Alcoa of Australia Limited

ENVIRONMENTAL OFFSET PROJECT (001) PLAN

Black Cockatoo Environmental Offset Project Plan (EOP001)

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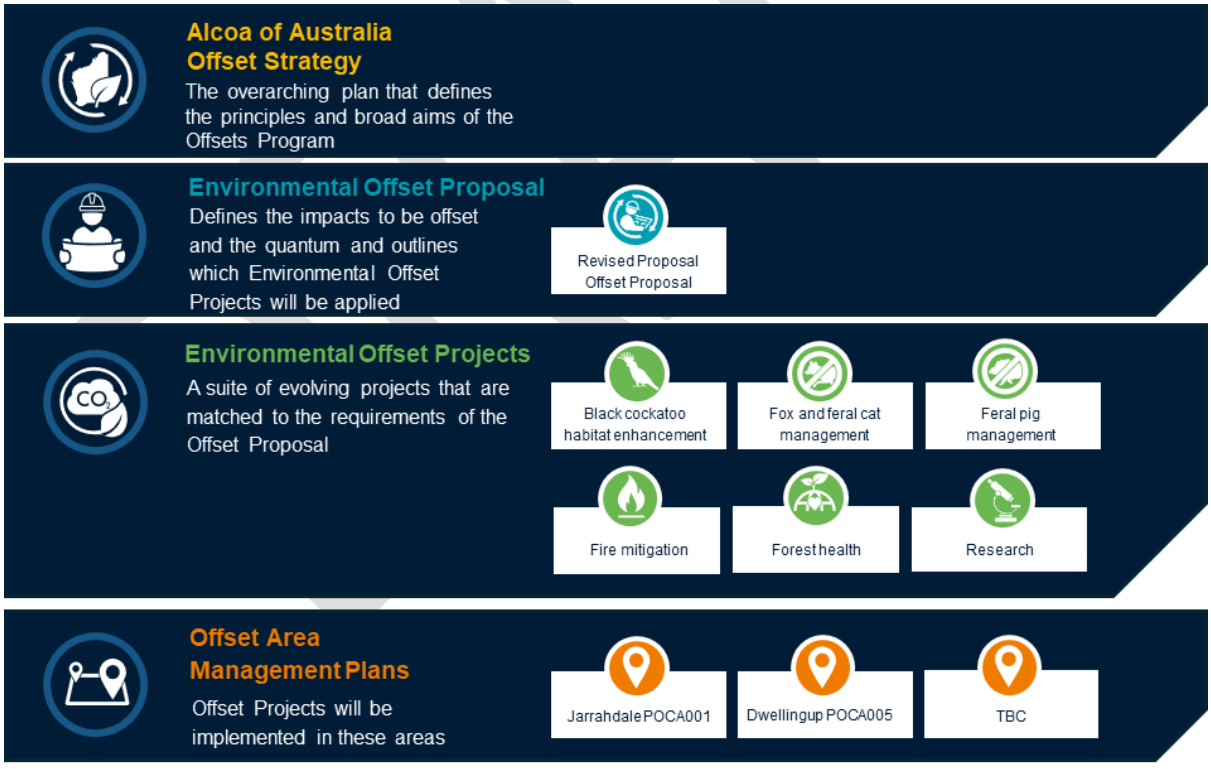
Executive Summary

Alcoa of Australia Limited (Alcoa) has been operating as an integrated bauxite miner and alumina producer in the south-west of Western Australia since 1963. In Western Australia Alcoa operate two bauxite mines (Huntly and Willowdale) located approximately 100 kilometres (km) south of Perth, three alumina refineries (Kwinana[1], Pinjarra, Wagerup) and two ports (Kwinana and Bunbury).

Alcoa's bauxite mines are in the Northern Jarrah Forest (NJF) Interim Biogeographic Regionalisation for Australia (IBRA) sub-region (JF01). The vegetation provides habitat for three threatened species of south-west black cockatoos: Carnaby's cockatoo (*Zanda latirostris*), Baudin's cockatoo (*Zanda baudinii*) and forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) and a range of native ground-dwelling and arboreal species.

This Environmental Offset Project Plan (the Plan) has been developed to support the environmental assessment of Alcoa's Pinjarra Alumina Refinery Revised Proposal (the Proposal), referred to the WA Government under Part IV of the *Environmental Protection Act 1986* (EP Act) and the Huntly Bauxite Mine Transition referred to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Alcoa's environmental offset document framework is provided in ES Figure 1-1 for context.



ES Figure 1-1: Environmental Offset Document Framework

The scope of this Plan is to describe the proposed conservation actions, survey methodology and monitoring framework to be undertaken as part of the black cockatoo environmental offset project (the Project). This Project proposes to maintain and enhance black cockatoo habitat within the NJF, through reducing habitat loss, surveying, managing

[1] Currently in curtailment.

and monitoring black cockatoo known, suitable and potential nesting trees and installing and maintaining drinking water sources. The Project will contribute to the outcomes in the Revised Proposal Offset Proposal (Alcoa 2025b).

Alcoa will conduct habitat surveys in accordance with appropriate guidance and methodologies to establish a baseline for the proposed offset conservation area (POCA). Alcoa has developed a set of indicative measurable indicators (parameters) specific to black cockatoos that can be used to measure the conservation actions against the Project targets. Performance indicators consider vegetation, habitat structure and condition, presence and condition of key habitat features (drinking water locations, roost and breeding sites) and the presence of black cockatoos within the POCA.

The conservation actions are proposed to be undertaken over a rolling 20-year timeframe, in a series of tranches that align with the mining process of progressive clearing followed by progressive post-mining rehabilitation. Alcoa will be responsible for the delivery of the Plan; however, delivery of conservation actions may be undertaken by various delivery providers. Monitoring will be undertaken annually to assess site specific elements. Monitoring against the performance indicators will be undertaken through black cockatoo habitat assessments every five years. Implementation and progress will be reviewed and evaluated annually by Alcoa's team of ecologists and offsets specialists. Alcoa are preparing an indicative cost schedule for the implementation of the Plan.

Alcoa proposes to contribute funding towards conservation and threat abatement actions over at least the next 20 years. The Plan has been prepared based on advice from forest and fauna ecologists and black cockatoo subject matter experts (SMEs), information in recovery and threat abatement plans and relevant scientific literature, and consideration of offset policy and guidance material and regional plans.

The team of Alcoa environmental scientists have extensive knowledge of the NJF. Since 1975, Alcoa has supported the publication of more than 260 refereed journal papers and book chapters, 80 technical studies, and about 60 higher-degree research theses. Alcoa has been monitoring fauna in the NJF since at least 1992.

The Project has been developed to align with actions in the black cockatoo recovery plans and threat abatement plans and uses the latest available science and research outcomes relevant to black cockatoos in the NJF. Management and monitoring will be conducted over the long-term (20 years) using an adaptive management framework to respond to new scientific findings and threats such as climate change. Consistent and regular monitoring and adaptive management approach allows emerging risks or issues to be identified and mitigated against in advance.

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Acronyms

Abbreviation	Definition
BC Act	*Biodiversity Conservation Act 2016* (WA)
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EP Act	*Environmental Protection Act 1986* (WA)
EPA (WA)	Environmental Protection Authority
ERD	Environmental Review Document
GKB	Gnaala Karla Booja Aboriginal Corporation
IBRA	Interim Biogeographic Regionalisation for Australia.
IUCN	International Union for Conservation of Nature
ha	hectares
km	kilometres
m	metres
ML1SA	Mineral Lease 1SA
MNES	Matters of National Environmental Significance
NJF	Northern Jarrah Forest
POCA	Proposed offset conservation area
PMST	Protected Matters Search Tool
SCP	Swan Coastal Plain
SME	Subject Matter Expert
WA	Western Australia

Definitions

Term	Definition
Black cockatoo(s)	Carnaby's cockatoo (*Zanda latirostris*[2]), Baudin's cockatoo (*Zanda baudinii*[2]) and forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*).
Black cockatoo known nesting tree	Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).
Black cockatoo potential nesting trees	Trees that have a suitable DBH to develop a nest hollow, but do not currently have hollows. Trees suitable to develop a nest hollow in the future are 300 mm DBH for wandoo, or 500 mm DBH for other tree species (e.g. jarrah or marri).
Black cockatoo suitable nest hollow	Any hollow with dimensions suitable for use for nesting by black cockatoos or assessed by a suitably experienced field ecologist based on hollow size, shape, and entry angle, irrespective of signs of use for breeding.
Black cockatoo suitable nesting tree	Trees with suitable nesting hollows present, although no evidence of use.
Foraging habitat	As in DAWE (2022), plant species known to support foraging within the range of each of the species.
Night roosting habitat	Night roosting habitat: Habitat that contains one, or a group of, known or potential roosting trees: - Known roosting tree: A tree (generally the tallest), native or introduced known to be used for night roosting or which demonstrates evidence of roosting. Usually close to an important water source and within an area of high-quality foraging habitat. During the breeding season, male black cockatoos roost in the vicinity of the nesting trees, therefore a breeding area may also be considered to be night roosting habitat. Roosting habitat is not always evident and can be discovered during surveys. - Potential roosting tree: A tall tree of any species within close proximity to water.
Northern Jarrah Forest	Northern Jarrah Forest Interim Biogeographic Regionalisation for Australia[3] (IBRA) sub-region (JF01)

[2] The scientific name of the Carnaby's cockatoo has changed from *Calyptorhynchus latirostris* to *Zanda latirostris* and the Baudin's cockatoo from *Calyptorhynchus baudinii* to *Zanda baudinii*.
[3] The Interim Biogeographic Regionalisation for Australia classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information.

Term	Definition
Offset period	20 years
On-ground management	This includes revegetation (re-establishment of native vegetation in degraded areas) and rehabilitation (repair of ecosystem processes and management of weeds, disease or feral animals). The objective of on-ground management actions is tangible improvement to environmental values in the offset area.
Post-mining rehabilitation	In relation to an area that has been disturbed, includes: (a) stabilisation of the area; and (b) restoration of the landforms of the area to a state that is as close as practicable to their original undisturbed state; and (c) the return of the native vegetation of the area to a state that is as close as practicable to its original undisturbed state.
Subject Matter Expert (SME)	A person who has accumulated great knowledge in WA's threatened species and this level of knowledge is demonstrated by the person's degree, licensure, and/or through years of professional experience with the subject.
Suitably experienced field ecologist	A person who has relevant professional qualifications and at least three (3) years of work experience designing and implementing surveys for black cockatoos using relevant protocols, standards, methods and/or literature.
Environmental Offset Document Framework	
Environmental Offset Strategy	Alcoa's overarching approach to delivering environmental offsets. It demonstrates that Alcoa can offset the environmental impacts from its operations with a high degree of confidence in a positive outcome.
Environmental Offset Program	Alcoa's suite of offset activities and measures to be developed, managed and implemented to offset environmental impacts from its operations.
Environmental Offset Proposal	States the environmental outcomes to be achieved through conservation actions to offset environmental impacts.
Environmental Offset Project Plan	Provide a detailed description of the conservation actions, the indicators and monitoring program to be used to measure the performance of the conservation actions towards the project targets.

Term	Definition
Offset Area Management Plans	Provide a detailed description of the proposed offset conservation area; the area in which the environmental offset projects (conservation actions) will be implemented.
Conservation actions	As used in Alcoa's environmental offset documents, includes any activities, actions or offset measures that contribute to environmental outcomes or the ongoing viability or recovery of a species or ecosystem.

1. Introduction

Alcoa of Australia Limited (Alcoa) has been operating as an integrated bauxite miner and alumina producer in the south-west of Western Australia since 1963. In Western Australia Alcoa operate two bauxite mines (Huntly and Willowdale) located approximately 100 kilometre (km) south of Perth, three alumina refineries (Kwinana[4], Pinjarra, Wagerup) and two ports (Kwinana and Bunbury). A State Agreement, between Alcoa and the WA Government, permitted Alcoa to mine bauxite within Mineral Lease 1SA (ML1SA) (Figure 1-1).

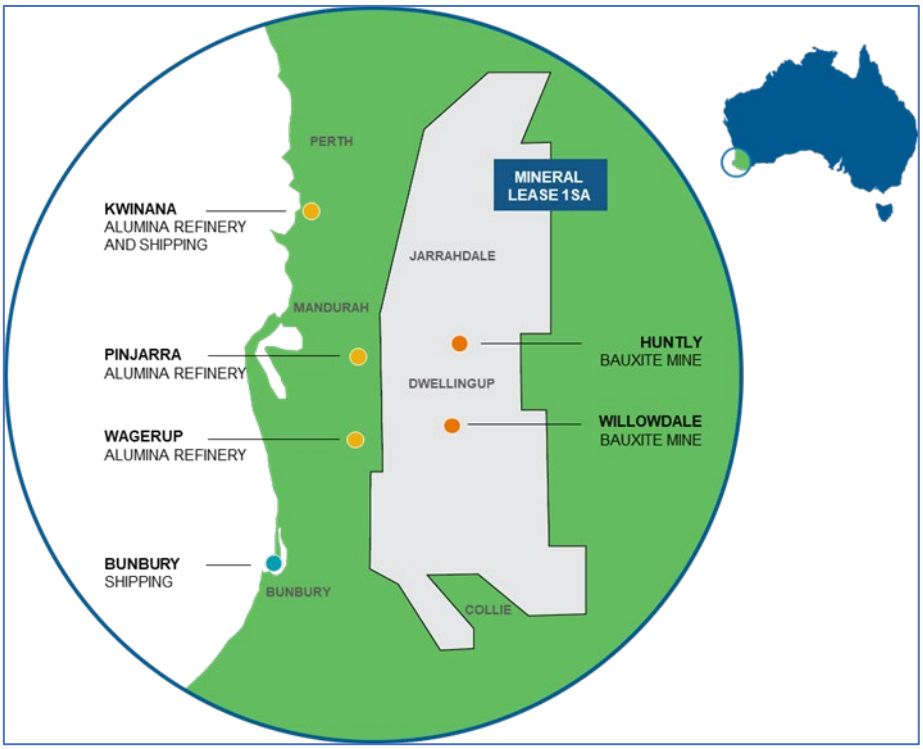

Figure 1-1: ML1SA and locations of Alcoa mining operations

Alcoa's bauxite mines are in the Northern Jarrah Forest (NJF) Interim Biogeographic Regionalisation for Australia (IBRA[5]) sub-region (JF01). The area is characterised as jarrah-marri forest with some bullich and blackbutt forest in the valleys grading to wandoo and marri woodlands in the east. This vegetation provides habitat for threatened and priority flora and fauna species, including the three species of south-west black cockatoos: Carnaby's cockatoo (*Zanda latirostris*), Baudin's cockatoo (*Zanda baudinii*) and forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*).

A summary of the Pinjarra Alumina Refinery Revised Proposal (the Proposal), referred to the WA Government under Part IV of the *Environmental Protection Act 1986* (EP Act) and the Huntly Bauxite Mine Transition referred to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is in Table 1-1.

[4] Currently in curtailment.
[5] The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australian's landscapes into 89 geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The bioregions are further refined to form 419 subregions.

The assessment of potential impacts from the Proposal are in the Environmental Review Document (ERD) (Alcoa, 2025c). The ERD describes how Alcoa applies the mitigation hierarchy, including avoiding and minimising impacts to black cockatoo known and suitable nesting trees, old growth and mature age forest and restricted range habitats including granite outcrops, swamps and stream zones. Where significant residual impacts to habitat for black cockatoos remains, Alcoa proposes to offset the impacts.

This Environmental Offset Project Plan (the Plan) has been developed to support the assessment of the Proposal. Areas in which this Environmental Offset Project is proposed to be implemented (referred to as proposed offset conservation areas (POCA)) are in Offset Area Management Plan(s).

Table 1-1: Summary of the Pinjarra Alumina Refinery Revised Proposal

Item	Details
Proponent	Alcoa of Australia Limited
Proposal	Pinjarra Alumina Refinery Revised Proposal
Proposal Description	Alcoa of Australia Limited is proposing to increase production at the Pinjarra Alumina Refinery by 5 per cent from 5.0 million tonnes per annum (Mtpa) to 5.25 Mtpa and transition the Huntly Bauxite mine to the proposed Myara North and Holyoake mine regions and re-enter the O'Neil mine region (the Proposal). The Proposal is in the Peel region of Western Australia (WA), approximately 100 km south-east of Perth. The Proposal is within a 23,900 hectare (ha) Mine Development Envelope and will require the clearing of up to 7,500 ha of native vegetation.
EPA Referral	Pinjarra Alumina Refinery Revised Proposal Referred February 2020 under Part IV of the *Environmental Protection Act 1986* (EP Act) Assessment number 2253 Assessed as a Public Environmental Review (10 weeks)
EPBC Referral	Huntly Bauxite Mine Transition Referred July 2022 under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) EPBC number 2022/09204 The Myara North and Holyoke DE is being assessed as an accredited assessment under the WA EP Act.

1.1 Purpose

The purpose of this Environmental Offset Project Plan (the Plan) is to demonstrate how the implementation of the Project will contribute towards the outcomes in the Offset Proposal.

1.2 Scope

This draft Plan is limited to a draft for consultation and has been prepared to support the assessment of the Proposal by the WA Environmental Protection Authority (EPA) and the Department of Climate Change, Energy, the Environment and Water (DCCEEW). This Plan has been prepared in alignment with the WA Government *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA 2024), the Commonwealth's *Environmental Offset Policy* (DSEWPC, 2012) and the Commonwealth *Environmental Management Plan Guidelines* (DCCEEW, 2024). This draft will be finalised following consultation with the EPA, DCCEEW, Department of Biodiversity, Conservation and Attractions (DBCA), stakeholders and the public.

The scope of this Plan is to describe the proposed conservation actions, survey methodology and monitoring framework to be undertaken as part of the black cockatoo environmental offset project (the Project).

This Plan should be read in conjunction with the:

- Environmental Review Document (ERD) for the Proposal (Alcoa 2025a)
- Environmental Offset Strategy (Alcoa 2024)
- Environmental Offset Proposal for the Proposal (Alcoa 2025b)
- Related Environmental Offset Project Plans included in the Environmental Offset Proposal.
- Related Environmental Offset Area Management Plans. Environmental Offset Area Management Plans describe the POCA and include any additional or specific actions relevant to the area.

1.3 Proposed objectives

The proposed objectives of this Plan are to:

- Identify, manage and protect important black cockatoo habitat within the NJF.
- Develop a network of permanent drinking water points for black cockatoos throughout State Forest.
- Contribute to ongoing research, knowledge and understanding of black cockatoo movement and use of habitats in the NJF.
- Provide information on the appropriateness, suitability and effectiveness of black cockatoo conservation measures.

- Provide beneficial conservation outcomes for other species that may use the habitat including but not limited to chuditch, woylie, quokka, numbats, western ring tailed possum, quenda, brush-tailed phascogale, western brush wallaby and rakali.

1.4 Project targets

This Project aims to enhance foraging, roosting and breeding habitat for black cockatoos through reducing existing threats and implementing additional recovery and conservation actions.

