



**NEWMONT BODDINGTON GOLD**

**BLACK COCKATOO MANAGEMENT PLAN**

**OCTOBER 2014**

**PREPARED BY: NEWMONT BODDINGTON GOLD PTY LTD**

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## 1. PURPOSE

This document articulates Newmont Boddington Gold Pty Ltd’s (NBGPL) commitment to avoid, minimise and offset potential impacts to three species of black cockatoos (Carnaby’s, Forest Red Tailed and Baudins) found within the influence of the mining operation. This Plan is integral to NBGPL’s commitment to manage all aspects of its operational footprint and represents a key component to the overall environmental management strategy for site. The initial evolution of this document sought to ratify commitments and actions as required by:

- EPBC 2006/2591 (Boddington Gold Mine Expansion Project); and
- EPBC 2011/6192 (Newmont Boddington Gold Interim Permit).

Consecutively this current manifestation seeks to incorporate Condition 10 from EPBC 2012/6370 (dated 16 May 2014) which requires NBG to prepare (and submit) a Black Cockatoo Management Plan (BCMP) for approval by the Minister.

## 2. SCOPE

The focus of the BCMP is on 3 species of black cockatoos (Carnaby’s, Forest Red-Tailed and Baudins) known to either roost, forage and/or breed on NBG tenements and in the immediate surrounds. The NBG mine is located 120 km south-east of Perth and 12 km to the north-west of the town of Boddington (Figures 1 and 2). The spatial extent of the Plan is designed to include all land owned or operated upon by NBG, which consists of:

- areas currently under operation for the purpose of mining;
- areas likely to be affected by mining operations through the course of executing the mine plan;
- areas distributed through tenement that will not be directly impacted through mining operations; and
- peripheral areas outside the mine that include but not limited to Hotham Farm, Saddleback Treefarms and potential offset locations.

The management plan scope includes both the operational life of the mine and closure where the goal will be to complete rehabilitation to produce a viable habitat post-mining capable of sustaining populations of the three species targeted.

## 3. OBJECTIVES

The BCMP provides NBG with a framework to manage any potential impacts of its operations on the three black cockatoos species. This framework is guided by Section 10 of the DotE approval (EPBC2012/6370) which specifies key aspects that will improve the sustainability of the species within the development envelope. These objectives are both operational and post closure in concept with the key aims around achieving positive conservation outcomes, such as the protection of existing habitats and the restoration of disturbed land. The plan is subject to continuous revision, based on the outcomes of stakeholder consultation, regulatory requirements and research partnerships.

An original BCMP was developed in 2005 to assist in the expansion of the operation into basement rock deposits with this updated plan seeking to improve and continue stewardship around these state and federally important fauna species. In developing the plan, NBG consulted with representatives from the Western Australian Museum, the WA Department of Environment and Conservation (DEC) (Now Department of Parks and Wildlife (DPaW)), Birds Australia (now BirdLife Australia), and other specialists in avian fauna management. The Plan is not intended to

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exist in isolation, but to support other conservation-based actions, such as the management measures identified in the recovery plans for these species (Cale 2003; Chapman 2008; DPaW 2013). It identifies opportunities for improving local capacities for undertaking conservation measures for black cockatoos, including restoration of degraded *Native Vegetation* and training and skills development programs for local indigenous people.

Table 1 lists management objectives, targets and key performance indicators relating to Black Cockatoo management at NBG.

**Table 1: Environmental Objectives and Targets for Protection and Management of Black Cockatoos**

Objective	Target	Key performance indicator
Maximise the likelihood of NBG tenements being used as feeding and breeding habitat during the life of the mine and following mine closure	No clearing or disturbance outside pre-defined approved boundaries and/or project site	No evidence of clearing beyond approved areas (project site). No evidence of unauthorised access outside mining areas. Annual tracking and reporting of any authorised clearing against approved project site.
	Clearly demarcate areas that have been set aside for conservation i.e. Potential Black Cockatoo Breeding <i>Habitat</i> .	Areas are demarcated on the ground. All clearing on site completed through the NBG Disturbance Application and Approval Form.
	Undertake progressive rehabilitation.	Areas no longer needed for mining stockpiles or infrastructure will be rehabilitated as soon as practicable. Generation of an annual Mine Closure cost report and formation of a Closure & Reclamation Technical Team that works to test closure assumptions and progress rehabilitation of available areas during operation.
	Rehabilitation will be designed according to ongoing research highlighting vegetation that is most suitable for feeding and (eventually) breeding.	Black Cockatoos are shown to be feeding in rehabilitated areas within six years of establishment (as based on current research and review of past site rehabilitation)  Rehabilitation follows expected successional trends: 1. Initially – high diversity ‘scrub’ stage characterised by dominance of proteaceous and marri 2. Interim – canopy trees of marri and jarrah begin to dominate; increase mid

Objective	Target	Key performance indicator
		<p>storey species and abundance and diversity of shrubs/scrub decline</p> <p>3. Established (&gt;15 years) – rehabilitation resemble mature forest (Marri and jarrah) in species and diversity, lower stem densities, well developed overstorey and moderate to poorly developed understorey.</p> <p>Large numbers of Wandoo and Marri that are more conducive than jarrah at producing hollows for breeding.</p>
	Minimise the spread of <i>Phytophthora</i> and <i>Armillaria</i>	No mapped increase as a result of ongoing/progressive surveys.
	Provision for fauna drinking sites to both increase habitat suitability and aversion to residue facilities	<p>Survey evidence showing use of drinking sites by Black Cockatoos.</p> <p>No sightings of Black Cockatoos utilising residue (tailings) facilities as a water source.</p>
Increase understanding of species	Ongoing monitoring and collaborative research programmes with the DEC (Now DPaW), Murdoch University and the Perth Zoo.	<p>Deliver improvements in management guidelines for artificial hollows/nests.</p> <p>Application of knowledge from rehabilitation foraging study to mine site revegetation practises.</p> <p>Fill knowledge gaps associated with population demographics (age and health).</p> <p>Develop understanding of species movement/migration.</p> <p>Engagement of surrounding bauxite operations in knowledge sharing and research.</p> <p>Attendance to annual Black Cockatoo research meeting to discuss progress, results and developing trends.</p>
	Ongoing monitoring of occurrence and breeding activity in natural and artificial hollows	<p>Improved occupation rates of artificial hollows in comparison to previous occupancy rates</p> <p>Annual survey of <i>Habitat Trees</i> and entry into database.</p>
Improve management outcomes	Ongoing investigations with the aim of continual	No reduction in Black Cockatoo activity

Objective	Target	Key performance indicator
	improvement to management actions in relation to Black Cockatoos.	

#### 4. INTRODUCTION

The Forest Red-Tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Baudin’s Cockatoo (*Calyptorhynchus baudinii*) and Carnaby’s Cockatoo (*Calyptorhynchus latirostris*) are endemic to the south-west of Western Australia. All have declined significantly since European settlement, predominantly due to the clearing of *Native Vegetation* for agriculture. Suburban expansion, commercial logging, mining, orchardists and the introduction of feral fauna such as the honey bees (*Apis mellifera*) are continuing impact populations. All three species are listed as either threatened or endangered under State and Federal legislation and are considered in need of special protection.

All three species occur at NBG, which is located along the eastern margin of the south west Jarrah forest (Worsley Alumina Pty 1999; Ninnox Wildlife 2006, 2011; Biggs 2008; Lee et al. 2010; Biggs et al. 2011; Finn 2011). These studies have determined that all three species feed within *Native Vegetation* and mine-site rehabilitation at NBG. Additionally nest sites for Carnaby’s Cockatoos and Forest Red-Tailed Black Cockatoo (FRTBC) have also been identified within NBG tenements and surrounding lands.

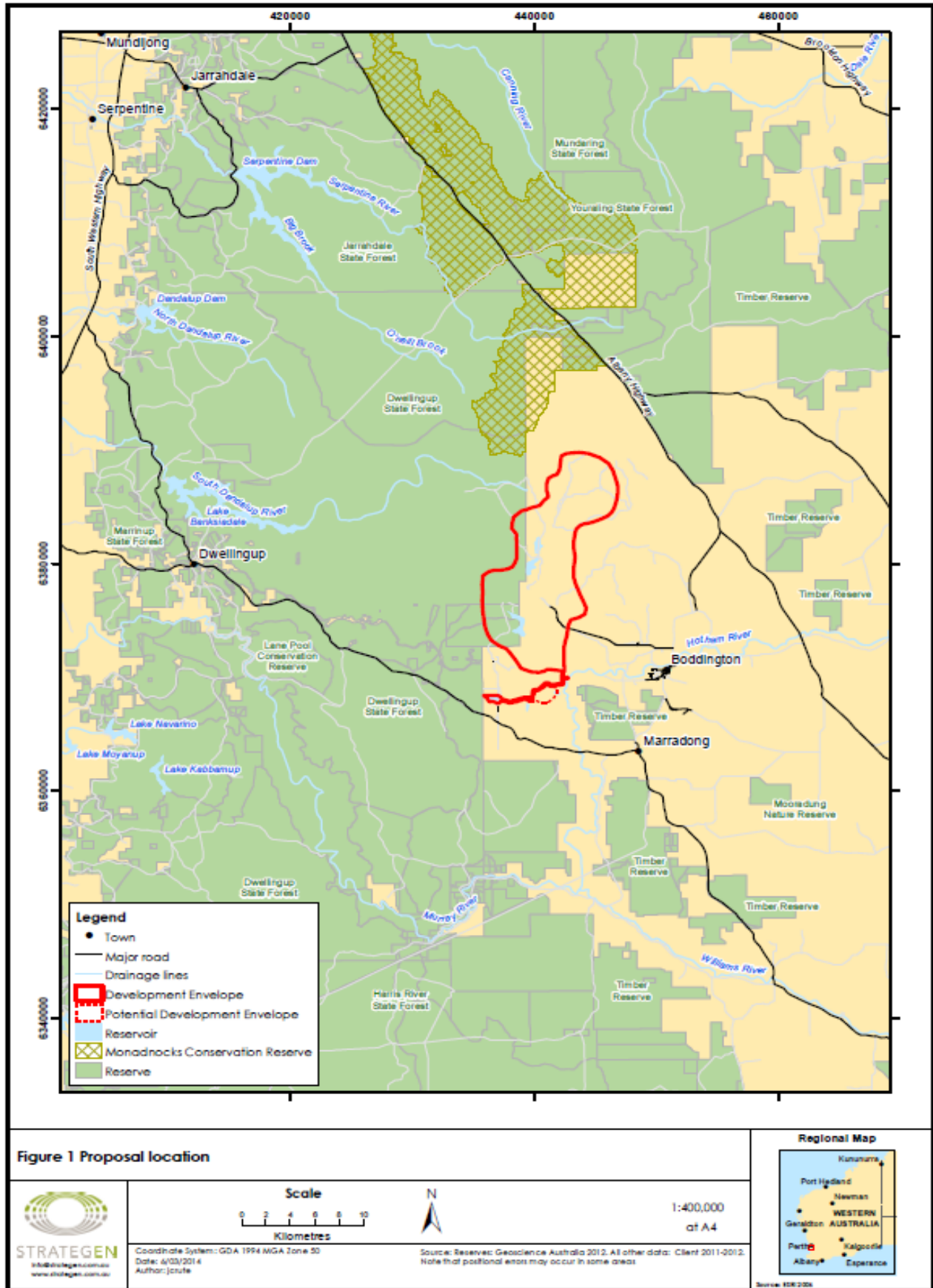
Table 2 summarises the conservation status of the three black cockatoos under the *Wildlife Conservation Act 1950* (WA) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

**Table 2: Conservation status of Black Cockatoos occurring at NBG (as of 22 July 2014).**

Species	Wildlife Conservation Act 1950 (WA)	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
<b>Forest Red-tailed Black Cockatoo</b> <i>Calyptorhynchus banksii naso</i>	Vulnerable (Schedule 1*)	Vulnerable
<b>Baudin’s Cockatoo</b> <i>Calyptorhynchus baudinii</i>	Endangered (Schedule 1*)	Vulnerable
<b>Carnaby’s Cockatoo</b> <i>Calyptorhynchus latirostris</i>	Endangered (Schedule 1*)	Endangered

\* Schedule 1 fauna are species considered ‘rare or likely to become extinct and in need of special protection’

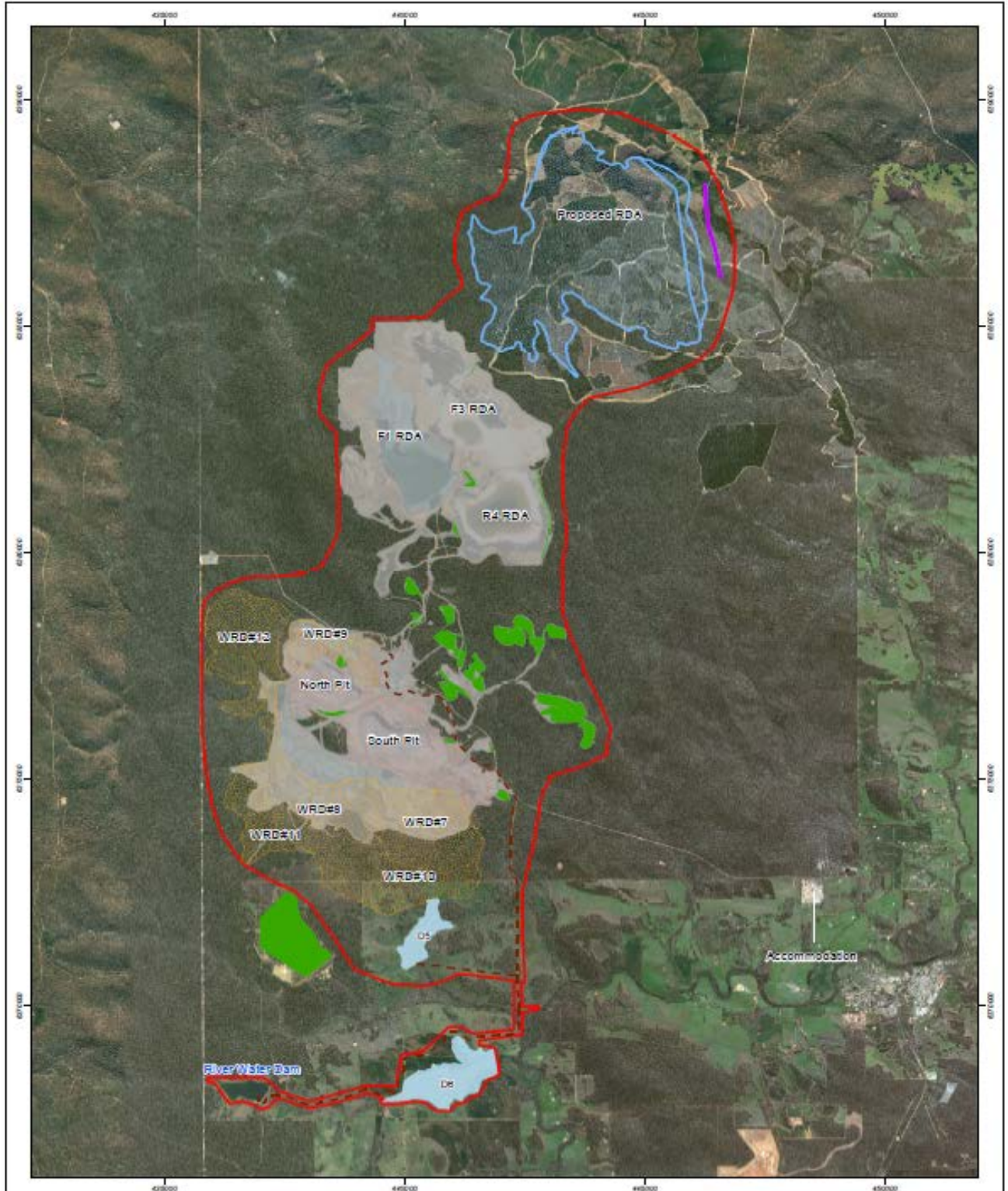
All three Black Cockatoo species are considered “Matters of National Environmental Significance (MNES)” under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). As a result any actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for the Environment.



**Figure 1: NBG Location Plan**

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**Figure 2 The Proposal**

Scale: 1:75,000 M.A.S.  
0 0.5 1 1.5 2 2.5 km  
Coordinate System: GDA 1984 MGA Zone 50  
Note that post-tolerances may occur in some areas.  
Date: 27/03/2014  
Author: CND Resources  
Source: Topography: Geoscience Australia 2011.

- Legend**
- Diversion Channel
  - Proposed Pipeline
  - Rehabilitated Area
  - Waste Rock Dumps (WRD)
  - PR
  - Residue Disposal Area (RDA)
  - Development Envelope
  - Approved Footprint
  - Proposed Dam



Path: C:\GIS\Correlat\2014\03\09\04\102\Boulder\_3\mxd\resolving\00-4027\BMA\1024\_01\_Figure\_2\_01.mxd

**Figure 2:NBG Aerial Location outlining approved Development Envelope**

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## SPECIES INFORMATION

### 4.1 Forest Red-tailed Black Cockatoo

#### 4.1.1 Species Range

FRTBC are endemic to Western Australia and occur throughout the forested areas of the south-west, with a species range extending north to Gingin (formerly to Dandaragan) and east to Mt Helena (formerly to Toodyay), Christmas Tree Well, North Bannister (formerly to Wandering), Mt Saddleback (formerly to Kojonup), Rocky Gully and the upper King River (Abbott 1998; Johnstone and Storr 1999; Garnett et al. 2011). Their range has contracted by 25 – 30% since European settlement, mainly because of habitat loss relating to the clearing of native forests for agriculture (Abbott 1998; Johnstone and Storr 1998; Garnett et al. 2011).

#### 4.1.2 Habitat Requirements

FRTBCs require the food plants and natural hollows available in the eucalypt forests of the south-west. Important tree species for this subspecies include: Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*), Blackbutt (*Eucalyptus patens*) and Karri (*Eucalyptus diversicolor*) generally in climates receiving more than 600mm of rainfall annually. .

