WATERLOO PROJECT OFFSET STRATEGY AND REHABILITATION MANAGEMENT PLAN LOT 110 SIMPSON ROAD, HENTY WA 6236

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LIST OF ABBREVIATIONS

AER	Annual Environmental Report
ASL	Above Sea Level
BGL	Below Ground Level
cm	Centimetre
DBH	Diameter at Breast Height
DSE	Dardanup Southern Extension
DoE	[Cth] Department of Environment (formerly Department of Sustainability, Environment, Water, Population and Communities)
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GDE	Groundwater Dependent Ecosystem
ha	Hectares
km	Kilometres
m	Metres
m^3	Cubic metre
mg/L	Milligrams per Litre
MNES	Matters of National Environmental Significance
MSCS	Mine Site Construction Services
OSRMP	Offset Strategy and Rehabilitation Management Plan
TDS	Total Dissolved Solids
WHROA	Woodland Habitat Rehabilitation and Offset Area

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Doral Mineral Sands (Doral) propose to mine the heavy mineral deposit located within Lot 110 Simpson Road, Henty Western Australia referred to as the 'Waterloo Project'. The Waterloo Project is located on Mining Lease M70/643 within the Dardanup Southern Extension (DSE) project area and south of the Dardanup Mine, approximately 15km east of Bunbury, Western Australia (Figure 1). The DSE was approved by the Environmental Protection Authority (EPA) on 13 August 2012 subject to the conditions of Ministerial Conditions No. 484 and by the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) (now called Department of Environment (DoE)) on 16 July 2012 subject to conditions made under Sections 130 (1) and 133 of the *Environment Protection Biodiversity and Conservation Act 1999* (EPBC Act) (ref: EPBC:2011/6087). The Waterloo Project was previously excluded from the DSE as the landholding was not within the ownership of Doral.

The Waterloo Project area lies on the eastern fringe of the Swan Coastal Plain, at the foot of the Darling and Whicher Scarps. The majority of the site overlies soils of the Forrestfield Soil Landscape Systems. Elevation onsite falls along a relatively constant gradient from 70m above sea level (ASL) in the east to 46m in the west. The majority of the Waterloo Project area has been extensively cleared of native vegetation in the past for agricultural purposes and is currently used for stock grazing (dairy and beef cattle). An ephemeral creek (Unnamed Creek) traverses in an east-west direction at the northern end of the site (Figure 2).

The Waterloo Project has an anticipated mine life of seven months and will involve the mining of new open cut pits to a maximum depth of 14.5m below ground level (bgl) with associated dewatering of shallow groundwater ranging from 650m^3/day at the commencement of mining to 34m^3/day at the end of mining. Ore will be transferred by haul road to the existing Wet Concentrator Plant at the Dardanup Mine for processing. Waste clay and sand materials from processing of this ore will be managed using existing infrastructure at the Dardanup Mine. All mine voids will be backfilled with overburden, sand and clay tails prior to rehabilitation. A total of no more than 6.93ha of native vegetation will be cleared within a nominated project area of approximately 43ha in accordance with Condition 1 of EPBC Act Approval 2013/6879, as shown in Figure 2.

This Waterloo Project Offset Strategy and Rehabilitation Management Plan (OSRMP) has been developed in accordance with Condition 3 of the EPBC Act Approval (EPBC2013/6879) and will aid in the rehabilitation and protection of habitat for Black Cockatoos.

1.2 PROJECT JUSTIFICATION

Doral employs 54 full time staff, approximately 50-60 full time on-site Mine Site Construction Services (MSCS) contractors and a further 30-40 casual shutdown maintenance contractors. Doral is focussed on providing economic benefits to the region and preferentially employ local contractors and neighbouring farmers to work within the operations whilst also supporting surrounding businesses. Doral is also a major sponsor to local festivals (Dardanup Bull and Barrel major sponsor), local sporting groups and school activities.

The Waterloo Project will allow the continuation of the Doral mining operations in the Dardanup region for a further seven months which shall continue the positive benefits to the local community and economy. The Waterloo Project is presently the final stage of Doral's mining activity within this region and following the completion of works, the area will be rehabilitated to agricultural lands as stated in Doral's Mine Closure Plan (Doral Mineral Sands, 2012).

1.3 PURPOSE AND SCOPE

This OSRMP has been prepared to in accordance with Condition 3 of the EPBC Act Approval (EPBC2013/6879).

Accordingly this OSRMP outlines Doral's approach to achieving long-term conservation gains for the Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*); Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) and Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*), in response to the predicted impacts to foraging habitat and potential breeding habitat for the proposed Waterloo Project. The OSRMP aims to secure a positive environmental outcome through creation of habitat suitable for foraging and future breeding by the three Black-Cockatoo species. The offsets are based on a "like for like" principle, targeting the protection, restoration and creation of habitat for Black-Cockatoos as detailed in the EPBC Act Offsets Policy (DSEWPaC, 2012a).

As the three Black Cockatoo species have similar habitat requirements they have been addressed together in this report.

1.4 POLICY CONTEXT

The following guidelines and documents have been used to develop the Offsets Strategy:

- ***Environment Protection and Biodiversity Conservation Act 1999*** **Environmental Offsets Policy October 2012 (DSEWPaC, 2012a).** This Policy Statement provides a description of the types of offsets that may be applied when impacts cannot be adequately reduced through avoidance and mitigation. Eight principles for environmental offsets are provided;
- ***Environment Protection and Biodiversity Conservation Act 1999*** **referral guidelines for three threatened black cockatoo species: Carnaby's Black-Cockatoo (endangered)** ***Calyptorhynchus latirostris*****, Baudin's Black-Cockatoo (vulnerable)** ***Calyptorhynchus baudinii*** **and Forest red-tailed Black-Cockatoo (vulnerable)** ***Calyptorhynchus banksii naso*** **(DSEWPaC, 2012b)**. These guidelines provide assistance in determining whether your action needs to be referred to the DoE. The guidelines refer to Black-Cockatoos only;
- **Black Cockatoos on the Swan Coastal Plain. Report for the Department of Planning Western Australia (Johnstone and Kirkby, 2007)**. This report provides information regarding the distribution, status, breeding, food, movements and historical changes to Carnaby's Black-Cockatoo, Baudin's Black-Cockatoo and the Forest Red-tailed Black-Cockatoo on the Swan Coastal Plain.