The Project will result in direct (for example, improving availability of drinking water in the drying climate) actions that improve the functionality of habitat areas, increase the likelihood of persistence in, and maintain the area of occupancy for, black cockatoos within the NJF.

The Project is expected to:

- Demonstrate an improvement in black cockatoo habitat or a tangible increase in usage of the habitat by black cockatoos from baseline within 20 years.

Indirect benefits from the implementation of this Project will provide valuable information on black cockatoo habitat management in managed areas in the NJF.

Alcoa has aligned the Project targets with the objectives in the black cockatoo recovery plans and the WA EPA Terrestrial Fauna environmental factor.

- The objective of the Terrestrial Fauna factor is: “To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.” (EPA 2016)
- The Carnaby’s Cockatoo Recovery Plan (DPaW 2013) objective is “To stop further decline in the distribution and abundance of Carnaby’s cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases.”
- The Forest Black Cockatoo Recovery Plan (Chapman 2008) objective is “To stop further decline in the breeding populations of Baudin’s Cockatoo and the Forest Red-tailed Black Cockatoo and to ensure their persistence throughout their range in the south-west of Western Australia.”

1.5 Performance criteria

This Project will be deemed successful if:

- There is a tangible increase in the area of suitable (functional) habitat available for or occupied by black cockatoos in the POCA within 20 years from the commencement of the Project.

This Project will exceed expectations if:

- There is a tangible increase in the breeding success for black cockatoos in the POCA within 20 years from the commencement of the Project.

2. Background and context

There are three species of black cockatoo endemic to the south-west of Western Australia: the Carnaby's cockatoo, Baudin's cockatoo and forest red-tailed black cockatoo. These species are collectively referred to in this document as black cockatoos.

All three species are listed as Threatened under the Western Australian *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth EPBC Act. The International Union for Conservation of Nature (IUCN) red list reports the current population trend for both Carnaby's and Baudin's cockatoo is decreasing (BirdLife International, 2022a, 2022b), with the forest red-tailed black cockatoo population also considered to be in a declining trend (DCCEEW 2024b).

Black cockatoos are large (approx. 50-60 cm), long-lived (in the wild they can live up to 60 years[6]), social birds who live in pairs or family groups or large flocks. Black cockatoos are highly mobile and can travel over 20 km in a day (Ryken 2019; Yeap 2022).

The NJF provides foraging, roosting and breeding habitat for all three species of black cockatoo.

2.1 Conservation status

The forest red-tailed black cockatoo is listed as Threatened (Vulnerable) under the EPBC Act and BC Act. The Carnaby's and Baudin's cockatoo are listed as Threatened (Endangered) under the EPBC Act and BC Act.

All three species of black cockatoo are Commonwealth Matters of National Environmental Significance (MNES).

2.2 Regional context

Black cockatoos range across the south-west of WA, including the Swan Coastal Plain, the Jarrah Forest, South Coast and Wheatbelt regions. The modelled distribution for each species, taken from the Department of Agriculture, Water and the Environment (DAWE) (2022) is in Figure 2-1, Figure 2-2 and Figure 2-3. DAWE is a former Commonwealth department; the environmental component is now DCCEEW.

DAWE (2022) and the Commonwealth Department of the Environment (2024b, c, d) indicate that at a regional level:

- Black cockatoos can be found in the NJF year-round but use the area at different times of the year and for different purposes.
- The forest red-tailed black cockatoo most commonly occurs in the jarrah forest region of the northern Darling Range; however, it can also be found on the Swan Coastal Plain at any time of the year in search of food.

[6] Forest red-tailed black cockatoos have an estimated life expectancy of 34.4 years (DCCEEW 2024b) while Carnaby's cockatoo are said to be capable of surviving for up to 60 years (DCCEEW 2024c) and Baudin's cockatoos may live for 25–50 years in the wild (DCCEEW 2024d).

- Carnaby's cockatoos breed in the inland areas of the Wheatbelt from July to December before migrating and residing in the coastal areas between January and July. The NJF hosts permanent and transient populations of Carnaby's cockatoo.
- Baudin's cockatoos generally nest in the far south-west of WA within jarrah, marri and karri forests from October to January, before foraging more widely during the non-breeding period across the central and northern parts of the Darling Plateau, and occasionally into the southern Swan Coastal Plain and south coast.

Notwithstanding the above, there are still significant knowledge gaps on how the black cockatoos move through and use the NJF at a local level. Ryken (2019) and Yeap (2022) found that tracking the highly mobile cockatoos (flocks can travel over 20 km across the landscape within a day) through tall, dense forest restricted flock follows and observations to forest edges or where the forest was accessible via access vehicle or walking tracks.

2.3 Population estimates

Williams (2016) found obtaining reliable population estimates of a highly mobile species is challenging. Population estimates vary depending on the source and date.

Pryor et al (2023), in the 2021 and 2022 Great Cocky Count reports, quotes current population estimates as: 34,000 for Carnaby's cockatoo (citing Saunders et al. 2021), 3,250 for Baudin's cockatoo (citing Johnstone et al. 2021a) and 16,800 for forest red-tailed black cockatoo (citing Johnstone et al. 2021b).

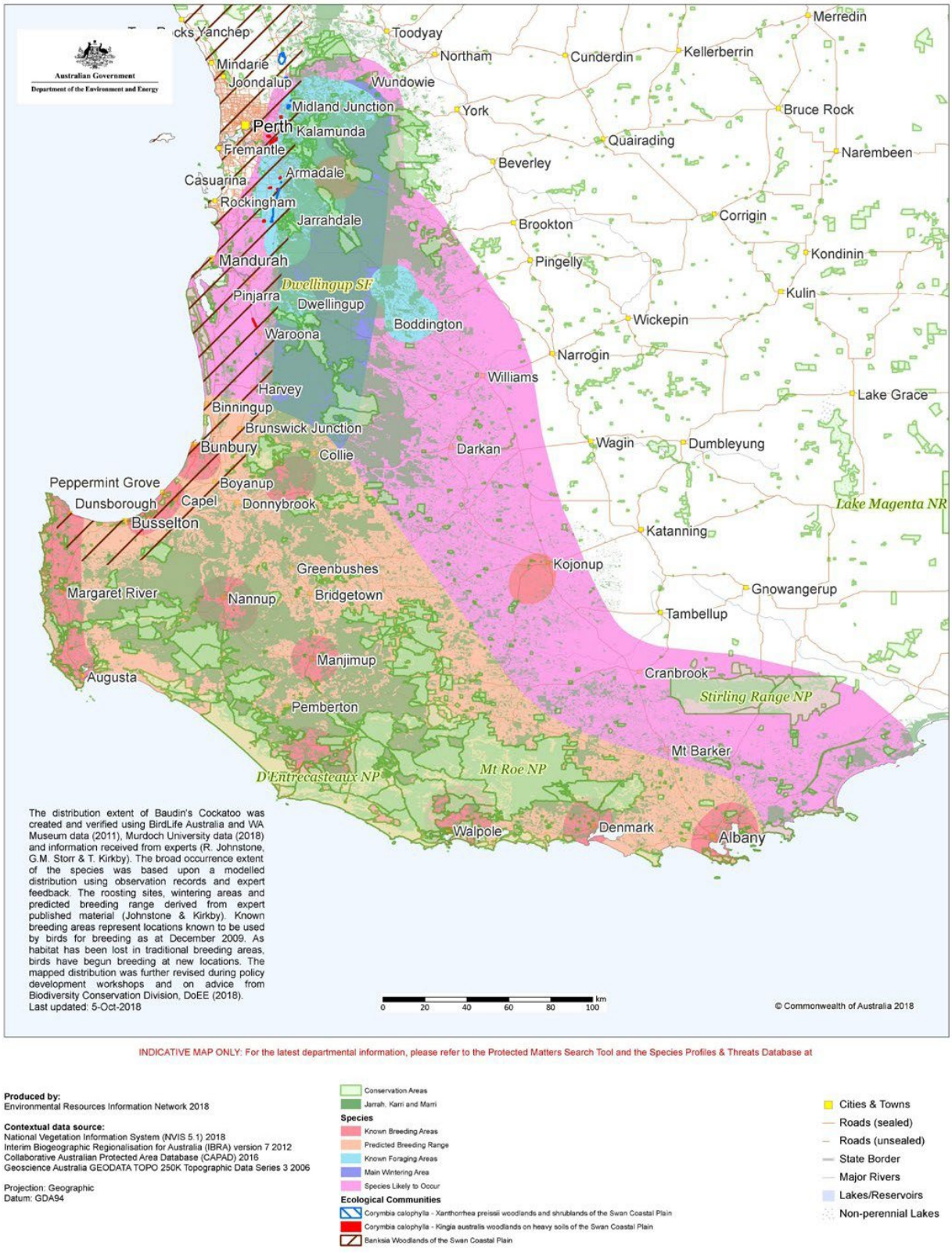

Figure 2-1: Baudin's cockatoo modelled distribution (DAWE 2022)

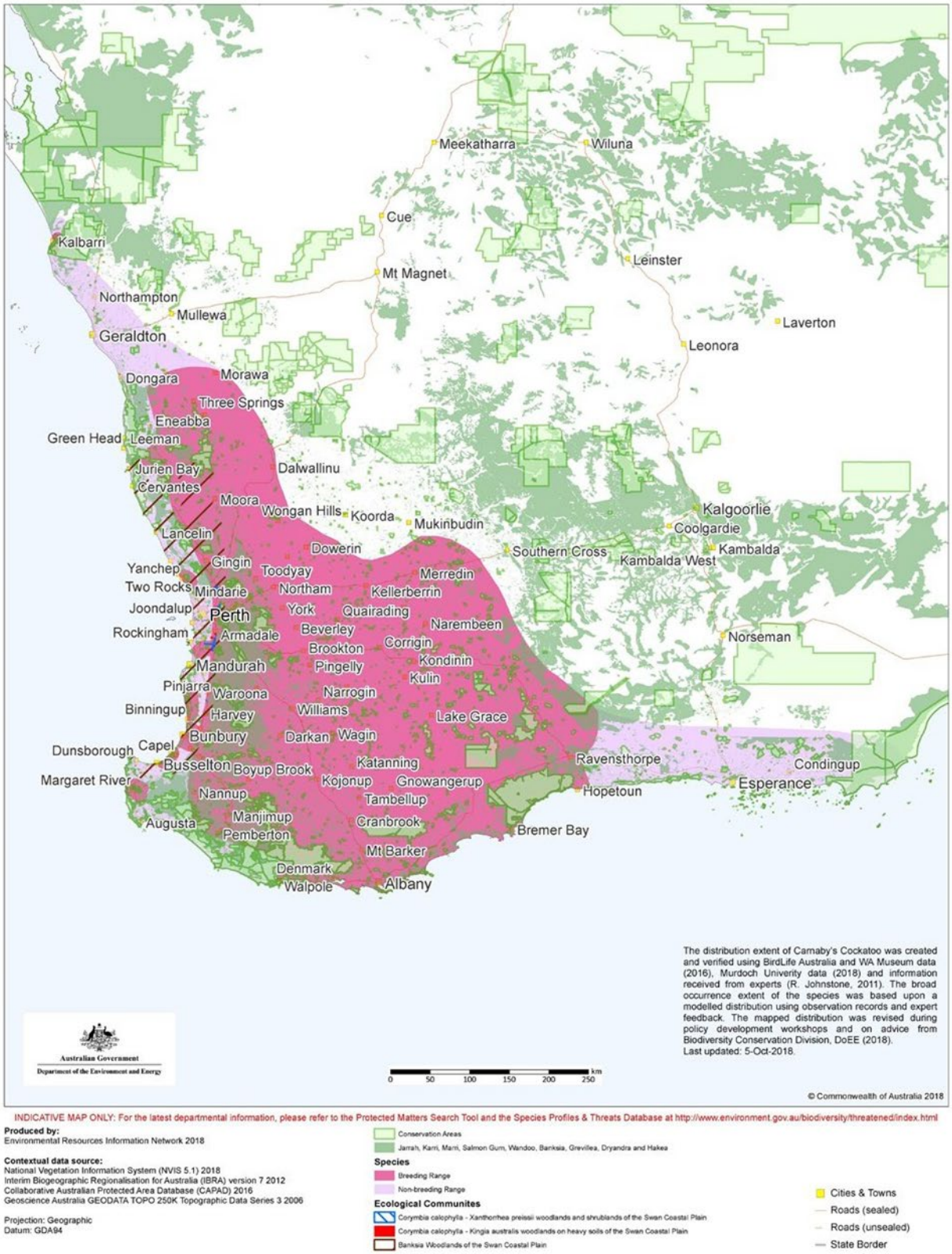

Figure 2-2: Carnaby's cockatoo modelled distribution (DAWE 2022)

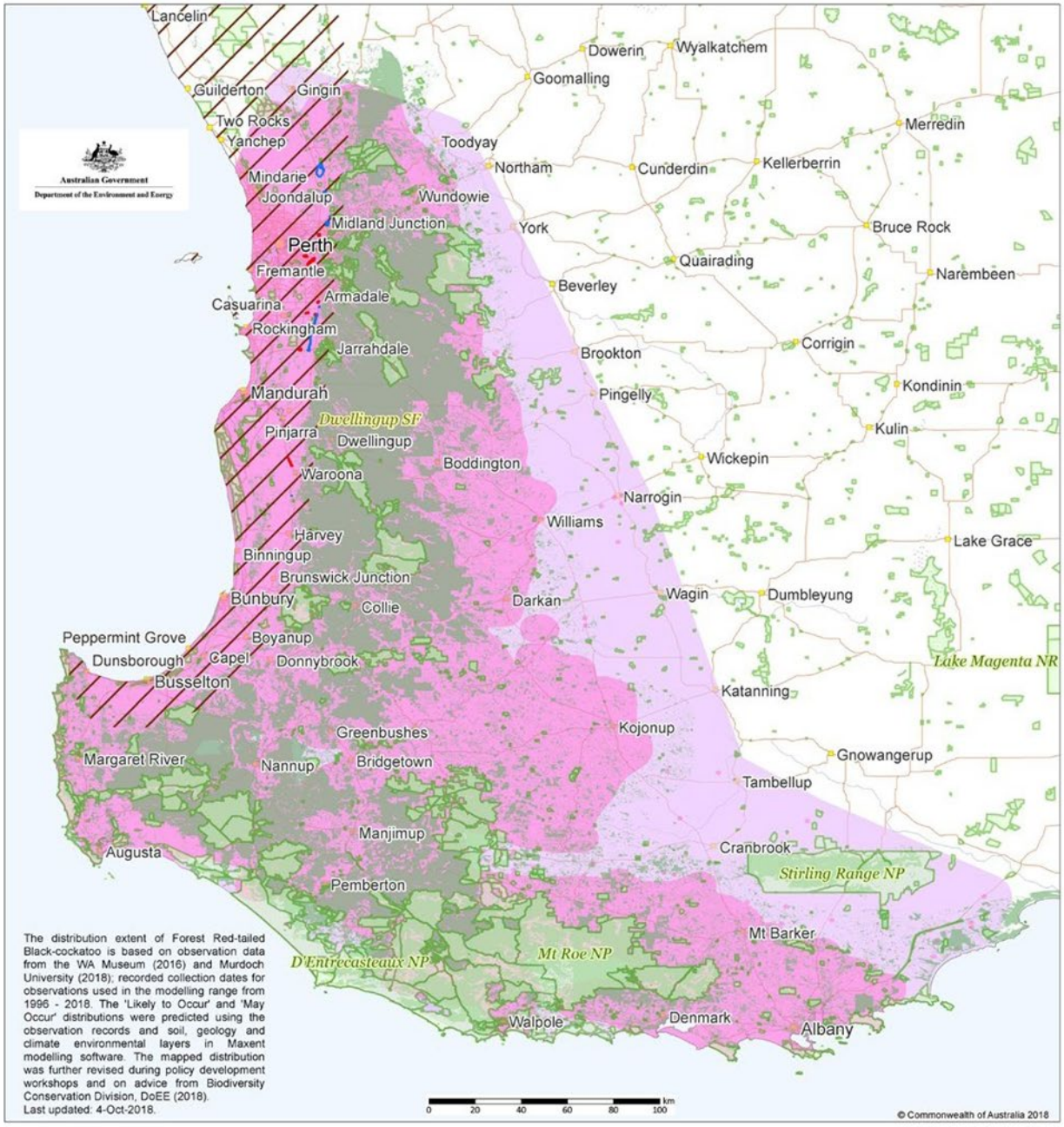

Figure 2-3: Forest red-tailed black cockatoo modelled distribution (DAWE 2022)

2.4 Habitat requirements

DAWE (2022) contains definitions of black cockatoo habitat as:

- Foraging habitat - plant species known to support foraging within the range of each of the species.
- Night roosting habitat - one, or a group of, known or potential roosting trees.
- Breeding habitat - known, suitable or potential nesting trees.

Each species of black cockatoo has differing habitat requirements as outlined in Table 2-1.

Table 2-1: Black cockatoo preferred habitat[7]

Black cockatoo	Preferred foraging habitat	Preferred roosting habitat	Preferred breeding habitat
Forest red-tailed black cockatoos	Primarily forage on seeds of jarrah and marri in woodlands and forest, and edges of karri forests, including wandoo and blackbutt.	Generally, roost in any tall tree but particularly tall jarrah, marri, blackbutt, tuart and introduced eucalypt trees or large trees on the edges of forests.	Generally, breed in woodland or forest but may also breed in partially cleared woodland or forest, including isolated trees where nest hollows have developed in suitable trees species, particularly marri, karri, wandoo, bullich, blackbutt, tuart and jarrah.
Carnaby's cockatoo	Forage on native shrubland, kwongan heathland and woodland seeds, flowers and nectar of native proteaceous plant species as well as Callistemon spp. and marri.	Roost in any tall trees, but particularly flat-topped yate, salmon gum, wandoo, marri, karri, blackbutt, tuart, introduced eucalypts and introduced pines, generally in or near riparian environments or natural and artificial permanent water sources.	Generally, breed in woodland or forest, but also in partially cleared woodland or forest, including isolated trees where nest hollows have developed in suitable trees species, particularly salmon gum, wandoo, tuart, jarrah, flooded gum, york gum, powderbark, karri and marri.
Baudin's cockatoo	Forage primarily on seeds of marri, rarely jarrah, in woodlands and forest, and seeds of native proteaceous plant species. During the	Generally, roosts in or near riparian environments or other permanent water sources. Any tall trees may provide roosting	Generally, breeds in woodland or forest, but also in partially cleared woodland or forest, including isolated trees where nest hollows have

[7] Information taken from DAWE 2022

Black cockatoo	Preferred foraging habitat	Preferred roosting habitat	Preferred breeding habitat
	breeding season they feed primarily on native vegetation, particularly marri (seeds, flowers, nectar and grubs).	habitat, but particularly jarrah, flooded gum, blackbutt, tuart and introduced eucalypts blue gum, lemon scented gum.	developed in suitable trees species, particularly karri, marri jarrah, wandoo, bullich and tuart.