#### 4.1.3 Life-History - Breeding

Though there are few published breeding records for this species, descriptions of nest hollows indicate that these birds require hollows with an entrance size of between 12 and 41 cm and approximately 1 to 5 m deep (Saunders 1979; Saunders et al. 1982; Whitford 2002). Hollows are generally between 8 and 14 m above ground. Within the Jarrah forest, nesting hollows are most commonly observed in Marri, with relatively few nests in Jarrah (R. Johnstone, WA Museum, personal communication).

One egg (sometimes two eggs, but with only one surviving), are laid on woodchips or charcoal at the bottom of a hollow and only the female incubates the egg which takes approximately 29 to 31 days (Johnstone and Storr 1998).

#### 4.1.4 Life History - Diet

Seeds of Marri and Jarrah comprise the main food source for FRTBC (Johnstone and Kirkby 1999). Seeds and fruit of other eucalypts, Forest Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*) may also be eaten. Recent observations indicate that the non-native Cape Lilac (*Melia azadarach*) has become an alternative food source in some areas (Johnstone and Kirkby 2010).

#### 4.1.5 Historical Impacts

The loss of nesting hollows throughout its range has had the greatest impact on the FRTBC. Loss of hollows has occurred through clearing of forests for agriculture, logging and mining. Additional impacts are associated with fragmentation of forest habitats by roads, power lines, mining, logging, orchards and surface water reservoirs. These processes have resulted in the loss of large mature (130-220 years old) eucalypts containing suitable hollows for nesting by this bird.

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## 4.2 Carnaby’s Cockatoo

### 4.2.1 Species Range

Carnaby’s Cockatoos are endemic to Western Australia and have the broadest distribution of the three species. The species occurs throughout much of the south-west land division within coastal and inland areas of woodland, heath, scrub, and forest (Saunders 1980; Johnstone and Storr 1999; Garnett et al. 2011). Their species ranges extends north to lower Murchison and east to Nabawa, Wilroy, Waddi Forest, Manmanning, Durokopping, Lake Cronin and just east of Condingup. In the non-breeding season flocks are observed to coastal areas, especially pine plantations (Saunders 1980; Finn et al. 2009)

### 4.2.2 Habitat Requirements

Carnaby’s Cockatoo forage in woodland, shrubland and heathland, usually breeding in areas receiving 350-700 mm of annual rainfall. Flocks of non-breeding birds then move to coastal areas, where pine plantations have become important feeding and roosting sites since the 1930s (DEC, Western Australia 2007). It eats seeds of Hakea, Grevillea, Banksia, Allocasuarina, Eucalyptus, and Dryandra, but also feeds on the seeds of weeds and exotic pines, insect larvae and nectar (Saunders 1982, 1990, DEC, Western Australia 2007). The species has also been recorded damaging persimmon and nut crops and the shoots of trees in orchards (DEC, Western Australia 2007). Its breeding success is dependent on the presence of heathland feeding areas within 12 km of its nesting habitat (DEC, Western Australia 2007b). It nests in hollows in large eucalypts, primarily salmon gum *E. salmonophloia* and wandoo *E. wandoo*. It is also now frequently found in marri *Corymbia calophylla*, jarrah *E. marginata* and karri *E. diversicolor* forests (DEC, Western Australia 2007)

The species’ long pair bonds and high breeding-site fidelity may mean that birds do not disperse following disturbance and may persist at the same breeding sites until all habitat in an area is cleared or the local population dies out (Saunders 1982). 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 cockatoo to effectively utilise the available food resources.

### 4.2.3 Life-History - Breeding

Carnaby’s Cockatoos are the most well-studied of the three species, based on long-term studies of breeding populations in the Wheatbelt by Denis Saunders and more recent work by Ron Johnstone and Tony Kirkby from the WA Museum. Though most breeding records are from Wheatbelt sites, breeding has also been recorded in coastal areas and within the Jarrah forest (Johnstone and Kirkby 2010; H. Finn, Murdoch University, unpublished data).

It is a long-lived species; females appear not breed until they are at least four years old (Saunders 1982, 1986, Saunders and Ingram 1998), and the oldest known female was at least 19 in 1989 (Saunders and Ingram 1998). Observations suggest that pairs remain together until the death of one of the partners (Saunders 1982). The eggs are usually laid between late July and late September (Saunders 1990), but laying may continue into October or November (Saunders and Ingram 1998). Less than half of the nest hollows available in an area of breeding habitat may remain unoccupied due to aggressive interactions between females during the selection and preparation of hollows (Saunders 1982). It is known that some females return to the same nest hollows in successive years (Saunders 1982, 1990). The species usually lays two eggs, although pairs rarely fledge two young, the second to hatch usually dying within 48 hours (Saunders 1982).

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The incubation period for four nests was found to be 28-29 days (Saunders 1982). Breeding pairs remain at nesting sites through the breeding season (mid-late winter to early-late spring but variable), then migrate toward coastal areas (e.g. the Swan Coastal plain) where they are sometimes observed in large flocks, particularly near pine plantations or large intact areas of Banksia woodland or coastal heathland.

Breeding records from Wheatbelt sites indicate that Carnaby's Cockatoos prefer large hollows in the trunk of mature eucalypts, particularly Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*Eucalyptus wandoo*) (Saunders 1979; Saunders et al. 1982). Other large eucalypts may also be used, including Marri in the Jarrah forest (H. Finn, Murdoch University, personal communication).

**4.2.4 Life History - Diet**

Carnaby's Cockatoos have been recorded feeding on a wide range of food plants, including the fruits, seeds, flowers, and nectar of many eucalypts (e.g. Jarrah, Marri) and proteaceous species (e.g. Banksia, Hakea spp.) (Saunders 1980; Johnstone and Storr 1998; Valentine and Stock 2008). They may also feed on introduced weeds and non-native plantation species (e.g. pine), as well as insect larvae.

**4.2.5 Historical Impacts**

This species has undergone a decline of more than 50% over the last fifty years (Garnett et al. 2011), largely because of clearing of *Native Vegetation* in the Wheatbelt. Clearing and land degradation have also reduced food availability within coastal feeding areas used during the non-breeding season (Saunders 1977; Saunders and Ingram 1987; Cale 2003). The proximity of nesting sites to feeding areas is of critical importance for this species, based on long-term study of breeding populations by Denis Saunders within areas considered to have adequate food supplies close to nests and in areas retaining little *Native Vegetation* (Saunders and Ingram 1987).

**4.3 Baudin's Cockatoos**

**4.3.1 Geographic Distribution**

Baudin's Cockatoos are endemic to Western Australia and occur within the forested areas of the south-west, with a species range extending north to Gidgegannup, east to Mt Helena, Wandering, Quindanning, the Perup River, Lake Muir and King River, and west to eastern strip of Swan Coastal Plain including West Midland, Byford, North Dandalup, Yarloop, Wokalup and Bunbury also the Stirling and Porongurup Ranges (Johnstone and Storr 1999; Johnstone and Kirkby 2008; Garnett et al. 2011).

**4.3.2 Habitat Requirements**

Baudin's Cockatoos require large amounts of Marri seed (their principal food source) and large hollows with mature eucalypts, particularly Karri.

**4.3.3 Breeding**

There are few breeding records for Baudin's Cockatoos (Johnstone and Kirkby 2008). The core of their breeding range lies within the Karri forest and the southern Jarrah forest.

**4.3.4 Diet**

The species feeds mainly on Marri seed, but also feeds on various Banksia and Hakea species (Johnstone and Kirkby 2008). They are also attracted to fruiting apples and pears, and known to strip bark from eucalypts in search of insect larvae.

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### 4.3.5 Historical Impacts

This species is thought to have declined greatly in the last 50 years, their slow rate of reproduction precluding them from replacing the large numbers being shot by orchardists (Johnstone and Storr 1998). Approximately one quarter of the original habitat of this species has been cleared for agriculture (Chapman 2008; Johnstone and Kirkby 2008).

### 4.4 Known and Potential threats to all 3 cockatoo species

Whilst individually the reasons may differ slightly, all three species of black cockatoo are generally impacted by the same known and potential threats which include:

- Extensive land clearing for agricultural activities leading to loss of habitat for breeding and foraging;
- Loss of habitat through mining activities such as bauxite, mineral sands.
- Fragmentation of land leading to greater risk of anthropogenic impacts (car, shooting) and proximity issues associated with foraging areas adjacent to nest sites;
- Absence of nest trees regeneration because of grazing by sheep and rabbits;
- Nest hollow decline due to continued commercial logging targeting mature trees;
- Remnant vegetation under impact from soil salinity and weed invasion;
- Introduction of plant pathogens (*Phytophthora cinnamomi*);
- Impact of introduced species such as honey bees (*Apis mellifera*) or competing cockatoo species such as the Galah (*Cacatua roseicapila*);
- Nest-robbing and damage to nest hollows as a result of illegal trade in Black Cockatoos;
- Spread of suburbia;
- Climate Change (prevalence of wildfires, heatwaves and droughts); and
- Disease.

## 5 LEGAL AND OTHER REQUIREMENTS

### 5.1 Legal Database

To ensure all NBG personnel have access to up to date Legal requirements and other Commitments, Newmont maintains a Legal and Other Commitments database. This database includes both a hard copy and electronic Legal Database which references all approvals and associated conditions granted to the operation. The hard copy database is located in the Environmental Superintendent’s Office, whilst the Electronic database is available on the Newmont Intranet (Prospector – link below).

The conditions and specific obligations for all current project approvals can be found within the Legal Database. This database must be used as the primary source of accessing approval documentation to avoid personnel accessing potentially out-dated information replicated in other documents, such as this Management Plan.

<http://prospector.newmont.com/apac/depts/ims/Pages/LROC.aspx>

In addition to the above, desktop and field verification audits may also be completed from time to time by the EPA and DotE to verify Boddington’s compliance with approval conditions.

### 5.2 Wildlife Conservation Act 1950 (WA)

The objective of the *Wildlife Conservation Act 1950 (WA)* is to provide for the protection of wildlife and its habitat. The statute is administered by the Executive Director of DEC (now DPaW), under the direction and control of the Minister for Environment. It provides general protection to all native fauna throughout the State. Under section 14(2)(a) of the Act, Minister for Environment may use fauna notices to list certain species as specially protected fauna. All three black cockatoo species identified in this Plan have been afforded special protection under Schedule 1 of the Wildlife Conservation Fauna Notice 2010(2). Schedule 1, Division 2, lists the Forest Red-tailed Black Cockatoo (no.48), Baudin’s Cockatoo (no.49) and Carnaby’s Cockatoo (no.50) as Western Australian bird species considered rare or likely to become extinct.

### 5.3 Environmental Protection Act 1986 (WA)

In 2002, an expansion project for BGM (now NBG) was approved under Part IV of the *Environmental Protection Act 1986 (WA)* via Section 46. Subsequent to this a Section 45C approval was granted for non-substantial changes in 2006. This statute is the principal legislation in WA for the prevention, control and abatement of environmental pollution and for the conservation, preservation, protection, enhancement and management of the environment.

In 2011, a Section 45C approval (non-substantial change) was submitted for minor changes to the operations disturbance footprint to facilitate continued operations whilst a larger approval was sought. This approval was granted in 2012, permitting an additional 29ha of disturbance.

In 2012, NBG referred the Life of Mine Extension Project to the Environmental Protection Authority (EPA). Following the submission of scoping documentation, the EPA assessed the project as requiring a 4 week Public Environmental Review under Section 38 of the Act. The PER was released to the public in August 2013, with Ministerial Approval received in June 2014. As a result of this review the existing Ministerial Statement (591) was superseded with Ministerial Statement 971 (MS 971).

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**5.4 Ministerial Statement 971 - Forest Disease Management**

Initially covered under Ministerial Statement 591 (8 May 2002), NBG had commitments (P38 – P 41) relating to the management of forest disease, in terms of monitoring and minimising the spread of forest areas affected by Jarrah Dieback (*Phytophthora*) within NBG lands. The *NBG Site Entry and Vehicle Hygiene Standard Operating Procedure* in addition to ongoing surveys outline NBG’s implementation of MS 591 into its operations.

MS591 has been superseded on the 12 June 2014 by Ministerial Statement 971 which under Section 6 requires the generation of a Weed and Forest Disease Management Plan to be approved by the Minister. This document is to be developed in consultation with the Department of Parks and Wildlife.

**5.5 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)**

The *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* (Cth) provides for the protection of the environment, particularly those aspects of the environment recognised under the statute as matters of national environmental significance (MNES). The aims of the EPBC Act include the promotion of ecologically sustainable development, the conservation of biodiversity, and the adoption of a cooperative approach to the protection and management of the environment.

The EPBC Act lists Carnaby’s Cockatoos (*Calyptorhynchus latirostris*) as Endangered and Forest Red-tailed Black Cockatoos (*Calyptorhynchus banksii naso*) and Baudin’s Cockatoos (*Calyptorhynchus baudinii*) as Vulnerable.

The Act provides actions that will have, or is likely to have, a significant impact on a listed threatened species must be referred to the Federal Environment Minister for a decision on whether assessment and approval is required under the EPBC Act.

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (Now Department of the Environment (DotE) recently released its draft referral guidelines for three species of Western Australian black cockatoos.

The BGM (now NBG) Expansion Project was originally referred to the Commonwealth Department of Environment and Heritage for assessment under the Act on February 8, 2006. This referral was assessed as Not a Controlled Action (with Particular Manner Requirements).

In 2011, the project was again referred to the Commonwealth to support the Interim approval, seeking an additional 29ha of disturbance. This referral was assessed as a controlled action (EPBC 2011/6192) and was approved in 2012 resulting in the first set of federal conditions for the project.

In 2012, the Life of Mine Extension Project again triggered referral of the project to the Commonwealth and as expected was assessed as a controlled action (EPBC (2012/6370). In May 2013, federal approval was received including a new and additional set of conditions to be implemented by NBG.

A key requirement of both approval documents is the completion and publication of an annual report outlining work completed during the reporting period (calendar year) and the compliance with approval conditions.

Where additional clearing is proposed, NBG will consider the *EPBC Act 1999 Draft Referral Guidelines for Three Threatened Black Cockatoo Species* and other relevant guidance documents in mine planning and environmental decision-making.

Table 3 lists the timeline of project development approvals through the life of the mine.

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**Table 3: Timeline of Project Development Approvals**

Date	Change/Approval
December 1985	Original project approval.
February 1988	Hedges Gold Mine project approval.
February 1988	Boddington Gold Mine stage 1 expansion to 4.5 Mtpa.
December 1988	Boddington Gold Mine stage 2 expansion to 6 Mtpa with an additional water supply reservoir (D1 WSR).
November 1989	Boddington Gold Mine mining and processing of basement and supergene ores, expansion to 6.75 Mtpa.
January 1993	Boddington Gold Mine mining of oxide ore from the eastern anomalies.
January 1995	Boddington Gold Mine rehabilitation strategy for mining area and residue disposal areas.
July 1997	Boddington Gold Mine Extended Basement Operation (EBO), additional residue storage, mining of minor oxide and ore bodies, increased throughput and modifications to rehabilitation strategy.
July 1997	Hedges Gold Mine expansion to 4 Mtpa and Section 46 Review.
December 1998	Boddington Gold Mine section 46 review (concurrent with EBO) to align existing conditions and commitments.
December 1998	Acquisition of Hedges mining areas. Co-proponents with Alcoa, administrative split of responsibilities.
May 2002	Section 46 review concurrent with EPS to review and amalgamate EBO, Oxide and Hedges existing conditions and commitments.
June 2002	Gas-fired power station and natural gas pipeline approval (now lapsed).
March 2006	Section 45C modifications for increased scale of the Boddington expansion.
April 2006	EPBC Assessment (2006/2591): EPBC Act 1999 Decision – Not a Controlled Action (with Particular Manner Requirements).
September 2006	Boddington Expansion Project Mining Proposal.
December 2011	EPBC Assessment (2011/6192): EPBC Act 1999 Decision – Controlled Action.
June 2012*	Section 38 (A504561) Public Environmental Review (4 week review) – Life of Mine Expansion Project (Approval Pending).
July 2012*	EPBC Assessment (2013/6370): EPBC Act 1999 Decision – Controlled Action. (Approval Pending following agreement to required Offset Package).
May 2014	EPBC Assessment (2013/6370): EPBC Act 1999 Decision – Controlled Action. (Approval Granted)
June 2014	Section 38 (A504561) Public Environmental Review (4 week review) – Life of Mine Expansion Project (Approval Granted).

\* Dates indicate regulator agency referral decision



## 5.6 Other Requirements

### 5.6.1 Integration with Recovery Planning

The BCMP seeks to integrate its management measures with actions identified in the recovery plans for these species wherever possible. This can be completed through consultation, a cooperative approach to research and monitoring, and the integration of the on-the-ground actions such as habitat conservation.

#### 5.6.1.1 Carnaby’s Black Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan

The initial Carnaby’s Black Cockatoo Recovery Plan 2002 - 2012 (Cale 2003) was developed for the Carnaby’s Black Cockatoo Recovery team. The Recovery Plan outlined the species’ distribution, habitat, ecology, reasons for listing, existing conservation measures, the strategy for recovery, the recovery objectives and specific recovery actions.

The strategy for recovery of the species includes actions to address:

- identification of priority areas;
- habitat management of priority areas;
- feeding habitats in priority areas;
- breeding habitats in priority areas;
- habitat management of non-breeding areas;
- monitoring of Carnaby’s Cockatoo populations;
- community involvement; and
- captive breeding programs.

In 2013, the WA Department of Parks and Wildlife in partnership with the Australian government released a revised Carnaby’s Black Cockatoo Recovery Plan was released addressing the intended plan and actions to be implemented from between 2013 – 2023. Within the revised document there are six broad themes to the recovery actions:

1. protect and Manage Important Habitat;
2. undertake Regular Monitoring;
3. conduct research to Inform Management;
4. manage Other Impacts;
5. engage with the Broader Community; and
6. undertake Information and Communication Activities.