2 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

2.1 BLACK COCKATOOS WITHIN THE WATERLOO PROJECT AREA

Three species of Black-Cockatoos listed under the EPBC Act are known to occur within the Waterloo Project area. A description of these species, their habitat preferences and conservation status under the EPBC Act is outlined below.

- **Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable**

  Forest Red-tailed Black-Cockatoos frequent the humid to subhumid south-west feeding on a variety of *Eucalyptus* species, from Gingin in the north, Albany in the south and west to Cape Leeuwin and Bunbury. Nesting occurs in hollows with a depth of 1-5m predominately in Marri (*C. calophylla*), Jarrah (*E. marginata*) and Karri (*E. diversicolor*). Forest Red-tailed Black-Cockatoos were formerly common but are now uncommon and patchily distributed.

- **Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) - Vulnerable**

  This species is most common in the far south-west of Western Australia where it breeds. It is known to breed from the southern forests north to Collie and east to near Kojonup. Baudin's Black-Cockatoo is typically found in vagrant flocks and utilises the taller, more open Jarrah (*E. marginata*) and Marri (*E. diversicolor*) woodlands, where it feeds mainly on Marri seeds and various Proteaceous species. Whilst they are seasonally present on the Swan Coastal Plain, Baudin's Cockatoos are more likely to occur in the eastern region of the coastal plain.

- **Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) - Endangered**

  Carnaby's Black-Cockatoo inhabits the south-west of Western Australia. Its preferred habitat is the woodland where it preferentially feeds on plants of the Proteaceae family. Preferred nesting trees include the smooth-barked Salmon Gum (*E. salmonophloia*) and Wandoo (*E. wandoo*), which contain deep hollows. Nesting also occurs in Marri (*Corymbia calophylla*) and Tuart (*E. gomphocephala*). Carnaby's Black-Cockatoo forages in woodland and kwongan heath that is dominated by Proteaceous species. Its main foods are the seeds of Hakeas, Grevilleas, Banksias, Eucalypts and introduced Pines.

Harewood (2012) conducted a fauna survey of the Waterloo Project area in September/October 2012 (Appendix A). Evidence of all three Black-Cockatoo species having been present at some stage was found in the project area (chewed Marri/Jarrah fruits, and direct observations of the Forest Red-tailed Black-Cockatoo).

2.2 BLACK-COCKATOO HABITAT WITHIN THE WATERLOO PROJECT AREA

All remnant native vegetation within the Waterloo Project area contains plant species documented as food for Black-Cockatoo species (including Marri, Jarrah and Flooded Gum trees). However, the degree to which specific areas would be used for foraging purposes varies depending on species composition and diversity. An assessment of potential Black-Cockatoo breeding habitat trees within a 43ha area found a total of 472 habitat trees with a diameter at breast height (DBH) greater than 50cm. Of these, 102 trees had hollows of some type and 12 trees with large (>12cm) entrance hollows (Figure 3).

Following the submission of referral information to the DoE, it was requested that additional information be provided for two hollows located within the disturbance area that were identified as having been used or is in use by fauna of some description (not necessarily Black-Cockatoos). This additional information has been provided to the DoE and is also included as Appendix B. Results showed that one of the hollows is no longer suitable for a Black-Cockatoo and the second hollow will be monitored for actual Black-Cockatoo use on a monthly/fortnightly basis to show evidence that the hollow is either being used or not being used by Black-Cockatoos. To date (August - December 2013) there is no evidence that this hollow is or has been used by a Black-Cockatoo.

Although very little understorey is present within the Waterloo Project area, Harewood (2012) describes the canopy connectivity within the CcEmEr habitat as 'relatively good' and varies from being 'relatively good to totally discontinuous' with the CcXp and EmXp habitat.

Aside from its value as potential foraging and breeding habitat for Black-Cockatoos, most of the remnant vegetation within the Waterloo Project area has little conservation value (Ecoedge Environmental, 2013). Its floristic values have been degraded by many years of grazing by livestock so there are few native species remaining apart from trees. Ecoedge Environmental (2013) mapped the condition of the vegetation within the Waterloo Project area according to the Keighery (1994) condition scale as 14ha 'degraded' and the remaining 29ha as 'completely degraded'. Plates showing the condition of the habitat are provided in Appendix C. Additional Plates for each habitat are also included in Harewood (2012) (Appendix A).

2.3 DIRECT IMPACTS TO BLACK-COCKATOO HABITAT

Based on fauna habitat mapping by Harewood (2012) and the known habitat requirements of these species, development of the Waterloo Project will require the removal of no more than 6.93ha (128 habitat trees) of foraging habitat and potential breeding habitat for the Forest Red-tailed Black-Cockatoo; Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo in accordance with Condition 1 of EPBC Act Approval 2013/6879.

Of the area to be cleared (see Figure 3) there are approximately 128 habitat trees with a DBH of greater than 50cm. Of these habitat trees, 28 contain hollows of some description and nine of these with large (>12cm) entrance hollows.

A summary of the type of habitat to be cleared is presented in Table 1. A map showing the area of disturbance to Black-Cockatoo Habitat is shown in Figure 3.

TABLE 1: BLACK-COCKATOO HABITAT TO BE CLEARED

MAPPING UNIT (FIGURE 3)	DESCRIPTION OF VEGETATION (FROM HAREWOOD 2012)	HABITAT FEATURES (FROM HAREWOOD 2012)	AREA TO BE CLEARED (HA)	NUMBER OF TREES TO BE CLEARED WITH DBH>500MM
CcEmEr	*Marri (Corymbia calophylla), Jarrah (E. marginata) and Flooded Gum (Eucalyptus rudis) parkland cleared woodland over grassland and introduced species bordering*	Eight habitat tree (DBH>50cm). Of these, one tree was observed to have one or more hollows.	0.13	8