2.5 Threatening processes

The threats to black cockatoos, as cited in the Carnaby's Cockatoo Recovery Plan (DPaW 2013) and the Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC 2008) are summarised in Table 2-2.

Table 2-2: Listed threats to black cockatoos

Carnaby's Cockatoo Recovery Plan (DPaW 2013)	Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC 2008)
• Loss of breeding habitat • Loss of non-breeding foraging and night roosting habitat • Tree health • Mining and extraction industries • Illegal shooting • Illegal taking • Climate change • Collisions with motor vehicles • Disease	• Killing by illegal shooting • Injury or death from *Apis mellifera* (European Honeybees) • Habitat loss • Nest hollow shortage and competition from other species

In addition to reviewing the recovery plans, Alcoa consulted with black cockatoo subject matter experts (SMEs) to identify threatening processes that may be specific to black cockatoos in the NJF. The common responses suggested threatening processes that need to be addressed included:

- Habitat loss from clearing for forest harvesting/salvaging, mining and/or development.
- Loss of access to fresh drinking water due to reduction in rainfall, hotter summers and lack of permanent water.
- Hot and intense fire that damages foraging habitat and destroys nest trees.
- Damage to habitat from disease (for example *Phytophthora* dieback).

- Competition for resources, specifically for suitable nesting hollows for breeding.

2.6 Existing conservation programs, actions and projects

The Commonwealth and WA government, local government authorities and environmental non-government organisations deliver projects that aim to increase the areas under protection and management for black cockatoos.

Alcoa sought to identify on-ground conservation actions that maintain or improve black cockatoo habitat currently undertaken within the forested areas of the NJF.

2.6.1 Recovery teams

Recovery plans set out the research and conservation actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community.

Recovery teams develop and/or co-ordinate the implementation of the recovery plans. Redacted copies of the 2008 to 2020 annual reports from the forest black cockatoo recovery team and 2013 to 2019 Carnaby's cockatoo recovery team were obtained from reports tabled in Parliament (Minister for Emergency Services 2022). These reports indicate the following management and monitoring actions have been conducted for black cockatoos in the NJF:

- Black cockatoo data is obtained from the Great Cocky Count[8], research programs[9] and through working with the Forest Products Commission to conduct pre-harvesting fauna surveys. Data is incorporated into the DBCA Threatened species and communities database and a subset of black cockatoo foraging, roosting and breeding habitat datasets are also publicly available on Data WA.
- Working with the Forest Product Commission to identify and protect marked black cockatoo habitat trees during harvesting and post-harvesting activities.
- Investigations were conducted into potential feral bee control mechanisms. The outcome of the investigation identified that there were limitations to implementation of control measures.
- Conducting investigations into the impacts of bushfire and prescribed burns on the retention of black cockatoo tree hollows.
- Field trials to look at the outcome of using soft edge mosaic burning regimes for the protection of black cockatoo nesting trees.

[8] The Great Cocky Count targets roosting habitat primarily on the Swan Coastal Plain but has been expanding into regional areas.
[9] Specifically, data obtained from Murdoch University's Black Cockatoo Conservation Management Project and WA Museum research projects.

- Identifying known breeding and roosting sites for Baudin's cockatoo. The assessment noted these sites are very low compared to Carnaby's and red-tailed black cockatoos, primarily due to the limitations of current survey techniques for identifying breeding and roosting sites for Baudin's cockatoo and forest red-tailed black cockatoo in extensive areas of State Forest.

The recovery teams have identified the need for viable techniques for more structured landscape scale monitoring in high and low rainfall forested areas to be developed.

2.6.2 Levels of protection

The black cockatoo recovery plans (DPaW 2013, DEC 2008) cite protection of foraging, breeding and roosting habitat as a key recovery action.

Protection of habitat occurs where there is an appropriate mechanism to prevent or restrict the clearing of vegetation that provides habitat for black cockatoos (DAWE 2022). This can be through formal land tenure instruments (under the *Conservation and Land Management Act 1984*, conservation covenants, etc.) or through informal black cockatoo or fauna protected areas.

Within the NJF IBRA[10] subregion around 11 per cent (212,726 hectares (ha)) is in protected land tenure[11] (CAPAD 2022). ML1SA has around 14 per cent (101,147 ha) that is classified as protected land tenure. These protected areas are predominantly vegetated and can therefore be considered as a proxy for protected areas for black cockatoos.

Protected areas are shown in Figure 2-4.

2.6.3 Key Biodiversity Areas

The Key Biodiversity Area Programme supports the identification, mapping, monitoring and conservation of Key Biodiversity Areas (KBAs). KBAs are areas mapped as being globally significant for the conservation of birds and wildlife that meet strict, international scientific criteria (IUCN 2016, KBA Standards and Appeals Committee 2020).

Eight Key Biodiversity Areas are within (or overlap) the NJF IBRA subregion.

Key Biodiversity Areas are included in Figure 2-4.

[10] The Interim Biogeographic Regionalisation for Australia classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information.

[11] The Collaborative Australian Protected Areas Database (CAPAD) classifies protected areas using the International Union for Conservation of Nature (IUCN) category of 1 to VI including strict nature reserve, wilderness area, National Park, natural monument or feature, habitat or species management area, protected landscape or seascape and protected area with sustainable use of natural resources.

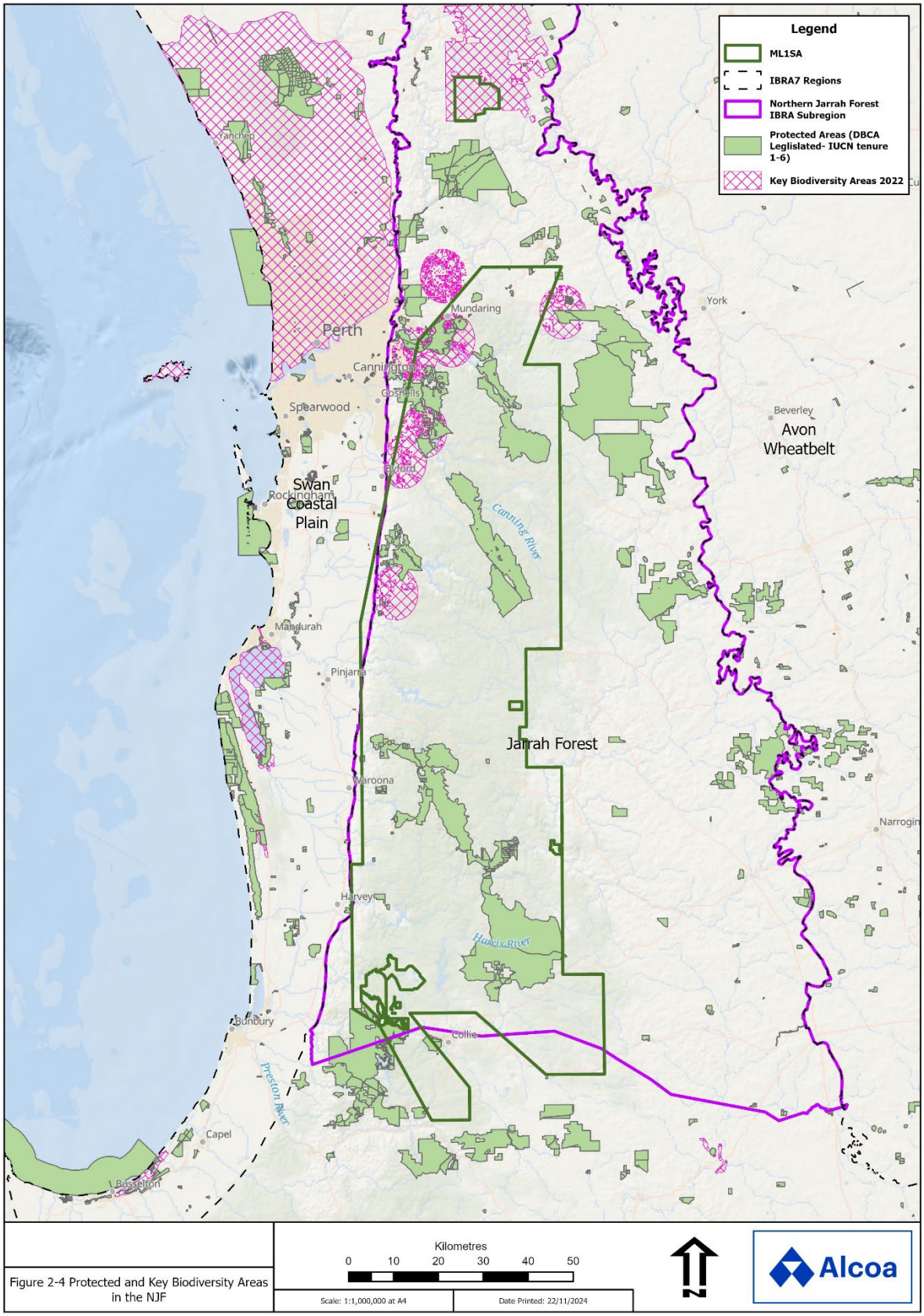

Figure 2-4: Protected and Key Biodiversity Areas in the NJF

2.6.4 Forest Management Plan

The Regional Forestry Agreements require the establishment of a Comprehensive, Adequate, Representative reserve system to ensure long-term conservation and protection of areas with high environmental and heritage values (DAFF 2019). As per Section 2.6.2, around 11 per cent of the NJF is considered a protected area.

The Forest Management Plan 2024-2033 (Conservation and Parks Commission 2023) outlines management objectives and management activities that aim to mitigate impacts on forest health, biodiversity values and restore degraded landscapes. The management activities are high-level and not specific or timebound. Activities that may improve outcomes for black cockatoos include ecological thinning, increased protection areas and improved fire regimes.

2.6.5 Alcoa's black cockatoo projects

Since 1975, Alcoa has supported the publication of more than 260 refereed journal papers and book chapters, 80 technical studies, and 60 higher-degree research theses; many of which have focused on black cockatoos in the NJF (Mastrantonis *et. al.* 2019, Craig *et. al.* 2021, Mastrantonis *et. al.* 2022).

Alcoa is continuing to undertake research projects to support conservation for black cockatoos and has been collecting data through its long-term fauna monitoring program.

From 2019 to 2021, the Alcoa Community Black-Cockatoo Recovery Project, funded through the Alcoa Foundation[12], has lifted awareness, collected important data, planted over 30,600 seedlings and revegetated 45 ha of land, monitored roost sites and installed 24 artificial nest sites.

Alcoa undertakes black cockatoo habitat assessments and on-ground surveys to identify black cockatoo habitat and nesting trees. This is to assist in retaining (except in exceptional circumstances[13]) known and suitable nest trees such that these trees remain available for use by black cockatoos during Alcoa's operations.

2.6.6 Other black cockatoo conservation projects in the NJF

Alcoa undertook an assessment of government funded or private black cockatoo projects that provide direct conservation outcomes for black cockatoos in the NJF and found:

- Most of the habitat restoration projects occur in the Wheatbelt (key breeding areas for Carnaby's cockatoo), the southern region (key breeding areas for Carnaby's and Baudin's cockatoo) and on the Swan Coastal Plain (non-breeding foraging areas for the Carnaby's cockatoo) where habitat has been cleared extensively for urban and agricultural development.

[12] Founded in 1952, the Alcoa Foundation collaborates with trusted charitable organizations around the world to be a catalyst for positive impact by investing in projects that advance sustainable social, environmental, and economic outcomes, with priority placed on the regions where Alcoa operates.
[13] Exceptional circumstances include where the design of haul roads or infrastructure has significantly progressed such that it is economically unfeasible to realign the haul road or re-cite the infrastructure; or where realignment or re-citing may result in the loss of additional vegetation or black cockatoo habitat.

- There has been success in the installation of black cockatoo watering points in metropolitan and urban parks. For example, in the Town of Victoria Park (Town of Victoria Park 2024) and in Mandurah (Alcoa 2022).
- Centres such as Perth Zoo and the Kaarakin black cockatoo conservation centre care for and rehabilitate injured cockatoos.
- The Newmont Hotham Farm Biodiversity Offset Project is converting former farmland to a functioning jarrah, marri, wandoo forest through revegetation of 300 ha of land to restore habitat for Carnaby's cockatoo, chuditch and woylie.

2.7 Stakeholder engagement

Alcoa is continuing to consult with key stakeholders regarding its proposed Environmental Offset Program (Alcoa 2023b, Alcoa 2024). This draft Environmental Offset Project Plan has been developed to support discussions with stakeholders.

Alcoa has discussed key recovery actions and threatening processes for black cockatoos in the NJF with species and forest ecology experts. The outcomes from these informal discussions have been incorporated into the proposed conservation actions. Alcoa intends to continue discussions with SMEs through the on-going development of this draft Plan.

Alcoa will also continue to consult with Traditional Owners to understand ways in which traditional land management practices can be incorporated into the Plan and agree the role local people can play in the delivery of this Project.

3. Black cockatoo project

Following review of the recovery plans and scientific literature (including Lee 2013, Craig et al 2021) and consultation with stakeholders and SMEs, Alcoa has proposed this black cockatoo project. The Project will implement conservation actions that benefit black cockatoos and/or their habitat in the NJF that are additional to those actions already being undertaken.

The proposed conservation actions include:

1. Reduce the threat of habitat loss.
2. Survey, manage and monitor black cockatoo known and suitable nesting trees (breeding areas).
3. Survey, manage and monitor black cockatoo potential nesting trees (potential breeding habitat).
4. Install, maintain and monitor drinking water sources.

This section sets out the proposed conservation actions and timeframes, the survey methodology and monitoring framework and the method to identify suitable and appropriate POCAs for implementation of this specific offset project plan.

Other Environmental Offset Projects will also provide benefits for black cockatoos, such as disease monitoring and management and early fire detection and/or suppression measures. These projects will be addressed in separate Environmental Offset Project Plans, which are currently under development.

3.1 Conservation actions

Black cockatoo conservation actions have been developed following discussions with black cockatoo SMEs. The actions defined in this Environmental Offset Project Plan are specific to black cockatoos; however, may have positive flow-on effects for other terrestrial fauna (including Threatened and priority species).

3.1.1 Action 1: Reduce the threat of habitat loss

Most of the land tenure around Alcoa's operations is State Forest (Alcoa 2024). The State Forest has some level of protection from clearing as it is Crown Land tenure and vested to the DBCA. However, there is no reserve category that prohibits mining from occurring, although the reserve category may be taken into consideration for proposals being formally assessed under Part IV of the EP Act, or other legislation, such as State Agreements.

Through its State Agreements, Alcoa has a mineral lease (ML1SA) over a large portion of the NJF. This mineral lease provides Alcoa the rights to access the bauxite resources, once relevant approvals are in place.

In the 2024 – 2033 Forest Management Plan (Conservation and Parks Commission 2023) the DBCA is proposing to investigate areas of State Forest and timber reserves that are no longer available for large-scale commercial timber harvesting for their suitability for inclusion in new or expanded conservation reserves, including national parks, conservation parks and

nature reserves. DBCA acknowledge that to progress the reserve proposals it will need to obtain agreement of the relevant State Agreement Act parties.

ACTION: Alcoa will engage with the DBCA to investigate areas of State Forest and timber reserves for inclusion into new or expanded conservation reserves within its mining lease

Alcoa acknowledges that changing conservation tenure can be a long and complicated process, involving multiple agencies and high-level government decisions. Alcoa cannot commit that the POCAs will have a change in conservation tenure but can commit to working with various government agencies to increase areas of conservation within the NJF.

3.1.2 Action 2: Protect and manage black cockatoo known and suitable nesting trees

Nesting trees for black cockatoos can take hundreds of years to develop. These trees can be difficult to locate in the NJF and information on how and where black cockatoos use nesting trees and information on where nesting trees are most likely to form and be used is limited (Minister for Emergency Services 2022). Mapping and monitoring of known and suitable nesting trees can provide information to help fill this knowledge gap (Minister for Emergency Services 2022).

Lee (2013) noted “efforts to support forest red-tailed black cockatoo breeding are better focused on in situ conservation of native vegetation.”.

Alcoa currently conducts large-scale and multi-phase surveys to identify nesting trees in and around its mining operations. This conservation action will include additional surveys outside Alcoa’s mining operations to locate known and suitable nesting trees.

According to Saunders *et. al.* (2022) Carnaby’s cockatoo nest hollows can benefit from maintenance every 3 to 4 years. Actions might include attaching material where the side of a hollow has blown out, or where the floor has collapsed, raising the floor to within 1,000 mm of the entrance by filling with rocks, soil and adding woodchips. Where appropriate, these repairs could occur in nest hollows within the NJF, which can be monitored to support this effectiveness of this action; make modifications to the repairs process and inform ongoing management of the nest hollow.

DBCA (2023) note that removing fuel loads from around the base of nesting trees (for example by raking leaf litter and other fuel away) and/or wetting the trunks prior to prescribed burns can protect known nest or hollow-bearing trees. Before considering these resource and time intensive actions, the locations of known and suitable nest trees will need to be identified.

ACTIONS:
Undertake baseline black cockatoo nesting tree assessments including collecting data on tree species, characteristics and health.

Spatially mapping the number of known and suitable nest trees within a POCA.

Implement a monitoring program within known breeding areas (methods may include bioacoustics recorders, cameras or visits during the breeding season).

Record known and suitable next trees identified opportunistically throughout the POCA (e.g. during other management activities.

Revisit and remap the number of known and suitable nest trees within the POCA every 5 years.

The results from the conservation actions include (but are not limited to):

- Highlighting areas within the NJF that need to have stronger protection mechanisms and on-going management to support the on-going viability for black cockatoos.
- Enhance knowledge and understanding of black cockatoo nesting habitats in the NJF. Data collected can be assessed against other areas in the NJF to determine if there are features or characteristics in the NJF that support higher/lower densities of known and suitable nest trees. This may support future impact assessments and/or locations of environmental offset sites.
- Conduct specific and targeted conservation actions directed towards protection of known nest trees or breeding areas. For example, raking the tree base to remove fuel loads and protect against fire, monitoring for fire, proactively implementing dieback treatment (use of phosphite can slow the spread and impact of *Phytophthora dieback*) or protection actions within the breeding area[14].
- Comparing known and suitable nest trees in the POCA against those outside (for example in a reference area[15]) provides information on which conservation actions can help sustain the number of known and suitable nest trees in the NJF.
- Extend the period in which the nest hollow remains suitable for use by black cockatoos by undertaking hollow maintenance or repairs on known nesting hollows. This action benefits black cockatoos as a black cockatoo breeding pair will return to the same hollow to nest, if they have had successful breeding events in the past, and of course,

[14] Some of these actions may be developed as part of other specific Environmental Offset Project Plans.
[15] Reference areas are areas outside the management area that can be used to assess the effectiveness of managed areas against unmanaged areas.

if the hollow is not already occupied by another breeding pair or invasive or other species (McMahon & Blyth 2005, Birdlife Australia 2024c, Saunders 1979).

- Monitoring of known and suitable nest trees over time will provide a better understanding of the tree species and characteristics that are more likely to result in successful breeding events, lifespan of trees with suitable nest hollows and causes of loss of hollow trees (i.e. from natural events such as senescence, climate events such as storms, drought or lightning strikes, fire or disease).