Many of these actions and themes are directly applicable to NBG and, where possible, considerations of these measures have been integrated into planning and decision-making under NBG’s BCMP. NBG also anticipates that findings from research conducted on-site will improve the scientific basis for management of Carnaby’s Cockatoos, particularly in relation to how the species uses revegetation and the breeding biology of the species in the eastern Jarrah forest.

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**5.6.1.2 Forest Black Cockatoo (Baudin’s Cockatoo - *Calyptorhynchus baudinii* and Forest Redtailed Black Cockatoo - *Calyptorhynchus banksii naso*) Recovery Plan**

The Forest Black Cockatoo (Baudin’s Cockatoo *Calyptorhynchus baudinii* and Forest Redtailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (Chapman 2008) was developed for the Baudin’s and Forest Red-tailed Black Cockatoo recovery team.

The Recovery Plan describes the species’ distribution, habitat, ecology, reasons for listing, existing conservation measures, the strategy for recovery, the recovery objectives and specific recovery actions.

The strategy for recovery of the species includes actions to address:

- management of feral Honeybees;
- identifying factors affecting breeding attempts and breeding success;
- minimising the effects of mining on habitat loss;
- managing forests for the conservation of Forest Black Cockatoos;
- identifying important groups of each species and protect from threatening processes;
- mapping feeding and breeding habitat, prepare management guidelines for these habitats;
- determining population numbers and distribution;
- determining the patterns and significance of movement; and
- maintaining the Cockatoo Care program and use other opportunities to promote the recovery of Forest Black Cockatoos.

Many of these actions are directly applicable to NBG and, where possible, considerations of these measures have been integrated into planning and decision-making under the NBG Black Cockatoo Management Plan. NBG also anticipates that findings from research conducted on-site will improve the scientific basis for management of Baudin’s Cockatoos and FRTBC, particularly in relation to how the species uses a landscape which combines native forest with other land uses and the breeding biology of FRTBC in the eastern Jarrah forest.

**5.6.2 The International Cyanide Management Code (ICMC)**

Newmont Australia Ltd is a signatory to the ICMC which is a voluntary initiative for the gold mining industry and the producers and transporters of the cyanide used in gold mining. The ICMC focuses exclusively on the safe management of cyanide used for the recovery of gold. The Code list clear protocols to manage production, transport, storage, use in processing, exposure to the environment and ultimately decommissioning of cyanide facilities. It also includes requirements related to financial assurance, accident prevention, emergency response, training, public reporting, stakeholder involvement and verification protocols.

The ICMC Standards of Practice 4.9, Implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and ground water quality is applicable to the management of Black Cockatoo species around Residue Disposal Areas (RDAs). In the planning stages for the expansion project NBG identified fauna access to the RDAs as a risk requiring management. Further information detailing this management is contained within Section 8.1.1.

NBG’s commitment to compliance with the International Cyanide Management Code is through the targeted corporate requirement of ongoing external party audits and certification.

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## 6 ECOLOGY OF BLACK COCKATOOS AT NBG

This section describes what is known about the ecology of Black Cockatoos at NBG based on: (a) general fauna surveys conducted at the site from the early 1980s to 2011 and (b) intensive study of the behavioural ecology of black cockatoos at NBG by Murdoch University from 2007 - 2011.

### 6.1 Overview

#### 6.1.1 General Ecology

The ecology of black cockatoos at NBG is based on three key resources: food, water, and (for Carnaby's Cockatoos and FRTBC) hollows. The availability of permanent water sources is likely to be a factor driving the daily patterns of the three species, and may enhance the suitability of NBG as a feeding and breeding habitat. Standing water is available year-round in several sumps, water supply reservoirs, and small farm dams around NBG and surrounds, and birds have been observed drinking from many of these. In winter, water is more generally available in ephemeral pools along roads and cleared areas.

Nest hollows at NBG occur in Marri, Wandoo, and Jarrah (other hollow-forming species occur infrequently), with Marri and Wandoo likely to provide the majority of nest hollows because of the poor hollow-forming capabilities of Jarrah. Trees with hollows are considered to be mature and range in age between 130 - 220 years.

#### 6.1.2 Baudin's Cockatoos

Baudin's Cockatoos primarily use NBG as seasonal feeding habitat and are present in greatest abundance from April through September. During other months (October - March), this species tends to be restricted to breeding areas in the Karri forest and the southern Jarrah forest (Johnstone and Kirkby 2008). However, small numbers have been sighted at NBG during summer. Birds observed during summer may be: early or late migrants, non-breeding birds resident over summer, or pairs breeding in the area. To date, no Baudin's Cockatoo nest sites have been observed at NBG. Boddington is considered to lie outside of the main breeding range of the species, with most of the species population breeding in the Karri forest and southern Jarrah forest (Johnstone and Kirkby 2008). The breeding range of the species may be shifting, with a recent breeding record from the Wungong catchment to the east of Perth (Johnstone and Kirkby 2008, 2009; Johnstone et al. 2010).

Marri is the key food resource for Baudin's at NBG, although the species also feeds on Jarrah and on grubs present under bark (and probably also on *Banksia grandis* and some other *Banksia* and *Hakea* species). Many flocks, particularly larger ones, appear to be relatively transient, residing at NBG for periods of days to weeks and moving across the landscape to find suitable feed trees. They may compete (to some extent) with FRTBC for access to good quality Marri fruits, which may be in limited abundance if previous Marri flowering season were poor.

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### 6.1.3 Carnaby’s Cockatoos

Carnaby’s Cockatoos occur at NBG year-round, and use NBG and the surrounding area as breeding and feeding habitat. Seasonal trends and observations of group size suggest that the species uses NBG and surrounds in several ways: (a) as a short-term feeding habitat (e.g. for flocks transiting between feeding areas on the Swan Coastal Plain and breeding sites in the Wheatbelt); (b) as a longer-term feeding habitat (i.e. weeks to months); and (c) as a breeding habitat. It is common to see large flocks present for short periods, generally within mine-site rehabilitation areas or in the pine plantation to the north-east of NBG. These observations contrast with more frequent sightings of small groups of 5 - 20 birds and more occasional observations of pairs and singletons.

Important food plants for Carnaby’s Cockatoos at NBG and its surrounds are: pine, proteaceous shrubs (particularly *Hakea* and *Banksia* spp.), and to a lesser extent, the eucalypts Jarrah and Marri. Carnaby’s Cockatoos only feed on young green Marri husks which are soft enough for them to manipulate so as to extract seeds. Their bills are substantially shorter than those of Baudin’s Cockatoos and less robust than FRTBC bills, both of which are highly adapted to feeding on Marri. Carnaby’s Cockatoos will also feed on ground vegetation (Saunders 1974; Finn et al. 2009).

Of the three species, Carnaby’s have the most flexible ecology, a characteristic which reflected in the range of habitats and food resources they use at NBG. Their ecology in the Jarrah forest habitat at NBG also differs markedly from that observed in other habitats in south-western WA. Groups at NBG are quite small, which contrasts with flock sizes of hundreds observed on the Swan Coastal Plain (Saunders 1980; Finn et al. 2009). This difference probably reflects the availability of food, with food being more dispersed and less abundant in forest habitats than in feeding habitats in other areas. Alternatively, this difference may reflect the characteristics of the populations that feed and breed at NBG.

### 6.1.4 Forest Red-tailed Black Cockatoo (FRTBC)

FRTBC are not thought to engage in extensive annual migrations like that the two white-tailed species (though seasonal, local-scale shifts may occur), but typically maintain a relatively small home range year-round. Thus, the flocks observed at NBG are likely to be long-term residents of the area and to range mainly with NBG tenements and the areas adjacent to it.

FRTBC at NBG have been observed to feeding primarily on Marri and Jarrah. They appear to prefer Marri and their movement patterns may reflect the availability of high quality Marri fruits. FRTBC are observed in family units (adult pair with juvenile), small assemblages (often comprised of multiple family units), and larger flocks. Flocks sometimes feed in the same area for a period of days to weeks, then move off to another area when resources in the area have been depleted.

## 6.2 Research and Surveys

Fauna surveys and monitoring have been conducted in the area within and adjacent to the current NBG mine-site since the early 1980s. Comprehensive surveys in 1984 during the autumn, winter and spring described the bird, mammal, amphibian and reptile fauna of the area in relation to vegetation and soil types present (Worsley Alumina Pty Ltd 1999). Further fauna sampling at NBG was undertaken in 1991, 1992, 2001, 2002 and 2011 by Ninox Wildlife Consulting.

Two studies were carried out in late 2005 to specifically gather more information on the use of the area by Carnaby’s Cockatoos. An initial and brief preliminary survey was carried out by Tony Kirkby of the WA Museum in November 2005 within the areas proposed for disturbance to support the NBG Expansion Project. Ninox Wildlife Consulting conducted a more detailed survey of the proposed disturbance footprint for the Expansion Project in December 2005.

From 2007 to 2010, Murdoch University research has addressed many aspects of the ecology of black cockatoos at NBG, including seasonal patterns in occupancy, group size, habitat use, selection of Jarrah and Marri ‘feed trees’, nesting activity, and use of mine-site rehabilitation as a feeding habitat.

The text below lists and further explains the fauna surveys and targeted research studies which have contributed to the understanding of black cockatoo in the surrounding landscape (e.g. presence, abundance, distribution):

- The Vertebrate Fauna of the Boddington Gold Mine (Ninox Wildlife Consulting 2003);
- The Ecology of three threatened Black Cockatoos within a mining production landscape in the Jarrah-Marri Forest of Western Australia (Lee J.2013)
- Assessment of Habitat Values for Black Cockatoos within the Eastern Acquired Lands at Newmont Boddington Gold Mine (Finn 2011);
- Landscape Position Predicts Distribution of Eucalypt Feed Trees for Threatened Black Cockatoos in the Northern Jarrah Forest, Western Australia (Biggs et al. 2011);
- Interim Report #1: Newmont Boddington Gold – Results of a Vertebrate Fauna Survey, Autumn 2011 (Ninox Wildlife Consulting 2011); and
- ‘Conservation of black cockatoos within a production landscape’ (Jessica Lee, Murdoch University, PhD project: 2008 – current).

### 6.2.1 The Vertebrate Fauna of the Boddington Gold Mine (Ninox Wildlife Consulting 2003)

Ninox Wildlife Consulting was commissioned by Boddington Gold Mine Management Company Pty Ltd (BGMMCo) to undertake a baseline survey of the vertebrate fauna on the NBG area, over three seasons during 2001 and 2002. The report also made comparisons to previous baseline investigations undertaken in 1984. The three species of black cockatoo’s were recorded during the survey.

- *Calyptorhynchus banksii naso* (FRTBC) - Recorded infrequently in 1984 (two sites only) but observed in eight of the 10 sites during 2001-2. The largest flock observed during systematic sampling was 50 birds in site BG03 during the winter survey.
- *Calyptorhynchus baudinii* (Baudin’s Cockatoo) - Recorded in four of the eight sites in 1984 but not recorded during 2001-2.
- *Calyptorhynchus latirostris* (Carnaby’s Cockatoo) - A single flock of 12 recorded in 1984, this species was more common in this current study. Recorded in five of the 10 sites with large flocks of 30 or more birds being observed in sites BG05 and BG07.

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**6.2.2 The Ecology of three threatened Black Cockatoos within a mining production landscape in the Jarrah-Marri Forest of Western Australia (Lee J.2013)**

The following PhD considered the conservation of Black Cockatoos within landscapes dedicated to mining with the research aims around:

- Describing the ecology of the three Black Cockatoos at NBG, particularly patterns in group size, site occupancy, habitat use and food plant use;
- Examine the effectiveness of ground-based hollow surveys, post felling inspections of hollows and behavioural observations as approaches for assessing Black Cockatoo breeding habitat in Jarrah-Marri Forest;
- Assess the successional stage of the rehabilitated mine pits and characterise variation in the structure and floristic of pits in order to identify features that might influence the availability of food resources for Black Cockatoos;
- Document feeding activity within rehabilitated mine pits and any associations with structural features of the vegetation
- Trial the implementation of artificial nest hollows for Black Cockatoos to assess their value as a tool for mitigating natural hollow loss;
- Conduct a review of the use of artificial nest hollows for Black Cockatoos to assess their value as a tool for mitigating natural hollow loss; and
- Investigate the use of natural and artificial water sources at NBG and assess the potential for interactions within Residual Disposal Areas (RDA) (Lee 2013).

Below are the highlighted findings from a number of these achieved aims.

**6.2.2.1 Ecology of three Black Cockatoos at NBG**

- All three species were encountered in remnant native forests as well as human modified habitats with Carnaby's Cockatoo using the broadest range of habitats including native forest, mine-site rehabilitation and pine plantations;
- Carnaby's Cockatoo occurred frequently at NBG and in relatively larger flocks that displayed seasonal changes in group size and occupancy, compared to FRTBC that occurred less frequently and in smaller family groups that suggest year round residency and lack of seasonality in numbers and movements. Baudins Cockatoo were also present in large flocks, but displayed higher abundances in autumn and winter and fewer numbers in spring and summer;
- Carnaby's Cockatoo was the most generalist of the three Black Cockatoos and fed on 10 of the 16 feed plant species recorded on the site while Baudins and FRTBC fed largely on Marri. Carnaby's and Baudins were also observed feeding on grubs (Lee 2013).

**6.2.2.2 Effectiveness of ground-based hollow surveys, post felling inspections of hollows and behavioural observations as approaches for assessing Black Cockatoo habitat in the Jarrah-Marri forest**

- The most effective approach for identifying nest sites is targeted behavioural observations at dawn and dusk during known breeding seasons;
- Ground based surveys may significantly overestimate the presence of suitable hollows but may provide useful assessment of relative hollow abundances if biases are identified and corrected; and
- Similarly, post-felling inspections appear ineffective at characterising hollow occupancy but provide opportunities for the collection of other data (Lee 2013).

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**6.2.2.3 Documents feeding activity within rehabilitated mine pits and any associations with structural features of the vegetation**

- From behavioural observations Carnaby’s and Baudin’s Black Cockatoos were the two most frequently encountered species in the mine-site revegetation. FRTBC were not observed using the revegetation, but were detected in the forest trees adjacent to mine site rehabilitated pits. Group sizes for both white-tailed species were similar to those observed in remnant forest areas;
- Carnaby’s cockatoo accounted for most of the feeding of the proteaceous plants in the rehabilitation vegetation while Baudin’s Cockatoo fed on Marri within the revegetation plots;
- Plot sampling of feeding residues confirmed that all three Black Cockatoo species used rehabilitated mining pits for feeding;
- While feeding activity varied from pit to pit, comparisons of interior and exterior plots within a pit demonstrated no difference in feeding activity; this suggested that Black Cockatoos do not have a preference for feeding locations within these rehabilitated mining pits; and
- Study confirmed that rehabilitated mine pits at NBG offer a food resource for all three Black Cockatoos in the form of proteaceous and myrtaceous food plants and indicated that food resources can start to become available as early as six years post establishment (Lee 2013).

**6.2.2.4 Trial the implementation of artificial nest hollows for Black Cockatoos to assess their value as a tool for mitigating natural hollow loss**

- The trial noted that Black Cockatoos were not observed inspecting or using either ‘cockatube’ or wooden box Artificial Nest Hollows (ANH) at the site; and
- The lack of use may be attributed to unfamiliarity, structural features that may be unappealing, position of the ANH and/or the presence of sufficient natural hollows in the NBG landscape (Lee 2013).

**6.2.2.5 Investigate the use of natural and artificial water sources at NBG and assess the potential for interactions within Residual Disposal Areas**

- All three Black Cockatoo species were observed using water sources at NBG. Drinking was observed at 15 distinct locations including natural and man-made resources;
- Most drinking occurred within a few hours of sunrise or sunset;
- Black Cockatoo appears to prefer water sources with firm and gently inclined edges for access surrounded by vegetation;
- Black Cockatoos infrequently came into proximity with potentially hazardous sections of the Residue Disposal Area (RDA) and were primarily observed flying overhead. Several factors make these RDA less preferable than other drinking sources present at NBG including greater perceived predation risk, open landscape, frequent traffic and availability of suitable alternate sources nearby; and
- Black Cockatoos were observed using the newly established faunal drinking points around the RDA (Lee 2013).

**6.2.3 Assessment of Habitat Values for Black Cockatoos within the Eastern Acquired Lands at Newmont Boddington Gold Mine (Finn 2011)**

Murdoch University was commissioned by NBGPL to undertake a study of the area immediately to the east of the NBG tenements (NBG eastern acquired lands) to assess the potential of the area as feeding and breeding habitat for Black Cockatoos based on: sightings of black cockatoos, identification of nesting sites, and plot-based sampling of vegetation, feeding residues, and potentially suitable hollows (using ground-based surveys)

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The study determined that all three black cockatoo species used the eastern acquired lands as feeding habitat. Four probable nesting sites were identified, indicating that native forest areas provide breeding habitat for Carnaby’s Cockatoos and Forest Red-tailed Black Cockatoos. Estimates of the occurrence of potentially suitable hollows in three tree species estimated that remnant native forest areas near NBG provide 0.38 Jarrah (*E. marginata*) hollows per ha, 0.27 Marri (*Corymbia calophylla*) hollows per ha, and 0.18 Wandoo (*E. wandoo*) hollows per ha. The report noted the need for further research to determine the factors influencing nest-site suitability.

**6.2.4 Methods to Assess Breeding Habitat for Black Cockatoos in the Jarrah Forest of South-western Australia (Finn et al. 2011)**

Murdoch University evaluated three approaches to locating potentially suitable hollows and probable nesting hollows at NBG: ground-based surveys for hollows, post-felling inspections of hollows, and behavioural observations of black cockatoos. They identified 11 probable black cockatoo nest hollows within the NBG expansion area (post-2005) and remnant forest areas on the NBG leases and private land (approx. 10,700 ha). Seven (63.6%) were found to be used by Carnaby’s Cockatoos, three (27.2%) Forest Red-tailed Black Cockatoos, and one unknown black cockatoo species (9.1%).