MAPPING UNIT (FIGURE 3)	DESCRIPTION OF VEGETATION (FROM HAREWOOD 2012)	HABITAT FEATURES (FROM HAREWOOD 2012)	AREA TO BE CLEARED (HA)	NUMBER OF TREES TO BE CLEARED WITH DBH>500MM
	ephemeral Creek.			
CcXp	*Marri (Corymbia calophylla) parkland cleared open woodland over a very open shrubland of Xanthorrhoea preissii over a grassland of introduced species.*	77 habitat trees (DBH>500mm). Of these, 16 trees were observed to have one or more hollows, with seven of these hollows possibly suitable for a Black-Cockatoo.	3.58	77
EmXp	*Jarrah (E. marginata) parkland cleared open woodland over a very open shrubland of Xanthorrhoea preissii over a grassland of introduced species.*	43 habitat trees (DBH>500mm). Of these, 11 trees were observed to have one or more hollows, with two hollows possibly suitable for a Black-Cockatoo.	3.22	43
TOTAL HABITAT TO BE CLEARED			**6.93**	**128 trees**

Clearing of more than 1ha of quality foraging habitat and/or clearing of any part of a vegetation community known to contain breeding habitat is considered to constitute a high risk of significant impact to these species under the EPBC Act as outlined in the EPBC Act referral guidelines for the three Black-Cockatoo species (DSEWPaC, 2012b).

2.4 INDIRECT IMPACTS TO BLACK-COCKATOO HABITAT

Mining in the Waterloo Project area will require groundwater levels to be lowered via dewatering. By reducing groundwater levels in the mining area, there is potential for groundwater drawdown to lead to stress to native vegetation (or possibly plant death) in or adjacent to the mining area. This indirect impact of mining, could lead to a reduction in the available Black-Cockatoo habitat in the vicinity of the project area.

Groundwater of interest in the Waterloo Project area comprises perched groundwater as well as water in the Superficial and Leederville aquifers. These systems are shown diagrammatically in Plate 1 and described in Table 2. Mining in the Waterloo Project area and subsequent dewatering will result in localised drawdown of the Superficial aquifer, as modelled by Parsons Brinkerhoff (2013).

Research of soil profiles and groundwater characteristics has indicated that the groundwater dependent ecosystems (GDEs) within the Waterloo Project area have access to a perched groundwater system which will not be affected by dewatering of the Superficial aquifer. These perched water tables are separated from the Superficial Aquifer by a clay layer immediately below the perched water table. Soil profiles within the Waterloo Project area indicate a perched groundwater table is present between 1mBGL to 4mBGL. The perched groundwater is recharged directly by rainfall and is not likely to be influenced by dewatering and subsequent drawdown of the Superficial aquifer beneath thereby reducing the risk to GDE's.

It is expected that impacts on the GDE as a result of dewatering will be negligible.

PLATE 1: GROUNDWATER IN THE DARDANUP AREA

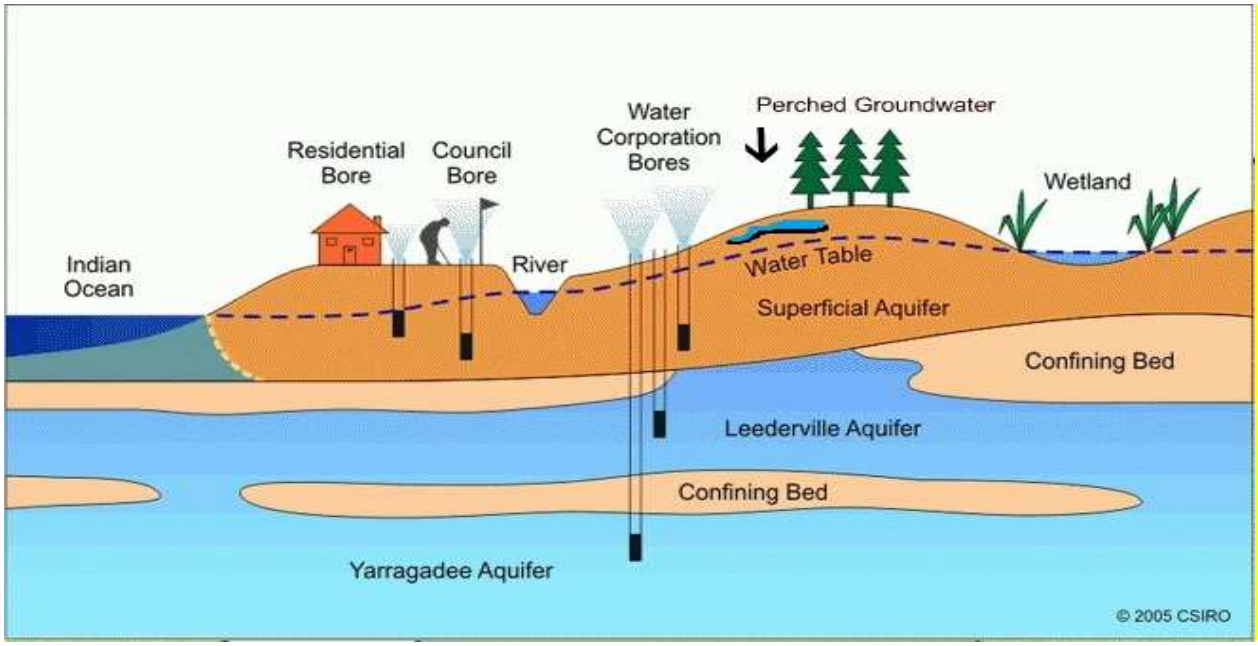

TABLE 2: GROUNDWATER CHARACTERISTICS IN THE DARDANUP AREA

AQUIFER NAME	DESCRIPTION
Perched	Perched groundwater is unconfined and occurs above impervious layers such as clays and silts which form an unsaturated zone. Perched groundwater is generally separate from the underlying Superficial Aquifer. In the Waterloo Project area, perched groundwater occurs between 1mBGL to 4mBGL depending on the nature of the impervious clay layer.
Superficial	The Superficial formations in the Dardanup area consist of Bassendean Sands, Guildford formation and Alluvium (west near Bunbury). The Superficial Aquifer is thin (5–15mBGL) to absent across the subarea, thinning towards the east and overlying the Leederville Aquifer. There is very little fresh groundwater in this aquifer with the water quality being mostly marginal to brackish (500–2000 mg/L TDS), especially towards the coast. In the Waterloo Project area, the average thickness of the Superficial Aquifer is between 10-12m with thicker portions located in the west of the DSE project area. The aquifer is thinner in the east of the DSE, which includes the Waterloo Project area.