Neither the Forest Management Plan, or the black cockatoo recovery plans, specifically outline actions to maintain black cockatoo nesting trees in State Forest.

3.1.3 Action 3: Protect and manage black cockatoo potential nest trees

As for known and suitable nesting trees, it is important to identify potential nesting trees. Potential nesting trees are important for the development of future hollow bearing trees.

As above, mapping, monitoring and maintaining black cockatoo potential nest trees will highlight areas that are a priority for protection and management and provide information to assist in addressing knowledge gaps on the location and formation of known and suitable nest trees.

ACTIONS:

Undertake a baseline black cockatoo potential nest tree assessment including collecting data on tree species, characteristics and health.

Estimate the number of potential nest trees within a POCA.

Revisit and remap the number of potential nest trees within a POCA every 5 years.

3.1.4 Action 4: Install, maintain and monitor drinking water sources

Black cockatoos prefer to forage, roost and breed within a few kilometres of a watering point (DAWE 2022) as they need to drink fresh water 1 – 2 times per day. They usually drink during the day whilst foraging, and in the evening immediately prior to roosting. Black cockatoos will drink opportunistically from multiple water sources including tree hollows and streams during wetter months; and ponds, water troughs and roadside puddles during dryer months (Craig *et al* 2021; Johnstone and Kirkby 1999).

Johnstone and Kirkby (1999) suggest the forest red-tailed black cockatoo has a detailed knowledge of its habitat, to the extent it learns and keeps track of drink sites and high-quality foraging habitat.

Impacts from climate change are likely to reduce the access to drinking water, especially in the predicted hotter summers. Craig *et al* (2021) surmised that the provision of permanent drink sites close to known or suitable nest hollows will maintain the availability of suitable hollows into the future. Lee (2013, citing multiple sources) noted that forest red-tailed black cockatoos have been reported to move away from areas that are burned or lacking water.

SMEs suggest black cockatoos watering points are also at risk from feral pigs, which damage or contaminate riparian habitat and the associated water source. While private properties in urban or rural areas provide water sources for black cockatoos (farm dams, troughs, bird baths, etc.), changes by landowners may inadvertently impact the availability of water sources for fauna. The SMEs also advise threats to black cockatoos when drinking include predation (by wedge tail eagles or other birds of prey or potentially carpet pythons (when drinking from tree hollows)), vehicle strike (when drinking from roadside puddles) or bee stings (sitting atop water bodies).

Craig *et al* (2021) suggested that permanent watering points could be provided through artificial water sources or by modifying (enlarging or increasing inflows) existing water sources.

The intent of this action is to provide a network of permanent water sources suitable for black cockatoos across the NJF.

3.1.4.1 Types of water points

Black cockatoos generally drink from available water sources such as tree hollows, streams, puddles, water troughs, farm dams during foraging, prior to settling into night roosts and first thing in the morning. DCCEEW (DAWE 2022) refer to watering points as natural water bodies and artificial water sources (e.g. artificial dams, lakes and ponds). Alcoa has further categorised potential black cockatoo watering points as artificial, manmade and natural, in accordance with the definitions provided below.

Artificial water points include “cockitroughs”. The Town of Victoria Park (2024) first designed the cockitrough in 2018 with the metals towers now installed in various urban and semi-urban areas across Perth. The towers are around 4 meters high, contain large troughs with solid perches that hold up to 12 black cockatoos at one time. The towers are connected to a water supply, with the water troughs refilled via a battery-operated irrigation control valve. The refilling process helps to flush clean leaf litter from the water through.

SMEs suggest that cockitroughs, appropriately located, are likely to be used by black cockatoos in the NJF, as they contain the elements that make a preferred drinking water source. Cockitroughs provide the perches and elevation preferred by black cockatoos, can be situated in an appropriate location (where there is mains or other water supply), can be close to (but not in) vegetation and required little disturbance to install.

Other artificial watering points can include troughs or bird baths, that need to be manually filled and maintained.

Man-made water points include dams/reservoirs, farm dams and DBCA fire water points. Large reservoir areas may provide drinking water sources for black cockatoos, with use of these areas contingent on accessibility and safety for the birds. Farm dams are used in rural properties to store rainwater or surface water runoff for watering livestock, crop spraying, irrigation, domestic supply and/or firefighting (Stanton 2005). Farm dams take many forms, with the focus on water storage and distribution. So, while some farm dams may provide suitable water points for black cockatoos, this is influenced by water accessibility, and exposure to predators. DBCA have established permanent fire watering points within the NJF for supply of water for ground and/or aerial firefighting on Department-managed lands (DEC 2008). These permanent fire watering points are generally clay-lined basins that collect surface water runoff.

Farm dams or fire water points can be modified to be suitable for use for black cockatoos by adding log perches, for example.

Natural water points include streams, ponds or rivers and other natural water storage areas such as puddles, tree hollows, rock outcrops. These water sources may be permanent, temporary, seasonal or occasional or transient.

3.1.4.2 Temporal nature of water points

Water points in the NJF are supplied by rainfall, surface water runoff or expressions of groundwater. Some water points will contain water year-round, others will be temporary. Alcoa has applied the following terms to describe the temporal nature of water points for black cockatoos.

Permanent water points provide water year-round in the same location. Examples include farm dams or water reservoirs, permanent streams or water ways or cockitroughs.

Semi-permanent or ephemeral water points provide water in the same location but only for short periods, or at certain times of the year. Examples include ephemeral streams or water bodies.

Temporary water points are created through environmental or anthropogenic means and may include puddles by the side of the road or on granite outcrops and water pooling in tree hollows. These water points may only be available for short periods, or at certain times in different locations.

3.1.4.3 Location of water points

Black cockatoos appear to prefer drinking water points that are located in open forest or semi-cleared areas such as granite outcrops; but are likely to avoid drinking sites in dense forest or very open landscape (SME *pers. comm.*). Forest red-tailed black cockatoos are thought to prefer to drink from an elevated position; but may also drink from ground sources such as roadside and track pools during the drier months (Johnstone and Kirkby 1999, Craig et at 2021). Newmont (2014) found that black cockatoos preferred water sources with firm and gently inclined edges for access surrounded by vegetation.

Ideally, water points should be located where they are visible (the birds need to know the water is there), accessible (not in dense forest below the canopy), close to vegetation (to allow for sentries on nearby trees and reduce predation risk, perhaps five to ten meters from the forest edge), elevated (above, but not too high above, the forest canopy, to reduce predation risk) and close to or within foraging, roosting or breeding habitat (SME *pers. comm.*).

3.1.4.4 Distribution of water points

Alcoa acknowledge there are likely to be multiple water points located throughout State Forest or in nearby agricultural, rural or urban areas that provide suitable alternate sources of water for black cockatoos.

Therefore, Alcoa suggest a suitable distribution of monitored and maintained permanent water points to be one watering point per 5 km^2 (or per 500 ha) within each POCA. The location of watering points will be determined on a site-by-site basis, depending on the availability of other permanent, semi-permanent or temporary water points. Alcoa will adapt

the number and/or location of water points within each POCA throughout the offset period based on results from the monitoring and maintenance program.

The intent of this action is to form a network of permanent water points over as wide an area within the NJF as possible.

3.1.4.5 Monitoring program

Alcoa will monitor the water points following installation (or selection) to determine if the water points are used by black cockatoos (by species), how often the water point appears to be used and/or if other species are also using the water source.

Cameras allow information to be collected on how many black cockatoos use the water point, the sex and species of black cockatoos using the water point, the condition of the water point and if other species are using the water point. Camera frequency can be set to take frequent photos during dawn and dusk and at reduced times during the day or night. The drawback with using cameras is the requirement to change the battery every month and the time required to review the data collected.

Acoustic recorders can provide information on *if* black cockatoos are *likely* to be using the water point. Recorders can be set to record sounds at certain frequencies and/or for certain times throughout the day/night to reduce the amount of data to be processed. Recorders have limited coverage and therefore multiple recorders may be required. The recorders, depending on settings, could also record other species in or around the water point. The drawback with using recorders is the requirement to change the battery (if not solar powered) and SD card; and the time required to process the images and review the data collected.

Site visits can also provide indirect evidence on the likely usage of the water point though observations of footprints, feathers and/or foraging evidence. This method may be relatively labour intensive, depending on availability of field staff and the locations of water sources.

The monitoring methodology used at each water point may vary, depending on the type and location of the water point. The monitoring is likely to be more intense and frequent at the start of the program and reduce once the water point appears to be well established, relatively self-sufficient and used either on a frequent or infrequent[16] basis.

3.1.4.6 Maintenance program

Alcoa will check the water points on an annual basis, likely to be around April or May, at the end of summer, before the first major rainfall events of winter. This will support any evidence gathered during the monitoring program.

Cockitroughs generally require little maintenance. Fire water points may require upkeep to remove carcasses, fix perches or remove weeds. The timing of maintenance or repairs will be based on the actions required.

[16] It is important to note that black cockatoos learn to adapt to their environment and will drink from a variety of sources for various reasons. Thus, the intent is to ensure permanent drinking water is available in locations the birds are aware of and can access if and when required.

3.1.4.7 Fire Water Points research project

Murdoch University's Harry Butler Institute is leading a collaborative Fire Water Points research project to explore the function of non-natural water points in conserving biodiversity (Murdoch University 2024). The project is gathering detailed habitat characterisation of 100 artificial water points and 30 natural refuge pools in the Warren IBRA bioregion. The results will be used to prepare predictive models and spatial analysis to inform conservation planning, including framework for renovation of existing water points, design of new water points, water point operation and maintenance.

Alcoa will contact the Fire Water Points project team to discuss how this offset project can be aligned with the research to gather similar information and inform water point conservation planning in the NJF IBRA subregion.

ACTIONS:
Locate known permanent fresh water suitable for black cockatoos within the POCAs and/or surrounds.

Install new fresh water drinking sources suitable for black cockatoos within the POCAs and/or surrounds.

Maintain known and established suitable drinking water sources. For example, remove environmental weeds of concern that impact water health or quality, remove carcasses, install perches or ledges to allow water to be accessed by black cockatoo, manage the surrounding vegetation for water quality and health.

Look at methods to remove impacts to waterways by feral pigs and implement targeted feral predator controls around the drinking water source to reduce predation during drinking (these actions are addressed under separate Environmental Offset Project Plans).

Work with and support private landowners near to the POCAs to maintain water sources for black cockatoos on their properties.

Ensure drinking water sources are installed and maintained within State Forest (Crown Land) within POCAs.

Monitor the use of the water sources over time.

The direct results from the conservation actions may include (but is not limited to):

- Drinking water resources for black cockatoos in (or near to) the POCA are quantified and spatially mapped.
- Planning and implement measures to assist with mitigating impacts from climate change on black cockatoos, given that they require water to be readily available in the vicinity of nest and roost locations.

- Conversion of non-functional habitat (due to inaccessible or lack of drinking water within a suitable range) to functional habitat through the provision or maintenance of water sources.
- Maintenance of forest habitat for black cockatoos for foraging, roosting and breeding.

The indirect results from monitoring drinking water resources for black cockatoos over time will provide:

- Information on how black cockatoos use the water sources.
- Key threats to drinking water sources for black cockatoos.
- Information on the most appropriate conservation actions to maintain drinking water in the NJF.

The Forest Management Plan does not specifically outline actions to maintain drinking water sources for black cockatoos in State Forest; however, Alcoa is proposing this action in response to advice provided by black cockatoo SMEs.

3.2 Methodology

Alcoa will collaborate with forest and fauna ecologists and specialists on the most appropriate methodology to identify, survey, manage and monitor black cockatoos and/or their habitat in the NJF.

Information in this section is based on current best-practice methods described in the *Referral guideline for 3 WA threatened black cockatoo species* (DAWE 2022), species recovery plans (DEC 2008, DPaW 2011), scientific literature and consultation with black cockatoo subject matter experts. The methodology will be enhanced during stakeholder consultation so that it is cost-effective, efficient, effective, timely, transparent, scientifically robust, reasonable and aligns with other species or forest monitoring programs.

As per Alcoa's adaptive management approach, the methodology will also be reviewed throughout the Project to respond to learnings from outcomes of conservation actions and/or when new government guidance or peer-reviewed and government accepted scientific studies are released.

3.2.1 Identification of offset conservation areas

Weerheim (2008) states the identification of key habitat areas is an important step in conservation planning. Alcoa consider that due to mining operations having impacts on vegetation in State Forest, the environmental offset program should focus on providing environmental offsets that maintain or enhance environmental values and vegetation within other areas of State Forest, as near to the impacts as possible. This will also provide beneficial conservation outcomes for the surrounding vegetation and species that are using the habitat in the local area.

Alcoa will identify proposed offset conservation areas following a desktop study, a basic terrestrial fauna habitat assessment and consultation with stakeholders. The process to identify and secure proposed offset conservation areas is detailed in the Offset Proposal

(Alcoa 2025b). Consultation with stakeholders will look at areas that align with areas proposed for improved conservation tenure under the 2024-2033 Forest Management Plan.

3.2.2 Baseline surveys

Alcoa propose to follow a Before-After-Control-Impact (BACI) survey design that can be used to evaluate the effectiveness of black cockatoo conservation actions being implemented and guide the adaptive management process.

Detailed survey design will be finalised following stakeholder input and feedback and results from the desktop and basic fauna habitat survey; however, an overview of the baseline survey method is provided this section.

A suitably experienced field ecologist will conduct black cockatoo breeding, roosting and foraging habitat surveys in accordance with the EPA's *Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) and the *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act* (DEWHA 2010).

Reference sites (located outside proposed offset conservation areas) will be identified and included in the survey and monitoring program. It is noted that there are already reference sites within the Northern Jarrah Forest – Alcoa has reference sites relevant to post-mining rehabilitation assessments, the DBCA has monitoring sites used by Western Shield, from the FORESTCHECK program and those proposed under the 2024-2033 Forest Management Plan.

Reference sites (outside proposed offset conservation areas subject to this Plan) will be identified and included in the survey and monitoring program. It is noted that there are already reference sites within the NJF: Alcoa has reference sites relevant to post-mining rehabilitation assessments; the DBCA has monitoring sites used by Western Shield and the FORESTCHECK program. The Forest Management Plan 2024-2033 Forest Health Monitoring Program Implementation Plan February 2024 to December 2033 also contains a set of indicators to monitor the health of the forest across a network of up to 100 fixed representative sites. The reference sites will enable an assessment of the health and quality of chuditch, woylie and quokka managed habitat against changes in unmanaged habitat.

The baseline survey will be conducted in the first year of the offset period and replicated during the monitoring program.

Monitoring results will be assessed against baseline levels at the managed offset site and against the (unmanaged) reference site(s).

Locations of monitoring sites will be provided in Offset Management Plans (as they will be specific to the proposed offset conservation areas).

A suitably experienced field ecologist will be required to ensure appropriate data and information is collected to allow the habitat to be scored using the black cockatoo habitat quality scoring tools (Appendix A[17]).

Baseline and monitoring surveys within the POCA may consist of:

[17] The habitat scoring tool is under development and will be provided in a later version of this Plan.

- Area searches (e.g. quadrats) or transects on foot through suitable habitat, detecting birds by sight, call and feeding signs.
- Road transects by vehicle or aerial transects by plane/drone, useful to look for suitable habitat, roosting and nesting trees in extensive areas.
- Use of other proven technologies including high resolution aerial imagery, remote sensing, bioacoustics recorders and cameras/recorders.

The baseline and monitoring surveys will:

- Identify and spatially map black cockatoo habitat (foraging, roosting, breeding) and extent for each black cockatoo species within the POCA.
- Identify and spatially map important black cockatoo habitat features (water sources, potential nesting trees, known or suitable nesting trees) within the POCA (and surrounds).
- Record locations of activity (foraging, roosting or breeding) by each black cockatoo species.
- Record the abundance of each type of black cockatoo species observed and document activity (foraging, resting/perching, drinking, prospecting hollows, etc.).
- Apply the black cockatoo habitat quality scoring tool to the POCA.
- Assess black cockatoo habitat within the POCA against the reference site.
- If possible, estimate the number of black cockatoos (per species) likely to be present in the POCA.
- If possible, identify potential movement corridors for black cockatoos (per species) within the NJF.

The survey results will be used to inform the Offset Area Management Plan.

3.2.3 Indicative performance indicators

Alcoa has developed a set of indicators that will be used to measure performance against the Project targets. The performance indicators have been developed to be measurable and are linked directly to the targets. The methodology used to monitor the performance indicators is consistent and compatible with other recognised monitoring programs (for example Birdlife Australia's data collection and nest monitoring) and have shown to be effective for identifying and prioritising breeding sites for recovery actions.

To provide evidence that the conservation actions are on a positive trajectory towards the Project targets, Alcoa has developed a set of measurable indicators (or parameters) specific to black cockatoos, described in Table 3-1.

Table 3-1: Indicative performance indicators

Indicator	Rationale
Vegetation type, structure and condition	Vegetation type, structure and condition is a suitable proxy for presence of habitat for black cockatoos.
Presence of key habitat features (drinking water)	Black cockatoos require fresh drinking water at least once a day for survival.
Presence of key habitat features (roost sites)	Black cockatoos roost together overnight in flocks. Roost sites appear to support social interactions between black cockatoos.
Presence of key habitat features (known or suitable nesting trees)	Black cockatoos nest in large hollows. It can take over 100 years for a tree to reach the dimensions in which a potentially suitable hollow can form. Nest trees with suitable hollows provide opportunities for black cockatoos to breed.
Presence of black cockatoos	Presence of black cockatoos, and evidence of use of the POCA for either foraging, roosting or breeding within five yearly timeframes will be used to indicate the POCA contains suitable and functional habitat.

3.2.3.1 Vegetation structure and condition

Forest red-tailed black cockatoos forage on marri, jarrah and/or karri forest, other eucalypt woodlands, or *Allocasuarina* woodlands. Areas of woodland supporting a greater than 50 per cent projected foliage cover >50% is considered to be of high-quality foraging value (habitat quality scoring tool provided by DCCEEW in February 2024).

Carnaby's cockatoo forage on native kwongan heath and shrubland and/or banksia and eucalypt woodlands. Projected foraging cover assessed to be >30% for kwongan heath and shrubland and >50% for banksia and eucalypt woodlands is considered to be high-quality foraging value (habitat quality scoring tool provided by DCCEEW in February 2024).

Baudin's cockatoo forage on marri-jarrah forest and woodlands with greater than> 50% per cent projected foliage cover is considered to be of high-quality foraging value (habitat quality scoring tool provided by DCCEEW in February 2024).

Night roosting habitat for black cockatoos includes tall trees located close to water sources. Carnaby's and Baudin's cockatoos appear to prefer trees in or around riparian habitat, while forest red-tailed black cockatoos may use any tree. The number of black cockatoos using a night roost site can vary.

Black cockatoos require nesting hollows in which to breed. Trees that have a suitable diameter at breast height (DBH) to develop a nest hollow (500 mm for eucalyptus or 300 mm for wandoo) but do not currently have hollows are referred to as potential nesting trees (DAWE 2022).