Behavioural observations of black cockatoos were the most effective approach to identify probable nest hollows ( $n = 10$  hollows; 90.9%). In nine of these cases, visual or acoustic cues indicated the potential presence of a nest, and in all ten cases, occupancy of a hollow was examined using ‘tree-knocking’, i.e. knocking the base of a tree and observing to see if a bird emerged from a hollow. Ground-based surveys ( $n = 1$  hollows; 9.1%) and post-felling inspections ( $n = 0$  hollows) were ineffective at identifying nest hollows despite large sample sizes and extensive field survey periods.

Ground-based post felling surveys conducted over approx. 1,200 ha from 2006 through 2011 identified 149 trees with potentially-suitable hollows from three tree species, of which 119 trees (79.9%) survived felling intact enough for inspection. Few of the potential hollows identified in Jarrah trees were considered large enough to be potentially suitable for black cockatoos ( $n = 28$  of 89 trees inspected; 31.5%). In contrast, large hollows occurred more frequently in Marri ( $n = 14$  of 22 trees inspected; 63.6%) and Wandoo ( $n = 8$  of 12 trees inspected; 69.2%). Of the probable nest hollows, six (54.5%) hollows were in Marri, four (36.4%) in Wandoo, and one (9.1%) in Jarrah.

**6.2.5 Landscape Position Predicts Distribution of Eucalypt Feed Trees for Threatened Black Cockatoos in the Northern Jarrah Forest, Western Australia (Biggs et al. 2011)**

Murdoch University studied the landscape distribution of two important black cockatoo food sources, the eucalypts Jarrah *Eucalyptus marginata* and Marri *Corymbia calophylla*, at a mine site in the north-eastern Jarrah forest in 2008. Jarrah and Marri were not distributed randomly across the landscape. Stem densities of Jarrah and Marri were highest on lower slopes and on ridge tops respectively, while stem densities for both species were lowest in lowland areas, where stems of Wandoo (*E. wandoo*) often occurred. The distribution of Jarrah and Marri ‘feed trees’ used by cockatoos did not follow this landscape pattern, with Marri feed trees showing a distinct association with lower slopes and lowland areas, and Jarrah feed trees more evenly distributed across landscape positions.

Multiple logistic regression with biotic (stem densities), topographical (landscape position), and disturbance (e.g. presence of cut stumps) variables indicated that feed trees were most likely to occur on lowlands and lower slopes in the absence of Wandoo. Although Jarrah and Marri occurred at a frequency ratio of 3:1, a significantly higher proportion of Marri trees (13.0%) were used as feed trees than were Jarrah trees (5.2%). These findings suggest that Marri is likely the more important food source at a landscape-scale, but longer-term studies are needed to rule out the possibility that the relative importance of the different tree species varies from seasonally and inter-annually.

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**6.2.6 Vertebrate Fauna Survey within Newmont Boddington Gold Mine. An Assessment of Potential Waste Rock Disposal Areas, July 2012 (Ninox Wildlife Consulting 2012)**

Ninox Wildlife Consulting was commissioned by NBGPL to undertake a vertebrate fauna survey on the NBG, during Autumn, 2011 and Summer 2012. The following species of Black Cockatoo were recorded.

- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) – Flock sizes ranged from a maximum of 24 individuals recorded in site BG10 to a single bird observed in site BG19. Flock sizes varied over a number of days within sites.
- *Calyptorhynchus baudinii* (Baudin’s Cockatoo) – All sightings during this study were made in May 2011 with two flocks were observed: a flock of eight at site BG15 and a flock of 14 at site BG14.
- *Calyptorhynchus latirostris* (Carnaby’s Cockatoo) – In May 2011, a flock of eight birds was observed at site BG14. Two individuals were observed in site BG18 in January 2012.

**7 BLACK COCKATOO MANAGEMENT AT NBG**

A large component of the BCMP relate to mining operations and the ability to avoid, minimise and/or mitigate impacts of operational activities on Black Cockatoo populations through practical and cost-effective measures which will at times include the development of offsets when impacts cannot be avoided to a degree acceptable to State and Federal jurisdictions.

NBG is responsible for environmental management controls prior to and during site preparation, construction, mining and closure. NBG is also responsible for establishing and managing land to be rehabilitated as offsets for areas within the *Project Site* that cannot be adequately rehabilitated once disturbance has occurred i.e. Waste Rock Dumps, Pits and Residue Disposal Areas. Unlike land developed for housing much of the site once the operation has concluded will be returned to forest. This commitment does not include the village camp which is situated within pastoral land leased from a local farmer for the term of the operation. The only requirement associated with the village is for the replacement of any established and ‘documented’ trees that are lost during the course of the tenure.

For the purpose of the state and federal approvals the management of Black Cockatoos at NBG are centred on the following objectives:

- Measures to identify and avoid clearing of *Potential Black Cockatoo Breeding Habitat* including but not limited to areas within the *Project Site*.
- Measures to identify *Native Vegetation* containing *nestlings* and controls to ensure that no clearing occurs until nestlings have left the hollow (without human intervention).
- Ensure the presence of education programmes for employees and contractors to first make them aware of the presence of Black Cockatoos within the *Project Site*.
- Provide employees and contractors with appropriate controls to minimise and avoid impacts to the three species that inhabit the NBG tenements.
- Research measures to maximise the rehabilitation of disturbed areas through the use of identified Black Cockatoo food plants and hollow producing tree species.
- Investigate and monitor the use of artificial breeding hollows.
- Measures to identify and limit the spread of *Phytophthora cinnamomi*.
- Prohibit pets and firearms within the *Project Site*.
- Measures to minimise the impact of death and injury to Black Cockatoos cause by vehicles strikes and other operation infrastructure.

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- Generation of systems to report and record incidents and interactions with Black Cockatoos on site.

For the purpose of the NBG BCMP the following terminology is used to define the above objectives:

- *Native Vegetation* – areas in and around the NBG *Project Site* within the Darling Botanical District of the Southwestern Botanical Province collectively known as the Northern Jarrah Forest. This ecosystem is characterised by open forests dominated by Jarrah (*Eucalyptus marginata*). Other dominant species include Marri (*Corymbia calophylla*) and Wandoo (*Eucalyptus wandoo*). In this ecosystem Jarrah, Marri and Wandoo are not distributed randomly across the landscape with stem densities of Jarrah and Marri highest on lower slopes and on ridge tops respectively, while stem densities for both species lowest in lowland areas, where stems of Wandoo occurred.
- *Potential Black Cockatoo Breeding Habitat* – is defined as tree species present within *Native Vegetation* that are known to support breeding within the range of Black Cockatoos which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For Wandoo, suitable DBH is 300 mm. For other tree species, suitable DBH is 500 mm. Within the NBG experience identification and management of *Potential Black Cockatoo Breeding Habitat* is synonymous with the identification and management of *Habitat Trees*. *Habitat Trees* (Section 7.1.1) are defined as typically mature and senescent species of Wandoo, Marri and Jarrah between 130-220 years of age that contain potential hollows and are marked in the field with an encircled, capital ‘H’. Field work suggests that as *Habitat Trees* Wandoo have the highest potential to contain nests followed by Marri with Jarrah having the lowest potential.
- *Project Sites* - is defined as the second proposed RDA, Waste Rock Dumps 10, 11 and 12.

Table 4 provides a summary of these aspects and the management actions NBG has in place for the protection of Black Cockatoos. Following this is further information regarding each aspect and the management action.

**Table 4: Summary of Management Actions for Protection of Black Cockatoos**

Aspect	Action	Timing	Responsibility
Vegetation clearing	<p>Demarcate areas on ground prior to clearing to ensure minimal area is impacted and trees of significance are avoided.</p> <p>Utilise the NBG Disturbance Application &amp; Approval process to ensure activity is in line with internal and external standards and regulations.</p> <p>Post clearing inspections to determine compliance with Ground Disturbance Approval and preparation for rehabilitation (if applicable).</p>	Prior to clearing & mining	NBG Mine Planning / NBG Sustainability & External Relations (SER) Department

Aspect	Action	Timing	Responsibility
	<p>Ensure declared and environmental weeds do not enter native forest from cleared areas and peripheral agricultural land.</p> <p>Ensure a management plan exists and is enacted to control weeds.</p>	During mining	NBG SER Department
	<p>Conduct surveys of <i>Native Vegetation</i> with the potential for Black Cockatoo breeding habitat to identify, 'field-mark' and record the presence of nesting hollows.</p> <p>Periodically revisit identified <i>Potential Black Cockatoo Breeding Habitat</i> to confirm presence of species and update corresponding database.</p> <p>Avoid clearing of <i>Potential Black Cockatoo Breeding Habitat</i> during breeding seasons.</p> <p>Install measures to ensure that <i>Black Cockatoo Breeding Habitat</i> that contains <i>nestlings</i> is not cleared until such times that the fauna have left their nests (without human intervention).</p>	During disturbance activity	NBG Mine Planning / NBG SER Department
	Retain <i>Native Vegetation</i> and <i>Potential Black Cockatoo Breeding Habitat</i> corridors through the mine site to enable fauna migration.	Ongoing	NBG Mine Planning / NBG SER Department
	<p>Authorised access to mine site and <i>Project Sites</i> by the public.</p> <p>Restricted access to <i>Native Vegetation</i> and <i>Potential Black Cockatoo Breeding Habitat</i> at all times. Access for NBG employees must be approved by SER Department.</p> <p>Access into <i>Native Vegetation</i> and <i>Potential Black Cockatoo Breeding Habitat</i> for operational reasons will be through authorised tracks that take into account mapped dieback areas and cleaning protocols.</p>	Ongoing	NBG Security/ NBG Geology/ NBG SER Department
Access to water Noise Light Infrastructure	<p>Install and maintain drinking points near <i>Potential Black Cockatoo Breeding Habitat</i> known nesting and feeding sites.</p> <p>Installation of fauna drinking points around the F1RDA to minimise fauna interactions with treated process water located within the central decant pond (Fig.3).</p>	Prior to and during mining	NBG SER Department
	Manage lighting to minimise light spill outside the mining area and so as to not impact <i>Potential Black Cockatoo Breeding Habitat</i> .	At all times	NBG Mine Planning / NBG SER Department
	Maintenance of roads and tracks to prevent formation of water holding structures which may attract fauna and increase the risk of vehicle strike	Ongoing	NBG Site Services Departments

Aspect	Action	Timing	Responsibility
	Installation of relevant signage on roads and entry points within the mine noting presence of Black Cockatoos.	Ongoing	NBG SER Department
	Traffic Management Plan on site with posted speed limits and enforcement of these limits to encourage safe driving and in turn minimise fauna strikes by vehicles.	Ongoing	HSLP Department
Rehabilitation Habitat retention / conservation Infrastructure	Undertake progressive rehabilitation as per operational mine plans.  Periodic meetings of the Closure Reclamation Technical Team (CRTT) to plan, track and reduce rehabilitation liability of the mine.	As per mine schedule	NBG Tech Services /NBG Projects/ NBG SER Department
	Apply research learning's to ensure relevant understorey and overstorey species beneficial to Black Cockatoos are used in rehabilitation seed mixes i.e. the importance of using proteaceous and myrtaceous food plants and the fact that they can supply a food resource with 6 years post establishment.	At all times	NBG SER Department
	Consultation with relevant stakeholders regarding areas to be rehabilitated.	Prior to area selection	NBG SER Department
	Ensure actions are consistent with existing black cockatoo recovery plans.	At all times	NBG SER Department
	Areas to be retained for conservation ( <i>Potential Black Cockatoo Breeding Habitat</i> ) to be clearly demarcated (i.e. protected from mining activities) to ensure minimum disturbance and no peripheral impacts.  Ensure areas selected for conservation are categorised as <i>Potential Black Cockatoo Breeding Habitat</i> .  Control feral bees in and around the mine site.  Control of feral pigs, cats and foxes in and around the mine site.  Control weeds around the mine site to prevent impacts to biodiversity.  Restrict access to mine owned land to NBG authorised personnel only.  Restriction of mine personnel to forest areas.  No access to pets or firearms on the NBG leases.	At all times	NBG Mine Planning / NBG SER Department
	Minimise fuel loads and undertake fire prevention controls in and around <i>Potential Black Cockatoo Breeding Habitats</i> .	Annually	NBG SER/ NBG Emergency Services Department
	Investigate the benefit of using artificial nest hollows in remnant <i>Native Vegetation</i> and <i>Potential Black Cockatoo Breeding Habitat</i> .	On going	NBG SER Department
	Monitor hollow(nesting) competition and where practical seek advice and manage to address any clear imbalances.	On going	NBG SER Department
Cockatoo specific projects	Continued support of research and conservation activities, as currently being	On going	NBG SER Department

Aspect	Action	Timing	Responsibility
	undertaken by NBG. Projects will be based on advice from Murdoch University and other subject matter experts.		
Awareness and education	<p>Site induction to include information regarding Black Cockatoos and any other factors that may have a direct or indirect impact on populations.</p> <p>Communication across the operation requiring the reporting of any events involving the injury or death of Black Cockatoos.</p> <p>Where applicable ensure onsite contracts include environmental conditions that may prevent indirect impact to Black Cockatoo populations.</p> <p>External communication of Black Cockatoo Management Plan at community meetings and local school engagements.</p> <p>Communication of studies and projects with government agencies through the Boddington Gold Mine Environmental Management Liaison Group Meeting (BGMEMLG)</p> <p>Attendance at relevant Black Cockatoo forums to ensure site is up to date with latest information whilst identifying opportunities for improved management and collaboration.</p> <p>Signage located on roads and entry points noting the presence of Black Cockatoos.</p>	Ongoing	NBG SER Department

### 7.1 Vegetation Clearing

This BCMP has been periodically updated to manage:

- The 2006 approval for the recommencement of the basement rock operation having a disturbance footprint of 3650ha;
- The 2012 approved Interim Modification Project which requested 29ha of additional vegetation clearing to cover pit modifications and extensions to No 7, 8 and 9 Waste Dumps; and
- The 2014 approved LOM Extension Project which noted the future clearing of 1755ha of Black Cockatoo, Woylie & Chuditch Habitat as detailed under S14 of EPBC 2012/6370 for expansion of the Waste Rock Dumps and a new Residue Disposal Area.

Outside of these above approvals, any additional clearing of vegetation, with the exception of temporary drill pads associated with DMP approved Programme of Works (PoW), is prohibited without:

- internal approval from the site SER Department for anything under one hectare; and
- external government approval for anything over a hectare.

For the purpose of planned ‘approved’ clearing, NBG undertakes extensive assessments of the areas to determine the presence of *Potential Black Cockatoo Breeding Habitat* which is typified by the occurrence of *Habitat Trees*. In addition to the presence of *Habitat Trees* the valuation of *Native Vegetation* also takes into account foraging, and/or roosting capabilities. This is an important consideration in that distance to food and water will determine the continued use of a existing breeding area. For the NBG experience assessment of *Native Vegetation* will take into account the following three aspects:

1. Types of food plants present with Marri having the highest value followed by proteaceous species and Jarrah with the lowest rating;
2. Proximity of vegetation to a water source with the optimum distance being 3 approximately kilometres; and
3. Presence of 'Habitat' trees with Wandoo having the highest value, Marri the next and Jarrah having the lowest value (Finn 2014).

Again, it is important to note however that *Potential Black Cockatoo Breeding Habitat* is regarded as the highest priority habitat on site on the fact that trees with suitable hollows are approximately 130-220 years of age and generationally irreplaceable whereas feeding habitats can be re-established within a very short 8-year period. Additionally retaining or increasing local breeding effort has a much higher conservation effort than sustaining a feeding habitat.

Therefore based on the above information the highest rated *Native Vegetation* on site within the confines of the Northern Jarrah Forest will be defined as Wandoo vegetation containing trees with potentially suitable hollows (*Habitat Trees*). Second highest would be areas of the forest that are dominated by Marri trees with potentially suitable hollows present. Third highest would be jarrah forest areas in which Marri is abundant (Finn 2014). This is of particular importance in that research has shown that Marri and Wandoo account for a disproportionate number of large hollows even though Jarrah predominates the site (Lee 2013).

Strategies arising from this process include;

- Ongoing survey of *Native Vegetation* to identify trees with potentially suitable hollows i.e. *Potential Black Cockatoo Breeding Habitat*;
- Ongoing surveys of *Native Vegetation* to map distribution of 'favourable' habitat;
- Avoidance of areas identified as *Potential Black Cockatoo Breeding Habitat*. This would look at trying to avoid any disturbance in areas abundant in Marri Wandoo & or other similarly hollow-bearing species. In the Northern Jarrah Forest area, Marri is abundant in the lower landscapes while Wandoo trees typically occur on lower slopes and along drainage lines. Therefore in planning it would be beneficial to avoid lower slopes, edges of drainage lines and valley floors for the construction of support infrastructure such as roads;
- Avoiding (where practical) removal of foraging trees and species with appropriate DBH during exploration activities;
- In execution of PoWs look at path of 'least resistance' when constructing drill pads and gridlines through *Native Vegetation*;
- Modification of the clearing footprint to avoid or minimise loss of *Potential Black Cockatoo Breeding Habitat*;
- Assessment of options to make pro-active use of *Native Vegetation* to be cleared, such as;
  - Recovery of high quality hollows and their relocation to other areas (see further detail below);
  - Relocation of *Habitat Trees* to other areas (see further detail below);
  - Collection of information on the use of the hollows and other aspects of the vegetation (through the NBG Habitat Tree Survey Form)
- Avoidance of clearing during the breeding season and confirmation that if breeding has taken place, that nestlings have fledged and family units have left the area; and
- Retention of corridors of established *Native Vegetation* throughout the mine site to facilitate fauna movement.