AQUIFER NAME	DESCRIPTION
Leederville	The Leederville formation in this area is made up of the Upper and Lower Vasse member. The aquifer thickness ranges between 100–300m, with depth ranging from 15–300mBGL. Generally groundwater salinity is >500 mg/L TDS, increasing with depth. In the Waterloo Project area, the Leederville Aquifer starts where the Superficial Aquifer ends (vertically) and can be up to 30-50m thick.

3 ONSITE MEASURES TO REDUCE IMPACTS TO HABITAT

To reduce the extent and significance of impact to Black-Cockatoo habitat the following measures will be carried out prior to, during and post the mining development:

1. Habitat Avoidance: Doral have avoided impacts to Black-Cockatoo habitat by locating mining infrastructure (i.e. haul roads and stockpiles) in previously cleared and completely degraded areas where possible;
2. Minimisation of the mining footprint: Doral have reduced the original disturbance area provided in the referral to DoE from 10.3ha (145 trees with DBH >50cm including 50 trees with hollows) to 6.93ha (128 trees with DBH >50cm including 28 trees with hollows);
3. Avoidance of trees known to contain hollows suitable for breeding where possible: A survey by Harewood (2012) located 102 trees containing one or more hollows within the Waterloo Project area. Of these, only 28 trees with hollows are located within the disturbance area, with nine of these hollows considered to be possibly suitable for a Black-Cockatoo. No evidence of use of these hollows by Black Cockatoos was identified;
4. Prior to undertaking clearance of native vegetation, Doral will undertake pre-clearance surveys. The surveys will:
    - Be undertaken by a qualified environmental scientist with previous experience in surveys of this type;
    - Be conducted in accordance with DoE survey guidelines for Australia's threatened bird species (DSEWPaC, 2012b); and
    - Be undertaken during likely breeding season for Black-Cockatoos (August to November) if possible.
5. The nine hollow bearing trees considered to be possibly suitable for Black-Cockatoos (Figure 3) will be re-assessed for Black-Cockatoo use prior to clearing;
6. The period for which the pits are dewatered will be minimised, thereby shortening the period for potential drawdown. Dewatering of mine pits is conducted using a passive dewatering technique whereby groundwater is not dewatered lower than the pit floor and following mining of the pit, the tails are hydraulically returned to the pit increasing the speed at which groundwater levels will rebound;
7. Dewatering will be timed with winter as far as practical to reduce the likelihood of stress to GDEs;
8. Monitoring vegetation health on a monthly basis in GDEs at risk when dewatering activity is occurring. An additional transect for vegetation health monitoring has been included in the CcEmEr vegetation type. The vegetation health monitoring will continue to be conducted in accordance with the DoE approved (ref: EPBC:2011/6087) Perched Groundwater, Soil Moisture and Vegetation Health Monitoring Program (Appendix D). No perched groundwater or soil moisture will be monitored in the Waterloo Project area as the current monitoring within the DSE is considered sufficient to monitor impacts. In the event that monitoring demonstrates adverse trends the following actions (individually or in combination) will be implemented:

- Short term cessation of activities likely to be causing the drawdown until such time as conditions allow for recommencement (e.g. soil moisture recharge due to rainfall, or alternatively via irrigation); and/or
- Artificial irrigation of the affected areas and/or modification of mining activities.

Following the avoidance of Black-Cockatoo habitat, minimisation of the mining footprint and mitigation measures, Doral will have a residual impact of no more than 6.93ha (128 habitat trees) of Black-Cockatoo foraging habitat and potential breeding habitat will be removed during the Waterloo Project in accordance with Condition 1 of EPBC Act Approval 2013/6879.

4 OFFSETS STRATEGY

4.1 RATIONALE AND OBJECTIVES

Doral is committed to achieving long-term conservation gains for Forest Red-tailed Black-Cockatoo, Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo, in response to the predicted impacts to foraging and potential breeding habitat in the Waterloo Project area. The Offsets Strategy has been developed to meet the expectations of the DoE with consideration to the DSEWPaC (2012a) Offset Principles as outlined in Table 3.

In developing this Offsets Strategy, frequent discussion with officers of the DoE has occurred to ensure that a suitable offset is provided in accordance with the DSEWPaC (2012a) *Environmental Offset Policy*.

TABLE 3: FEDERAL GOVERNMENT OFFSET PRINCIPLES AND DORAL'S OFFSET STRATEGY

PRINCIPLE	DORAL OFFSET STRATEGY
1. Deliver and overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action.	Given the current landuse of the project area (cattle grazing), without rehabilitation and management (including fencing and long-term protection) the viability of the protected matter would be degraded over time as no new growth would occur. The Waterloo Offset Area will be rehabilitated and managed to improve the overall value of the land to Black Cockatoos for foraging and potentially breeding purposes in the longer term thus improving the viability of the protected matter. Existing and created Black Cockatoo habitat will be protected in perpetuity through the use of a formal mechanism (conservation covenant).
2. Be built around direct offsets but may include other compensatory measures	Offsets will be focused on direct offsets in accordance with policy guidelines, and will make up 100% of the offsets package. Direct offsets proposed are the retention, enhancement (through rehabilitation) and conservation (in perpetuity) of 288 existing Black Cockatoo habitat trees and the creation/enhancement of 14.95ha of new foraging habitat within the Waterloo Offset Area (Figure 4). Of the 288 total habitat trees being conserved, 46 have one or more hollows and 3 of these have a hollow possibly suitable for a Black Cockatoo. Indirect offsets will include the improvement in the management of degraded and completely degraded habitat subject to rehabilitation within the Waterloo Offset Area.
3. Be in proportion to the level of statutory protection that applies to the protected matter.	Offsets were calculated utilising the DoE Impact and Offset Calculator. The Black Cockatoo species with the highest level of statutory protection (Carnaby's Cockatoo) was used to