Vegetation type, structure and condition provides an indication that suitable habitat for a black cockatoo is likely to be present within the POCA. Maintaining and/or enhancing vegetation that supports black cockatoo foraging, roosting and or breeding supports the

species recovery. Vegetation type, structure and condition can be measured through vegetation and targeted black cockatoo habitat field surveys.

3.2.3.2 Key habitat features

Key habitat features are a suitable proxy to show the ability of the habitat to support use by black cockatoos. Key habitat features for black cockatoos include drinking water sources located near foraging, roosting and breeding habitat, and the presence and connectivity of roosting, breeding and foraging habitat.

Connectivity between water sources, foraging, roosting and breeding is important for black cockatoos (Craig 2022). A female black cockatoo will remain in the hollow while the egg is incubating and for a short time after the chick has hatched. She will only leave the hollow for the male to provide her with food and water. After this the female will leave the nest to forage and drink. Thus, the further foraging and water is away from the next, the more time the nest is unprotected (Craig 2022).

Drinking water

Black cockatoos require fresh drinking water at least once, generally twice, per day for survival. Access to safe drinking water may increase the cockatoo's use of foraging, breeding and roosting habitat. Drinking water is an indicator that supports the presence of suitable habitat for a black cockatoo within the POCA. Maintaining and/or enhancing drinking water for black cockatoos is becoming increasingly important in this drying climate.

Roost sites

A night roosting site is an area where there is one or more known night roosting trees and includes the vegetation within a 500 metre (m) radius of each known night roosting tree. Black cockatoo SMEs have observed white-tailed black cockatoos tending to roost on top of the canopy, with family groups nearby but with small gaps between each bird. Forest red-tailed black cockatoos tend to roost within the canopy with family members touching. The SMEs also suggest night roosting sites may play a role in the social behaviour of black cockatoos and where they "share" knowledge of the forest.

Protecting large roost sites affords greater opportunities for black cockatoos to adequately rest, and to retain connectivity to the landscape and other black cockatoos. As nocturnal roost sites can be transitional and vary in the extent to which they are used, greater overall protection of appropriate forest areas and specific habitat types allow opportunities for variable use of nocturnal roost sites.

Night roost sites can be identified during black cockatoo habitat assessments (DAWE 2022).

Breeding sites

Black cockatoos breed in large hollows in suitable tree species. The hollows have specific requirements – such as angle, depth, direction facing, proximity to other black cockatoo nesting trees.

A suitable nesting tree is a tree that contains suitable nesting hollows (any hollow with dimensions suitable for use for nesting by black cockatoos) but there is no evidence or indication the hollow has been used by black cockatoos for breeding. Reasons for the hollow not being used can be known (for example occupancy of other species or feral bees), suspected (too close to other breeding hollows, aspect, previous failed breeding attempts) or

unknown. The number of suitable nesting trees within the POCA increases the breeding opportunities for black cockatoos.

A known nesting tree is a tree, that is alive or dead but still standing, that contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).

There are mixed opinions on whether the lack of suitable nest hollows is a limiting factor in black cockatoo breeding. Some SMEs consulted have suggested, given the number of large trees in the jarrah-marri habitat, that suitable nesting hollows is not a limiting factor in the NJF. SMEs suggest that ensuring suitable resources (foraging, roosting, water sources) are present nearby to nesting hollows.

Presence of suitable nest trees is an indicator that suitable habitat for a black cockatoo breeding is likely to be present within the POCA. Presence of known nest trees is an indicator that black cockatoo breeding has occurred or is occurring in the POCA. Protecting against loss of black cockatoo breeding habitat (known and suitable) is key to the species recovery; however, it is also necessary to obtain more information on the use of nest trees and breeding success. Black cockatoo known and suitable nest trees, and outcomes from breeding events can be measured through black cockatoo field surveys and monitoring of known breeding trees.

3.2.3.3 Presence of black cockatoos

Black cockatoos are a highly mobile, wide-ranging species. They forage across the NJF, moving across the landscape, likely by applying learnt behaviour to locate the highest quality foraging habitat. It has been hypothesised by some SMEs that this follows the fruiting cycle of the marri tree, but other SMEs have observed variations in this pattern. In effect, it appears black cockatoos seek out high quality foraging habitat; however, will use any foraging habitat opportunistically.

Therefore, the absence of black cockatoos from a POCA in any one year or season may not necessarily mean the habitat is no longer suitable for the species. Presence and absence within a certain area (e.g. the POCA) needs to be measured across a longer time scale to understand when and potentially why black cockatoos use areas within the NJF as they do. This indicator, when considered collectively and holistically across multiple POCAs in the NJF, will show that black cockatoos are utilising the habitat in the POCA. The more evidence of use recorded, the higher the likelihood that the habitat is of high value to black cockatoos.

3.2.4 Methodology to implement the actions

Alcoa will develop a well-planned, coordinated, and targeted black cockatoo management program. Specific management methods and control sites will be selected following collection of the baseline survey.

Management methods will be selected for proposed offset conservation areas based on the black cockatoo habitat and consultation with the DBCA, Traditional Owners, government and non-government agencies, community groups, other proponents and local landholders.

Offset Area Management Plans will identify areas within the POCA where the conservation actions will be implemented. Conservation actions are likely to be revised during the offset period to align with best practice or in response to the earlier management actions.

3.3 Implementation

Alcoa will undertake management actions outlined within the Plan if the Proposal is approved and will commence implementing the Plan as soon as practicable after approval of the Proposal. Alcoa will make all efforts possible to commence implementing the Plan prior to disturbance being undertaken.

3.4 Delivery

Alcoa will be responsible for the delivery of the Plan; however, delivery of conservation actions may be undertaken by various delivery providers. Delivery providers may include a team of ecologists employed directly by Alcoa, WA government agencies (e.g. DBCA), Traditional Owners (e.g. ranger groups), environmental practitioners, consultants or specialists, environmental non-government organisations and/or community groups.

Delivery partners will be selected following expressions of interest and after a fair and equitable tender process that considers value for money and the delivery partners experience, capability and capacity to deliver the project.

3.5 Conservation actions

The conservation actions are proposed to be undertaken over a rolling 20-year timeframe, in a series of tranches. This is to align with the progressive clearing, which is followed by progressive post-mining rehabilitation, which will return foraging habitat within 20 years and assist with restoration of roosting habitat in the longer-term[18].

The timings may change during the offset period depending on the targets being attained. For example, in cases where the drinking water source is relatively self-sustaining and shown to be well used, the monitoring and management may be scaled back to allow funding to be used to support other conservation actions in or around the proposed offset conservation areas.

Indicative timing for the proposed conservation actions during the offset period are in Table 3-2.

Table 3-2: Implementation of actions timeframes

Management Action	Proposed Timing
Baseline survey (assess habitat quality, identify key habitat features, spatially map known and suitable nest trees; estimate the number of potential nest trees; locate and spatially map known fresh water sources, record presence/absence of black cockatoos).	Year 1 of offset implementation
Monitor known and suitable nest trees in accordance with SME and DBCA guidance.	Annually, during breeding season

[18] Lee et al 2008 have demonstrated that black cockatoos have been found foraging on post-mining rehabilitation within eight years.

Management Action	Proposed Timing
Maintenance of known and suitable nest hollows in accordance with DBCA guidance.	Every 3 years[1], outside breeding season
Conduct black cockatoo habitat assessment	Year 5, 10, 15 and 20 of offset implementation
Install drinking water sources	Year 2 and 3 of offset implementation
Monitor drinking water sources	Summer[2]
Maintain drinking water locations	As required[3]

1 - Maintenance of nest hollows every 3 years as per (Saunders et al 2022); however, if during monitoring it is noticed that nest hollow needs repair or maintenance, the maintenance should be done as soon as possible after the nest hollow is no longer in use by black cockatoos.

2 – Summer means towards the end of Spring (when the water sources should be plentiful), mid-summer and at the end of summer. This is to ensure water is available during the driest, hottest parts of the year. During winter cockatoos are likely to opportunistically use other water sources (e.g. puddles, tree hollows, etc.).

3 – Maintenance actions for fresh water sources may not be needed (if the water source is established and self-sustaining) or may need to be done when the water source is at lower levels or post-winter if, for example, weeds are the issue.

3.6 Deliverables and milestones

Projects deliverables are reports resulting from operations and surveys. The delivery provider will provide Alcoa with an operational report as outlined in Section 3.12.3.1. Baseline and fauna habitat assessment reports will be provided to Alcoa by the suitably experienced ecologist, as outlined in Section 3.12.3.2. An offset close out report will be prepared by Alcoa at the end of the offset period, or once this Project is complete.

3.6.1 Indicative deliverables

A summary of the indicative Project deliverables and timeframes is in Table 3-3

Table 3-3: Indicative Project deliverables

Deliverable	Timing
Identification and authorisation to operate within the proposed offset conservation area(s)	Prior to offset period commencing[19]
Baseline survey report	15 months following the commencement of the offset period / baseline survey commencing

[19] Alcoa proposes to provide POCAs for Tranche 1 prior to approval. Additional POCAs to be identified as per the Offset Proposal.

Deliverable	Timing
Operational reports	Annually, following the commencement of the Project
Fauna habitat assessment reports	Year 5, 10, 15 and 20 of implementation
Close out report	Year 20

3.6.2 Indicative milestones

Project milestones are where results from the black cockatoo conservation actions demonstrate that the Project is on a positive trajectory to meet the Project targets and provide a positive conservation benefit for black cockatoos. Indicative Project milestones and timings are in Table 3-4.

Table 3-4: Indicative Project milestones

Milestone	Timing
Vegetation type, structure and condition is maintained (according to baseline and with regards to reference sites)	At years 5, 10, 15 and 20 of the offset period
Number of permanent drinking water sources available for black cockatoos is increased	Within 5 years of offset commencing
Roosting habitat is maintained or improved from baseline (and relative to reference sites)	At years 5, 10 15 and 20 of the offset period
Number of known and suitable nest trees have been located, recorded and monitored	Throughout the 20 years of the offset period
Evidence that black cockatoos have consistently used the POCA for foraging, roosting and/or breeding	Throughout the 20 years of the offset period

3.7 Key risks and management strategies

Risks to the implementation of this draft Environmental Offset Project Plan can be through proponent-based events, environmental stochastic events or external events. Where the Environmental Offset Team consider the Plan has not, or is not, delivering on targets, deliverables or milestones; or are not on a trajectory to meet the targets, or there are indications of poor project performance, Alcoa will liaise with the delivery partner and identify areas for improvement. Key risks, mitigation and contingency actions are identified in Table 3-6

3.8 Adaptive management and continual improvement

An adaptive management framework ensures there are mechanisms in place to take account of the risk of the project not meeting its objectives in the timeframe predicted, and to manage any unforeseen consequences.

Alcoa has built flexibility into this Plan through:

- Procedures – reviewing and evaluting the progress of on-ground management allows the Environmental Offset Team to adapt the decision-making process over time.
- Resources – engaging the most appropriate contractor or delivery agent for the action(s). Allows the distribution of works to be shared across businesses, agencies and environmental non-government organisations. Built in contingency to account for unanticipated events.
- Actions – undertake continuous review of the management actions, surveys and reports. Applying best practice or emerging technologies.

Reports will be reviewed by the Environmental Offsets Advisory Group to ensure appropriate responses are developed to potential or actual events.

Alcoa proposes to manage risks associated with the Project through the following actions.

- On-going consultation with stakeholders and delivery partners (Section 2.7).
- Clearly defined objectives, targets and monitoring program (Section 1.3, 1.4, 3.12).
- Reporting and evaluation mechanisms (Section 3.12.3 and 3.12.2).
- Clear governance arrangements (Section 3.9).
- Ensuring sufficient funding is available, including for contingency actions (Section 3.10).

3.9 Governance arrangements

This Plan has been prepared based on advice from species subject matter experts and reviewing species recovery plans and relevant scientific literature. The Plan will be revised based on feedback during consultation with DCCEEW, EPA Services, government agencies and the public.

Agreements between Alcoa and delivery partners will be legally binding, such as contracts, grant agreements or service agreements.

Governance documents will include requirements for timeframes, reporting, financial management, milestones, deliverables, targets and other legal or governance requirements as appropriate.

3.10 Financial commitments

Alcoa will work with black cockatoo SMEs and stakeholders to find cost-effective and innovative survey and monitoring methodologies, without compromising the objectives of this

Plan. This will allow more of the funding to be directed towards conservation actions. Conservation actions will also be planned to be delivered in a cost-effective way, this may be through a combination of delivery partners and/or agencies, environmental non-government organisations or community groups.

Alcoa will also seek opportunities to ensure that survey, monitoring and/or management is methods are aligned with broader conservation programs or projects to achieve cost efficiencies, both for Alcoa and other conservation programs or projects. Alcoa's aim is that the gathering of data and implementation of actions will support cumulative outcomes when combined with other strategic or landscape scale initiatives in the region.

An indicative high-level cost estimate for conservation actions is provided in Table 3-5. Delivery partner(s) will prepare a detailed cost schedule to deliver the Environmental Offset Project, or aspects of the Environmental Offset Project. The cost estimate will be reviewed by the Environmental Offset Advisory Group to ensure the costs are reasonable and sufficient to deliver the targets and objectives set out in this Plan.

Alcoa will ensure there are internal resources available to oversee and project manage the delivery of this Environmental Offset Project.

Funds will be provided to delivery partners in accordance with the agreement between Alcoa and the delivery partner(s).

Table 3-5: Environmental Offset Project anticipated costs

Item	Approx. cost (AUD)
Project planning	TBA
Baseline survey	TBA
Installation/maintenance of appropriate drinking water sites	TBA
Maintenance of known and suitable nest hollows	TBA
Fire mitigation measures around known and suitable nest trees (or high value breeding areas)	TBA
Monitoring known and suitable nest hollows	TBA
Field surveys in years 5, 10, 15 and 20 of the offset period	TBA
Project management and reporting	TBA
Contingency	TBA

Table 3-6: Risk Management

Potential Risk	Mitigation	Contingency Action
Alcoa is unable to access POCAs	• The NJF IBRA subregion is approximately 1.9 million ha, and Alcoa reasonably expects to locate suitable areas of black cockatoo habitat that are acceptable for POCAs. • ML1SA is 710,000 ha. Most of ML1SA is State Forest and contains habitat suitable for black cockatoos. Alcoa has assessed the area within ML1SA and large areas would benefit from conservation actions to support black cockatoo recovery. • Areas proposed for conservation actions for black cockatoos will be confirmed following discussion with stakeholders, Traditional Owners and black cockatoo SMEs.	• Alcoa will deliver the Environmental Offset Project in alternative IBRA bioregions within the species range, for example the Swan Coastal Plain, the Avon Wheatbelt or the Warren Region, or within the Southern Jarrah Forest IBRA subregion.
WA Government does not support Alcoa implementing conservation actions within State Forest (either within or outside ML1SA) as an environmental offset	• Alcoa has developed the Environmental Offset Program in consideration of WA and Commonwealth offset policies and guidance, recovery plans and consultation with black cockatoo SMEs. • Alcoa will continue to engage with WA Government and regulatory agencies to seek support for the Environmental Offset Program.	• Alcoa will deliver the Environmental Offset Project in alternate IBRA bioregions within the species range, for example the Swan Coastal Plain, the Avon Wheatbelt or the Warren Region, or within the Southern Jarrah Forest IBRA subregion.

Potential Risk	Mitigation	Contingency Action
Delivery partner does not implement conservation actions as per contract	• Alcoa will consider the capability and capacity of the delivery partner to implement the conservation actions prior to entering into any agreements (contract, grant or other legal agreement). • Alcoa will form a good working relationship with the delivery partner to ensure there is open and transparent communication around the management. • The delivery partner will be required to prepare and provide annual reports that demonstrate the conservation actions are being implemented in accordance with the agreements.	• Meet with the delivery partner to understand why conservation actions are not implemented as per contract. • Engage additional delivery partners to deliver necessary conservation actions. • Engage a new delivery partner. • Stand up a new environmental team to deliver conservation actions.
Outcomes from monitoring indicate the offset is not on a trajectory to deliver the Project targets and objectives.	• Conservation actions have been proposed based on current scientific knowledge and understanding and consultation with SMEs to provide a high level of confidence that the outcomes and objectives can and will be achieved. • POCAs will only be selected following assessment to understand the current context and habitat quality at the area; and that there are real, tangible threats to the habitat that can be mitigated through management. • Ongoing monitoring is expected to ensure any issues are identified early and can be rectified through adaptive management.	• Alcoa has developed a monitoring and evaluation framework that includes an adaptive management approach. • Conservation actions will be revised following new scientific understanding or from findings through implementing current conservation actions. • If a conservation action is not on a positive trajectory to meet the proposed outcomes and objectives within an appropriate timeframe, Alcoa will discuss alternative conservation actions with SMEs and stakeholders.

Potential Risk	Mitigation	Contingency Action
Delivery of the environmental offset project does not contribute a net benefit for black cockatoos within 20 years, as indicated by an overall reduction in black cockatoo habitat despite management actions implemented by the Project.	• Alcoa commits to retaining (wherever possible) black cockatoo known and suitable nesting trees. A large portion of the Development Envelope will not be cleared (retained in mining avoidance zones and/or limited disturbance areas). Clearing occurs in a staged manner (not all habitat is removed at the commencement of the Proposal). Alcoa rehabilitates the cleared area following mining, with post-mining rehabilitation expected to return foraging and roosting habitat for black cockatoos within 20 years. • Alcoa expects that the actions above combined with the environmental offset (including the management, evaluation and adaptive management process) has a high likelihood of providing a net benefit to black cockatoos within 20 years.	• An alternate offset will be developed.
There is a severe and prolonged decline in habitat or population(s) of black cockatoos caused by unforeseen circumstances outside the Projects' control.	• Alcoa will be monitoring black cockatoo habitat and/or populations through mining pre-clearance surveys, fauna management plans, post-mining rehabilitation completion criteria monitoring, environmental offset monitoring, Alcoa's Research Centre, and collaboration with the DBCA, environmental NGOs and researchers. • Alcoa considers we are in a good position to identify emerging threats early.	• Alcoa will work with appropriate agencies or organisations to implement actions to mitigate against the impacts from these threats. • Should a fire occur, Alcoa will use contingency funding to implement restoration actions including intensive weed and feral animal control, and/or replanting if necessary. • Alcoa will consider installing artificial nest boxes if too many hollow bearing trees are

Potential Risk	Mitigation	Contingency Action
	• Alcoa will maintain a portion of project funding for contingency actions.	damaged and artificial hollows are reasonably be expected to be used by black cockatoos. • Consider implementing management on surrounding vegetation to provide habitat and foraging for populations impacted by the fire. • Failing this, a new offset conservation area or project may be identified for management, or an alternate offset will be developed.

3.11 Record keeping, publication and reporting

Alcoa will store all reports and correspondence relevant to this Environment Offset Project Plan in accordance with current legislation.