Of these strategies, the translocation of *Habitat Trees* was considered prohibitively expensive and logistically difficult, given the need to utilise heavy machinery, the need to excavate root systems, the large size of the trees and the senescent state of many trees bearing large hollowing (meaning that trees would not have survived transplantation). The recovery of high quality hollows for relocation have proven difficult to implement given the weight of the wood surrounding the

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hollow cavity, the often degraded state of the wood surrounding the hollows and the systems needed to attach the ‘new’ hollow to a tree. Artificial nest hollows suggested a more cost effective and practical option.

Vegetation clearing at NBG is strictly controlled and requires, for almost all cases external referral and approval as per various statues present at the state legislature. Once external government approvals have been received NBG still recognises that *Native Vegetation* within the approved area provides important habitat for Black Cockatoos. For each clearing area, the NBG Environmental Disturbance Approval process is used to ensure environmental assessment is conducted but not limited to priority species, vegetation complexes, aboriginal heritage, forest disease, *Habitat Trees*, drainage, rehabilitation.

**7.1.1 Habitat Tree Marking and Spatial Database Management**

Known ‘Habitat’ trees and artificial hollows within the NBG tenements are surveyed according to the NBG Cockatoo Monitoring –Work Instruction document (See Appendix 7) which allows for the varied nesting season for the three different species of Black Cockatoos. The field work involves ‘tree knocking’ around the girth of the habitat tree, behavioural observations and looking for signs of feeding residue. The collected data is uploaded into spreadsheets which are then forwarded onto Murdoch University Black Cockatoo research personnel.

All areas planned to be cleared require a Black Cockatoo tree survey to be completed, prior to clearing activities commencing. All potential habitats that could be impacted as a result of the clearing activities are marked with a large “H” contained within a white circle to indicate the potential for a Habitat tree. Each identified tree has some basic details recorded including the GPS coordinates, which are all recorded in the ArcGIS NBG Black Cockatoo Tree layer.

In circumstance whereby clearing of a habitat tree is unavoidable, the tree is “knocked” prior to clearing to enable any fauna present within the tree an opportunity to relocate to a safer location. Following clearing of the tree, a post felling inspection is completed, to confirm the presence of absence of black cockatoo habitation. The Black Cockatoo Tree Layer is then updated to record the tree as being “felled”.

**7.1.2 Access to Water**

In the planning stage for the expansion project, an environmental risk analysis conducted by NBG identified fauna access to the residue disposal areas and exposure to cyanide as a risk requiring management. Ecologists from Donato Environmental Services assessed the risk, including the potential risk to Black Cockatoos. Their research identified a number of measures NBG could implement to minimise the risk of wildlife interacting with residue disposal areas. Many of these measures apply an understanding of animal behaviour to implement strategies that remove the animals from the risk or ensure that the area is unattractive to fauna. Black cockatoos are known to avoid drinking from open and/or exposed water bodies and standing on soft ground, characteristics that are typical of the residue disposal areas at NBG.

NBG has implemented the following controls to reduce the risk of black cockatoos drinking from the RDAs:

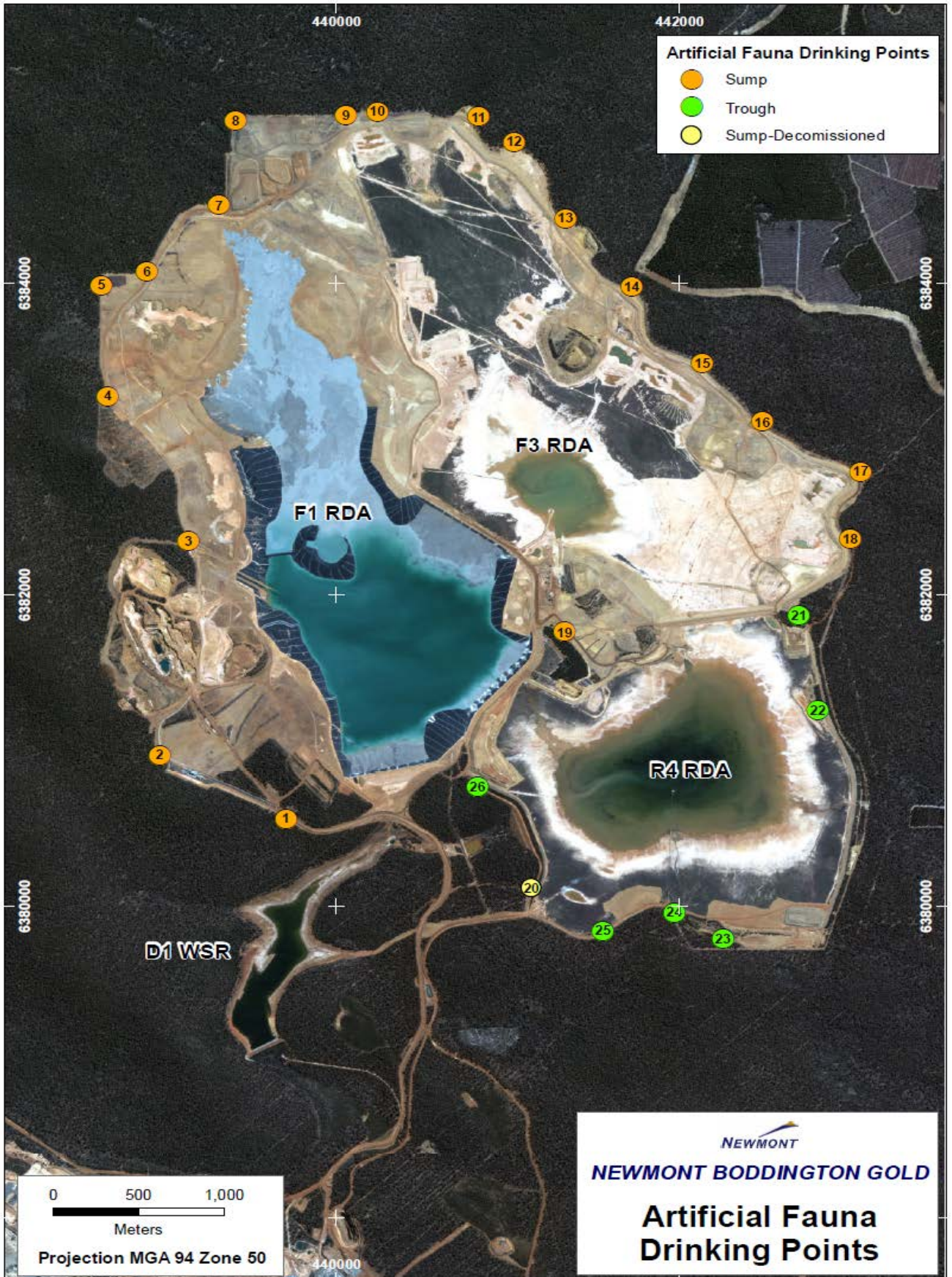
- Installation of artificial fauna drinking points monitored by the SER Department;
- Maintaining a permanent water body on R4 RDA to create an ecosystem attractive to fauna rather than sourcing resources from F1 RDA;
- Maintaining water bodies (i.e. D1 WSR) on the site of higher water quality. These are naturally more attractive to the birds than the residue disposal areas.
- Compliance with the CN Code and commitment to destruct WAD CN to below 50ppm to ensure no impact to Black Cockatoos should they drink from F1 RDA;
- Use of bird scarers to deter birds off the RDA; and
- Wildlife Observations to monitor wildlife accessing F1 RDA.

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Through her PhD and the use of camera traps Lee (2013) confirmed 15 different anthropogenic water sources at NBG (not including ephemeral water sources) were being used by the three species of Black Cockatoos. The findings indicated that Black Cockatoos used Fauna Drinking Points (FDP) and that birds were not observed to use the Residue Disposal Areas when FDP were in place (Lee 2013). Figure 3 displays locations and types of artificial fauna drinking sites established around the RDAs.

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**Figure 3: Artificial Fauna Drinking Points at NBG**

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### 7.1.3 Noise

Noise associated with NBG operations may result from mining, processing, pumping, light vehicle access and transport activities. Anecdotal observations suggests that black-cockatoos do not exhibit a strong aversion response to man-made noise on-site, as they have observed flying, roosting, or feeding near noise-making infrastructure. Experience elsewhere indicates that black cockatoos are generally tolerant to high noise levels when breeding, as nest sites have been observed near roads and other high-activity areas.

The main source of noise which occurs nearby forested areas is from heavy earthmoving equipment operating within the pits, either hauling ore to the primary crusher and conveyor system or hauling waste rock to the waste rock dumps. Other noise sources will include the spigot discharges of tailings into the residue disposal areas and the general plant noise associated with the processing plant.

Whilst allowable noise levels are specified in the *Environmental Protection (Noise) Regulations 1997*, this legislation applies only to the impacts to stakeholders and makes no reference to the impact of noise on the environment.

Since 2006, NBG has been involved with supporting a number of research partnerships. Within all studies there has been no demonstration, suggestion or conclusion of any correlation between operational noise and impacts to Black Cockatoo breeding. Recent studies have demonstrated that all 3 species of Black Cockatoo are foraging in rehabilitation areas (7 – 8 years age) which are located throughout the *Project Sites* and construction sites. Further visual evidence shows that like most fauna, Black Cockatoo's have adapted to the modified environment and will nest in tree hollows in close proximity to waste dumps and operational roads.

### 7.1.4 Light

Effective lighting is a necessary for safety reasons during mining operations. Where possible, lighting will be minimised where it could possibly interfere with black cockatoo habitat, particularly if roosting spots are identified close to mining operations. However, behavioural observations at NBG suggest that these species do not maintain consistent roost sites at NBG (as they may do in other areas), but tend to roost opportunistically with native forest areas (H. Finn, Murdoch University, personal communication). Positioning and design of lighting will be managed to minimise light penetration outside the *Project Sites*.

### 7.1.5 Rehabilitation

NBG has committed to progressive rehabilitation during the life of the mine. Initially, rehabilitation efforts are planned for the outer slopes of the waste dumps and residue disposal areas as their final landform completion date is known. Current site rehabilitation prescriptions and procedure based on ongoing research take into account:

- Understanding *Native Vegetation* succession and the importance of using fast growing proteaceous species such as Banksia and Hakea species which within a few years establishes a thick shrub layer over the rehabilitated area which in turn provides foraging seed and flower for Black Cockatoo.
- The importance of the short lived-proteaceous species which tend to produce food in predictable seasons rather than the Jarrah and Marri whose reproductive cycle is subject to environmental conditions and mat only flower every few years.
- The importance of the early establishment of Marri over jarrah due to the apparent time lag between the species developing fruit.

As noted under Section 6.2.2.3 this work suggests active foraging areas for Black Cockatoos 6-years post establishment.

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The overall goal of the rehabilitation program is to ensure that, upon completion of mining operations, the mine site will have an effective vegetation cover that provides the habitat resources required to support the range of species that inhabited the area prior to mining commencing. For black cockatoos, this means establishing revegetation that provides a similar suite of food plants as remnant Jarrah forest.

In addition, the *Plants for Carnaby's Search Tool* (Groom 2010a) is an on-line resource available on the DPaW webpage which provides information on plants used by Carnaby's cockatoos for food, night roosting or nesting, and captures information from both the published and unpublished literature (DPaW 2013).

Detailed information regarding progressive and post mine closure rehabilitation is regularly reviewed and updated within the NBG Mine Closure Plan. This document must be submitted to state regulators every 3 years (as a minimum) and is generally updated following changes in assumptions regarding mine closure as the results of ongoing studies are further understood.

The Mine Closure Plan contains specific information regarding measures to maximise rehabilitation during operations as well as how rehabilitation activities will be undertaken to promote the return of flora species and communities which support the return of Black Cockatoo species to previously disturbed areas (Refer to Section 4.2.4 of the NBG Closure Plan 2012).

**7.1.6 Infrastructure**

NBG regularly maintains roads and tracks to prevent the generation of potholes which can represent a hazardous water source for black cockatoos during dry periods. Vehicle speeds are controlled on roads across the site and signs are posted at key points along access roads to make drivers aware of potential fauna. These measures should reduce interaction between vehicles and fauna. Whilst they are primarily intended to reduce safety risks to personnel on site, there is a corollary benefit of reducing fauna mortalities (including black cockatoos) from interaction with vehicles.

In addition to existing fauna awareness signage, NBG is required to maintain relevant signage specifically noting the presence of Black Cockatoos on roads and entry points to the operation. Where signage does not already exist it must be installed.

**7.1.7 Habitat Conservation, Restoration and Creation**

NBG actively seeks to identify opportunities to achieve environmental benefits outside of the immediate mine site. Initiatives currently in place include;

- Commitment to address Hotham Catchment rehabilitation through the Hotham-Williams Catchment Environmental Alliance (HWCEA). Projects in the past have included the installation of a fish ladder over the town weir to encourage upstream migration, establishment of a walk trail along the Hotham River and tree planting during a corporate volunteer's day. Whilst commitments relating to supporting community initiatives are not included within Ministerial Statement 971, NBG is committed to continuing to support viable projects as identified within the region. The 2014 and onwards focus will be the supporting of the soon to be recognised (and government funded) Peel-Harvey Catchment Council which has the goal of improving the connectivity and health of riparian corridors and bushland patches across ~11,900km<sup>2</sup> of catchment. This organisation will seek to replace the HWCEA and has project links with the Carnaby's Cockatoo Recovery Plan and the National Wildlife Corridors Plan.
- Commitment to controlling feral animal on NBG owned land. These typically would include provisions for the control of cats and foxes. NBG has also successfully completed baiting for feral pigs through the Hotham Declared Species Group. The control of feral bee populations is also being addressed through limiting apiarists' activities and destructing

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detected hives. NBG has recently acquired new land (Hotham Farm and Saddleback tree farms) and a program will be in place to limit bee and feral pig populations in these areas.

- Annual attendance by the SER group to an education and tree planting day at the Kaarakin Black Cockatoo Conservation Centre.

Each of these initiatives involves engagement with the local community and will provide an opportunity for NBG to re-invest in a way that provides for a mutual benefit to both.

**7.1.7.1 Forest Disease**

NBG maintains a number of detailed plans and procedures regarding the management of forest disease (typically referred to as Dieback) and those factors and processes which contribute towards its spread. The application of controls to limit the spread of forest disease is of critical importance in contributing towards the prevention of tree hollow loss.

Those controls critical to the prevention of forest disease at NBG includes but are not limited to;

- all vehicles entering or leaving site must to be free from soil or vegetative matter;
- regular mapping to monitor known boundary spread and identify any new infestations;
- vehicle and equipment inspections by Environment and Security Gatehouse personnel;
- signage and clean/wash down locations at nominated boundaries;
- workforce education through inductions, aspects of contract, department and project presentations;
- Environmental Disturbance Approvals used prior to any ground disturbance or rehabilitation material movement (including regrowth or infrastructure maintenance activities);
- maintenance of all Forest Disease data within ArcGIS spatial database;
- only authorised access within forested areas; and
- Project specific forest disease management plans developed when interaction is unavoidable.

The management actions and their application relating to forest disease are further informed and guided by the Commonwealth *Threat Abatement Plan for disease in Natural Ecosystems caused by Phytophthora cinnamomi* (Threat Abatement Plan).

Whilst this management plan does not detail all processes regarding forest disease management, Section 12 lists all documents relevant to the management of forest disease at NBG.

In addition to those processes which focus on “dieback”, NBG is currently investigating opportunities to expand knowledge and monitoring at the site for other factors which contribute towards tree loss such as Marri Canker (*Quambalaria coyrecup*). Given Marri is an important potential hollow producing species, diseases other than those which commonly occur in the region must be understood and monitored.

**7.1.7.2 Repairing Hollows**

Following the ongoing surveys of nesting trees if an accessible hollow is located with damage then repairs where safe to do so will be considered. Furthermore any suspected activity by poachers will immediately be reported to the DPaW.

**7.1.7.3 Cockatoo Specific Projects**

NBG has supported and will continue to undertake a range of research and conservation activities that are consistent with the aims and actions identified in the recovery planning for the three species. The NBG project has a projected 17 year operational life, which provides the opportunity to sustain research projects over extended time periods, thereby allowing for monitoring, assessment, and on-going improvement of management measures (in contrast to short-term

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projects with poor monitoring time-frames). Based on recommendations from research completed to date, NBG includes cockatoo-specific projects in its annual work planning process, under the guidance of Murdoch University and with the advice and approval of the BGMEMLG.

**7.1.7.4 Artificial Nesting Boxes**

Murdoch University researchers and NBG have installed 24 artificial nest hollows (of two differing designs) within NBG tenements and surrounds. Although monitoring to date has not identified use of these hollows, monitoring will continue in order to assess their long-term efficacy. Continued efforts to identify nest sites in natural hollows may also help to determine the attributes black cockatoos prefer for nesting sites (e.g. proximity to water and food sources, height of hollows).

Research on the use of artificial nesting boxes in the NBG area suggests that one of the primary reasons for no use to date is the presence of sufficient hollows within forested areas surrounding NBG. This is supported by the high level of artificial nest hollow success observed in Wheatbelt areas of WA where natural Hollows are limited as a result of large scale clearing.

Of the three black cockatoo species occurring the south-west of Western Australia, Carnaby's cockatoo has been found to be the most willing species to use artificial hollows. The underlying philosophy for using artificial nest hollows, the key elements of design and construction and the need for regular maintenance and monitoring have been described in a series of three information sheets produced by DPaW and the WA Museum. The methodology for repairing existing, but substandard, natural hollows is described in an information brochure being developed jointly by Birdlife Australia and DPaW (DPaW, 2013).

In addition to the construction of artificial nest hollows onsite, NBG continues to support community groups and other stakeholders in the provision of materials (typically HDPE Pipe) for use as hollow construction materials.