PRINCIPLE	DORAL OFFSET STRATEGY
	determine the probability of annual extension which then formed the basis for further calculation of appropriate offsets for this species.
4. Be of a size and scale proportionate to the residual impacts on the protected matter.	Offsets were calculated utilising the DoE Impact and Offset calculator. Therefore, the offsets proposed have been developed based on a scale of habitat enhancement/conservation that meant a minimum of the 100% direct offset requirement was met in proportion to the size and scale of residual impacts.
5. Effectively account for and manage the risks of the offset not succeeding.	Potential risks to the successful management and rehabilitation of the Waterloo Offset Area will be assessed and management actions prescribed to address these risks.
6. Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action).	A separate approvals process under State legislation is underway concurrent to the Federal process. The State process will address impacts and management to species of conservation of significance State legislation. Offsets proposed in this document are based on addressing residual impacts specifically to the protected matter (Black Cockatoos).
7. Be efficient, effective, timely, transparent, scientifically robust and reasonable.	An implementation strategy to meet rehabilitation targets and completion criteria will ensure the delivery of offsets in a timely and transparent manner. Completion criteria will be realistic and based on previous rehabilitation success in the area.
8. Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	Offsets will be monitored and reported to DoE annually through the Doral Mineral Sands Annual Environmental Report (AER). An independent environmental audit of the offset will be conducted within three years of approval and every three years following until mine closure.

Specific environmental objectives for the Waterloo Offset Area are as follows:

- Provide appropriate offsets to compensate for the impacts of the proposal on Black-Cockatoo foraging and potential breeding habitat;
- Offsets are to relate specifically to the matter being impacted by targeting the restoration, creation and protection of habitat for Black-Cockatoos;
- Ensure that the offset proposed maintains and improves the extent and quality of Black-Cockatoo habitat over time;
- Offsets are enforceable, monitored and auditable;
- Ensure offsets are long-lasting and provide a framework for their ongoing management.

4.2 PROPOSED OFFSETS

Doral is proposing conservation offsets for the loss of foraging and potential breeding habitat as a result of mining in the Waterloo Project area. Accordingly, to compensate for the loss of no more than 6.93ha of foraging habitat and potential breeding habitat, direct offsets referred to as the 'Waterloo Offset Area' will result in the protection and enhancement of a total of 288 existing habitat trees (including 46 trees with one hollow or more and three trees with hollows possibly suitable for black cockatoos) and the establishment of new habitat trees and shrubs over 14.95ha that will enhance the conservation value of the site for Black Cockatoos. The offsets are described in Table 4 and shown on Figure 4.

The Waterloo Offset Area has been divided into four management areas in accordance with the current value as Black Cockatoo habitat, vegetation condition, proposed revegetation strategy and future management as shown in Table 4.

TABLE 4: DESCRIPTION OF DIRECT OFFSETS PROPOSED FOR THE WATERLOO PROJECT

MANAGEMENT AREA	Area (ha)	CURRENT ENVIRONMENT	CURRENT CONDITION (ECOEDGE ENVIRONMENTAL, 2013)	CURRENT VALUE AS COCKATOO HABITAT	OFFSET PROPOSED
A	6.08	Totally Cleared (Pasture). This area is cleared of all vegetation and now contains only grassland with widely scattered trees.	Completely degraded	Very low value Black-Cockatoo habitat with the exception of sparsely scattered Marri, Jarrah and Flooded Gum trees which may provide very limited foraging habitat in this area. A total of 27 trees with DBH>50cm are located in this area which includes 11 trees containing one or more hollows.	Exclusion of grazing, re-vegetation, enhancement (through rehabilitation) and conservation in perpetuity of 27 existing habitat trees (including 11 trees with one or more hollows) and the planting of new habitat trees and shrubs over 6.08ha at a density of 1300 stems/ha.
B	4.60	Parkland Cleared Woodland (CcEmEr) over Grassland of introduced species. No native understory is present.	Degraded	Marri, Jarrah and Flooded Gum trees provide overstorey foraging habitat with relatively good canopy connectivity. A total of 199 trees with DBH>50cm are located in this area, which includes 10 trees containing one or more hollows, with two hollows possibly suitable for Black Cockatoos.	Exclusion of grazing, re-vegetation, enhancement (through rehabilitation) and conservation in perpetuity of 199 existing habitat trees (including 10 trees with one or more hollows) and the planting of new habitat trees and shrubs over 4.60ha at a density of 800 stems/ha.

MANAGEMENT AREA	Area (ha)	CURRENT ENVIRONMENT	CURRENT CONDITION (ECOEDGE ENVIRONMENTAL, 2013)	CURRENT VALUE AS COCKATOO HABITAT	OFFSET PROPOSED
C	2.24	Parkland Cleared Woodland over Grassland of introduced species and Parkland Cleared Open Woodland over a very open Shrubland of *Xanthorrhoea preissii* over a Grassland of introduced species	Degraded	Marri, Jarrah and Flooded Gum trees provide overstorey foraging habitat with grass trees providing some (limited) understory foraging habitat. A total of 46 existing habitat trees are located in this area, which includes 14 trees with one or more hollows.	Exclusion of grazing, re-vegetation, enhancement (through rehabilitation) and conservation in perpetuity of 46 existing habitat trees (including 14 trees with one or more hollows) and the planting of new habitat trees and shrubs over 2.24ha at a density of 800 stems/ha.
D	2.03	Parkland Cleared Woodland over Grassland of introduced species and Parkland Cleared Open Woodland over a very open Shrubland of *Xanthorrhoea preissii* over a Grassland of introduced species	Degraded/Completely Degraded	Marri, Jarrah and Flooded Gum trees provide overstorey foraging habitat with grass trees providing some (limited) understory foraging habitat. A total of 16 existing habitat trees are located in this area, which includes eight trees with one or more hollows and one tree with a hollow possibly suitable for a Black-Cockatoo.	Exclusion of grazing, re-vegetation, enhancement (through rehabilitation) and conservation in perpetuity of 16 existing habitat trees (including 8 trees with one or more hollows and one tree containing a hollow possibly suitable for breeding for a Black-Cockatoo) and the planting of new habitat trees and shrubs over 2.03ha at a density of 1300 stems/ha.