Field survey reports and data will be made available in accordance with current legislation. At present, this requires submission of the field survey report and spatial data to the WA Index of Biodiversity Surveys for Assessments (IBSA). Alcoa will also provide data to Commonwealth agencies as per any existing or future legislation.

Delivery partner annual reports and/or project progress updates will be provided to key stakeholders and made public as appropriate.

Annual compliance reports will also be made public in accordance with any conditions of approval (if approved).

3.12 Monitoring, evaluation and reporting

Monitoring, evaluation and reporting is discussed in this section. Table 3-7 links the Plan targets to performance indicators with trigger and threshold criteria and the response, monitoring and reporting actions.

3.12.1 Monitoring

The delivery provider will provide a report to Alcoa annually, describing the conservation actions undertaken, the outcomes of conservation actions, financial details, works proposed or recommended for the following year and identify risks to undertaking conservation actions. The reports will be reviewed and evaluated against the Plan's objectives and outcomes by Alcoa's Environmental Offset Team and Environmental Offset Advisory Group.

Alcoa representatives will visit the POCAs at least once per year, to confirm conservation actions are being undertaken in accordance with this Plan or as agreed with the Environmental Offset Team following advice from the Environmental Offset Advisory Group and/or relevant stakeholders.

Alcoa will undertake fields surveys at POCAs every five years. The survey results will be assessed against the baseline survey, reference sites and/or previous field surveys.

3.12.2 Evaluation

Annual reports and field survey reports and data will be reviewed by the Environmental Offset Advisory Panel. The evaluation will consider:

- Appropriateness of conservation actions in the context of a changing climate, changing environmental conditions or new scientific findings.
- Changes in extent and/or condition of black cockatoo habitat compared to baseline survey, preceding surveys and the reference site(s).
- Changes in vegetation composition and condition at the reference site against the reference site benchmark.

- Changes in presence/absence or condition of black cockatoo habitat features (water sources, potential breeding habitat, trees with suitable nest hollows) compared to baseline surveys, preceding surveys and the reference site.
- Changes in usage within the POCAs (foraging, roosting or breeding evidence, movement corridors) compared to baseline survey, preceding surveys and the reference site(s).
- The number of black cockatoos (by species) observed compared to baseline survey, preceding surveys and the reference site(s).
- Results from the application of the black cockatoo habitat scoring tool compared to baseline surveys, preceding surveys and the reference site(s).
- The estimated number of black cockatoos (by species) likely to be present in the POCA compared to baseline surveys, preceding surveys and the reference site(s).

Following the evaluation, the Environmental Offset Advisory Panel will prepare an internal memo detailing any emerging threats to black cockatoos, project risks, recommendations for adaptive management, proposed changes to the on-ground conservation actions or research requirements. The Environmental Offset Team will be responsible for actioning the recommendations within the memo.

3.12.3 Reporting

Reporting for the Plan include preparation of annual operational reports by the delivery partner, fauna habitat survey reports by an independent suitability experienced ecologist and ad-hoc additional reports that are prepared in response to exceedance of trigger or threshold criterion. Reports will look at general trends and investigate or identify longer term patterns in habitat condition and use against milestones.

3.12.3.1 Annual operational report

The delivery provider will provide an operational report to Alcoa on an annual basis, within three months from the anniversary of the Plan commencing. This report will contain:

- Detailed summary of the conservation actions implemented. This includes actions undertaken that demonstrate the delivery provider is implementing the on-ground actions as agreed, field observations and monitoring data.
- Responses to unanticipated events (such as severe weather events, fire) and the appropriateness, suitability and/or outcome of the response.
- Progress towards milestones, deliverables and outcomes.
- Exceedance of the trigger or threshold criterion including discussion of proposed corrective actions and timeframes for implementation of the corrective actions.
- Current or emerging constraints to accessing black cockatoo habitat areas or limitations of actions implemented.

- Detailed financial statement including incomings, outgoings, and forecast expenditure for the next five years.
- Detailed schedule and plan to implement conservation actions for the upcoming year and high-level plan for the next five years.
- Project evaluation identifying areas for improvement, identification of approaches which are working well and suggestions for adaptive management.
- Recommendations for additional controls or actions relevant to the proposed offset conservation area. If appropriate, provision of a timeframe and cost proposal to implement the recommended action(s).
- A review of any project-related risks (funding, resource, access) and how they can be mitigated or minimised.
- Emerging or potential risks to the achievement of the proposed outcomes.

The operational report will be reviewed and evaluated against the Plan objectives and outcomes by the Environmental Offset Advisory Panel and Environmental Offset Team.

The annual report (or a summary/redacted version) will be provided to regulators, stakeholders and will be published on Alcoa's website.

3.12.3.2 Fauna habitat assessment reports

Fauna habitat assessments will be conducted as part of the baseline surveys and in years 5, 10, 15 and 20 of the offset period, and will be documented in a fauna habitat assessment report for each proposed offset conservation area. These reports will be prepared based on the requirements in the *EPA's Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) and the *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act* (DEWHA 2010).

The five yearly fauna habitat assessment reports will be provided to Alcoa by the suitably experienced ecologist and reviewed by the offset assessment group. The report will be provided to the delivery partner, regulators (as part of any conditions on approval) and uploaded to relevant government information portals (for example Index of Biodiversity Surveys for Assessments (IBSA) program).

3.12.3.3 Ad-hoc reports

Ad-hoc reports will be provided to relevant stakeholders and regulators where a specific issue is to be addressed. The report will include a description of the issue (exceedance of trigger or threshold criterion), background and context, response actions proposed to be undertaken, expected outcomes from the response actions, timeframes, costs and further monitoring or reporting proposed.

3.12.4 Response Actions

Alcoa will assess the performance indicators against the baseline data for the proposed offset conservation area, and against reference sites.

Trigger criteria will provide a warning to the Environmental Offset Advisory Panel, Environmental Offset Team and delivery partner that the Project is not on a trajectory to meet outcomes and that actions should be undertaken to resolve the issue, ahead of a threshold criterion being exceeded.

Threshold criteria indicate an environmental outcome is unlikely to be met and require immediate actions to resolve the cause of the exceedance.

Indicative trigger and threshold criteria and associated responsive actions or adaptive management actions are in Table 3-7. Response actions have been listed individually for each set of triggers and threshold criterion; however, Alcoa will consider responsive actions holistically. This is because implementing one responsive action may result in an unwanted and indirect secondary trigger or threshold criterion exceedance. For example, actions to install or maintain a drinking water source may cause impacts to surrounding vegetation.

If the Environmental Offset Advisory Group and/or Environmental Offset Team consider the Plan has not, or is not, delivering on targets, deliverables or milestones; or does not indicate it is on trajectory to meet the targets, or there are indications of poor project performance, Alcoa's Environmental Offset Team will liaise with the delivery partner and identify areas for improvement.

Table 3-7: Response to exceedance of trigger or threshold criteria

Indicators: • Vegetation type, structure and condition • Presence of key habitat features (drinking water) • Presence of key habitat features (roost sites) • Presence of key habitat features (known or suitable nest trees) • Presence of black cockatoos	Response actions	Monitoring	Reporting
Trigger criterion 1 – Field ecologist or land manager observes a decline in vegetation condition or extent in areas within the POCA over a period of two years. Threshold criterion 1 – Habitat quality assessment fails to show improvement in vegetation condition after a period of five years.	Trigger level action – Map out the area, or areas, where the vegetation structure or condition appears to be degrading. Increase visual monitoring of the area to quarterly. Consider the likely or potential cause for decline (e.g. seasonal event, fire, drought, storm, disease, groundwater changes). Evaluate if the observed degradation is likely to be caused by a short-term one off event where the vegetation is expected to recover, or if the degradation is severe or likely to be long-term. If severe, engage a suitability experienced field consultant to conduct a habitat assessment within the area(s) of decline. Modify or develop new conservation actions. Threshold level action – Consult a subject matter expert to assess the likely cause of the decline. Modify conservation actions. Reassess the black cockatoo habitat within 24 months.	Black cockatoo habitat quality will be assessed at the commencement of the offset period. As part of implementing the conservation actions, field ecologists will be at the POCA regularly, allowing for early indications of potential vegetation decline or stress. Alcoa environmental staff (preferably those familiar with the POCA and NJF in general) will visit the POCA at least once per calendar year. Black cockatoo habitat assessments to be conducted at year 5, 10, 15 and 20 of the offset period as described in Section 3.2.2 and Table 3-2 Monitoring sites (including reference or control sites) will be defined in Offset Management Plans.	Alcoa/delivery partner will provide an annual report to the offset advisory panel. The report content is in section 3.12.3 but will include exceedance of the trigger criterion, proposed corrective actions and timeframes for implementation of corrective actions. Every five years the annual report will incorporate a five yearly progress review, with results of the black cockatoo habitat assessment field survey, measures against the baseline and exceedance of trigger criterion.
Trigger criterion 2 – A drinking water site/s is observed to be in poor condition or is underutilised by black cockatoos. Threshold criterion 2 - Utilisation of water sites across the POCA is observed to decrease by more than 25% over more than two years, despite ongoing maintenance.	Trigger level action – Consider the likely or potential cause for poor condition (overgrown with weeds, carcass in the water body, water level decline) or underutilisation (preferable temporary or permanent water sources are located nearby). Implement actions to restore the drinking water quality. Continue monitoring the drinking water site. Threshold level action – Consult a SME to assess the likely reason for the lack of use of the drinking water site (location, accessibility, connectivity, other water sources nearby). Restore or modify drinking water site. Seek support from landowner where preferable drinking water sites are to maintain drinking water Install new or additional drinking water sites within or surrounding the POCA. Continue to monitor drinking water sites.	Available black cockatoo water sources will be assessed at the commencement of the offset period. As part of implementing the conservation actions, field ecologists will be at the POCA regularly, allowing for early indications of potential decline in drinking water sources. Alcoa environmental staff (preferably those familiar with the POCA and NJF in general) will visit the POCA at least once per calendar year. Black cockatoo habitat assessments to be conducted at year 5, 10, 15 and 20 of the offset period as described in Section 3.2.2 and Table 3-2. Monitoring sites (including reference or control sites) will be defined in Offset Management Plans.	As above
Trigger criterion 3 – Black cockatoo occupancy of a known night roosting site is not recorded over two or more years whereby the roost site has not been impacted\damaged or lost through factors outside	Trigger level action – Consider the likely or potential cause for black cockatoos no longer using a night roosting site. What are the observable changes (development nearby, reduced drinking water or loss of	Black cockatoo night roost sites will be mapped and assessed at the commencement of the offset period. As part of implementing the conservation actions, field ecologists will be at the POCA regularly, allowing for	As above

Indicators: • Vegetation type, structure and condition • Presence of key habitat features (drinking water) • Presence of key habitat features (roost sites) • Presence of key habitat features (known or suitable nest trees) • Presence of black cockatoos	Response actions	Monitoring	Reporting
Alcoa's control such as illegal clearing or catastrophic fire. Threshold criterion 3 – No evidence of roost occupancy is recorded at a known roost site over a five year monitoring period.	foraging habitat nearby)? Consider actions to improve or restore use of night roosting sites. Threshold level action – Consult a subject matter expert to assess the likely reason for the lack of use of the night roost site. Repair drinking water sites or revegetate areas around the roost tree. Install new or additional drinking water sites within or surrounding the POCA. Increase intensity of monitoring at the night roosting site.	early indications of potential changes in, or use of, night roost sites. Alcoa environmental staff (preferably those familiar with the POCA and NJF in general) will visit the POCA at least once per calendar year. Black cockatoo habitat assessments to be conducted at year 5, 10, 15 and 20 of the offset period as described in Section 3.2.2 and Table 3-2. Monitoring sites (including reference or control sites) will be defined in Offset Management Plans.	
Trigger criterion 4 – monitoring of known or suitable nest hollows indicates a known nest hollow has not been utilised for a period of more than two years OR Monitoring of black cockatoo nesting hollows identifies that a suitable hollow has had multiple consecutive failed breeding attempts OR A previously suitable nest hollow is observed to have structural damage which may impact suitability. Threshold criterion 4 – the availability of breeding hollows has decreased by >5% from baseline levels due to occupation by other species, feral bees or tree felling (natural or anthropogenic).	Trigger level action – Outside of the breeding season, assess the hollow using a pole camera or drone. Record the condition of the hollow and its apparent suitability or obviously unsuitability. Implement maintenance to repair the hollow (if possible). Assess the surrounding area for changes that may make the hollow less attractive for breeding (for example lack of water or suitable habitat nearby). Consult a black cockatoo SME for possible reasons why the hollow may not be conducive to survival of the chick. Assess if this against other hollows in the area (i.e. is there a lack of successful breeding in other hollows in the area or is this occurring in this one hollow only). Assess against the overall environmental conditions for breeding (are conditions good for breeding but unsuccessful or are conditions not conducive to breeding). If the hollow is no longer viable, remove it from the monitoring program. Threshold level action – Assess the reason for the decline in black cockatoo suitable nest hollows. Consult with a SME. If appropriate and following consultation with SMEs and the DBCA, install artificial nest hollows to support breeding temporarily until new natural hollows form. Revegetate areas where nearby foraging habitat has been lost or is degraded. Check and repair any water sources. Install new or additional drinking water sites within or surrounding the POCA.	Black cockatoo known and suitable nest trees will be mapped and assessed at the commencement of the offset period. As part of implementing the conservation actions, field ecologists will be at the POCA regularly and may identify additional known or suitable nest trees. These trees will be added to the black cockatoo known and suitable nest tree monitoring program. Alcoa environmental staff (preferably those familiar with the POCA and NJF in general) will visit the POCA at least once per calendar year. Black cockatoo habitat assessments to be conducted at year 5, 10, 15 and 20 of the offset period as described in Section 3.2.2. Monitoring of known and suitable nest trees is described in Table 3-2. Monitoring sites (including reference or control sites) will be defined in Offset Management Plans.	As above

Indicators: • Vegetation type, structure and condition • Presence of key habitat features (drinking water) • Presence of key habitat features (roost sites) • Presence of key habitat features (known or suitable nest trees) • Presence of black cockatoos	Response actions	Monitoring	Reporting
Trigger criterion 5 – A sustained reduction in evidence (primary sightings or foraging evidence) of black cockatoos using the POCA is observed over a period of two or more years. Threshold criterion 5 – The estimated abundance of black cockatoos utilising habitat the POCA reduces by 10% over a five year period.	Trigger level action – Consider the likely or potential cause for reduction in black cockatoos' activity within the POCA. What are the observable changes (development nearby, reduced drinking water)? Consider actions to improve or restore use of the POCA. Threshold level action – Consult a SME to assess the likely reason for the lack of use of the POCA. Repair drinking water sites or revegetate areas around the roost tree. Install new or additional drinking water sites within or surrounding the POCA. Increase intensity of monitoring at the site. Consider new findings or research outcomes that change the current understanding of black cockatoo use of the NJF.	Black cockatoo estimates will be developed at the commencement of the offset period. As part of implementing the conservation actions, field ecologists will be at the POCA regularly, allowing for early indications of potential changes in, or use of, the POCA by black cockatoos. Alcoa environmental staff (preferably those familiar with the POCA and NJF in general) will visit the POCA at least once per calendar year. Black cockatoo habitat assessments to be conducted at year 5, 10, 15 and 20 of the offset period as described in Section 3.2.2. Monitoring of known and suitable nest trees is described in Table 3-2 Monitoring sites (including reference or control sites) will be defined in Offset Management Plans.	As above

4. Key offset concepts

Alcoa reviewed, and where appropriate incorporated, information from a range of policy, guidelines and documents in the preparation of this Plan.

The WA and Commonwealth Governments are undergoing legislative reforms relevant to environmental approvals and offsets. This Project has been developed to meet the current environmental offset policies and guidance but also look to the future direction for the need for conservation and recovery actions to be funded by investment from the private sector, including in the form of environmental offsets.

Conservation actions have been proposed based on current scientific knowledge but with enough scope to be adaptive and respond to increasing or emerging threats.

Consideration has also been given to the Western Australian EPA public advice on considering environmental offsets at a regional scale (EPA 2024), and the need for environmental offsets to be part of a broader suite of integrated strategic actions across bioregions.

4.1 Offset policies

This Environmental Offset Project aligns with the six principles identified in the WA Environmental Offset Policy (GoWA 2011) and the principles of the Commonwealth's Environmental Offset Policy (DSEWPaC 2012).

- Avoidance and mitigation options for black cockatoos have been pursued (Alcoa 2023a).
- Alcoa has committed to post-mining rehabilitation to return habitat as soon as practicable after the disturbance is no longer required (Alcoa 2023a).
- The Environmental Offset Project provides the most cost-effective outcomes for black cockatoos (Maron et al 2021, DEC 2008, DPaW 2011).
- The Environmental Offset Project has been prepared collaboratively by Alcoa and environmental, offset, field and research officers (Section 2.7).
- This Environmental Offset Project has been based on actions in the recovery plan and research outcomes from the latest scientific papers on black cockatoos in the NJF (Section 4.2 and 4.3).
- This Environmental Offset Project describes how offsets will be applied within a framework of adaptive management (Section 3.8).
- This Environmental Offset Project is focused on longer-term strategic outcomes that deliver an overall conservation outcome that improves or maintains the viability of black cockatoos (Section 1.4).
- Implementation of on-ground management, recovery and threat abatement actions for black cockatoos is a direct offset.

- This Environmental Offset Project Plan effectively accounts for and manages the risks of the offset not succeeding (Section 3.7).
- The conservation actions proposed in this Environmental Offset Project Plan are additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs (Section 3.1).
- This Environmental Offset Project Plan provides conservation actions that are efficient, effective, timely, transparent, scientifically robust and reasonable (Section 3).
- This Environmental Offset Project Plan has transparent governance arrangements including being able to be readily measured, monitored, audited, and enforced (Section 3.2.2, 3.2.3, 3.6, 3.11, 3.12).

4.2 Recovery plans

Implementing on-ground management to enhance black cockatoo habitat and conserve areas with mature trees supports the objectives of the relevant black cockatoo recovery plans.

This Project aligns with Action 1 Protect and Manage Important Habitat in the Carnaby's Cockatoo Recovery Plan (DPaW 2013). Detailed mapping and assessment of Carnaby's cockatoo habitat within the NJF is limited. The region is large in extent and, difficult to traverse which makes following black cockatoo movement and usage of areas difficult. Rather than specifically following flocks of black cockatoos, the assessments conducted under this Project will assess general patterns of black cockatoo use and occupancy of an area. Collectively the data obtained, and conservation actions will address:

- Identifying areas within the NJF that are critical to the survival of Carnaby's cockatoo, through the identification and mapping of known and potential breeding habitat trees.
- Protecting and enhancing existing Carnaby's cockatoo habitat, including known and potential breeding, foraging and roosting habitat.
- Maintaining (and supplementing) natural and artificial water sources which may be used by Carnaby's cockatoos.
- Increase hollow availability by repairing damaged and sub-optimal breeding hollows used by black cockatoos.