**7.1.7.5 Management of Hollow Competition**

Competition for suitable nesting sites is one of the major threats to the successful recovery of the black cockatoos (Cale 2003; Chapman 2003). To date, hollow competitor species do not appear well-established at NBG. Murdoch University researchers have assessed more than 200 potential hollows during ground-based surveys at NBG, of which fewer than 10 contained nests of bees. In addition, although Galahs (*Cacatua roseicapilla*) are common around the Boddington town-site (10+ km from the mine), they have not been observed at the mine-site (H. Finn, Murdoch University, personal communication). These observations suggest that, at current time, the eastern margin of the northern Jarrah forest does not experience the same levels of competition for natural nest hollows as has been observed in the western Jarrah forest and in some Wheatbelt areas. However, NBG will continue to monitor the presence and abundance of hollow competitor species and, if appropriate, assess the need for management measures (in collaboration with DPaW) to deter or remove competitor species such as introduced bees, corellas and galahs). As mentioned previously NBG has excluded apiarist activities on all NBG controlled land.

**7.1.8 Injury and Mortalities**

If actions of the mine result in injury of a Black Cockatoo there is a procedure in place to contact relevant groups such as Kaarakin Black Cockatoo Conservation Centre and the Darling Range Wildlife Shelter for assistance and care.

Furthermore if the interaction has the unfortunate result in death of a Black Cockatoo or if a deceased bird is located anywhere on the tenements, NBG has developed a procedure with Murdoch University to refrigerate and deliver the bird as soon as possible to Murdoch University for an autopsy and use in its demographic aging project. To facilitate this process Murdoch University School of Veterinary and Biomedical Sciences have produced a Anatomic Pathology Submission Form that is populated with relevant information about the event and submitted with the deceased bird to Murdoch.

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Any events that result injury or death of a Black Cockatoo will be registered in NBG’s internal incident database (Cintellate) and reported in an annual compliance report and annual environmental report.

**7.1.9 Collaboration**

NBG recognises the importance of on-going consultation and liaison with stakeholders having an interest in the outcomes of the NBG Black Cockatoo Management Plan. Through the work started at the NBG mine, the opportunity exists to broaden the scope of the black cockatoo research programs in the region by collaborating with the other mining companies operating in the Jarrah forest and the southwest generally. Specific examples of collaboration include:

- Co-sponsoring of a current black cockatoo health study with BHP Billiton Worsley Alumina (BHPWAPL) Pty Ltd after NBG approached them to explore involvement as an industry research partner.
- A process has been initiated to deliver discovered deceased black cockatoos for post-mortem examination to Murdoch University to support information relating to demographics and health.
- Surveys examining black cockatoo feeding activity within mine-site rehabilitation at NBG were subsequently extended to survey rehabilitation areas held by BHPWAPL and Alcoa World Alumina Australia.

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## 7.2 Monitoring, Communications and Reporting

### 7.2.1 Internal Monitoring

Monitoring will be conducted to measure performance against the objectives and targets within Table 4. NBG sees the monitoring of those parameters listed in Table 5 as a key aspect in furthering our knowledge of the ecology of the black cockatoos.

NBG continues to partner and support groups including Murdoch University, Perth Zoo, DPaW and the Black Cockatoo Preservation Society to build on the knowledge gained from previous studies relating to Black Cockatoo demographics, health risks to the species and other knowledge gaps.

Table 5: Monitoring Program for Protection and Management of Black Cockatoos and supporting Environment

Parameter	Frequency and location	Purpose	Responsibility
Integrity of boundary mark-ups	During clearing and disturbance activities	To prevent any unauthorised clearing	NBG Technical Services & Environment Departments
Presence of breeding black cockatoos	During breeding season for each species at all identified potential breeding sites (including artificial hollows)	To prevent disturbance to breeding birds	NBG Environment Department
Presence of foraging black cockatoos	Targeted annual surveys and intensive studies (where appropriate)	To monitor use of revegetation and <i>Native Vegetation</i>	NBG Environment Department
Watering points maintained	Monthly check of existing watering points	To ensure maintained and in working order	NBG Processing & Environment Departments
Use of watering points by black cockatoos	Summer census	To monitor use of artificial water points	NBG Processing & Environment Departments
Composition of rehabilitation seed mix	Prior to rehabilitation	Include known black cockatoo food plants wherever possible in consultation with DPaW	NBG Environment Department
Emergence of seedlings in rehabilitated areas	Rehabilitation monitoring conducted at years 1, 3, 7, 12 & 20 or as required	Rehabilitation success	NBG Environment Department
Control of weeds in rehabilitated and boundary areas	Annually in accordance with site procedures	To prevent weed encroachment impacting local vegetation communities	NBG Environment Department
Control and prevention	Remove bees when	Reduce competition for	NBG

of bees in surrounding forest	encountered during surveys	breeding hollows	Environment Department
Management of fire risks nearby known breeding habitats	Noted annually during habitat tree surveys	Reduce the fuel load and potential for hollow loss as a result of fire	NBG Environment Department
Management of Forest Disease	3 yearly on active NBG tenements and land management areas	Manage tree loss and Identify and map forest disease boundaries	NBG Environment Department
Marri Canker and other pathogen identification	Investigating potential to include within regular Dieback Surveys	Identify “less common” causes of tree death	NBG Environment Department

**7.2.2 Internal Communication**

All employees and business partners (contractors) working on the mine site are required to undergo a detailed induction which currently contains a significant environmental component. The induction program explains the relevance and application of the NBG Black Cockatoo Management Plan and specific environmental performance requirements at the NBG mine. The induction program is also seen as an opportunity to enlist interested employees and contractors in taking part in the environmental management program for the mine. Like safety, care and responsibility for environmental issues is seen as a core responsibility of each and every worker on the mine site and they are held accountable for their actions in this context. Opportunities will be sought to encourage active engagement of staff in the environmental initiatives and environmental programs planned by NBG.

A key aspect of the induction program is ensuring personnel have an awareness and understand the requirement to report all incidents involving injury or death of a black cockatoo to the site Environment department. All such occurrences must be reported in the annual compliance report discussed below.

**7.2.3 External Consultation & Reporting**

NBG recognises the importance of on-going consultation and liaison with stakeholders having an interest in the outcomes of the BCMP. Currently, this is achieved through integration with the overall consultation and liaison program established for the Boddington Project.

Section 6 (Legal and Other Commitments) of this document outlines the operations approval history, including approvals granted by the Commonwealth. On the 21<sup>st</sup> December 2011, DSEWPAC (Now DotE) assessed the NBG Interim Permit and considered the impacts constituted a controlled action. Following this decision further information was supplied, with the permit officially approved on 1 August 2012. Condition 9 of the 2012 approval and Condition 3 of the 2014 approval requires NBG to submit an annual compliance report, outlining compliance with all approval conditions; most of which are focussed on management of impacts to Black Cockatoos. The interim report must be completed by 31 January each year, whilst the 2014 approval is to be submitted by 30 June each year. Both reports are posted on the Newmont Corporate webpage – [www.newmont.com](http://www.newmont.com).

NBG has established a strong and effective community liaison program and all the initiative detailed in this plan complement those already in place. Through the work started at the NBG mine, the opportunity exists to broaden the scope of the black cockatoo research program in the region by collaborating with the other mining companies operating in the Jarrah forest and the southwest generally.

A number of research projects have been completed at Boddington and the surrounding area, with outcomes from these studies shared with NGO’s, government departments and at the local community through:



- publication of findings through local newsletters;
- scientific journals through work conducted by Murdoch University;
- public meetings in the Boddington, Dwellingup, Wandering and Williams townships;
- topical discussions at local schools during the course of participating in initiatives such as World Environment Day and regular Environmental Club activities;
- information about updated research and management actions is also frequently shared in Newmont’s Global Sustainability Report (Beyond the Mine) which is a component of Newmont Corporation commitment to the DOW Jones Sustainability Index;
- the Annual Environmental Report provides details on research activities conducted at NBG which includes the management of black cockatoos; and
- the Boddington Gold Mine Environmental Management Liaison Group (BGMEMLG) which discusses environmental performance to representatives from numerous state agencies. The group is chaired by the Department of Mines and Petroleum (formerly Industry and Resources) as the lead agency. These meetings are held bi-annually.

NBG maintains systems to formally communicate on a range of subjects, including black cockatoo conservation, with those communities located within a 50km radius of the operation. A key component of the communication plan incorporates bi-annual community meetings at Boddington and Dwellingup with meetings also held in Wandering and Williams based on community demand. These meetings are often used as a vehicle to share conservation messages regarding black cockatoos and provide updates on the findings and outcomes from studies completed.

Through less formal methods NBG can promote community initiatives relating to Black Cockatoo Management such as Birdlife Australia’s Great Cockey Count to help develop a greater regional understanding of populations and behaviours within the region.

In addition, sharing publications such as “*Carnaby’s Black Cockatoo and your Farm*” with local residents through distribution via the NBG Community information Centre, helps promote the conservation message and knowledge with stakeholders within the wider community who may not typically have access to these materials.

Aside from the programs mentioned above, other opportunities to share information on Black Cockatoo preservation and management can be found through the following;

- Cockatoo Care program – WA museum;
- Black Cockatoo Information sheets – WA Museum and Online;
- Birdlife Australia’s Carnaby’s Black Cockatoo Recovery Project;
- public awareness programs at Perth Zoo;
- The Black Cockatoo Preservation Society Education Program; and
- NGO, State and Federal Government websites.

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### 7.3 Contingency actions

Contingency actions (Table 6) will be initiated if monitoring indicates that management measures have not been successful or effective and / or environmental targets are not being achieved.

**Table 6: Contingency Actions**

Trigger	Action	Responsibility
Clearing occurs beyond demarcated boundaries	Investigate cause. Undertake remediation works. Update procedure and training as necessary. Report event to State and Federal Regulators	NBG Tech Services and Environment Departments
Breeding birds located in area to be cleared	Wait until nestlings have left nest before felling any large trees and / or undertake clearing during non-breeding season Replace cleared trees with artificial hollows in an undisturbed area or neighbouring area.	NBG Tech Services and Environment Departments
Seed mix contains insufficient black cockatoo food plant and hollow-producing tree species	Source more appropriate seed. If already installed supplement seeding with additional planting or seed.	NBG Environment Department
Poor seedling emergence in rehabilitation	Investigate cause. Change procedure if necessary. Supplement with additional seed or planting.	NBG Environment Department
Numbers of black cockatoos detected during monitoring decreases significantly	Investigate cause. Undertake research if necessary.	NBG Environment Department

## 8 FUTURE WORK

In addition to the current work being conducted as explained above, NBG proposed to continue to look for opportunities to improve its management of Black Cockatoos through:

- continued assessment and when required changes to the application and establishment of viable artificial nesting boxes;
- sponsorship of programs to improve the understanding of the demographics and health of Black Cockatoos;
- sponsorship to understand movement and migration of respective Black Cockatoo species through tracking and remote sensing programmes;
- support the establishment of the proposed Peel-Harvey Catchment Council and through this provide technical advice and help around establishment of a Natural Resource Management Office, control of feral animals and linking of vegetation corridors;
- continue to support the identification and protection of nest sites at NBG and examine the possibility of support and protection of nest sites on private lands in the Boddington area, e.g. by helping land-holders fence high-value vegetation or undertake restoration;

- improve knowledge sharing and collaboration through the development of relationship with key Black Cockatoo entities such as Birdlife Australia, Murdoch University and Department of Parks and Wildlife.

Completion of the projects and programs outlines above will vary on an annual basis, depending on those aspects included within annual business plans. In addition, studies or programs not listed within this management plan may also be undertaken, as knowledge of the species changes and develops over time.

## 9 REVIEW OF THE PLAN

This document represents the overall plan for the life of the project which is currently approved for 17 years. To effectively implement the plan, black cockatoo programs will be incorporated into the NBG Environment Department’s Annual Business Plan where appropriate. The NBG Black Cockatoo Management Plan will be reviewed and updated annually or more frequently depending, on statutory changes or other updated information available, for the life of the operation.

The NBG Black Cockatoo Management Plan is one of suite of environmental management plans developed for NBG for its certified Environmental Management System. To maintain certification to ISO 14001, NBG require an annual independent third party audit of the system and its implementation, the results of which are made available to Government and will be made available to the Review Committee.

The review of the program will be undertaken with input from relevant research institutions and with input from the BGMEMLG. The review will include an assessment of the previous year’s activities and monitoring results and will use this to provide guidance to NBG on the direction and activities for the ensuing year’s program.

This plan may also require review as per condition 6 of the 2014 Federal Approval, which requires a proponent to alter the Management Plan at the direction of the minister.

## 10 DEFINITIONS AND ABBREVIATIONS

Abbreviation	Definition
BGM	Boddington Gold Mine
BGMEMLG	Boddington Gold Environmental Management Liaison Group
BGMMCo	BGM Management Company Pty Ltd
BHPWAPL	BHP Billiton Worsley Alumina Pty Ltd
Cth	Commonwealth
DEC	Department of Environment and Conservation
DotE	Department of the Environment (Previously DSEWPaC).
DPaW	Department of Parks and Wildlife (Previously DEC)
DSEWPaC	Department of Sustainability, Environment, Water, Populations and Communities
EPBC	Environment Protection Biodiversity and Conservation
FTRBC	Forest Red-tailed Black Cockatoo
ICMC	International Cyanide Management Code
NBG	Newmont Boddington Gold (the site)
NBGPL	Newmont Boddington Gold Pty Ltd (the company)

**11 RELATED DOCUMENTS**

Document No.	Title	Available
NBG-ENV-FM-70-11264	Habitat Tree Survey Form	Prospector
NBG-ENV-FM-70-11274	Environmental Disturbance Application and Approval Form	Prospector
	Biodiversity Management Plan (Draft)	Prospector
	ArcGIS Spatial Database – Forest Disease Layer	ArcGIS
NBG-ENV-SO-70-12629	NBG Legal Requirements and Other Commitments	Prospector
<b>Forest Disease Related Documents</b>		
NBG-EXP-SO-70-11337	NBG Exploration - Driving on Forest Tracks	Prospector
NBG-MNS-MP-70-11920	NBG Mining Operations Traffic Management Plan	Prospector
NBG-ENV-SO-70-11213	Site Entry and Vehicle Hygiene Procedure	Prospector
NBG-MNS-SD-70-17010	NBG Dump and Stockpile Construction Standard	Prospector
NBG-MNS-PR-70-14523	NBG Survey - Flagging Standard	Prospector
January 2014	Threat Abatement Plan for disease in natural ecosystems caused by <i>Phytophthora cinnamomi</i>	Department of the Environment website

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## 13 APPENDICIES

### Appendix 1 – Further Murdoch University Research Information (2007 – 2010)

#### Description of Research

Since 2007, Murdoch University research has addressed many aspects of the ecology of black cockatoos at NBG, including seasonal patterns in occupancy, group size, habitat use, selection of Jarrah and Marri ‘feed trees’, nesting activity, and use of mine-site rehabilitation as a feeding habitat.

These studies have been reported in an Honours thesis (Biggs 2008), an unpublished report to NBG (Finn 2011) and two papers published in scientific journals (Lee et al. 2010; Biggs et al. 2011). Much of the research was undertaken for a PhD project, which is currently (as of January 2012) approaching the thesis submission stage (J. Lee, Murdoch University, unpublished data).

Unpublished datasets include: (a) an assessment of the occurrence of potentially suitable nest hollows using ground-based surveys and post-felling inspections and (b) the identification of eleven probable nest sites within NBG tenements and surrounding areas (H. Finn, Murdoch University, unpublished data).

#### General Black Cockatoo Ecology at NBG

Murdoch University researchers employed various methods for the field study of black cockatoos at NBG (Biggs 2008; Lee et al. 2010; Biggs et al. 2011; Finn 2011). Two different approaches were used to locate black cockatoos: vehicle-based searches and searches on foot (either opportunistically or via transects). From December 2008 to July 2010 complete vehicle-based surveys of the NBG site and an area to the north (the ‘land exchange area’) were conducted once a month. Surveys were also conducted periodically at dawn and dusk and in rehabilitation areas (the latter as part of a larger study of the use of rehabilitation sites by black cockatoos).

When black cockatoos were observed a ‘behavioural survey’ was conducted. Birds which were flying are not sampled. Data collection for a behavioural survey was based on a 10-minute scan sampling period in which the observer attempted to identify all the birds present and to determine their predominant activity (i.e. the activity state of >50% of group members). Additional data were also recorded, including location, habitat type (Table 2), and specific behaviours.

Group sizes for black cockatoos at NBG are generally small (< 20 birds), although flocks of more than 50 birds sometimes occur. Group size for Baudin’s Cockatoos ranged from two to 107 individuals, with a mean of 14.5 + 3.5 birds (n = 32 sightings). Group size for Carnaby’s Cockatoos varied from one to 90 individuals, with a mean of 10.1 + 1.3 birds (n = 116 sightings). Group size for FRTBC ranged from one to 45 individuals, with a mean of 7.4 + 0.6 birds (n = 127 sightings). Group size also varied seasonally (Figure 3).

The three species differ in their use of the habitats present at NBG and adjacent areas (Table 3). Encounters with the three species varied significantly across habitat types ( $\chi^2 = 59.25$ ,  $p < 0.001$ ). While all three species were encountered mainly in native forest, Carnaby’s Cockatoos and Baudin’s Cockatoos were encountered next most frequently in mine-site rehabilitation areas, whereas FRTBC were not seen in rehabilitation areas at all.