4.3 LOCATION OF DIRECT OFFSETS

The Waterloo Offset Area is located directly adjacent to the area of impact (Figure 4) on Doral owned land. The location of the offset area was selected due to:

- Its potential ecological value. The degraded and completely degraded vegetation within the Waterloo Offset Area provides some existing Black-Cockatoo foraging habitat and potential breeding habitat already, however after revegetation and the protection of this site through the placement of a conservation covenant, the ecological value of the site will be increased. In addition approximately 25% of the hollows considered to be suitable for Black-Cockatoos are located within the Waterloo Offset Area;
- Its connectivity as one continuous offset area (i.e. minimisation of edge effects), proximity to the Waterloo Project area and accessibility for management by Doral;
- Its proximity to the existing Woodland Habitat and Rehabilitation Offset Area (WHROA) and its potential value as an ecological link between the two offset areas;
- To enable a “like for like” principle targeting the protection, restoration and creation of habitat for Black Cockatoos.

Due to the proximity of the Waterloo Offset Area to mining pits and dewatering activities (in the Superficial aquifer), the potential impacts on the Waterloo Offset Area from groundwater drawdown were investigated. One groundwater dependent community, CcEmEr occurs within the Waterloo Offset Area. An investigation of the soils and geology in the Waterloo Project area show that the Waterloo Offset Area exhibits characteristics of perched groundwater with impervious layers between 1mBGL and 4mBGL. This indicates that the existing habitat within the Waterloo Offset Area will not be affected by the predicted drawdown of the Superficial aquifer due to the presence of groundwater within a perched layer. Plantings in the Waterloo Offset Area are unlikely to be affected by drawdown of the Superficial aquifer due to the presence of perched groundwater and on the basis that planting will occur in the winter months. Advice from Mattiske Consulting (2011) indicates that young and small plants are unlikely to be dependent on groundwater due to a shallower root system.

Photos of the Waterloo Offset Area are also shown in Appendix C.

4.4 OFFSET IMPLEMENTATION STRATEGY

Table 5 outlines the short, medium and long term actions for the implementation of the Waterloo Offset Area.

TABLE 5: OFFSETS IMPLEMENTATION STRATEGY

ACTION	SHORT TERM - WITHIN TWO YEARS OF COMMENCEMENT OF MINING	MEDIUM TERM - WITHIN FIVE YEARS OF COMMENCEMENT OF MINING	LONG TERM- PRIOR TO MINE DECOMMISSIONING
Backfill and rehabilitate mine pits within the Waterloo Offset Area in accordance with Condition 6-1 and 6-2 of Ministerial Statement 484.	x		
Fencing of the Waterloo Offset Area to exclude grazing stock and pests to be erected (Haul Road section to initially be excluded from fencing) in accordance with Condition 3e of EPBC Act Approval 2013/6879).	x		
Following the erection of fencing, destocking of the offset area will be conducted in accordance with Condition 3e of EPBC 2013/6879.	x		
Removal of unnecessary fence on the western boundary of the Waterloo Offset Area in accordance with Condition 3e of EPBC 2013/6879.	x		
Pest control /Weed Control in accordance with Condition 3 of EPBC 2013/6879.	x	x	
Rehabilitate Haul Road in accordance with Condition 6-1 and 6-2 of Ministerial Statement		x	

ACTION	SHORT TERM - WITHIN TWO YEARS OF COMMENCEMENT OF MINING	MEDIUM TERM - WITHIN FIVE YEARS OF COMMENCEMENT OF MINING	LONG TERM- PRIOR TO MINE DECOMMISSIONING
484.			
Fencing to include the Haul Road (amend existing fencing) in accordance with Condition 3e of EPBC Act Approval 2013/6879.		x	
Rehabilitation targets have been met (Refer to Section 6) in accordance with Condition 3d of EPBC Act Approval 2013/6879.		x	
Quarterly Monitoring (refer to Table 10, Section 7) in accordance with Condition 3g of EPBC Act Approval 2013/6879.	x	x	
Independent Environmental Audit in accordance with Condition 5 of EPBC Act Approval 2013/6879.	x (within three years)	x (every three years)	x
Conservation Covenant has been placed on the Waterloo Offset Area in accordance with Condition 2 of EPBC Act Approval 2013/6879.	x		

4.5 LONG-TERM PROTECTION OF THE WATERLOO OFFSET AREA

Doral will seek to provide long-term protection of the 14.95ha Waterloo Offset Area by entering into a restrictive conservation covenant with the National Trust of Australia (WA) under section 21A of the *National Trust of Australia (WA) Act 1964* within two years of approval. This will involve contacting the Conservation Covenant Program Coordinator and providing maps/plans of the Waterloo Offset Area. At present preliminary discussion with the National Heritage Trust (WA) is being undertaken for the WHROA and will now include the Waterloo Offset Area into these discussions. A restrictive conservation covenant will be placed on the area such that:

- Restricts or prohibits activities on the land that could degrade the conservation value of the land, in particular to Black Cockatoos;
- Is a legally binding document, and is registered on the Certificate of Title of the property;
- Is permanent to offer protection of the covenanted land in perpetuity; and
- Any modifications in the long-term future (>8 years) shall be negotiated with the landowner and relevant regulatory authorities to ensure that the Black-Cockatoo habitat of the covenanted land is not compromised.

5 REHABILITATION MANAGEMENT PLAN

5.1 REHABILITATION OF DISTURBED AREAS

In accordance with Ministerial Statement 484:6-2 (State Legislation) the agreed end landuse of the Waterloo Project area is agricultural pasture. This means that under State legislation, Doral is required to rehabilitate the Waterloo Project disturbance areas back to pasture. This was confirmed in a meeting on 8 October 2013 with Euan Sutherland (Assessing Officer, OEPA Compliance Branch). As such, due to the location of the northern mine pit and existing haul road (approximately 1.17ha) within the Waterloo Offset Area it is considered impractical to exclude these areas. Therefore in addition to State Legislation, the additional revegetation of the northern mine pit and haul road section will be conducted under Condition 2 of EPBC Act Approval 2013/6879 which will provide additional foraging habitat for Black-Cockatoos.

5.1.1 Mine Pit

Following mining of the mine pit within the proposed Waterloo Offset Area (1.02ha), the following rehabilitation works will be undertaken.

