage coverage of suitable foraging species (mostly *B. attenuata* with a small amount of *B. menziesii*) of about 10%, but this was temporarily reduced by the time since fire (about three years) and the canopy of the Banksias was still regenerating (for example, see Plate 1). As a result, a vegetation condition score of 3/6 was assigned to this VSA in recognition that the foliage cover will increase post-fire.

Small areas of VSA 2 (Banksia Low Woodland) occur in the north-east and south-east of the project area; the projected foliage coverage of suitable foraging species in this VSA is about 20-30%, but is patchy with occasional denser areas. As in VSA 1, the projected foliage cover has also been temporarily reduced across part of VSA 2 by the recent fire. Recognising the patchy density and the impact of fire, VSA 2 was assigned a vegetation condition score of 5/6.

The remainder of the project area consists of VSA 3 (Melaleuca Dampland) which contains lower quality foraging vegetation due to the absence of *Banksia* species. The vegetation condition score for this VSA is 2/6.

3.2.2.2 Calculation of context score

Based on the native vegetation dataset from DPIRD (2023a) the amount of native vegetation remaining within 15 km of the project area is c. 51, 431 ha. Therefore, the project area ([redacted]) comprises 0.26 % of the native vegetation in the 'local area' (see Appendix 3).

For VSA 1 and VSA 2, a context score of 2/3 was given. This is slightly higher than suggested by the extensive foraging habitat nearby, but the project area is adjacent to cleared land to the west. In addition, while there is no recorded breeding nearby, there is a likelihood that breeding is occurring in

the region with large trees likely around wetlands to the east. For VSA 3, the vegetation score was low, and so a context score of 0/3 was given. This recognises that this patch of vegetation, while providing some foraging value, is less important in the local landscape given the abundance of higher quality foraging habitat nearby.

3.2.2.3 Species density score

Evidence of foraging was observed within the project area, and there are abundant records of Carnaby's Black-Cockatoo nearby (see Section 3.2.1.1). Therefore, it is considered that this species is likely to be regularly present in the project area. A species density score of 1 was therefore given for all VSAs, as all provide foraging habitat.

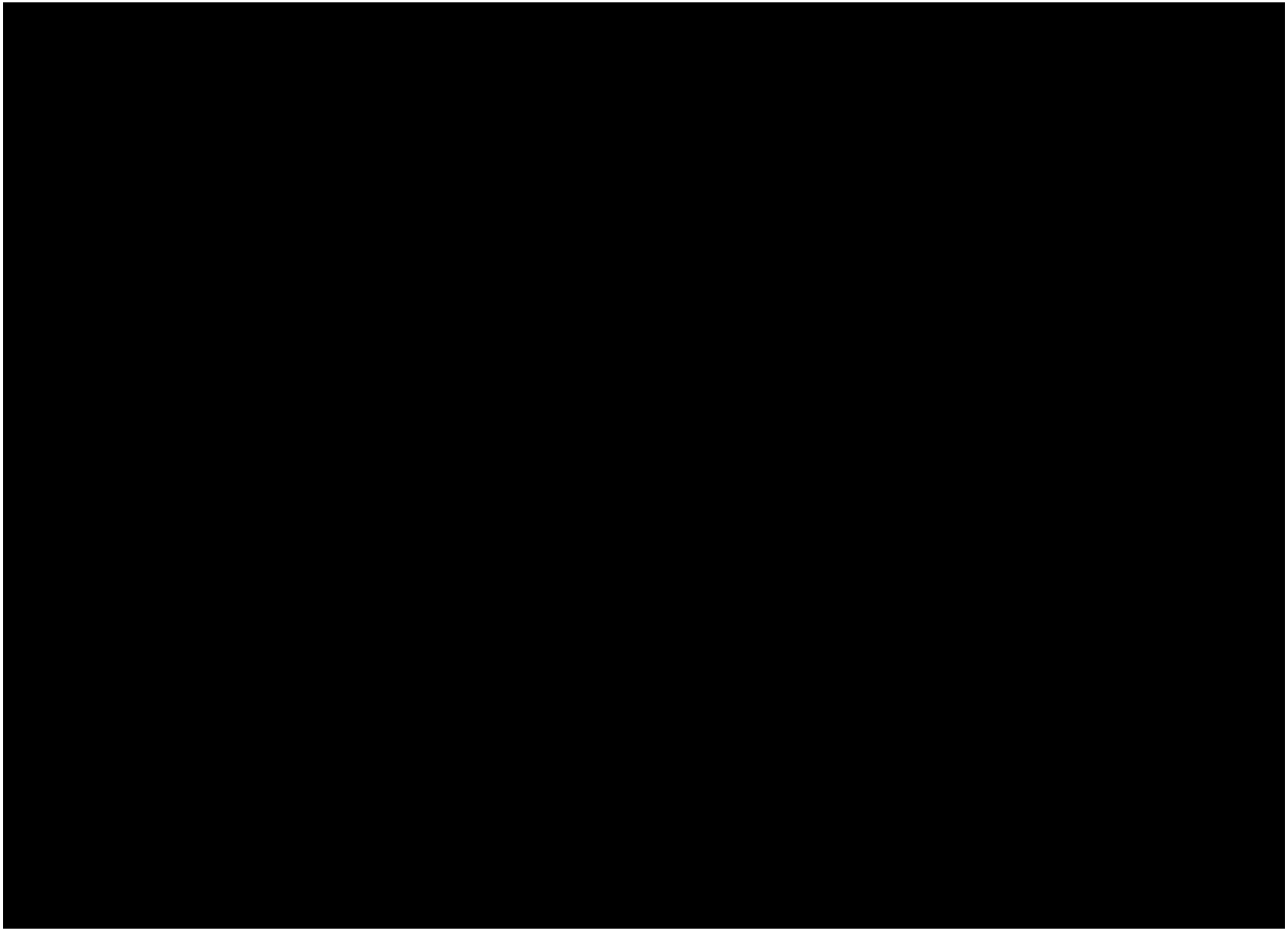

Figure 3-2. Distribution of foraging scores (HQS out of 10) for Carnaby's Black-Cockatoo.