The Project also aligns with Action 2 Undertake Regular Monitoring in the Carnaby's Cockatoo Recovery Plan (DPaW 2013). The Project will monitor vegetation condition of Carnaby's cockatoo breeding habitat and foraging habitat, including nesting hollows, and stand structure of woodlands and monitor night roost sites known to occur within the POCA.

The Project also aligns with actions in the Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEWHA 2009).

The highest priority is to secure funding to implement recovery actions. The funding provided by Alcoa towards recovery actions will be significant and will be used to:

- Identify and manage important Baudin's and forest red-tailed black cockatoo habitat and protect these areas from threatening processes.
- Identify factors affecting the frequency of Baudin's and forest red-tailed black cockatoo breeding attempts or likelihood of breeding success and manage nesting hollows to increase recruitment.
- Help to minimise the effects of mining on breeding, roosting and foraging habitat used by the Baudin's and forest red-tailed black cockatoos.
- Inform forest management actions for the conservation of Baudin's and forest red-tailed black cockatoos.
- Map critical foraging and breeding habitat for the Baudin's and forest red-tailed black cockatoos.
- Monitoring population numbers and distribution of Baudin's and forest red-tailed black cockatoos in the NJF.
- Collect information which may assist with determining the patterns and significance of movement of Baudin's and forest red-tailed black cockatoos in the NJF.

Other recovery actions relate to reducing the issues surrounding black cockatoos foraging in orchards. This Project does not specifically address these issues as it relates more to farming in the Wheatbelt bioregion.

Discussion of how this Plan aligns with the recovery actions is in Table 4-1.

While not addressed directly in this Plan, separate Environmental Offset Project Plans will be prepared around managing pathogens, reducing the risk of fire and improving the flora and vegetation species diversity and/or abundance. These projects will provide direct outcomes for flora, vegetation and fauna species in the NJF at a holistic level and is therefore not included in this Plan.

Table 4-1: Consistency with Recovery Plans

Recovery Plan/Conservation Advice	Recovery Action	Addressed in this Plan
Carnaby's cockatoo (*Calyptorhynchus latirostris*) Recovery Plan, (DPaW 2013)	Action 1: Protect and Manage Important Habitat Action 2: Undertake Regular Monitoring	Action 1 notes protection and regeneration of existing habitat is significantly more efficient and effective than planting of species that support Carnaby's cockatoo. This project will deliver **direct outcomes** for the Carnaby's cockatoos as follows: • Increasing the areas of Carnaby's cockatoo foraging, roosting and breeding habitat that is actively managed and protected • Providing additional water points in relative proximity to habitat to mitigate impacts from climate change. • Repair of damaged and suboptimal hollow to extend the life of suitable hollows, which can take over 100 years to develop. Action 2 states regular monitoring of Carnaby's cockatoo populations and habitat will provide information on the size of the breeding population, breeding success, and use of habitat by the species, and changes in those parameters over time. This project will deliver **indirect outcomes** (that will lead to direct outcomes) for Carnaby's cockatoos as follows: • On-going and regular monitoring of foraging, roosting and breeding habitat will provide information that can be used in predictive modelling and development of future conservation actions. • Collect information that can be used in deriving estimates of the population.
Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC 2008)	14.6. Identify factors affecting the number of breeding attempts and breeding success and manage nest hollows to increase recruitment. 14.7. Determine and implement ways to minimise the effects of mining and urban development on habitat loss. 14.8. Determine and implement ways to manage forests for the conservation of Forest Black Cockatoos. 14.9. Identify and manage important sites and protect from threatening processes. 14.10. Map feeding and breeding habitat critical to survival and important populations and prepare management guidelines for these habitats. 14.11. Monitor population numbers and distribution.	This project will deliver **direct outcomes** to forest black cockatoos as follows: • Monitoring of nest trees as part of this offset Plan will provide information which may aid in early identification of factors affecting breeding attempts and success. • The offset will protect areas of black cockatoo habitat in the NJF and may minimise the effects of habitat loss due to mining activities. • Implementation of a suite of management actions with ongoing monitoring and evaluation will provide scientific information to support best practice management and conservation of black cockatoo habitat. • Surveying of offset areas will provide information that identifies important breeding/roosting sites and management actions will aid in protecting these sites from key threatening processes. This project will deliver **indirect outcomes** to forest black cockatoos as follows: • Ongoing and regular monitoring of foraging, roosting and breeding habitat will provide information that can be used in predictive modelling, development of future conservation actions and adaptive management of existing actions. • Provide information that can be used in deriving estimates of the population and distribution.

Recovery Plan/Conservation Advice	Recovery Action	Addressed in this Plan
Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) (DEWHA 2009)	Regional Priority Actions	Regional Priority Actions include monitoring the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary; determining and implementing ways to minimise the effects of mining on habitat loss; and determining and implementing ways to manage forests for the conservation of the subspecies. This project will deliver **indirect outcomes** (that will lead to direct outcomes) for forest red-tailed black cockatoos and Baudin's cockatoos as follows: • Ongoing and regular monitoring of foraging, roosting and breeding habitat will provide information that can be used in predictive modelling, development of future conservation actions and adaptive management of existing actions. • The effectiveness of conservation actions will be assessed and shared with conservation action groups and/or agencies to support conservation actions across a wider area. • Provide information that can be used in deriving estimates of the population.
Conservation Advice *Calyptorhynchus baudinii* Baudin's cockatoo (TSSC 2018),	Primary Conservation Actions	Primary Conservation Actions for Baudin's cockatoo is to limit the amount of illegal shooting and to increase the number of nest hollows, mainly through limiting further loss of mature trees. This project will deliver **direct outcomes** to Baudin's cockatoos as follows: • Protection and management of large areas of State Forest (encompassing existing hollow-bearing trees and future habitat trees) to limit the loss of mature trees. • Repair of damaged and sub-optimal hollows to extend the life of suitable hollows, which can take over 100 years to develop. This project will deliver **indirect outcomes** (that will lead to direct outcomes) for Baudin's cockatoos as follows: • Identification and mapping of existing hollow-bearing trees to provide information to fire management groups. This may assist with reducing physical damage to known or suitable nesting trees occurring during or after fire operations. • Mapping and monitoring Baudin's cockatoo observations within POCAs, will help with understand the attributes that are attractive to the species when selecting a breeding site.

4.3 Threatened Species Action Plan

The 2022-2032 Threatened Species Action Plan (DCCEEW 2022), released in October 2022, maps a pathway to protect, manage and restore Australia's threatened species and important natural places. The Threatened Species Action Plan lists 20 priority places and 110 priority species and has four objectives and 22 targets to be met over a ten-year period.

Relevant to this Plan, the Threatened Species Action Plan lists the Carnaby's cockatoo as priority species. This Plan will contribute to actions identified under Target 2: Implementation of priority actions for priority species by:

- Identifying key black cockatoo habitat in the NJF.
- Identifying threats to key black cockatoo habitat in the NJF.
- Identifying actions required to improve key black cockatoo habitat in the NJF.
- Commencing key recovery actions and/or building on activities underway, expanding collective recovery and threat management to key black cockatoo habitat in the NJF.

DCCEEW (2022) also lists the chuditch, quokka, numbat and western ringtail possum as priority species. These species are likely to benefit from an improvement in black cockatoo habitat within the NJF.

Data and information obtained throughout the Project will be shared with DCCEEW (via Environmental Online, Environmental Information Australia or other means requested by DCCEEW).

5. Conclusion

Alcoa has a high degree of confidence this Project will deliver the outcomes stated and contribute to the long-term viability of black cockatoos in the NJF.

- This Project has been prepared collaboratively by Alcoa, species ecologists and research officers using current scientific research.
- Species ecologists have over 20 years' experience working with threatened mammals in the Jarrah Forest and understand the current threats and on-ground actions that are key to the long-term viability of population(s) of chuditch, and/or woylie in the NJF.
- The team of Alcoan environmental scientists have extensive knowledge of the NJF. Since 1975, Alcoa has supported the publication of more than 260 refereed journal papers and book chapters, 80 technical studies, and about 60 higher-degree research theses. Alcoa has been monitoring fauna in the NJF since at least 1992.
- The Environmental Offset Project has been developed to align with actions in the black cockatoo recovery plans and uses the latest available science and research outcomes relevant to black cockatoos in the NJF.
- Management and monitoring will be conducted over the long-term (20 years) using an adaptive management framework to respond to new scientific findings and threats such as climate change. Consistent and regular monitoring and adaptive management approach allows emerging risks or issues to be identified and mitigated against in advance.
- Alcoa proposes to contribute funding towards conservation and threat abatement actions over at least the next 20 years.

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Appendix A – Black cockatoo habitat quality scoring tool

Report

26 February 2025

To	Bianca Lockley	**Contact No.**	+61 8 6222 8384
Copy to	Ashley Bird	**Email**	heath.morgan@ghd.com
From	Heath Morgan	**Project No.**	12633192
Project Name	Pinjarra Alumina Refinery Revised Proposal – Environmental Review Document		
Subject	Threatened fauna habitat scoring tool – explanatory report		

1. Introduction

1.1 Purpose of this report

The purpose of this report is to describe the process and outcomes of the development of fauna habitat quality scoring methods to support the calculation of residual significant impacts[1] to threatened fauna habitat, for presentation in the Pinjarra Alumina Refinery Revised Proposal ('the Proposal') Environmental Review Document (ERD).

2. Scope and limitations

2.1 Scope of work

The scope of the work completed was:

– Develop scoring method for threatened fauna species habitat, for species likely to occur in the Proposal Development Envelope (DE) (Carnaby's, Baudin's and Forest Red-tailed Black Cockatoo, Chuditch, Quokka and Woylie)
– Provide rationale and justification as to the suitability of the scoring methodology with respect to fauna habitats within the Northern Jarrah Forest IBRA (Interim Biogeographic Regionalisation for Australia) sub-region.

2.2 Limitations

This report: has been prepared by GHD for Alcoa of Australia and may only be used and relied on by Alcoa of Australia for the purpose agreed between GHD and Alcoa of Australia as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Alcoa of Australia arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

[1] The Commonwealth use the term residual significant impact, whereas the Western Australian Government use significant residual impact. Within this report, residual significant impact is used to refer to both terms.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

3. Threatened fauna habitat scoring

3.1 Habitat scoring guidance

The development of threatened fauna habitat scoring for the Proposal ERD has considered guidance on habitat quality in the EPBC Act *How to Use the Offsets Assessment Guide* (undated) and the WA *Environmental offsets metric: Quantifying offsets in Western Australia* (DWER 2021). Table 1 presents a summary of the EPBC Act and WA guidance with respect to threatened species. As presented, the two guidance documents align broadly on three habitat scoring components, being site condition, site context, and species population.

The development of threatened fauna habitat scoring has also considered guidance of habitat requirements and key threats for the six EPBC Act listed fauna species assessed as known or likely to occur in the Proposal DE (the 'subject listed species'), namely:

Known to occur:

– Baudin's Cockatoo (*Zanda baudinii*) (Endangered)
– Carnaby's Cockatoo (*Zanda latirostris*) (Endangered)
– Forest Red-tailed Black-Cockatoo (FRTBC) (*Calyptorhynchus banksii naso*) (Vulnerable)
– Chuditch (*Dasyurus geoffroii*) (Vulnerable)
– Quokka (*Setonix brachyurus*) (Vulnerable)

Likely to occur:

– Woylie (*Bettongia penicillata ogilbyi*) (Endangered)

A summary of the guidance of habitat requirements and key threats is presented in Table 2 for Black Cockatoos and Table 3 for the subject listed species that are critical weight range (CWR) mammals.

3.2 Habitat scoring framework

The overall rationale for the habitat scoring framework is to score habitat quality based on available datasets at the time of preparing the ERD, such as the fauna habitat / vegetation types or vegetation condition mapped over the Proposal DE, or inferred water habitats mapped in proximity to the DE. Accordingly, habitat quality elements that do not have available datasets at the time of preparing the ERD are excluded (e.g. canopy cover, den density, density of prey species, density of feral predators). These habitat quality elements may potentially be introduced into the habitat scoring framework at a later stage (e.g. offset monitoring) if the necessary datasets become available.

The habitat guidance and literature (Table 2, Table 3), baseline survey results (GHD 2024, 2025a, 2025b), and advice by specialists (T. Kirkby, M. Craig, pers. comm.) indicate that the importance of site condition, context and species stocking for Black Cockatoos is substantially different from that of the subject CWR mammals. Accordingly, a separate scoring framework is proposed for each of the two fauna groups.

Black Cockatoos are dependent on foraging resources and habitat features (nest trees, roost trees and drinking water) that vary substantially with fauna habitat / vegetation types. In contrast, the subject CWR mammals can forage across all fauna habitat / vegetation types but are substantially affected by feral predators (in the case of Quokka, restricting the habitat types it would otherwise occupy) and/or habitat fragmentation. The collection of field records for Black Cockatoos and CWR mammals also differs substantially. Black Cockatoos are readily identified during field surveys, with distinctive calls and daytime visibility while roosting, in flight, or by conspicuous foraging residues. The subject CWR mammals are comparatively cryptic, being nocturnal and with relatively small, localised (in the case of Quokka) and/or sparse populations that reduce the recording of individuals or their signs (e.g. scats, diggings).

The habitat scoring framework has adopted three habitat components considering both the EPBC Act and WA guidance, namely:

1. Site / vegetation condition, including:
    - vegetation condition, using the condition scale developed for the Proposal DE (Mattiske 2024)
    - presence of habitat species and features
2. Site context, including:
    - species movement patterns
    - proximity to suitable habitat
    - context of species population
    - presence of threats
3. Species stocking rate / habitat value:
    - species presence and population

The scoring for each habitat component is generally scored out of 3. Site condition is scored out of 4 for Black Cockatoos, reflecting its relative importance for these highly mobile species, whereas site context is scored out of 4 for CWR mammals, reflecting the importance of key threats and connectivity for ground fauna. Scores for each habitat component are then summed to make a score out of 10.

The habitat scoring framework is presented in Table 4 for Black Cockatoos and Table 5 for CWR mammals. Each framework contains supporting notes, where relevant. Table 6 provides supporting definition of habitat / features for input into the scoring framework.

Table 1 Threatened species habitat quality – EPBC Act and WA environmental offsets guidance

EPBC Act offset guide habitat quality component	Description in relation to threatened species	WA offset metric habitat quality component	Description in relation to threatened species
Site condition	Condition of a site in relation to the ecological requirements of a threatened species. Includes considerations such as: – vegetation condition and structure, – the diversity of habitat species present, and – the number of relevant habitat features.	Vegetation condition	Condition of the native vegetation present at a site. Evaluation should include (but not be limited to) consideration of: – forms of disturbance and/or threats: disturbance from land use and management practices, edge effects – number of weeds: disturbance opportunistic, those carried by vectors, persistent perennials, aggressive invaders in the absence of disturbance – soil stability: the presence of stems and other plant bases, surface feeder roots, humus/organic matter, duricrust, cryptograms, lichens, litter and debris – number of native plants: species composition of a particular vegetation type, and a sense of whether there has been a loss of components – number of strata: vegetation structure of a particular vegetation type, and a sense of whether there has been a loss of components – seedlings and sapling presence: regenerative capacity, for resilience – vegetation health: general health of the overstorey and understorey, signs of stress, atypical leaf colouration, leaf/limb or whole plant death. It may be appropriate for the condition to be determined using the Keighery scale in the intensive land use zone.
Site context	The relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species. Includes considerations such as: – movement patterns of the species, – the proximity of the site in relation to other areas of suitable habitat, and – the role of the site in relation to the overall population or extent of a species or community.	Site context	The relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of the threatened species. Evaluation should include (but not be limited to) consideration of: – movement patterns; that is, where a mobile species – proximity of the site in relation to other areas of suitable habitat, such as size of the site in the context of the surrounding landscape/region, – connectivity with other suitable or known habitat – proximity to water – importance of the site in relation to the overall species population – vegetation extent, such as extent of vegetation type within the bioregion, percentage of vegetation coverage within the local area – the occurrence of threats on or near the site.
Species stocking rate	Usage and/or density of a species at a particular site. The principle acknowledges that a particular site may have a high value for a particular threatened species, despite appearing to have poor condition and/or context. Includes considerations such as: – survey data for a site in regards to a particular species population. – the role of the site population in regards to the overall species population viability.	Habitat value	The ability of a site to support the threatened species. Evaluation should consider whether a particular site may have a high importance for the threatened species, despite, for example, appearing to have low-scoring vegetation condition. The evaluation should include (but not be limited to) consideration of: – the presence of a species on the site (confirmed/modelled through survey data) – the density of a species at the site – the context of a species population at the site in regard to the overall species population – any threats present at the site that may impact the survival of species.