The pit volume will progressively be filled with a heterogeneous mixture of sand tailings, dried clay tailings and oversize. The return of clay fines material and subsoil (silty sand) will emulate the pre-mining hydraulic properties of the region. Topsoil and subsoil will be replaced in order to promote the establishment and survival of native vegetation. Following replacement of subsoils, the surface will be contoured to provide drainage and then ripped where possible. Prior to planting, rip lines will be furrowed where possible to collect water, directing it to the root-zone and also help to remove hydrophobic soils if present. Furrow spoil will be hilled on the down-slope side to better trap and retain water.

Planting of native vegetation within the Waterloo Offset Area will be undertaken in a semi-random manner to ensure the final vegetation appears as natural as possible. Tubestock will be used in all cases, however if weed control is successful in the first two years some seed may be spread over areas to enhance the rehabilitated area to a natural looking bushland.

5.1.2 Haul Road

Once the Haul Road within the Waterloo Offset Area (approximately 0.15ha) is no longer required for mining and rehabilitation earthworks in the southern areas of the DSE, the haul road will be closed and rehabilitated. Rehabilitation will consist of removal of culvert across the creek line, stripping the construction material back to the subsoil and replacement of topsoil by dozer push. Ripping and planting will then occur as detailed above.

5.2 SITE PREPARATION

5.2.1 Fencing

The 14.95ha Waterloo Offset Area will be fenced to exclude stock and pests. A 1.5m high boundary fence will be constructed from 1.8m high cyclone mesh with a combination of treated pine and steel

posts spaced approximately every six metres. The additional 30cm of mesh will be turned out against the ground, to minimise the intrusion by foxes, rabbits and kangaroos. Prior to fencing, the area will be de-stocked, kangaroos excluded and unnecessary fencing removed.

5.2.2 Soil Preparation

Deep ripping is highly effective as it breaks apart a compaction layer which forms at approximately 150mm depth from continual grazing and traffic associated with agricultural practices at 10 to 40cm depth (Gilkes and Hunt, 1992).

Ripping and furrowing will be undertaken where possible which will generally be in Management Areas A, C and D. The soil will be ripped where possible to 50 to 80cm depth in late summer/early autumn, as this is when the soil compaction layer will shatter. Any areas with compacted clay may be treated with gypsum prior to ripping. Rip lines will follow contours and will be kept outside the foliage line of remnant vegetation to minimise disturbance to the root system of the existing vegetation. Prior to planting, rip lines will be furrowed where possible. Furrows collect water, directing it to the root-zone and also help to remove hydrophobic soils if present. Furrow spoil will be hilled on the down-slope side to better trap and retain water.

In Management Area B, planting will be done in soil that will be dug by manual means.

5.3 PEST CONTROL

5.3.1 Foxes

Baiting with 1080 poison-impregnated egg and/or meat baits will be undertaken for two to four weeks in March and September annually. Baits will be checked at least every three days, with fresh baits laid if required. The location of baits will be determined when a risk assessment to surrounding residents has been undertaken.

5.3.2 Rabbits

Evidence of rabbit activity has been observed within the Waterloo Offset Area. This has the potential to compromise revegetation efforts. As such tree guards will be installed at the time of planting.

Oat baits impregnated with 1080 poison will be laid once or twice, depending on weather conditions and rabbit activity. The baits will be laid in and around active areas during February-March when alternative food sources are at their lowest and (weather permitting) in spring (October-November).

Activity post-baiting will initially be monitored monthly. Once existing populations have substantially declined, monitoring frequency will reduce to quarterly with baiting repeated as necessary.

Rabbit warren destruction techniques have been successfully trialled in the WHROA during 2013 and will be conducted as required within the Waterloo area within the winter period.

5.3.3 Kangaroos

A 1.5m high boundary fence will be constructed from 1.8m high cyclone mesh with a combination of treated pine and steel posts spaced approximately every six metres. Prior to finalising the fencing, Kangaroos will be excluded from the Waterloo Offset Area (herded out) as they can impact

revegetation efforts by grazing on newly planted seedlings and juvenile plants. In the event that excluding kangaroos from the Waterloo Offset Area increases pressure on adjacent areas, Doral will work collaboratively with surrounding land owners (subject to DPaW approvals) where necessary to manage kangaroo numbers at a sustainable level.

5.3.4 Grasshoppers

Grasshopper numbers fluctuate from year to year depending on seasonal conditions. Numbers will be monitored close to planting/seeding time; baits will be laid if necessary. Baiting is undertaken for between two and four weeks in both March and September of each year.

5.4 WEED CONTROL

Weed coverage in the Waterloo Area is estimated to range from approximately 80-100% and as such weed control measures outlined below will be applied biannually (weather permitting and where required).

Many of the weeds in the 14.95ha Waterloo Offset Area include broadleaf species that can be controlled using a 'frog friendly' Glyphosate-based herbicide such as Roundup Biactive® or similar. Herbicides will be applied twice a year just after the break of season (April to May) and in late winter to early spring.

Romulea rosea (Guildford grass), a bulb species from the Iridaceae family is present in the Waterloo Offset Area. This species is not as effectively controlled by Glyphosate. A bulb-specific herbicide containing metsulfuron-methyl will be applied within the Waterloo Offset Area prior to any application of Glyphosate. Spraying will be undertaken approximately six to eight weeks after shoots have emerged, when the old bulb/corm is exhausted and the new bulb/corm is developing. This will permit enough chemical to be absorbed by the new bulb/corm to kill it.

Some areas within Management Area B have limited access for machinery. In these areas weeds will be sprayed by hand using backpack sprayers or equivalent delivery system to ensure that only weeds are impacted by the spray. The remainder of the Waterloo Offset Area (Figure 4) contains mostly pasture species. These are able to be accessed by a ute mounted or quad bike spraying units. This will be undertaken during suitable weather conditions (i.e. very little air movement blowing away from existing vegetation) to ensure adjacent vegetation will not be impacted by spray drift.

Couch grass (*Cynodon dactylon*) and kikuyu (*Pennisetum clandestinum*) have been recorded in the Waterloo Offset Area and occurs in the wetter parts of the site. A grass selective herbicide will be used.