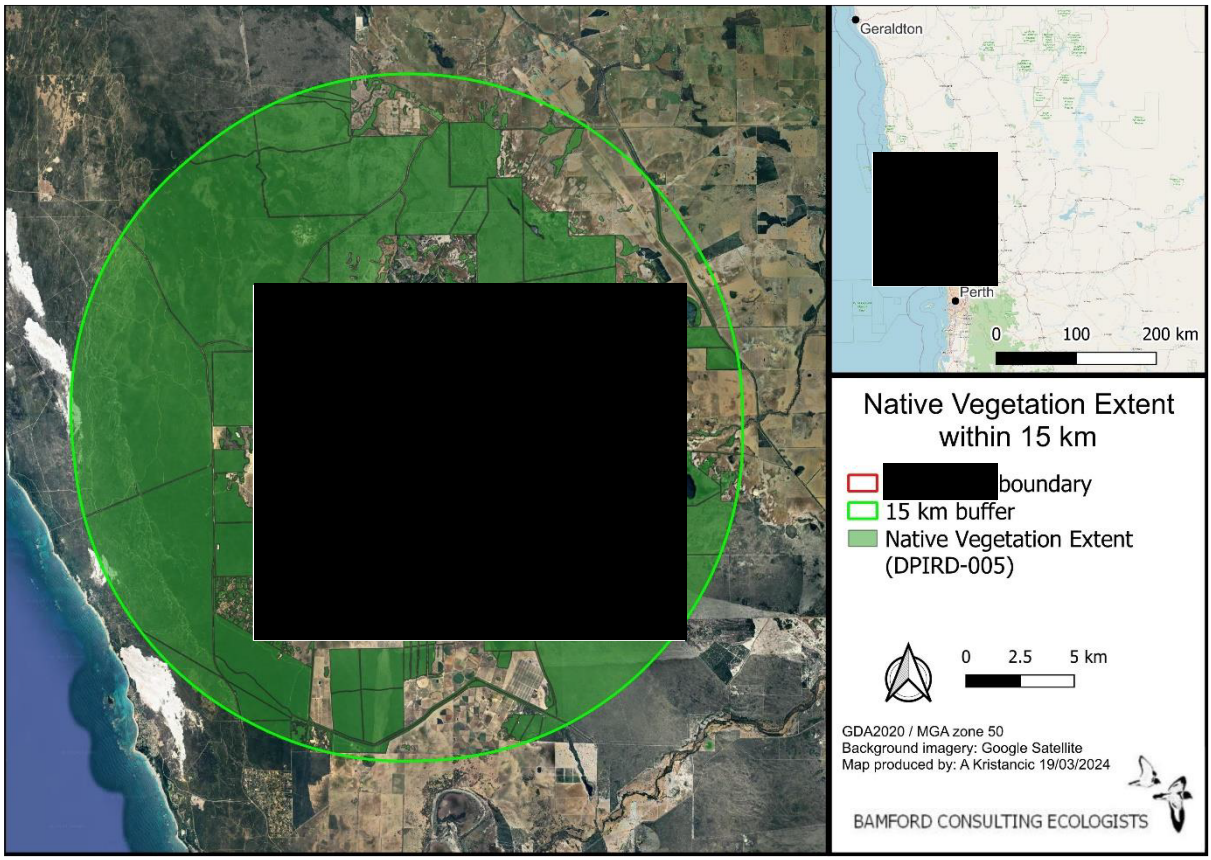

Figure 3-3. Estimated native vegetation in the local area (15 km buffer around the project area).

3.2.3 Black-cockatoo breeding

There were no large trees within the project area, so no trees were assessed as potential nest trees. There are no known breeding sites within 15 km of the project area, based on publicly available records from DBCA (2023a). About [redacted] of the project area, breeding is known to occur in the Cataby Important Bird Area (Johnstone *et al.*, 2015). About [redacted] the project area, Eco Logical Australia (2020) assessed another potential offset site and found that it contained six potential breeding trees, based on their size (diameter at breast height >500mm), but none contained hollows. Known breeding areas in the region are shown on Figure 3-4.

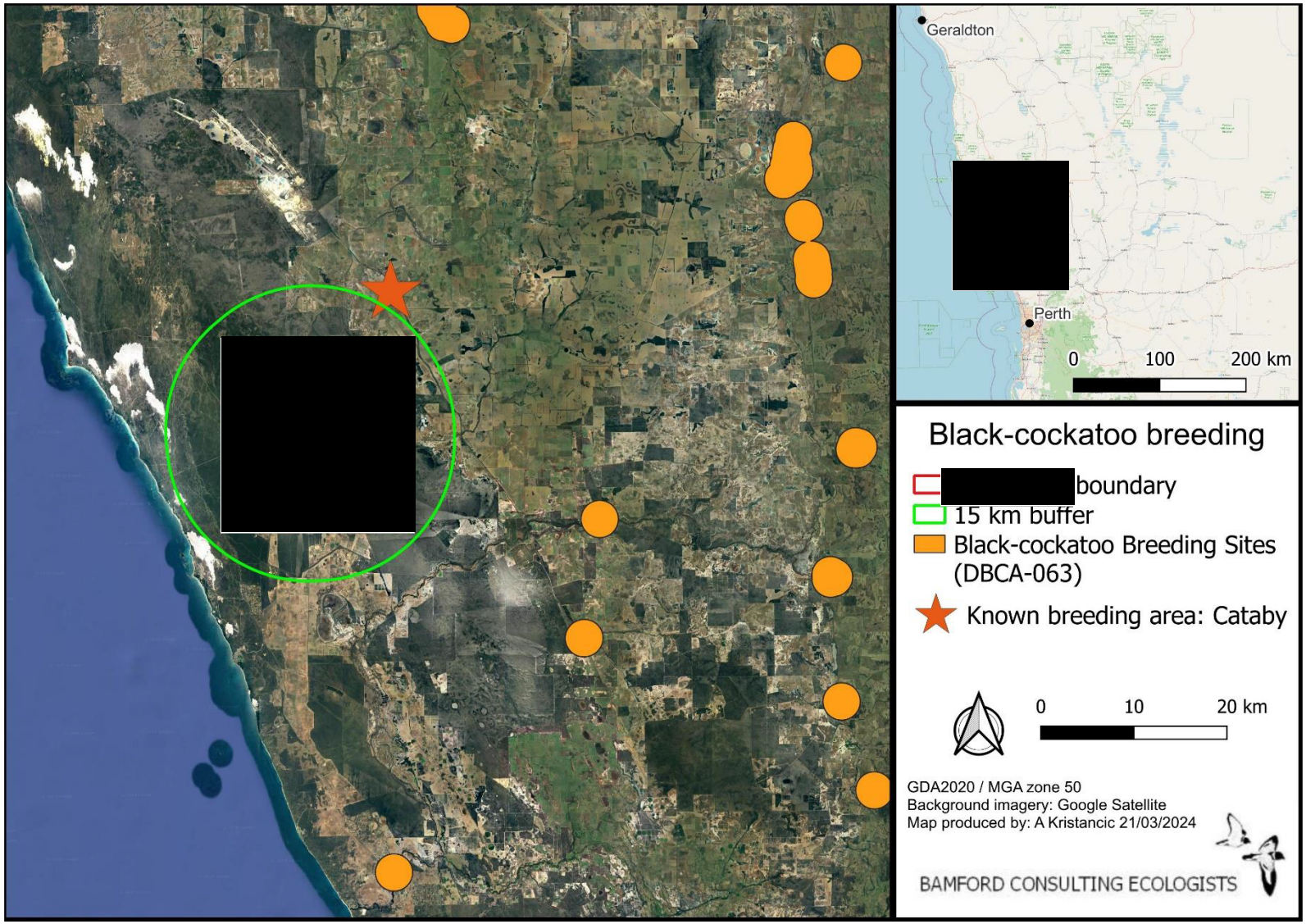

Figure 3-4. Known breeding sites in the region.

3.2.4 Black-cockatoo night roosting

No signs of roosting were observed during the site inspection, and the environment is not typical of that used for roosting as it lacks tall trees.

There is one confirmed roost within 15 km of the project area (BirdLife Australia, 2023; DBCA, 2023b). This site was last confirmed used in 2022 when 1510 white-tailed black-cockatoos (presumably Carnaby's) were counted. This site has been used every year since surveys began at this site in 2013. Note that the dataset available (BirdLife Australia, 2023) contains data up to 2022; therefore this site may have been used in 2023. Within the broader region, there are several more confirmed and unconfirmed roosts; unconfirmed roosts are not yet confirmed to have black-cockatoos using them but are considered likely (or anecdotally noted) roost locations. Known roost locations within the region are shown on Figure 3-5.