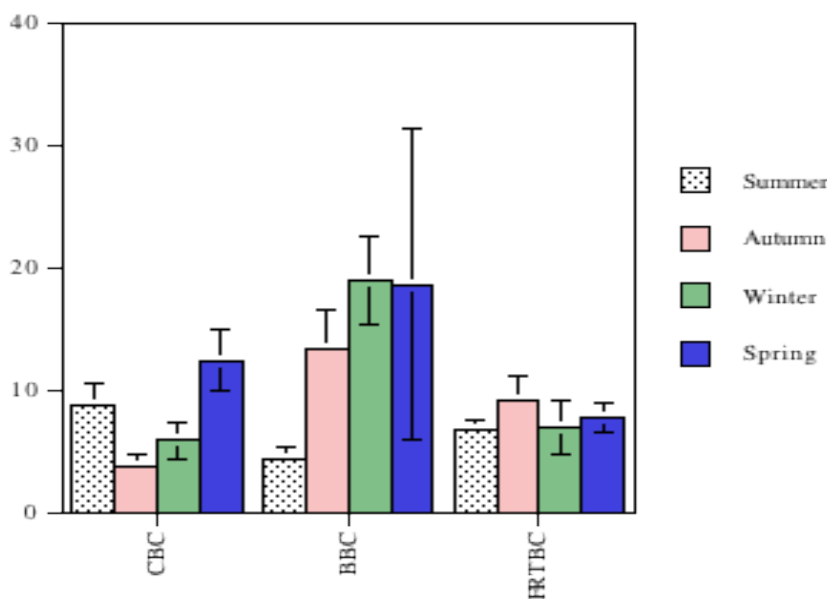
The use of sixteen native plant species at NBG within native forest and mine-site rehabilitation habitats was documented as food plants, based on observations of birds feeding on plants or feeding residues distinctive to black cockatoos (Finn 2011). Feeding residues from pine were also observed within the pine plantation and occasionally within native forest or rehabilitation areas close to stands of pine.

Based on behavioural observations of feeding birds, the three species varied significantly in their use of food plants ( $\chi^2 = 112.92$ ,  $p < 0.001$ ) (Table 4).

Carnaby's Cockatoos fed much more extensively on proteaceous shrubs (*Banksia*, *Hakea* spp.) than the two other species, which fed mainly on Marri. Carnaby's Cockatoos and Baudin's Cockatoos were observed peeling back bark to search for grubs.

**Table 1: Natural & Anthropogenic Habitat Types Identified within NBG and Surrounds**

Habitat Type	Description
Native Forest	Continuous to nearly continuous canopy, usually with <i>E. marginata</i> and <i>C. calophylla</i> main canopy forming trees; mid-storey layer including <i>A. fraseriana</i> , <i>B. grandis</i> , <i>B. sessilis</i> , <i>Persoonia longifolia</i> , and <i>Hakea</i> spp. ground and shrub layer including <i>Banksia</i> and <i>Hakea</i> spp.
Native Woodland	Open habitat with discontinuous canopy, usually with <i>E. wandoo</i> as the main canopy forming tree; ground and shrub layer including <i>Banksia</i> and <i>Hakea</i> spp.
Modified Landscape	Human-modified aspects of the landscape not characterised by other habitat types (e.g. mining infrastructure such as powerlines, haul roads)
RDA/WSR	Residue Disposal Area (RDA) or Water Supply Reservoir (WSR). Large (> 1km <sup>2</sup> ) man-made water bodies.
Mine-site Rehabilitation	Young (<12 years post-establishment) revegetation with high stem densities; Canopy species include <i>E. marginata</i> , <i>C. calophylla</i> , and <i>E. wandoo</i> ; diverse and well-developed shrub later comprising such as <i>Banksia</i> and <i>Hakea</i> spp.
Sump	Small man-made water bodies designed as drainage and seepage sumps
Pine plantation	Stands of pine trees within a commercial forestry landscape
Paddock	Agricultural pasture areas with large open areas of grass and occasional single paddock trees
Remnant Vegetation	Patch of remnant <i>Native Vegetation</i> within a forestry or agricultural matrix



**Figure 1. Flock sizes of three species of black cockatoos seasonally at NBG, using data aggregated over the period 2007 – 2010.**



Table 2. The numbers of encounters with black cockatoos in different habitat types at NBG and LEA combined. Percentages are shown in parentheses. The Shannon diversity and evenness for the data are shown, with 95% confidence limits determined by bootstrapping.

Habitat type	Carnaby's Cockatoo	Baudin's Cockatoo	FRTBC
Native Forest	54 (46)	20 (59)	87 (72)
Native Woodland	15 (13)	4 (12)	13 (11)
Modified Landscape	6 (5)	2 (6)	8 (7)
Mine-site Rehabilitation	23 (19)	7 (21)	0 (0)
RDA/WSR	3 (3)	0 (0)	1 (1)
Sump	1 (1)	0 (0)	0 (0)
Pine Plantation	14 (12)	0 (0)	0 (0)
Paddock	2 (2)	1 (3)	11 (9)
Remnant Vegetation	0 (0)	0 (0)	1 (1)
Shannon H	1.546	1.16	0.954
(± 95% CL)	(1.355-1.668)	(0.769-1.342)	(0.732-1.107)
Evenness	0.586	0.638	0.433
(± 95% CL)	(0.517-0.728)	(0.513-0.847)	(0.364-0.637)

**Table 3: Plants where black cockatoos were observed feeding at NBG and LEA combined. Percentages are shown in parentheses. The foods were flowers and seeds in most cases, but lifting bark to search for grubs is entered separately.**

Food plant	Carnaby's Cockatoo	Baudin's Cockatoo	FRTBC
Banksia spp.	11 (15)	0 (0)	0 (0)
'Dryandra' spp.	14 (19)	1 (4)	0 (0)
Hakea spp.	10 (14)	0 (0)	0 (0)
Jarrah	15 (20)	1 (4)	21 (30)
Marri	2 (3)	16 (70)	46 (65)
Pine	14 (19)	0 (0)	0 (0)
Forest Sheoak	1 (1)	0 (0)	1 (1)
Yarri	0 (0)	0 (0)	3 (4)
Grub (Wandoo)	1 (1)	4 (17)	0 (0)
Grub (Marri)	0 (0)	1 (4)	0 (0)
Unknown	6 (8)	0 (0)	0 (0)
Shannon H	1.925	0.966	0.835
(± 95% CL)	(1.719-1.994)	(0.470-1.251)	(0.636-0.970)

Evenness	0.762	0.525	0.576
(± 95% CL)	(0.693-0.918)	(0.451-0.835)	(0.507-0.806)

CBC vs BBC  $t_{28.015} = 4.3945$ ,  $p = 0.000145$

CBC vs FRTBC  $t_{135.79} = 9.34$ ,  $p < 0.0001$

BBC vs FRTBC  $t_{31.297} = 0.277$ , n.s.

### Assessments of Hollow Occurrence

Three approaches were used to locating potentially suitable hollows and probable nesting hollows at NBG: (1) ground-based surveys for hollows; (2) post-felling inspections of hollows, and (3) behavioural observations of black cockatoos. Ground-based surveys and post-felling inspections were carried out in areas where clearing occurred for the NBG Expansion Project (H. Finn, Murdoch University, unpublished data).

Eleven probable black cockatoo nest hollows were identified at NBG and surrounds, seven (63.6%) for Carnaby's Cockatoos, three (27.2%) for Forest Red-tailed Black Cockatoos, and one for an unknown black cockatoo species (9.1%). Behavioural observations of black cockatoos were the most effective approach to identify probable nest hollows ( $n = 10$  hollows; 90.9%). In nine of these cases, visual or acoustic cues indicated the potential presence of a nest, and in all ten cases, occupancy of a hollow was examined using 'tree-knocking', i.e. knocking the base of a tree and observing to see if a bird emerged from a hollow. Ground-based surveys ( $n = 1$  hollows; 9.1%) and post-felling inspections ( $n = 0$  hollows) were ineffective at identifying nest hollows despite large sample sizes and extensive field survey periods.

Ground-based surveys identified 149 trees with potentially-suitable hollows from three tree species, of which 119 trees (79.9%) survived felling intact enough for inspection. Few of the potential hollows identified in Jarrah trees were considered large enough to be potentially suitable for black cockatoos ( $n = 28$  of 89 trees inspected; 31.5%). In contrast, large hollows occurred more frequently in Marri ( $n = 14$  of 22 trees inspected; 63.6%) and Wandoo ( $n = 8$  of 12 trees inspected; 69.2%). Of the probable nest hollows, six (54.5%) hollows were in Marri, four (36.4%) in Wandoo, and one (9.1%) in Jarrah.

### Distribution of Eucalypt Feed Trees within the NBG Landscape

A 2008 study examined the landscape distribution of Jarrah and Marri, two important black cockatoo food sources at NBG (Biggs 2008; Biggs et al. 2011). Jarrah and Marri were not distributed randomly across the landscape. Stem densities of Jarrah and Marri were highest on lower slopes and on ridge tops respectively, while stem densities for both species were lowest in lowland areas, where stems of Wandoo (*E. wandoo*) often occurred. The distribution of Jarrah and Marri 'feed trees' used by cockatoos did not follow this landscape pattern, with Marri feed trees showing a distinct association with lower slopes and lowland areas, and Jarrah feed trees more evenly distributed across landscape positions. Multiple logistic regression with biotic (stem densities), topographical (landscape position), and disturbance (e.g. presence of cut stumps) variables indicated that feed trees were most likely to occur on lowlands and lower slopes in the absence of Wandoo. Although Jarrah and Marri occurred at a frequency ratio of 3:1, a significantly higher proportion of Marri trees (13.0%) were used as feed trees than were Jarrah trees (5.2%). These findings suggest that Marri is likely the more important food source at a landscape-scale, but longer-term studies are needed to rule out the possibility that the relative importance of the different tree species varies from seasonally and inter-annually.

### Feeding Activity with Mine-site Rehabilitation

Data on the feeding activity of black cockatoos within rehabilitation areas at NBG was collected using field observations and vegetation sampling. On-going behavioural observations began in November 2007. Rehabilitation sites were surveyed bi-monthly, with recording of black cockatoo group size, activity, and foods used.

Initials vegetation sampling occurred in winter 2009 and involved sampling nine rehabilitation areas at NBG, with each area containing five interior (>25m from any edge) plots and five exterior plots ( $n = 90$  total plots). Plot sizes are: 10 m x 10 m for interior plots and 5 m x 20 m for exterior plots; all plots are separated by >75 m.

For each plot, data were collected on vegetation composition, structure, and phenological status, and on the presence/absence and characteristics of black cockatoo feeding residues. Feeding residues vary by plant species, but include branches, seed husks, flowers, and eucalypt fruits that are broken, cracked open, or show distinctive signs of manipulation by black cockatoos (Biggs et al. 2011). It is generally possible to determine the black cockatoo species leaving the residue, either by the plant species fed upon or characteristics of the feeding trace (e.g. FRTBC shear Marri fruits, while Baudin's Cockatoos pry seeds out, leaving the fruit intact).

Though analyses are not complete there are two preliminary findings from this study. Firstly, rehabilitation areas at NBG are starting to provide food for black cockatoos, with Carnaby's Cockatoos eating seeds from proteaceous shrubs (*Banksia* and *Hakea* spp.) and Baudin's Cockatoos and FRTBC eating seeds of regenerating Marri. Secondly, all three species fed in rehabilitation areas established as recently as 2002, indicating that food resources can start to become available within eight years post-revegetation.

Vegetation sampling in winter 2009 suggested differences in the feeding activity of the three black cockatoos within rehabilitation areas. Carnaby's Cockatoo feeding residues were observed in 53 of 90 (58.9%) plots, Baudin's Cockatoo in 27 plots (30%), and FRTBC in 6 plots (6.7%). Carnaby's Cockatoos fed on the largest number of stems ( $n = 172$ ) mainly from two species: *Banksia squarrosa* ( $n = 110$  stems, 64%) and *Hakea undulata* ( $n = 45$  stems, 26%). Baudin's Cockatoos fed on 54 Marri stems and FRTBC on 8 Marri stems. No Jarrah feeding residues were observed. Numbers of interior and exterior plots with feeding residues were similar for all three species: Carnaby's Cockatoos – 28 interior/25 exterior; Baudin's Cockatoos – 16 interior/11 exterior; and FRTBC 2 interior/4 exterior.

Possible explanations for the absence of Jarrah feeding residues in plots include: food preference, energetic and nutritional differences in seeds from regenerating Marri and Jarrah (Cooper et al. 2002), the timing of sampling, and structural differences in regenerating Marri and Jarrah stems. It cannot be explained by the absence of Jarrah fruits as 22% of Jarrah stems contained fruits: cf. 52% of Marri stems.

Carnaby's Cockatoos and Baudin's Cockatoos were observed feeding in 15 of the 24 rehabilitation areas at NBG, with the youngest areas established in 2002 [Carnaby's Cockatoos:  $n = 24$  observations; Baudin's Cockatoos:  $n = 10$  observations]. FRTBC were not observed feeding within rehabilitation areas, although they were observed feeding in forest areas immediately adjacent to them.

Group sizes for feeding Carnaby's Cockatoos and Baudin's Cockatoos were similar, except for occasional large assemblages of Carnaby's Cockatoos [Carnaby's Cockatoos: mean group size =  $16.9 \pm 4.1$ , range = 2-72; Baudin's Cockatoos: mean group size =  $11.8 \pm 2.9$ , range = 3-25]. These group sizes correspond with the small group sizes for birds observed feeding in remnant forest areas at NBG. As field observations only began in November 2007, it is not possible to determine whether black cockatoos fed within rehabilitation areas before then.

The lack of FRTBC feeding activity within rehabilitation areas is curious, given frequent observations of the species at NBG from 2007-11. The problem is not a lack of food, because Baudin’s Cockatoos feed on Marri stems in rehabilitation areas. There may be differences in perceived predation risk, as anecdotal observations suggest that FRTBC are more sensitive to the presence of predators than are the other two species. Raptors occurred in seven of the 34 observations of black cockatoos within rehabilitation areas, and chased black cockatoo flocks on two occasions. If FRTBC do perceive the rehabilitation areas at NBG as more dangerous than undisturbed forest habitat, they may only use these areas at a later successional stage, when older age-class trees offer better concealment and vantage points.

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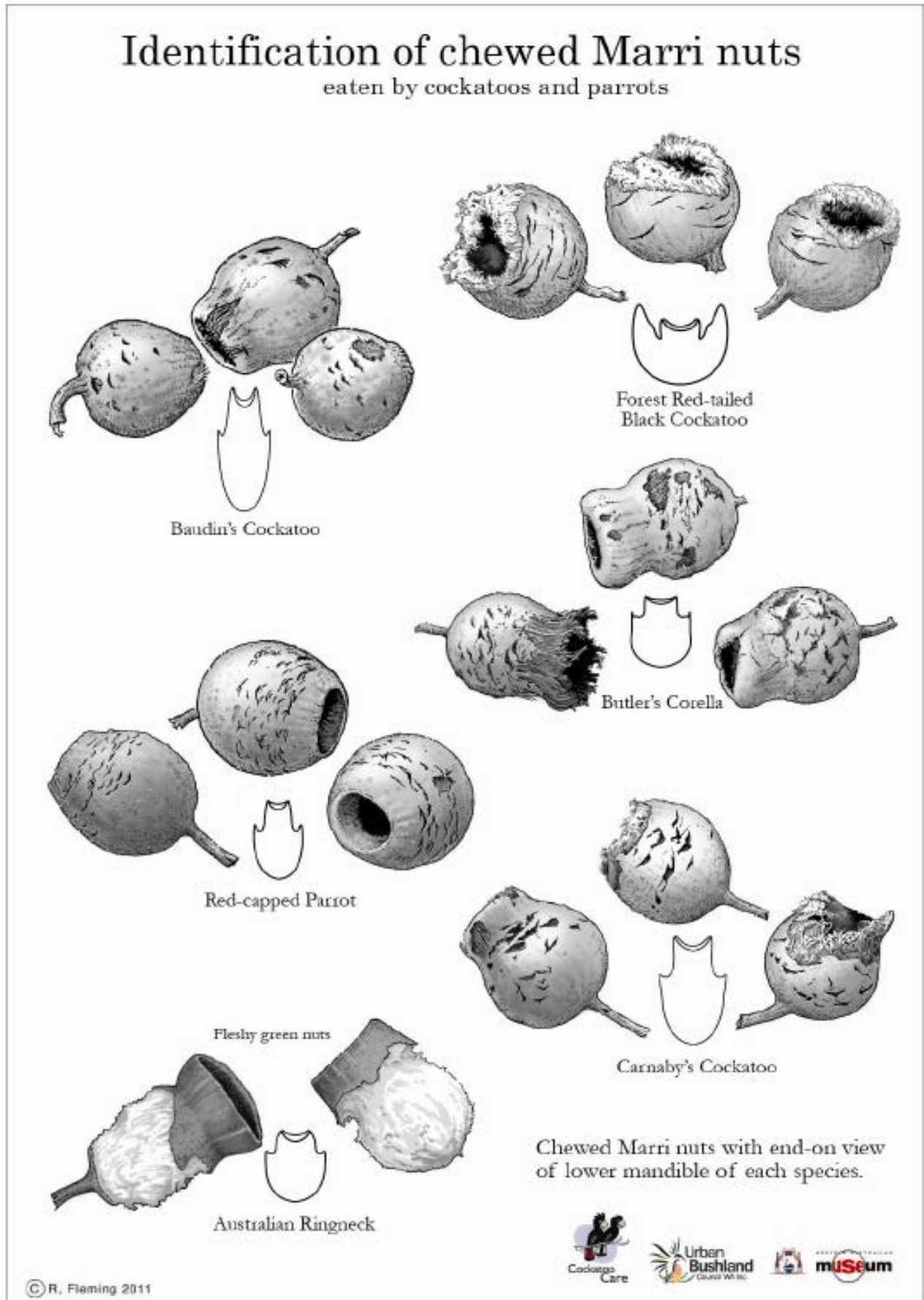
**Appendix 2 – Usage of Habitat Type for species of Conservation significance potentially occurring in the Development Envelope (Figure 1)**

Habitat Types	Eucalypt /Paperbark on seasonally wet valley floors	Yarri-Wandoo on wetter lower slopes	Eucalypt woodlands on wetter lower slopes	Jarrah-Marri woodland forest over heath understorey	Mixed Wandoo/ Jarrah/Marri woodland over heath understorey	Mallee Heath	Heath & rock Sheoak on granite outcrops	Wandoo woodland	Jarrah-Marri forest over Sheoak-Banksia	Jarrah-Marri woodland forest
Vegetation Units within Habitat Types	A, A2, A3	L, LG	W, AD, AX, AY	DG, HG, H, H2, SW	M2, MG	G1, G3, G4	G2	M, Y, YG,	P, PS, PW, S, SP, ST	B, D, E, Z, J, O, R
Forest Red Tailed	S	S	S	S	P	S		S	S	S
Baudin's		P	P	S	P			S	S	P
Carnabys	S	S	P	S	P	P	P	S	S	S