Table 2 Summary of published habitat guidance – Black Cockatoos

Species	Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)	Baudin's Cockatoo (*Zanda baudinii*)	Carnaby's Cockatoo (*Zanda latirostris*)
Habitat description (with relevance to Northern Jarrah Forest habitats)	Referral guidelines (DAWE 2022) Foraging – Primarily seeds of Jarrah and Marri in woodlands and forest, also Allocasuarina cones and fruits of Snottygobble. Less important foods include Blackbutt, Bullich, Sheok, and Hakea spp. Breeding – Generally in woodland or forest, but may also breed in partially cleared woodland or forest, including isolated trees. Nest in hollows in live or dead trees (many eucalypt species may provide suitable hollows), particularly Marri, Wandoo, Bullich, Blackbutt, and Jarrah. Roosting – Any tall trees may provide roosting habitat, but particularly tall Jarrah, Marri, Blackbutt, and introduced eucalypt trees or large trees on the edges of forests.	Referral guidelines (DAWE 2022) Foraging – Primarily seeds of Marri, rarely Jarrah, in woodlands and forest, and seeds of native proteaceous plants (e.g. Banksia, Dryandra and Hakea spp.). Also insects and insect larvae, Kangaroo Paw, tips of Pinus spp. Breeding – Generally in woodland or forest, but may also breed in partially cleared woodland or forest, including isolated trees. Nest in hollows in live or dead trees (many eucalypt species may provide suitable hollows), particularly Marri, Jarrah, Wandoo and Bullich. Roosting – Generally in or near riparian environments or other permanent water sources. Any tall trees may provide roosting habitat, but particularly Jarrah, Flooded Gum, Blackbutt, and introduced eucalypts.	Referral guidelines (DAWE 2022) Foraging – Native shrubland, kwongan heathland and woodland on proteaceous plants (e.g. Banksia, Hakea and Grevillea spp.), as well as Callistemon spp. and Marri. Also seeds of Pinus spp, insects and insect larvae. Breeding – Woodland or forest, but also in partially cleared woodland or forest, including isolated trees. Nest in hollows in live or dead trees (many eucalypt species may provide suitable hollows), particularly Wandoo, Jarrah, Flooded Gum, and Marri. Roosting – Generally in or near riparian environments or natural and artificial permanent water sources. Any tall trees may provide roosting habitat, but particularly Wandoo, Marri, Blackbutt, introduced eucalypts and pines.
Critical habitat	Recovery Plan (DEC 2008): – areas currently occupied by the cockatoos; – natural vegetation in which the cockatoos nest, feed and roost – natural vegetation through which the cockatoos can move from one occupied area to another; and – suitable vegetation within the recorded range in which undiscovered cockatoo populations may exist – Marri, Karri and Jarrah forests, woodlands and remnants in the south-west of Western Australia receiving more than 600 mm of annual average rainfall.	Recovery Plan (DEC 2008): – areas currently occupied by the cockatoos; – natural vegetation in which the cockatoos nest, feed and roost – natural vegetation through which the cockatoos can move from one occupied area to another; and – suitable vegetation within the recorded range in which undiscovered cockatoo populations may exist – Marri, Karri and Jarrah forests, woodlands and remnants in the south-west of Western Australia receiving more than 600 mm of annual average rainfall.	Recovery Plan (DPaW 2013): – The eucalypt woodlands that provide nest hollows used for breeding, together with nearby vegetation that provides feeding, roosting and watering habitat that supports successful breeding; – Woodland sites known to have supported breeding in the past and which could be used in the future, provided adequate nearby food and/or water resources are available or are re-established; – In the non-breeding season, the vegetation that provides food resources as well as the sites for nearby watering and night roosting that enable the cockatoos to effectively utilise the available food resources.
Key threats	Recovery Plan (DEC 2008): – killing by illegal shooting – feral honeybees (sting deaths / nest exclusion) – habitat loss (clearing, harvesting) – nest hollow shortage – nest hollow competition (other birds, feral bees)	Recovery Plan (DEC 2008): – killing by illegal shooting – feral honeybees (sting deaths / nest exclusion) – habitat loss (clearing, harvesting) – nest hollow shortage – nest hollow competition (other birds, feral bees)	Recovery Plan (DPaW 2013): – loss of breeding habitat (hollow bearing trees) Loss of non-breeding foraging and night roosting habitat – tree health (e.g. Phytophthora dieback) – mining and extraction activities – illegal shooting and taking – climate change – collisions with motor vehicles – disease

Table 3 Summary of habitat guidance – critical weight range mammals

Species	Chuditch (*Dasyurus geoffroii*)	Woylie (*Bettongia penicillata ogilbyi*)	Quokka (*Setonix brachyurus*)
Habitat description (with relevance to Northern Jarrah Forest habitats)	Recovery Plan (DEC 2013): The major portion of the remaining natural populations occur in varying densities in jarrah forests and woodlands in the south-west corner of WA, and in woodlands, mallee shrublands and heaths along the south coast, east to the Ravensthorpe area. Chuditch are solitary animals for most of their life. In the absence of foxes, they occupy relatively large home ranges, males ranging over 15 km² and females 3-4 km². Home ranges may overlap; however there tends to be a smaller non-overlapping 'core' area defined by den locations: 4 km² and 0.9 km² for males and females respectively. Both sexes occur at similar densities in the jarrah forest.	Recovery Plan (Yeatman and Groom 2012): Known from a variety of habitats. Current habitat includes tall eucalypt forest and woodland, dense myrtaceous shrubland, kwongan (proteaceous) or mallee heath. Thickets and other suitable habitat types such as heath, provide refuges for woylies against predators. Woylie occupy home ranges, the size of which varies between habitats, sites and according to woylie density. Small home ranges (less than 6 ha) are generally observed at high density occurrences.	Habitat use in the northern jarrah forest is largely restricted to swamps and riparian habitat (Hayward et al 2005, Dundas et al 2017). Within swamps, they are habitat specialists, preferring early seral stages that have been burned within the previous 10 years. This preference derives from a combination of dietary requirements and refuge from predation. As swamps mature they become suboptimal, forcing quokkas to colonize new patches. Since the collapse of the metapopulation following the introduction of the fox, quokkas have been forced to remain at a site because predation inhibits dispersal (Hayward et al 2005). Home-range sizes are estimated at approximately 6-7 ha and core ranges approximately 1.2 ha (Hayward et al 2004). Ranges shift to the edge of swamps in winter, and toward the centre in autumn as the swamps dried.
Critical habitat	Recovery Plan (DEC 2012) – areas currently occupied by chuditch; – areas of natural vegetation in which chuditch breed, forage or use to move from one area to another; – areas of suitable vegetation within the recorded range in which undiscovered populations may exist; – areas not currently occupied due to recent fire but capable of supporting populations when sufficiently recovered – areas previously occupied that provide suitable habitat and into which can be reintroduced Chuditch have historically been present in a large variety of habitats so it is not possible to list a set of characteristic habitats that should be preserved. However, some key aspects are required for chuditch survival in an area. These are: adequate den resources (e.g. hollow logs, burrows or rock crevices), adequate prey resources (particularly large invertebrates) and sizeable areas (> 20 000 ha.).	Recovery Plan (Yeatman and Groom 2012) Although habitat suitable for the woylie varies across its current range, a number of key habitat requirements appear to be essential for the persistence of the species within this range. Woylies may persist in the following habitats where there is adequate introduced predator (fox and cat) control or exclusion: – tall eucalypt forest and woodland; – dense myrtaceous shrubland; and, – kwongan (proteaceous) or mallee heath. All habitat meeting these key requirements within the current range, which is either known to be occupied by woylies or to have the identified potential to be occupied by woylies, is considered habitat critical to the survival of the species.	Recovery Plan (DEC 2013) Habitat critical to the survival of the quokka has been well defined for the northern jarrah forest subpopulation and comprises Taxandria linearifolia swamps. Quokkas are thought to occur as, or previously occurred as, metapopulations dispersing from swamp to swamp over time as vegetation structure changes with time since fire. Habitat critical to survival includes areas of natural vegetation where the understorey is sufficiently thick and complex to provide a predation refuge close to more open, recently burnt vegetation which is used as a food source. Habitat changes seasonally, in wetter months after wetlands become inundated the quokkas core home range shifts toward the periphery of the swamp, leaving the quokka more exposed to predation. When this habitat is altered, and in the presence of feral predators, the carrying capacity of a site may also be reduced.
Key threats	Recovery Plan (DEC 2012) – land clearing, particularly of riparian vegetation, and the removal of suitable den logs and den sites – predation by, and competition from, foxes and feral cats – mortality from poisoning, trapping, illegal shooting, and road kills	Recovery Plan (Yeatman and Groom 2012) – fox predation – cat predation – habitat alteration (clearing, Phytophthora dieback) – native predators – climate change, particularly reduced rainfall and increasing temperatures – disease	Recovery Plan (DEC 2013): – fox predation – cat predation – feral pigs - destruction of habitat – Phytophthora dieback (impact likely to be variable) – clearing of habitat – altered fire regimes – altered hydrological regimes – climate change – disease

Table 4 Scoring framework – black cockatoos

Guidance summary	Site / vegetation condition	Site context	Species stocking rate / habitat value
EPBC Act offset guide	Ecological requirements of a threatened species. – vegetation condition and structure, – the diversity of habitat species present, and – the number of relevant habitat features.	Relative importance in terms of the landscape, taking into account connectivity needs. – movement patterns of the species, – proximity in relation to other areas of suitable habitat, and – role in relation to the overall population or extent of a species or community.	Usage and/or density of a species. – survey data for a site. – the role of the site population in regards to the overall population viability.
WA offset metric	Vegetation condition, as per Keighery in the intensive land use zone	– movement patterns – proximity of the site in relation to other areas of suitable habitat – connectivity with other suitable or known habitat – proximity to water – importance in relation to the overall species population – vegetation extent – occurrence of threats.	– presence of species (confirmed/modelled through survey data) – density of species – context of species population in regard to the overall population – any threats present[2].
Score	**Site / vegetation condition**	**Site context**	**Species stocking rate / habitat value**
4	– vegetation cover is dominated by foraging species, AND – contains potential breeding and/or roosting habitat, AND – vegetation condition is Good or better	n/a (scored out of 3)	n/a (scored out of 3)
3	– vegetation cover is dominated by foraging species, AND – vegetation condition is Good or better OR pine plantation (Carnaby's Cockatoo only)	– within 2 km of perennial water resources, AND – within 6 km of extensive (> 1000 ha) foraging resources	– local resident population in high numbers, including breeding
2	– vegetation cover is dominated by foraging species, AND – vegetation condition is Degraded or worse OR – vegetation has limited foraging species, AND – vegetation condition is Good or better	– between 2-3 km of perennial water resources, AND – within 6 km of extensive (> 1000 ha) foraging resources	– local resident population in small numbers, including breeding, with seasonal use by non-residents (no breeding)
1	– vegetation cover has limited foraging species, AND – vegetation condition is Degraded or worse	– more than 3 km from perennial water resources OR – between 6-12 km of extensive (> 1000 ha) foraging resources	– seasonal or transient use by small numbers (no breeding)
0	– vegetation cover does not contain foraging species	– more than 12 km of extensive (> 1000 ha) foraging resources	– no historic records, or records during baseline surveys
Notes	– The NJF is mapped as predominantly comprising open forest with 30-70% projection foliage cover of tallest stratum (Heddle et al 1980, NVIS[3]). No data on foliage cover is available at the local scale. – Presence and abundance of foraging species, as well as roosting and breeding habitat features, vary considerably across native vegetation types in the Jarrah forest. – While Degraded or Completely Degraded condition vegetation may provide foraging, breeding or roosting habitat (e.g. scattered trees in a parkland cleared context), the degraded vegetation condition may reduce recruitment and replacement of habitat species over the long term. Phytophthora dieback infestation may affect tree health for vulnerable species (e.g. Jarrah, Banksia spp.), noting most key foraging, breeding and roosting species (including Marri, Blackbutt, Bullich and Pinus spp.) are not vulnerable. – Vegetation condition mapping using condition scale developed for the Proposal DE by Mattiske Consulting (2024). – Note: pine plantation provides highly productive foraging resources for Carnaby's Cockatoo that is artificially recruited despite Completely Degraded vegetation condition. – Black Cockatoos favour key foraging species (Marri, Jarrah, Pinus spp.) (T. Kirkby, pers. comm.) that dominate the vegetation cover in their respective vegetation types, foraging on other plant species (and insects) as required.	– Black Cockatoos forage over a wide area, mainly nesting within 12 km of foraging resources and roosting within 2 km of water resources (DAWE 2022). – Craig et al. (2022) found ¾ of known nest hollows used by FRTBC were within 3 km of perennial water bodies. Unpublished data (M. Craig, pers. comm.) found a statistically significant increase in FRTBC foraging residues within 2 km of perennial water bodies compared to further than 2 km from perennial water bodies. – Unpublished observations are that FRTBC will use water sources from rural areas (particularly elevated troughs) and river pools (T. Kirkby, pers. comm.), whereas use of reservoirs occurs in low numbers (M. Craig, pers. comm.). Baudin's and Carnaby's Cockatoo will use water sources from rural areas, river pools, reservoirs, and seasonally from running streams (T. Kirkby, pers. comm.). – Population scored under species stocking rate / habitat value. – Modelled distribution of all three Black Cockatoos covers the Proposal MDE and surrounding land. Not scored. – No spatial data available to score key threats (feral honeybees, nest availability, nest competition, climate change). Phytophthora dieback threat scored as site / vegetation condition.	– Black Cockatoos are conspicuous and readily identified through calls, observation while roosting/flying, and/or foraging residues. – Forest-red Tailed Black Cockatoos occupy the Proposal DE as a resident, breeding population (T. Kirkby, pers. comm.). Baseline surveys (GHD 2024, 2025a, 2025b) recorded numerous observations of the species within the Proposal DE. – Baudin's and Carnaby's Cockatoos primarily occupy the DE on a seasonal basis, foraging during the non-breeding season of autumn-winter and returning to their breeding habitat for the spring-summer. Small, resident breeding populations also occur in proximity to the MDE (T. Kirkby, pers. comm). Baseline surveys (GHD 2024, 2025a, 2025b) recorded sparse observations of both species within the Proposal DE.

[2] Note this is a repeat from site context so is covered by the site context component.
[3] **https://www.agriculture.gov.au/sites/default/files/documents/mvg3-nvis-eucalypt-open-forest.pdf**

Table 5 Scoring framework – critical weight range mammals

Guidance summary	Site condition	Site context	Species stocking rate
EPBC Act offset guide	Ecological requirements of a threatened species. – vegetation condition and structure, – the diversity of habitat species present, and – the number of relevant habitat features.	Relative importance in terms of in the landscape, taking into account connectivity needs. – movement patterns of the species, – proximity in relation to other areas of suitable habitat, and – role in relation to the overall population or extent of a species or community.	Usage and/or density of a species. – survey data for a site. – the role of the site population in regards to the overall population viability.
WA offset metric	Vegetation condition, as per Keighery in the intensive land use zone	– movement patterns – proximity of the site in relation to other areas of suitable habitat – connectivity with other suitable or known habitat – proximity to water – importance in relation to the overall species population – vegetation extent – occurrence of threats.	– presence of species (confirmed/modelled through survey data) – density of species – context of species population in regard to the overall population – any threats present.
Score	**Site condition**	**Site context**	**Species stocking rate**
4	n/a (scored out of 3)	– key threats absent: • all species: feral predators eliminated (e.g. fenced enclosure, intensive control), AND • Quokka: feral pigs eliminated (e.g. fenced enclosure, intensive control), OR • Chuditch: no sealed roads within 2.2 km (male range) AND – high connectivity of habitat: • Chuditch: connected to > 20,000 ha of native vegetation with limited fragmentation	n/a (scored out of 3)
3	– Excellent or Pristine vegetation condition	– key threats reduced: • all species: feral predators suppressed (Western Shield baiting), AND • Chuditch: no sealed roads within 1.1 km (male core area / female range), OR • Quokka, Woylie: dense riparian vegetation that provides refuge from feral predators AND – high connectivity of habitat: • Chuditch: connected to > 20,000 ha of native vegetation with limited fragmentation • Quokka, Woylie: connected to a large riparian corridor > 5 km in length	– resident population in high numbers
2	– Good or Very Good vegetation condition	– key threats reduced: • all species: feral predators suppressed (Western Shield baiting), AND • Chuditch: no sealed roads within 1.1 km (male core area / female range), OR • Quokka, Woylie: dense riparian vegetation that provides refuge from feral predators AND – moderate connectivity of habitat: • Chuditch: connected to 5,000-20,000 ha of native vegetation with limited fragmentation • Quokka, Woylie: connected to a moderate riparian corridor 1-5 km in length	– resident population in small numbers
1	– Degraded vegetation condition	– key threats prevalent: • all species: feral predators suppressed (Western Shield baiting), AND • Chuditch: sealed roads within 1.1 km (male core area / female range), OR • Quokka, Woylie: open upland vegetation that does not provide refuge from feral predators OR – low connectivity of habitat: • Chuditch: connected to <5,000 ha of native vegetation with limited fragmentation • Quokka, Woylie: connected to a small riparian corridor < 1 km in length	– sparse population, transient use
0	– Completely degraded vegetation	– key threats prevalent: • all species: no feral predator suppression (e.g. outside of Western Shield baiting)	– species, if present, is below detectable densities
Notes	– All native vegetation / fauna habitat types within Jarrah forest are expected to	– Chuditch males range over 15 km^2 (2.2 km radius) with a core area of 4 km^2 (1.1 km radius), females range over 3-4 km2 (1.1 km radius) with a core area (0.54 km radius) (DEC 2012).	– No local population estimates are available for Chuditch. The total population of the Jarrah forest (north and south) is estimated at approximately 1,400 to 12,500 adults, however the

Guidance summary	Site condition	Site context	Species stocking rate
	provide foraging and denning resources for CWR mammals. – Degraded condition vegetation (including Phytophthora dieback impact) reduces the diversity and abundance of native flora, reducing the foraging resources for native herbivores, and impacting the food web and thus foraging resources for native carnivores. – No spatial data available to score dens as habitat features, which may occur throughout	– Chuditch require sizable areas (>20,000 ha) to survive. Chuditch need large natural areas because of their large home ranges and resource requirements (DEC 2012). – Limited fragmentation includes scattered forest tracks with infrequent traffic and timber harvesting. High fragmentation includes mining, rural development and sealed roads. – Modelled distribution of all three CWR mammals cover the Proposal MDE and surrounding land. Not scored. – CWR mammals are less reliant on watering habitat for drinking. – Population scored under species stocking rate / habitat value. – No spatial data available to score threats of climate change or fire regime. Phytophthora dieback threat scored as site / vegetation condition.	sparse and dispersed / nomadic nature of the species makes it difficult to accurately estimate abundance and/or density, and to define key populations (DEC 2012). – Woylie populations are estimated to be sparse over the Northern Jarrah Forest, at approximately 400 animals over 7750 km^2 as at 2010 (TSSC 2018) or an average of 1 animal per 19 km^2. The largest natural populations are located in Upper Warren (Perup and Kingston) and Dryandra, with a number of translocated populations in offshore islands and fenced sanctuaries that provide refuge from feral predators (TSSC 2018). – Quokka populations in the Northern Jarrah Forest persist in small, isolated populations around favoured riparian habitat (Dundas et al 2017). Populations recorded in the vicinity of the Huntly Mine are estimated to be small, with approximately 5-25 animals recorded in each swamp (Dundas et al 2017).

Table 6 Supporting definition of fauna habitat / features for input to scoring framework

Fauna habitat types mapped over MDE	Associated vegetation types mapped over MDE	Black Cockatoos – site / vegetation condition – habitat species / habitat features			CWR mammals – site context – vegetation density as a predator refuge
		Forest Red-tailed Black-Cockatoo	Baudin's Cockatoo	Carnaby's Cockatoo	
Blackbutt Forest	AW, C, CW	Foraging, breeding, roosting	Limited foraging, roosting	Limited foraging, roosting	Dense / predator refuge
Bullich Forest	W	Foraging, breeding, roosting	Limited foraging, breeding, roosting	Limited foraging, roosting	Open
Flooded Gum Woodland	AC	Limited foraging, roosting	Limited foraging, roosting	Limited foraging, breeding, roosting	Dense / predator refuge
Granite Outcrop Association	G, G1, G2, R	Limited foraging	Limited foraging	Limited foraging	Open
Jarrah Marri Forest	D, DA, DG, E, P, PG, PS, PT, PW, Q, S, SP, ST, SW, T, TP, TS	Foraging, breeding, roosting	Foraging, breeding, roosting	Foraging, breeding, roosting	Open
Melaleuca Dampland	A	Limited foraging	Limited foraging	Limited foraging	Dense / predator refuge
Wandoo Woodland	Y, YG, AY	Foraging, breeding, roosting	Foraging, breeding, roosting	Foraging, breeding, roosting	Open
Mine rehabilitation		Foraging	Foraging	Foraging	Open
Pine Plantation		None	Foraging	Foraging, roosting	Open
Watering habitat based on available spatial datasets					
Perennial watering habitat		– Rural and urban zoned land – Permanent river pools	– Rural and urban zoned land – Permanent river pools – Drinking water reservoirs	– Rural and urban zoned land – Permanent river pools – Drinking water reservoirs	n/a

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GHD Pty Ltd ABN 39 008 488 373

Level 10, 999 Hay Street

Perth, Western Australia 6000, Australia

T +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** permail@ghd.com | **ghd.com**