The limited number of known roosts close to the project area is not due to a lack of suitable roosting habitat but likely reflects a lack of survey effort in this area. Roosting is very likely to take place closer to the project area than available data indicate; this is suggested by the foraging evidence observed during the site inspection, as black-cockatoos typically travel <6 km from their roosts when foraging (Department of Environment and Conservation, 2012). The presence of roost sites nearby could be determined by conducting evening roost site surveys in the appropriate season.

3.2.5 Black-cockatoo watering points

There were no potential water sources for black-cockatoos within the project area. Within 15 km of the project area, there are several farm dams to the south and several lakes to the east, which may provide suitable watering points. It is likely that there are also several stock troughs/dams in the vicinity and, if so, it is probable that these sites could provide water for much of the year.

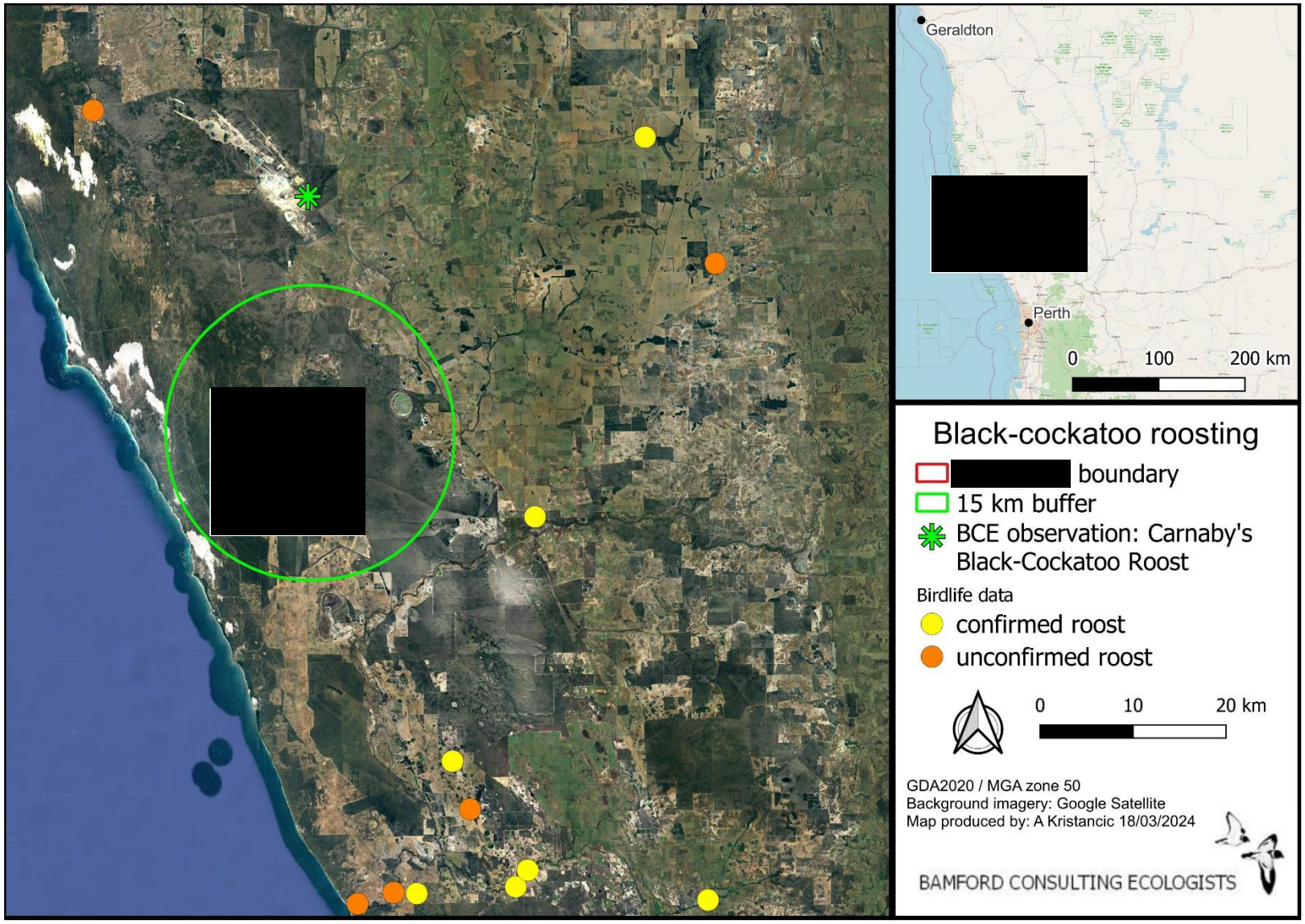

Figure 3-5. Known black-cockatoo roost locations within the region.

3.3 Conservation significant fauna

3.3.1 Vertebrate fauna

Key conservation significant fauna expected in the project area, other than Carnaby's Black-Cockatoo, include the Jewelled Ctenotus (Swan Coastal Plain), Black-striped Burrowing Snake and Brush Wallaby (*Notamacropus irma*), which are all expected to have resident populations within the project area. The Quenda, Woylie and Tammar Wallaby were recorded in Nambung National Park in the early 2000s as part of a translocation project but are otherwise not expected in the project area as they are all considered locally extinct in this area. The Peregrine Falcon is known from the area and may utilise the project area when foraging, but the project area does not contain suitable nesting sites (tall trees or cliff faces). Information on the conservation status, distribution and habitat, salient ecology and expected occurrence within the project area is provided below for key conservation significant vertebrate fauna, including Carnaby's Black-Cockatoo.

Jewelled Ctenotus (Swan Coastal Plain subpopulation) (*Ctenotus gemmula*) CS2 (P3)

Conservation status: Listed as Priority 3 by DBCA.

Distribution and habitat: The Jewelled Ctenotus occurs in two isolated subpopulations in Western Australia: one on the Swan Coastal Plain from Cataby south to Perth, and another along the south coast (IUCN, 2017). The Swan Coastal Plain subpopulation is listed as Priority 3 by DBCA, and is threatened by habitat loss associated with mining and urbanisation (IUCN, 2017). Typical habitat for this species includes *Banksia* and Mallee woodlands and heath on sandplains (IUCN, 2017).

Ecology: A fossorial skink that shelters in leaf litter (Huang, 2009).

Expected occurrence: **Resident.** This species has been recorded by BCE during trapping in Cooljarloo (c. 30 km north-north-east). The *Banksia* woodland on sandy soil that makes up the majority of the project area provides suitable habitat for this species.

Black-striped Burrowing Snake (*Neelaps calonotos*) CS2 (P3)

Conservation status: Listed as Priority 3 by DBCA.

Distribution and habitat: Restricted to coastal sandplains from near Dongara to Mandurah **(Bush *et al*., 2010)**. Appears to be absent from the eastern coastal plain (M. Bamford pers. obs.). Within the Perth Metropolitan area this species may be restricted to large reserves **(How & Shine, 1999)**.

Ecology: A fossorial species that preys upon small, fossorial skinks in the upper layers of loose sand (Bush *et al*., 2010).

Expected occurrence: **Resident.** This species has been recorded by BCE during trapping in Cooljarloo (c. 30 km north-north-east). The project area is within the distribution of this species and there is suitable habitat within the project area; it is therefore expected to be resident.