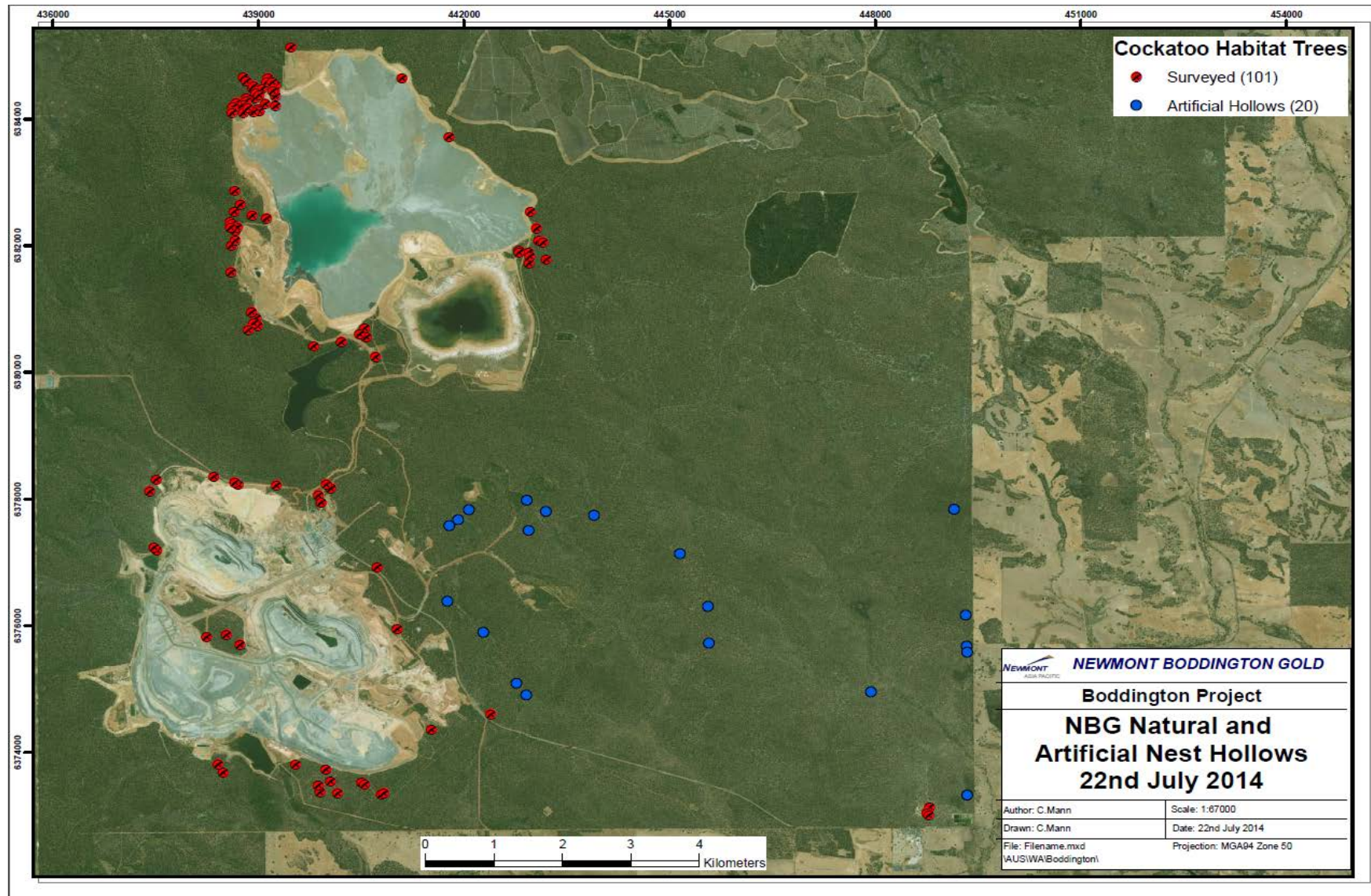
Appendix 3 – Carnaby’s Cockatoo Life Cycle Chart

	Hen	Cock	1st egg		2nd egg		Comments	
NESTING CARNAUBY'S	Week 1 Arrive Breeding area- Hollow prospecting				<b>Acknowledgments:</b> This document was produced by Rick Dawson (DPaW) & Denis Saunders (CSIRO) Thank you!		Female checks for suitable hollows	
	Week 2 Prospecting -generally off feeding morning and afternoon						Fighting over suitable hollows	
	Week 3 Mating						Generally mate close to hollow - up to 26 days before 6 days after laying	
	Week 4	Egg laid	Male feeds Hen Dawn, mid morning and dusk	7 days	28 - 29 days		Hen Fed normally 10min morning and up to 45min dusk.	
	Week 5	Possible second mating should be completed					14 days	1-16 days between second egg laid - generally 8 days
	Week 6	Incubation - Second egg should have been laid	Male feeds Hen Dawn, mid morning and dusk	21 days		28 - 29 days		
	Week 7	incubation -Egg Hatches	Male feeds Hen mid morning and dusk	28 days				
	Week 8	Brooding	Male feeds Hen mid morning and dusk	7 days				All down and egg tooth visible
	Week 9	Brooding - Second egg hatches	Male feeds Hen mid morning and dusk	14 days				Eyes open, Pin feathers - grey in colour
	Week 10	Brooding	Male feeds Hen mid morning and dusk	21 days	Bill may have grey streaks, some down , becoming black in colour, tail starts to emerge	7 days	Generally die within 48 hrs	
	Week 11	Hen feeds morning brooding afternoon and night time only	Male feeds Hen mid morning and dusk	28 days			14 days	Eyes open, Pin feathers - grey in colour
	Week 12	Hen feeds morning brooding afternoon and night time only	Male feeds Hen/chick mid morning and dusk	35 days	Well covered in black feathers, cheek patch prominent white tail pains start to appear	21 days	Bill may have grey streaks, some down , becoming black in colour, tail starts to emerge	
	Week 13	Hen feeds morning brooding afternoon and night time only	Male feeds Hen/chick mid morning and dusk	42 days				28 days
	Week 14	Brooding night time only	Male feeds Hen/chick mid morning and dusk	49 days	White tail panes clearly visible	35 days	Well covered in black feathers, cheek patch prominent white tail pains start to appear	
	Week 15	Brooding night time only	Male feeds Hen/chick mid morning and dusk	56 days				42 days
	Week 16	no brooding - feed mid morning and dusk	Male feeds Hen/chick mid morning and dusk	63 days	In hollow exercising wings	49 days	White tail panes clearly visible	
	Week 17	no brooding - feed mid morning and dusk	Male feeds Hen/chick mid morning and dusk	70 days	Top of hollow to be fed flapping wings			56 days
	Week 18	no brooding - feed mid morning and dusk	Male feeds Hen/chick mid morning and dusk	77 days	Fledge - on first flight does not return to nest	63 days	In hollow exercising wings	Parents may abandon 2nd chick or will continue to feed until fledged
	Week 19	Feeds first chick in trees, and second chick fed mid morning and dusk	Feeds first chick in trees, and second chick fed mid morning and dusk			70 days	In hollow exercising wings	
	Week 20	Feeds first chick in trees, and second chick fed mid morning and dusk	Feeds first chick in trees, and second chick fed mid morning and dusk			77 days	Fledge - on first flight does not return to nest	Chick Fledge from 70 to 80 days most gone by 75 days - first wing flaps it will fledge
If nest fails it will be 20 days (approx) till next egg laid in different nest.		2 clutch nests have a higher percentage of hatching.		Eggs laid in the first half of laying season have a better chance of fledging.		Chicks can be banded from 3-4 weeks.		
						Nesting Hens excessively disturbed/handled during eggs and upto 2 week old chick may abandon nest.		

Appendix 4 – Black Cockatoo feeding identification diagram



**Appendix 5 – June 2014 NBG Known Black Cockatoo Habitat Tree Map**



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**Appendix 6 – Murdoch University Necropsy Submission Form**

School of Veterinary & Biomedical Sciences  
South St, Murdoch  
Western Australia 6150  
Telephone: (61-8) 9360 2356  
Facsimile: (61-8) 9310 4144  
Duty Pathologist: 04202 77743



**MURDOCH**  
**UNIVERSITY**  
PERTH, WESTERN AUSTRALIA

**ANATOMIC PATHOLOGY SUBMISSION FORM**

1. Test Required: Post Mortem Examination
2. Time & Date of Death: *(Please complete)*
3. Cause of Death: Natural Causes.
4. Teaching Case (if non-teaching period please process as Routine case) n/a – Research Case
5. Disposal (Small Animals only): Bulk Cremation
6. Report to (Email): Please email results to Dr Kris Warren, VBS, [k.warren@murdoch.edu.au](mailto:k.warren@murdoch.edu.au) and Javier Brodalka, Environmental Manager, Newmont Boddington Gold, [Javier.Brodalka@Newmont.com](mailto:Javier.Brodalka@Newmont.com)

Pathology No:  
Date In:  
Pathologist:

<p><b><u>Owner's Details:</u></b>  <b>Dr Kris Warren, VBS</b>  <b>Javier Brodalka, Newmont Boddington Gold</b>                  Please process cases Research cases and charge to the following account:                  01.26.21.0289.2.xxxxx.07859.  <b>Ph:</b> Kris Warren 2647                  Javier Brodalka: 98834251, mobile: 0407961711</p>	<p><b><u>Consulting Veterinarian:</u></b>  <b><i>Date of Consult:</i></b></p>
<p><b><u>Patient's Details: Black Cockatoo</u></b></p> <p><b><i>Species:</i></b></p> <p><i>Please conduct as thorough a post-mortem examination as possible, dependent on the state of autolysis of the bird. When possible please comment on appearance of gonads e.g. active or inactive/immature. If it is a fresh carcass, please record the bird's body weight and assess body condition according to keel scoring system by Harrison and Lightfoot 2006.</i></p>	



*Regardless of the state of autolysis, please take both lateral and VD radiographs the bird to check for fractures and pellets. Please include copies of these radiographs in the report. If a pellet is identified please retrieve the pellet and give to Kris Warren. Please collect crop content and faeces from colon and store frozen for Kris Warren. Please remove one wing (whichever wing is in best condition) and store frozen for Kris Warren's aging research project. Please store these in the Necropsy freezer in knife room past the change room. Please email Kris to advise her that the samples have been placed in the freezer. Please email results of necropsy examination through to Kris Warren and Javier Brodalka.*

**Instructions for NBG Environmental Staff:**

*When found, the cockatoo carcasses should be placed immediately in a fridge (not freezer) and should be transported to the Pathology Department at Murdoch University ASAP. The cockatoo should be placed in an esky with ice bricks and delivered to Loading Zone 5 in the School of Veterinary and Biomedical Sciences, Murdoch University. Loading Zone 5 is open until 4.30pm from Monday-Friday, therefore all efforts should be made to ensure that the cockatoo can be delivered to Loading Zone 5 prior to 4.30pm. If the cockatoo can only be transported to Loading Zone 5 after 4.30pm then it should be delivered to Reception at the Murdoch Pet Emergency Centre – with clear instructions for the bird to be placed in a fridge and staff in Loading Zone 5 to be contacted the next morning. Staff in Loading Zone 5 will arrange for the bird to be taken to the Pathology Department.*

*In addition to providing a thorough history below, NBG Environmental staff should contact the Duty Pathologist on 0420 277 743 to advise them that a cockatoo is being sent to Pathology via Loading Zone 5 for necropsy examination associated with Kris Warren's Black Cockatoo Health Research Project.*

**History:**

*Please provide a thorough history including the date found, location and any other relevant information which may assist with determining the cause of death.*

## Appendix 7 – NBG Cockatoo Monitoring –Work Instruction

### 1.0 SCOPE

NBG works in conjunction with Murdoch University undertaking Black Cockatoo research during breeding/nesting seasons. There are three types of black cockatoo’s found on NBG tenements; Forest Red Tailed (FRTBC), Carnaby’s (CBC) and Baudins (BBC).

The nesting season varies for each species and is displayed in table 1 below.

Species	Breeding/Nesting Season
Forest Red Tails	October/November – Additional season occurs in March/April depending on Autumn rainfall.
Baudins	August/September to February/March
Carnaby	July/August to January/February


**To encompass all black cockatoo breeding seasons the monitoring is to be scheduled from July to February with additional monitoring based on autumn rainfall.**

This work instruction will apply to those who are required to undertake Cockatoo Hollow Monitoring.





### 2.0 INSTRUCTIONS

#### 2.1 Preparation and Equipment



- Satellite Phone
- First aid kit
- Data Record Logsheets, found in Prospector
  - Black Cockatoo Artificial Nest Hollow Survey – Form
  - Black Cockatoo Natural Nest Hollow Survey – Form
- Water/Sunscreen
- GPS
- Camera
- Binoculars
- Axe Handle (For tree-knocking)

Step	Details	Results
2.1.1	As the sites are located in remote areas ensure you follow the NBG-STP-SPOT Sattellite GPS Messenger Use and Operation for Remote Workers.	 <b>Note</b> Ensure you have spare AAA batteries in the work vehicle.


## 2.2 Monitoring of Natural Hollows

Step	Details	Results
2.2.1	Drive to monitoring location, safely park-up.	 <b>Note</b> Locations of Tree Hollows can be found in Step 2.2.2.
2.2.2	Using GPS coordinates and Map, proceed on foot to Monitoring Location.	 <b>Note</b> Map and GPS Coordinates for natural tree hollows found at G:\Environmental\16. Operational Control\16.03 Biodiversity\16.3.1 Fauna\Monitoring and Measurement\Murdoch-BGM Cockatoo Data\2012 Hollow Surveys
2.2.3	Tap around the girth of the tree trunk with the axe handle, do this for 1-2 minutes, Looking up at hollow to see if a Cockatoo is present in hollow	 <b>Note</b> The vibrations from tapping the tree will draw the attention of an animal nesting in the hollow.
2.2.4	Record on Black Cockatoo Natural Nest Hollow Survey Form, Tree number, feeding residue, if present, and any signs of nesting activity. Be sure to record if hollow is inhabited by <b>ANY</b> fauna, eg. Bees, possums.	 <b>Note</b> Feeding residue would be chewed gumnuts and scattered leaves on the ground. Mainly you would see chewed honkey nuts.

### 2.3 Monitoring of Artificial Hollows

Step	Details	Results
2.3.1	Drive to monitoring location, using map and GPS coordinates, safely park-up.	 <b>Note</b> All Artificial Hollows are located near road side.
2.3.2	Repeat Steps 2.2.3-2.2.5.	
2.3.3	Once all hollows have been checked and details recorded drive back to office and record details in artificial and natural hollow spread sheets.	 <b>Note</b> G:\Environmental\16. Operational Control\16.03 Biodiversity\16.3.1 Fauna\Monitoring and Measurement\Murdoch-BGM Cockatoo Data\2012 Hollow Surveys

### 2.4 Entering Data

Step	Details	Results
2.4.1	Record data in the Black Cockatoo Natural Nest Hollow Survey and Black Cockatoo Artificial Hollow Survey Spread Sheets. Ensure all boxes are filled out and notes are entered if locations could not be accessed due to dieback, fallen trees etc.	Spread Sheets can be found at; G:\Environmental\16. Operational Control\16.03 Biodiversity\16.3.1 Fauna\Monitoring and Measurement\Murdoch-BGM Cockatoo Data\2012 Hollow Surveys
2.4.2	Once data has been entered into spread sheet and checked by the Environmental Superintendent, forward to Researches at Murdoch University.	 <b>Note</b> Murdoch Contact Hugh Finn (H.Finn@murdoch.edu.au)

### 3.0 DEFINITIONS

Define terms and explain abbreviations or acronyms. Add more rows to the table if required. Delete entire section if not required.

Term	Description
<b>NBG</b>	Newmont Boddington Gold
<b>STP</b>	Standard Task Procedure

#### 4.0 RESPONSIBILITY

Role	Responsibilities
Environmental Superintendent - Monitoring	<ul style="list-style-type: none"> <li>Ensure appropriate training and personnel for the job requirements.</li> <li>Provide appropriate documentation and support for field technicians to carry out the job safely and competently.</li> </ul>
Environmental Field Technicians.	<ul style="list-style-type: none"> <li>Carry out cockatoo hollow monitoring and record data to a high standard.</li> </ul>

#### 5.0 REFERENCES & APPENDICES

Item	Title	Location
<b>Appendix 1</b>	Cockatoo Hollow Map	G:\Environmental\16. Operational Control\16.03 Biodiversity\16.3.1 Fauna\Monitoring and Measurement\Murdoch-BGM Cockatoo Data\2012 Hollow Surveys
<b>Appendix 2</b>	Cockatoo Hollow Coordinates	G:\Environmental\16. Operational Control\16.03 Biodiversity\16.3.1 Fauna\Monitoring and Measurement\Murdoch-BGM Cockatoo Data\2012 Hollow Surveys
<b>Appendix 3</b>	Black Cockatoo Artificial Nest Hollow Survey Form	Prospector, Document Center
<b>Appendix 4</b>	Black Cockatoo Natural Nest Hollow Survey Form	Prospector, Document Center

#### 6.0 DOCUMENT CONTROL

This section enables readers to track changes and identify authors.

Rev.	Approved	Description of Changes	Author	Approver
0			Ben Walley/Jo Batt	Melanie Durack
1	12/02/2013	Review	Jo Batt	Ben Walley
2	16/10/2013	Review added in observation time period and SPOT use.	Ben Walley	Peter Carruthers
3				
4				

**Map 1: Cockatoo Hollow Map**