Western Brush Wallaby (*Notamacropus irma*) CS2 (P4)

Conservation status: Listed as Priority 4 by DBCA.

Distribution and habitat: Endemic to the South-West more or less south of line from Geraldton to Esperance, although it has disappeared from much of the Wheatbelt due to clearing. Occurs in a wide range of vegetation types from Eucalypt Woodland to Banksia Woodland, Shrublands and Kwongan. Locally common in dry sclerophyll forest and woodland in the south-west however it has declined in recent decades due to predation and habitat destruction (Menkhorst & Knight, 2011).

Ecology: Based on detailed radio-tracking study in Banksia Woodland in Whiteman Park (Bamford & Bamford, 1999), a largely solitary species that browses on shrubs and bushes; rarely on grass. Rarely drinks free-standing water and rarely ventures from dense vegetation. Individuals occupy home ranges of up to c. 10 ha; larger in males than females and those of females overlap.

Expected occurrence: **Resident.** It is expected to be present in the project area, in areas where the understorey is dense and provides sufficient shelter. It is regularly recorded in the Cooljarloo area (BCE database).

Carnaby's Black-Cockatoo (*Zanda latirostris*) CS1 (E, S2D2)

Conservation status: Endangered under the EPBC Act and Schedule 2 Division 2 under the BC Act.

Distribution and habitat: Endemic to south-western Western Australia, from Kalbarri in the north, east to Merredin and Ravensthorpe, and then further east along the south coast to the Esperance area (DCCEEW, 2023d; Johnstone & Storr, 1998). Breeds (July to December) predominantly in the east of its range with a migration to coastal areas in the non-breeding period. In recent years, however, the species has expanded its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain (DCCEEW, 2023d). Heavily reliant on areas of Banksia woodland and proteaceous shrubland/heath for foraging (DCCEEW, 2023d; Johnstone & Storr, 1998).

Ecology: Diurnal granivore, feeding predominantly on the seeds of the Proteaceae (especially banksias) but also known to feed on a very wide variety of plants, including non-native ornamentals and plantation species such as pine (DCCEEW, 2023d; DPaW, 2013; Groom, 2011; Johnston *et al*., 2016; Valentine & Stock, 2008). Reliant on large tree-hollows in eucalypts (especially smooth-barked species such as Wandoo and Salmon Gum) for breeding (DCCEEW, 2023d; Johnstone & Storr, 1998; Saunders, 1974). Threatened by habitat loss, habitat degradation, nest hollow shortage, and competition for available nest hollows from other parrots and feral Honeybees, illegal shooting and illegal trade (Burbidge, 2004; DCCEEW, 2023d).

Expected occurrence: **Regular visitor.** There is moderate quality foraging habitat in the project area and evidence of foraging was observed during the site inspection in March 2024, as well as a feather from an individual. It is likely that Carnaby's Black-Cockatoo visits the project area regularly to forage, but there were no potential nest trees and no signs of roosting observed in the project area. Full details of the black-cockatoo habitat assessment are provided below in Section 3.2

3.3.2 Invertebrate fauna

Invertebrate fauna of conservation significance include listed threatened species and short-range endemic (SRE) (or potential SRE) species; although it should be noted that SRE and potential SRE species are often not well documented. The project area sits within DBCA's Midwest management region (DBCA, 2023b), within which (DBCA, 2023f) have listed 22 threatened or priority invertebrate fauna. The project area is not within the range of all 22 species. Based on previous surveys and records within the region, some of these listed species may be present in the project area.

Bothriembryon perobesus (a bothriembryontid land snail (Moore River), P1) was collected about 20 km north of the project area in 2012 (Bennelongia, 2013). Suitable habitat includes *Banksia* woodland and low shrubland on sandy soils (Bennelongia, 2021), similar to that present in the project area.

The Banksia woodland of the project area is also likely to provide suitable habitat for several conservation significant insects, possibly including:

- *Austrosaga spinifer*, spiny katydid (Swan Coastal Plain) (P2)
- *Hemisaga vepreculae*, thorny bush katydid (Moora) (P2)
- *Hylaeus globuliferus*, woolybush bee (P3)
- *Synemon gratiosa*, Graceful Sunmoth, (P4), dependent on presence of host plant species (*Lomandra hermaphrodita* or *Lomandra maritima*)

Based on previous surveys in the region, several SRE or potential SRE species may also be present, including the following:

Spiders: several mygalomorph spiders (genera include *Aname, Idiosoma, Kwonkan, Aganippe*) have been collected in the region (BCE database), and it is expected that mygalomorph spiders will be present in the project area. Suitable habitat for these species generally includes areas with a substrate where a burrow can be dug, in areas with shrub cover to provide protection and create leaf litter (used for shelter and to create burrow lid/door). Such habitat occurs throughout the project area.

Millipedes: several species of *Antichiropus* millipedes thought to be SRE species have been recorded in the region in previous surveys by BCE (Bamford *et al*., 2012). Two of these were collected in Banksia woodland similar to that found in the current project area.

3.4 Patterns of biodiversity

Investigating patterns of biodiversity can be complex and are often beyond the scope even of detailed or targeted investigations, but it is possible to draw some general conclusions based upon the VSAs present in the project area. The landscape in the project area is relatively uniform, with the two *Banksia* woodland VSAs only differing slightly in the height and density of *Banksia* trees but having a similar understorey in terms of structure and composition. The understorey of these VSAs is likely to provide shelter for a variety of ground-dwelling fauna (such as reptiles, frogs, and small mammals). The loose sand and leaf litter of these VSAs is likely to support the conservation significant Black-striped Burrowing Snake and Jewelled Ctenotus. The *Banksia* trees of these VSAs provide the highest foraging value for Carnaby's Black-Cockatoo (of all VSAs present) and are also likely to provide habitat for other birds as well as bats and small arboreal reptiles. The *Melaleuca* dampland of VSA 3 is expected to have a lower fauna species richness but the heavier and seasonally damp soils may be important for range restricted invertebrates, and the small area of seasonal inundation may be sufficient for frogs to breed. The plant species present provide low value foraging habitat for Carnaby's Black-Cockatoo, in the form of *Hakea* shrubs. The understorey of this VSA contains a mix of shrubs that provide complex vegetation structure and therefore shelter for a variety of fauna species. The substrate here may be less suitable for the Black-striped Burrowing Snake and Jewelled Ctenotus, particularly during inundation. It is likely that the Brush Wallaby will utilise all VSAs of the project area, so long as the understorey is dense enough to provide sufficient shelter.

3.5 Ecological processes

The nature of the landscape and the fauna assemblage indicate some of the ecological processes that may be important for ecosystem function (see Appendix 1 for descriptions and other ecological processes). The main ecological processes which have affected and continue to affect the fauna assemblage are likely to be: (i) existing habitat loss, as the region has experienced very high levels of land clearing historically, and only small, generally isolated patches of remnant vegetation remain; (ii) landscape connectivity, because of the highly fragmented nature of vegetation in the area; and (iii) the presence and abundance of feral and some native species. These and additional ecological processes which are affecting fauna are discussed here:

Existing habitat loss

The survey area is located in a region where native vegetation has been cleared for agriculture and only a small proportion of the original native vegetation remains. The vegetation within the project area is relatively intact, and large areas of native vegetation remain within 15 km. However, the high level of land clearing in the region as a whole will have contributed to the loss and decline of many fauna species, such as the locally extinct species detailed in Appendix 6. As the current project area is being considered as an offset, there is no proposed reduction in existing habitat. However, localised events such as bushfires can temporarily result in habitat loss for native fauna. The connection between the project area and the large area of native vegetation to the east is likely to provide a buffer against such events, as fauna can escape into adjacent habitat and return once the habitat has regenerated.

Landscape connectivity

In the broader region, habitat loss has led to fragmentation of vegetation and loss of landscape connectivity, which has also contributed to the loss and decline of many fauna species, as indicated by the large number of species (especially mammals) that are considered locally extinct in the area. The project area is currently part of a large area of continuous native vegetation (that includes several protected areas in the form of Nature Reserves), and landscape connectivity on a local scale within this native vegetation is expected to be good.

Should the project area become isolated from this large area of native vegetation, the resultant loss of landscape connectivity is likely to negatively impact the fauna assemblage. The conservation significant reptiles may not be adversely affected by a loss of landscape connectivity as reptiles are known to persist in small patches of remnant native vegetation. For example, Bamford and Calver **(2012)** have documented the persistence of some species (about 25% of the original assemblage) at the level of the urban garden, but also found that some species disappear from small reserves due to cat predation. Loss of landscape connectivity is likely to result in the project area no longer being able to support the Western Brush Wallaby. The impact of local events such as bushfires or temporary increased abundance of feral predators is also likely to have a larger impact on fauna within an isolated remnant (as they cannot easily escape from threats).

Feral/introduced species and interactions with over-abundant native species

Introduced species occur throughout Western Australia and it is expected that species such as the Feral Cat, Red Fox, European Rabbit and House Mouse a will be present in the project area. Introduced

species are likely to be placing considerable pressure on the native fauna in the region, including the key conservation significant species supported by the project area. Foxes and Feral cats impact native fauna via predation, and Rabbits may compete with native fauna for resources and cause degradation of vegetation.

Local hydrology

The *Melaleuca* dampland appears to be subject to seasonal inundation and this may influence the fauna assemblage supported by the project area. The fauna assemblage may vary seasonally depending on inundation. Banksias can also be sensitive to local hydrology.

Fire

Native vegetation in the survey areas is subject to fire and while appropriate fire regimes can benefit biodiversity, inappropriate regimes can lead to a loss of biodiversity. There is probably no current managed fire regime. The majority of the project area was burnt c. 3 years prior to the current site inspection, but the vegetation has substantially regenerated. During this regeneration, the project area may not have been able to support the usual fauna assemblage, due to a lack of shelter and food resources. It is expected that due to the connectivity between the project area and native vegetation to the east, this would have only influenced the fauna assemblage in the short-term, while vegetation was regenerating.

4 Summary of fauna values

Vegetation and Substrate Associations (VSAs). Three VSAs were identified in relation to fauna in the project area. The majority of the project area is made up of Banksia Open, Low Woodland (VSA 1), comprised of *Banksia* spp. with scattered Coastal Blackbutt (*Eucalyptus todtiana*) over grass trees and mixed shrubs on sandplain. The remainder of the project area comprises two small areas of Banksia Low Woodland (VSA 2) which is similar to VSA 1 but less open and slightly taller, and an area of Melaleuca dampland (VSA 3), which comprises a patchy woodland of *Melaleuca preissiana* over damp heath of mixed shrubs including *Hakea trifurcata*(?), on dark, peaty soil. The majority of the project area was burnt c. 3 years prior to the current site inspection but has substantially regenerated.

Key species of conservation significance. The project area is expected to support four key conservation significant vertebrate species: the Jewelled Ctenotus (CS2 (P3)), Black-striped Burrowing Snake (CS2 (P3), Carnaby's Black-Cockatoo (CS1 (EN, S2D2)) and the Brush Wallaby (CS2 (P4)). The targeted black-cockatoo assessment is summarised below.

It is likely that the Banksia woodlands of the project area will support a variety of conservation significant invertebrates, including species listed under federal and/or state publications, as well as a suite of short-range endemic (SRE) or potential SRE species.

Black-cockatoo assessment. The survey area is out of range for the Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo. Carnaby's Black-Cockatoo is expected as a regular visitor. Foraging evidence and a feather from Carnaby's Black-Cockatoo were recorded in the project area. Suitable foraging habitat for Carnaby's Black-Cockatoo is present throughout the project area, in the form of *Banksia* spp. in VSA 1 and VSA 2, and *Hakea* shrubs in VSA 3. The *Banksia* woodland of VSA 2 is less

open than VSA 1, resulting in a higher density of *Banksia* trees (compared with VSA 1) and therefore the highest foraging value of all VSAs.

No suitable nesting hollows were observed during the site inspection; the vegetation consists primarily of *Banksia* woodland containing tree species that do not readily provide breeding sites for black-cockatoos. There are no known breeding sites within 15 km of the project area, but breeding is known to occur just outside this radius, in the Cataby Important Bird Area. There did not appear to be any suitable roost-site locations within the project area; night-roosting is not expected to occur in the project area. The area in general is known to support black-cockatoo roosting, and the closest known roosting site is c. 10 km from the boundary of the project area.

Summary of black-cockatoo assessment

- Foraging value – overall the project area is of moderate foraging value for Carnaby's Black-Cockatoo, with a (rounded) weight average foraging score of 6/10. Foraging scores ranged from 7/10 for areas with the highest density of *Banksia* trees (VSA 2), to 6/10 for areas with a lower density of *Banksia* trees (VSA 1) and 3/10 for areas with no *Banksia*, but which contained palatable *Hakea* shrubs (VSA 3).
- Breeding value – no trees were large enough to be assessed as potential nesting trees. The closest known breeding sites are within the Cataby Important Bird Area, c. 16 km from the boundary of the project area.
- Roosting value – No suitable areas for roosting sites were apparent within the project area. The closest known and confirmed roost is c. 10 km from the project area and was last confirmed used in 2022, when 1510 birds were counted. It is expected that this roost site would also have been confirmed used in 2023; the dataset available does not extend past 2022.

Patterns of biodiversity. Vegetation in the project area is relatively uniform, with the two *Banksia* woodland VSAs only differing slightly in the height and density of *Banksia* trees but having a similar understorey in terms of structure and composition. The understorey of these VSAs is likely to provide shelter for a variety of ground-dwelling fauna (such as reptiles, frogs, and small mammals). The loose sand and leaf litter of these VSAs is likely to support the conservation significant Black-striped Burrowing Snake and Jewelled Ctenotus. The *Banksia* trees of these VSAs provide the highest foraging value for Carnaby's Black-Cockatoo (of all VSAs present) and are also likely to provide habitat for other birds as well as bats and small arboreal reptiles. The *Melaleuca* dampland of VSA 3 is distinctive and likely to be less rich in fauna species, but with some restricted to the heavy soils and seasonally damp conditions. The substrate here may be less suitable for the Black-striped Burrowing Snake and Jewelled Ctenotus, particularly during inundation. It is likely that the Brush Wallaby will utilise all VSAs of the project area, so long as the understorey is dense enough to provide sufficient shelter.

Key ecological processes. The ecological processes that are expected to influence the fauna assemblage include existing habitat loss, landscape connectivity and the presence of feral species. Local hydrology may impact fauna as there is a small area of damplands that appears to be seasonally inundated. It is not expected that fire is currently having a significant impact on the fauna assemblage, but changes to natural fire regimes have the potential to negatively affect the fauna assemblage. The bushfire c. 3 years prior to the current site inspection may have had a short-term impact on the fauna assemblage but it is expected that being part of a large, continuous patch of native vegetation would have buffered the project area against any long-term impacts.

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6 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

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.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in

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Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN, 2012), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The *Biodiversity Conservation Act 2016* uses a series of divisions within three Schedules to classify conservation status that largely reflect the IUCN categories (IUCN, 2012).

Conservation Significance (CS) 2: Species listed as Priority by DBCA but not listed under State or Commonwealth Acts.

In Western Australia, DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the *Biodiversity Conservation Act 2016* but for which DBCA feels there is cause for concern.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA, 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (Dell & Banyard, 2000).

Marine-listed species

Some conservation significant species may also be listed as 'Marine' under the EPBC Act. This listing protects these species in 'Commonwealth areas' which include "marine areas beyond the coastal waters of each State and the Northern Territory, and includes all of Australia's Exclusive Economic Zone (EEZ)" (DEH, 2000). The EEZ extends to 200 nautical miles (approximately 350 kilometres) from the coast (DEH, 2006). This may mean that the 'Marine' listing does not apply to the project/survey area (depending on its location). Therefore, when a species is otherwise protected (under the EPBC Act or BC Act) or priority-listed (by the DBCA) then the Marine listing is also noted but it does not have site-specific relevance. In cases where a species is solely Marine-listed (for a list see DEH, 2000) and a project/survey area is not within a Commonwealth area then it is treated like all other fauna.

Invertebrates

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or

confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey, 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes and conditions that apply to the existing environment and that affect and maintain fauna populations in an area. As such they are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a survey area may be affected and effectively determined by processes such as:

- fire regime.
- landscape patterns (such as extent of existing habitat, fragmentation and/or linkage).
- the presence of feral species.
- hydrology.

Appendix 2. Categories used in the assessment of conservation status.

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided at the end of this appendix.

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN, 2012), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The *Wildlife Conservation Act 1950* uses a series of seven Schedules to classify conservation status that largely reflect the IUCN categories (IUCN, 2012).

Conservation Significance (CS) 2: Species listed as Priority by DBCA but not listed under State or Commonwealth Acts.

In Western Australia, DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the *Wildlife Conservation Act 1950* but for which DBCA feels there is cause for concern.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA, 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (Dell & Banyard, 2000).

Conservation significance categories under legislation and the DBCA Priority system

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* and the Western Australian *Biodiversity Conservation Act 2016*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
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.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Biodiversity Conservation Act 2016, updated 2023*

Schedule 1	Specially protected fauna Division 1 – Species of special conservation interest (S1D1) Division 2 – Migratory species (S1D2) Division 3 – Species otherwise in need of special protection (S1D3)
Schedule 2	Threatened species Division 1 – Critically endangered species (S2D1) Division 2 – Endangered species (S2D2) Division 3 – Vulnerable species (S2D3)
Schedule 3	Extinct species (S3)

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands. Taxa in need of monitoring.
Priority 4. (P4)	Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 3. 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; also Pricklybark (Coastal Blackbutt) where it occurs in Banksia Woodlands) 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).

A. 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 12 km 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.

B. 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.

C. 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 & 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 4. Conservation significant fauna species expected in the project area.

Latin Name	Common Name	Status	Expected Occurrence
INVERTEBRATES			
Austrosaga spinifer	Spiny Katydid (Swan Coastal Plain)	CS2 (P2)	
Hemisaga vepreculae	Thorny Bush Katydid (Moora)	CS2 (P2)	
Hylaeus globuliferus	Woolybush Bee	CS2 (P3)	
Synemon gratiosa	Graceful Sunmoth	CS2 (P4)	
Bothriembryon perobesus		CS2 (P1)	
REPTILES			
Ctenotus gemmula (Swan Coastal Plain subpopulation)	Jewelled Ctenotus	CS2 (P3)	Resident
Neelaps calonotos	Black-striped Snake	CS2 (P3)	Resident
BIRDS			
Apus pacificus	Fork-tailed Swift	CS1 (MI, S1D2)	Irregular visitor
Falco peregrinus	Peregrine Falcon	CS1 (S1D3)	Irregular visitor
Zanda latirostris	Carnaby's Black-Cockatoo	CS1 (EN, S2D2)	Regular visitor
MAMMALS			
Notamacropus irma	Brush Wallaby	CS2 (P4)	Resident

Appendix 5. Vertebrate fauna species observed (sightings unless otherwise indicated) during field investigations.

Latin Name	Common Name	Status	Notes
REPTILES			
Tiliqua rugosa	Bobtail		Tracks
BIRDS			
Dromaius novaehollandiae	Emu		droppings
Phaps chalcoptera	Common Bronzewing		
Cacatua pastinator	Western Corella		
Eolophus roseicapilla	Galah		
Zanda latirostris	Carnaby's Black-Cockatoo	CS1 (EN, S2D2)	Foraging signs, feather
Barnardius zonarius	Australian Ringneck		
Malurus assimilis	Purple-backed Fairy-wren		
Anthochaera carunculata	Red Wattlebird		
Gavicalis virescens	Singing Honeyeater		
Lichmera indistincta	Brown Honeyeater		
Manorina flavigula	Yellow-throated Miner		
Phylidonyris niger	White-cheeked Honeyeater		
Acanthiza inornata	Western Thornbill		
Sericornis maculatus	Spotted Scrubwren		
Pachycephala rufiventris	Rufous Whistler		
Cracticus torquatus	Grey Butcherbird		
Rhipidura albiscapa	Grey Fantail		
Grallina cyanoleuca	Magpie-lark		
Corvus coronoides	Australian Raven		
MAMMALS			
Tachyglossus aculeatus	Short-beaked Echidna		Tracks and scats
Macropus fuliginosus	Western Grey Kangaroo		Tracks and scats
Vulpes vulpes	Red Fox	Int	Tracks
Felis catus	Feral Cat	Int	Tracks

Appendix 6. Locally extinct conservation significant fauna species.

Latin Name	Common Name	Status
Dasyurus geoffroii	Chuditch	CS1 (VU, S2D3)
Parantechinus apicalis	Dibbler	CS1 (EN, S2D2)
Isoodon fusciventer	Quenda	CS2 (P4)
Macrotis lagotis	Greater Bilby	CS1 (VU, S2D3)
Bettongia penicillata ogilbyi	Woylie	CS1 (EN, S2D1)
Notamacropus eugenii derbianus	Tammar Wallaby	CS2 (P4)
Lagostrophus fasciatus	Banded Hare-Wallaby	CS1 (VU, S2D3)
Pseudomys fieldi	Djoongari/Shark Bay Mouse	CS1 (VU, S2D3)
Macroderma gigas	Ghost Bat	CS1 (VU, S2D3)

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APPENDIX 2: ASPIRATIONAL REVEGETATION SPECIES LIST

Scientific Name	Common Name	Family	Carnaby's Cockatoo Foraging Species
Acacia barbinervis subsp. *borealis*		Fabaceae	
Acacia blakelyi		Fabaceae	
Acacia lasiocarpa var. lasiocarpa		Fabaceae	
Acacia microbotrya	Manna Wattle	Fabaceae	
Acacia rostellifera	Summer-scented Wattle	Fabaceae	
Acacia saligna subsp. *Wheatbelt*		Fabaceae	
Adenanthos drummondii		Proteaceae	
Amphibromus nervosus		Poaceae	
Andersonia heterophylla		Ericaceae	
Anthocercis littorea	Yellow Tailflower	Solanaceae	
Aotus procumbens		Fabaceae	
Aphelia cyperoides		Centrolepidaceae	
Apectospermum spinescens		Myrtaceae	
Azolla rubra		Salviniaceae	
Banksia attenuata	Slender Banksia	Proteaceae	Y
Banksia dallanneyi subsp. media	Couch Honeypot	Proteaceae	Y
Banksia grandis	Bull Banksia	Proteaceae	Y
Banksia menziesii	Firewood Banksia	Proteaceae	Y
Banksia prionotes	Acorn Banksia	Proteaceae	Y
Banksia sessilis var. *sessilis*	Parrot Bush	Proteaceae	Y
Banksia shuttleworthiana	Bearded Dryandra	Proteaceae	
Boronia scabra subsp. *scabra*		Rutaceae	
Borya sphaerocephala	Pincushions	Boryaceae	
Brachyloma preissii	Globe Heath	Ericaceae	
Brachyscome bellidioides		Asteraceae	
Brachyscome iberidifolia	Swan River Daisy	Asteraceae	
Bulbine semibarbata	Leek Lily	Asphodelaceae	

Scientific Name	Common Name	Family	Carnaby's Cockatoo Foraging Species
Burchardia congesta	Milkmaids	Colchicaceae	
Caladenia hirta subsp. *rosea*	Pink Candy Orchid	Orchidaceae	
Calothamnus quadrifidus subsp. quadrifidus	One-sided Bottlebrush	Myrtaceae	
Calothamnus sanguineus	Silky-leaved Blood Flower	Myrtaceae	
Calytrix angulata	Yellow Starflower	Myrtaceae	
Calytrix sapphirina		Myrtaceae	
Carex thecata		Cyperaceae	
Centrolepis aristata	Pointed Centrolepis	Centrolepidaceae	
Centrolepis drummondiana	Drummond's Centrolepis	Centrolepidaceae	
Centrolepis glabra	Smooth Centrolepis	Centrolepidaceae	
Chamaescilla corymbosa	Blue Squill	Hemerocallidaceae	
Chorizandra enodis	Black Bristlebrush	Cyperaceae	
Chorizema aciculare subsp. *laxum*		Fabaceae	
Comesperma calymega	Blue-spike Milkwort	Polygalaceae	
Conospermum stoechadis subsp. *stoechadis*	Common Smokebush	Proteaceae	
Conostephium minus	Pink-tipped Pearl Flower	Ericaceae	
Conostylis juncea		Haemodoraceae	
Conostylis latens		Haemodoraceae	
Crassula decumbens var. *decumbens*		Crassulaceae	
Crassula peduncularis	Purple Stonecrop	Crassulaceae	
Cryptandra pungens		Rhamnaceae	
Cyanothamnus ramosus subsp. *anethifolius*		Rutaceae	
Cycnogeton lineare		Juncaginaceae	
Dampiera linearis	Common Dampiera	Goodeniaceae	
Darwinia neildiana	Fringed Bell	Myrtaceae	
Darwinia pinifolia		Myrtaceae	
Daviesia divaricata subsp. *divaricata*	Marno	Fabaceae	

Scientific Name	Common Name	Family	Carnaby's Cockatoo Foraging Species
Diplolaena obovata		Rutaceae	
Diuris laxiflora	Bee Orchid	Orchidaceae	
Diuris septentrionalis	Northern Bee Orchid	Orchidaceae	
Drosera glanduligera	Pimpernel Sundew	Droseraceae	
Drosera menziesii	Pink Rainbow	Droseraceae	
Drosera ramellosa	Branched Sundew	Droseraceae	
Drosera stolonifera	Leafy Sundew	Droseraceae	
Elatine gratioloides	Waterwort	Elatinaceae	
Eleocharis acuta	Common Spikerush	Cyperaceae	
Elythranthera brunonis	Purple Enamel Orchid	Orchidaceae	
Eremaea fimbriata		Myrtaceae	
Eucalyptus gomphocephala	Tuart	Myrtaceae	Y
Eucalyptus incrassata	Ridge-fruited Mallee	Myrtaceae	
Eucalyptus rudis	Flooded Gum	Myrtaceae	Y
Eucalyptus rudis subsp. *rudis*	Flooded Gum	Myrtaceae	Y
Eucalyptus todtiana	Coastal Blackbutt	Myrtaceae	Y
Ficinia marginata	Coarse Club Rush	Cyperaceae	
Geranium solanderi	Native Geranium	Geraniaceae	
Glossostigma diandrum		Phrymaceae	
Gnephosis drummondii		Asteraceae	
Gompholobium shuttleworthii		Fabaceae	
Gompholobium tomentosum	Hairy Yellow Pea	Fabaceae	
Gonocarpus cordiger		Haloragaceae	
Goodenia micrantha		Goodeniaceae	
Goodenia reinwardtii	Common Verreauxia	Goodeniaceae	
Guichenotia sarotes		Malvaceae	
Haemodorum spicatum		Haemodoraceae	

Scientific Name	Common Name	Family	Carnaby's Cockatoo Foraging Species
Hakea anadenia		Proteaceae	
Hakea costata	Ribbed Hakea	Proteaceae	
Hakea incrassata	Marble Hakea	Proteaceae	Y
Hardenbergia comptoniana	Native Wisteria	Fabaceae	
Hibbertia crassifolia		Dilleniaceae	
Hibbertia sericosepala		Dilleniaceae	
Hibbertia subvaginata		Dilleniaceae	
Hypocalymma xanthopetalum	Yellow Myrtle	Myrtaceae	
Hypolaena exsulca		Restionaceae	
Isolepis cernua var. *setiformis*	Nodding Club Rush	Cyperaceae	
Isolepis congrua		Cyperaceae	
Isolepis oldfieldiana		Cyperaceae	
Isolepis producta		Cyperaceae	
Isotoma pusilla	Small Isotome	Campanulaceae	
Jacksonia restioides		Fabaceae	
Kunzea micrantha		Myrtaceae	
Lachnagrostis filiformis		Poaceae	
Lachnagrostis plebeia		Poaceae	
Lagenophora huegelii		Asteraceae	
Lagenophora platysperma		Asteraceae	
Lambertia multiflora var. *multiflora*	Many-flowered Honeysuckle	Proteaceae	Y
Lechenaultia floribunda	Free-flowering Lechenaultia	Goodeniaceae	
Lepidosperma apricola		Cyperaceae	
Leptocarpus canus	Hoary Twine-rush	Restionaceae	
Leptoceras menziesii	Rabbit Orchid	Orchidaceae	
Leptomeria empetriformis		Santalaceae	
Leucopogon polymorphus		Ericaceae	

Scientific Name	Common Name	Family	Carnaby's Cockatoo Foraging Species
Leucopogon sprengelioides		Ericaceae	
Liparophyllum capitatum		Menyanthaceae	
Lyginia barbata		Anarthriaceae	
Lysinema pentapetalum	Curry Flower	Ericaceae	
Marsilea drummondii	Common Nardoo	Marsileaceae	
Melaleuca clavifolia		Myrtaceae	
Melaleuca preissiana	Modong	Myrtaceae	
Melaleuca teretifolia	Banbar	Myrtaceae	
Melaleuca trichophylla		Myrtaceae	
Microtis media	Tall Mignonette Orchid	Orchidaceae	
Microtis orbicularis	Dark Mignonette Orchid	Orchidaceae	
Millotia myosotidifolia		Asteraceae	
Mirbelia spinosa		Fabaceae	
Monotaxis grandiflora var. *grandiflora*	Diamond of the Desert	Euphorbiaceae	
Myriocephalus appendiculatus	White-tip Myriocephalus	Asteraceae	
Myriocephalus occidentalis		Asteraceae	
Myriophyllum limnophilum		Haloragaceae	
Ophioglossum lusitanicum	Adder's Tongue	Ophioglossaceae	
Ottelia ovalifolia	Swamp Lily	Hydrocharitaceae	
Paracaleana nigrita	Flying Duck Orchid	Orchidaceae	
Pauridia glabella		Hypoxidaceae	
Petrophile axillaris		Proteaceae	
Petrophile brevifolia		Proteaceae	
Philydrella drummondii		Philydraceae	
Phlebocarya ciliata		Haemodoraceae	
Phylloglossum drummondii	Pygmy Clubmoss	Lycopodiaceae	
Pittosporum ligustrifolium		Pittosporaceae	

Scientific Name	Common Name	Family	Carnaby's Cockatoo Foraging Species
Podotheca angustifolia	Sticky Longheads	Asteraceae	
Podotheca chrysantha	Yellow Podotheca	Asteraceae	
Podotheca gnaphalioides	Golden Long-heads	Asteraceae	
Prasophyllum gracile	Little Laughing Leek Orchid	Orchidaceae	
Pterochaeta paniculata	Woolly Waitzia	Asteraceae	
Quinetia urvillei		Asteraceae	
Ranunculus pumilio var. *pumilio*		Ranunculaceae	
Ranunculus sessiliflorus	Smallflower Buttercup	Ranunculaceae	
Rytidosperma occidentale		Poaceae	
Schoenus odontocarpus		Cyperaceae	
Schoenus plumosus		Cyperaceae	
Scholtzia involucrata	Spiked Scholtzia	Myrtaceae	
Scholtzia parviflora		Myrtaceae	
Senecio pinnatifolius var. *latilobus*	Variable Groundsel	Asteraceae	
Siloxerus multiflorus		Asteraceae	
Solanum symonii		Solanaceae	
Sphaerolobium medium		Fabaceae	
Stenanthemum notiale subsp. *chamelum*		Rhamnaceae	
Stirlingia latifolia	Blueboy	Proteaceae	
Stylidium androsaceum	Book Triggerplant	Stylidiaceae	
Stylidium calcaratum	Book Triggerplant	Stylidiaceae	
Stylidium crossocephalum	Posy Triggerplant	Stylidiaceae	
Stylidium despectum	Dwarf Triggerplant	Stylidiaceae	
Stylidium diuroides	Donkey Triggerplant	Stylidiaceae	
Stylidium ecorne	Foot Triggerplant	Stylidiaceae	
Stylidium inundatum	Hundreds and Thousands	Stylidiaceae	
Stylidium neurophyllum	Coastal Plain Triggerplant	Stylidiaceae	

Scientific Name	Common Name	Family	Carnaby's Cockatoo Foraging Species
Stylidium perpusillum	Tiny Triggerplant	Stylidiaceae	
Stylidium rigidulum	Flagon Triggerplant	Stylidiaceae	
Stylidium schoenoides	Cow Kicks	Stylidiaceae	
Stypandra glauca	Blind Grass	Hemerocallidaceae	
Styphelia ciliosa		Ericaceae	
Thelymitra antennifera	Lemon-scented Sun Orchid	Orchidaceae	
Thelymitra campanulata	Shirt Orchid	Orchidaceae	
Thysanotus multiflorus	Many-flowered Fringe Lily	Asparagaceae	
Trachymene pilosa	Native Parsnip	Araliaceae	
Tribonanthes australis	Southern Tiurndin	Haemodoraceae	
Tribonanthes longipetala	Branching Tiurndin	Haemodoraceae	
Tribonanthes porphyrea	Purple-budded Tiurndin	Haemodoraceae	
Tribonanthes uniflora	Woolly Tiurndin	Haemodoraceae	
Tribonanthes variabilis	Hairy-stigma Tiurndin	Haemodoraceae	
Tricostularia neesii	Nees' Tricostularia	Cyperaceae	
Trithuria austinensis		Hydatellaceae	
Trithuria submersa		Hydatellaceae	
Utricularia multifida	Pink Petticoats	Lentibulariaceae	
Utricularia tenella		Lentibulariaceae	
Utricularia violacea	Violet Bladderwort	Lentibulariaceae	
Waitzia podolepis		Asteraceae	
Waitzia suaveolens	Fragrant Waitzia	Asteraceae	
Waitzia suaveolens var. *suaveolens*		Asteraceae	
Wurmbea dioica subsp. *alba*		Colchicaceae	
Wurmbea monantha		Colchicaceae	

APPENDIX 3: MONITORING TEMPLATES

Revegetation Site Assessment

Patch Number: _____ GPS Location: _____ Date: _____

Assessor(s): _____

Key Site Characteristics

Characteristic	Description	Outcomes
Area	1 ha = 10 000 m^2	
Threatened or Priority flora	Specie(s)	
Threatened or Priority fauna	Specie(s)	
Threatened or Priority Ecological Communities	Type, area, location	
Vegetation community	e.g. Banksia Woodland	
Other		

Presence of Threatening Processes:

Threatening Process	Present (Y/N)	Description	Consider During Revegetation Planning (Y/N)
Weeds			
Feral/pest animals			
Plant disease or pathogens			
Fire			
Vegetation removal or death			
Evidence of unauthorised access			

Treatment(s) Required

Restoration Treatment	Description	Required (Y/N/NA)	Length/Area/ Amount
Natural regeneration potential	Yes/No		
Direct seeding	Species, area locations		
Fertiliser treatment	Tablet, granular		
Fire restoration	Area, species, other		
Fence installation/repair	Length, type, locations		
Removal of feral fauna population(s)	e.g. bees, rabbits, foxes		
Removal of rubbish, litter, soil	Amount, location		
Replanting with tubestock	Area, species		
Restoration of clear, bare areas	Area, species		
Seed collection	Yes/no		
Soil breaker or ripping (compaction)	Area, depth, locations		
Soil wetter (hydrophobic soils)	Amount required		
Vegetation health assessment (e.g. *Phytophthora* dieback assessment)	Obvious signs of decline, fungi or other symptoms present		
Weed control	Grasses, herbs, bulb, trees/shrubs, vines, area, location		

Monitoring Information

Date	
Personnel	
Weather conditions	
General notes (e.g. observations of Carnaby's Cockatoo)	

Photo Monitoring

Photo Point	Location Description	GPS co-ordinates	Photo ID (this monitoring period)
1			
2			
3			
4			
5			

Revegetation Area

Transect No.	Location Description	GPS (Start and end of transect)	Photo ID (This monitoring period)
1			
2			
3			
4			
5			

	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Quadrat 5
Native Vegetation Condition (Scale Attributed to Keighery)					
Native Percentage Cover					
Weed Percentage Cover					
Area of Bare Ground					
Presence of Leaf Litter					

Weeds

Species	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Quadrat 5

Native Flora Species

Species	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Quadrat 5