Narrowleaf Cotton Bush (*Gomphocarpus fruticosus*) and Apple of Sodom (*Solanum linnaeanum*) occur at low densities in the WHROA. These are currently being removed by hand and will continue to be controlled using a combination of physical removal and chemical control prior to revegetation.

5.5 REVEGETATION

Species lists and densities for the Waterloo Offset Area are outlined in Tables 6, 7, 8 and 9. The species list has been compiled based on known Black-Cockatoo foraging and breeding species (DSEWPAC, 2012b; Johnstone and Kirkby, 2007) and to ensure the resultant vegetation is compatible

with the surrounding vegetation. While there are other known foraging species for Black-Cockatoos, the ones listed below are local to the area and are the most suitable for the vegetation complexes and soil types within the Waterloo Offset Area and are therefore most likely to survive. The species listed also meet the (unofficial) 'local provenance' guidelines for revegetation projects (Ecoedge Environmental *pers. comm*).

TABLE 6: SPECIES LISTS AND DENSITIES FOR MANAGEMENT AREA A

REVEGATION TYPE	SPECIES	AREA (ha)	# STEMS	DENSITY (stems/ha)
Trees	*Corymbia calophylla*	6.08	1945	320
	Eucalyptus marginata	6.08	577	95
	Eucalyptus patens	6.08	577	95
	Eucalyptus rudis	6.08	577	95
Large shrubs/small trees (>3m)	*Banksia attenuata*	6.08	395	65
	Banksia grandis	6.08	760	125
	Banksia ilicifolia	6.08	395	65
	Banksia littoralis	6.08	395	65
Shrubs/understorey (<3m)	*Hakea lissocarpha*	6.08	456	75
	Hakea prostrata	6.08	456	75
	Hakea ruscifolia	6.08	456	75
	Hakea trifurcata	6.08	456	75
	Hakea varia	6.08	456	75

TABLE 7: SPECIES LISTS AND DENSITIES FOR MANAGEMENT AREA B

REVEGATION TYPE	SPECIES	AREA (ha)	# STEMS	DENSITY (stems/ha)
Large shrubs/small trees (>3m)	*Banksia littoralis*	4.60	460	100
Shrubs/understorey (<3m)	*Hakea lissocarpha*	4.60	460	100
	Hakea prostrata	4.60	460	100
	Hakea ruscifolia	4.60	460	100
	Hakea trifurcata	4.60	460	100
	Hakea varia	4.60	1380	300

TABLE 8: SPECIES LISTS AND DENSITIES FOR MANAGEMENT AREA C

REVEGATION TYPE	SPECIES	AREA (ha)	# STEMS	DENSITY (stems/ha)
Trees	*Corymbia calophylla*	2.24	448	200
	Eucalyptus marginata	2.24	212	95
	Eucalyptus patens	2.24	212	95
	Eucalyptus rudis	2.24	212	95
Large shrubs/small trees (>3m)	*Banksia attenuata*	2.24	145	65
	Banksia grandis	2.24	305	125
	Banksia ilicifolia	2.24	145	65
	Banksia littoralis	2.24	145	65
Shrubs/understorey (<3m)	*Hakea lissocarpha*	2.24	168	75

REVEGATION TYPE	SPECIES	AREA (ha)	# STEMS	DENSITY (stems/ha)
	Hakea prostrata	2.24	168	75
	Hakea ruscifolia	2.24	168	75
	Hakea trifurcata	2.24	168	75
	Hakea varia	2.24	183	75

TABLE 9: SPECIES LISTS AND DENSITIES FOR MANAGEMENT AREA D

REVEGATION TYPE	SPECIES	AREA (ha)	# STEMS	DENSITY (stems/ha)
Trees	*Corymbia calophylla*	2.03	649	320
	Eucalyptus marginata	2.03	192	95
	Eucalyptus patens	2.03	192	95
	Eucalyptus rudis	2.03	192	95
Large shrubs/small trees (>3m)	*Banksia attenuata*	2.03	131	65
	Banksia grandis	2.03	253	125
	Banksia ilicifolia	2.03	131	65
	Banksia littoralis	2.03	131	65
Shrubs/understorey (<3m)	*Hakea lissocarpha*	2.03	152	75
	Hakea prostrata	2.03	152	75
	Hakea ruscifolia	2.03	152	75

REVEGATION TYPE	SPECIES	AREA (ha)	# STEMS	DENSITY (stems/ha)
	Hakea trifurcata	2.03	152	75
	Hakea varia	2.03	152	75

5.6 PLANTING

The Waterloo Offset Area will be planted in a semi-random manner to ensure the final vegetation appears as natural as possible. Tubestock will be used in all cases, however if weed control is successful in the first two years some seed may be spread over areas to enhance the rehabilitated area to a natural looking bushland.

Planting will be initially undertaken in 2014 after one round of weed control has been completed and following the installation of fences. Rehabilitation will be conducted progressively over a three year period. Approximately one third of the area will be planted out each year. In addition to balancing resource and labour demands over the project timeframe, this will enable effective management of risks which may arise from species unavailability, abnormally dry, late or otherwise difficult seasons, and other such risks. Spreading the project over multiple years allows contingencies to be planned that can address any threats to or impacts on project success.

5.7 SOURCE

Seed will be sourced locally wherever possible. Consistent with previous rehabilitation projects, existing Doral offsets areas will be harvested for seed as will the neighbouring bushland outside of Doral landholdings where available. Reconnaissance visits will be made to bushland for which Doral has permission to harvest seed to determine the species diversity and seed quantity that can be sourced in time for orders to be placed with local seed merchants or nurseries for the planting seasons as required. It is Doral's intention to engage volunteer seed collectors associated with local community groups where possible in order to develop the skills and experience of group members and support the local community. Support or donations or a combination of both will be used to remunerate groups who assist with this aspect of the project.

Seed collected will be given to the Leschenault Community Nursery where plant stock will be grown specifically for this project. Any species not able to be supplied by collecting seed or this nursery will be sourced from other nearby suppliers. Tubestock for the planting seasons are sourced from local suppliers.

6 PERFORMANCE AND COMPLETION CRITERIA

Completion criteria for the Waterloo Offset Area are broken into two key areas:

- Rehabilitation Performance Criteria; and
- Completion Criteria.

6.1.1 Rehabilitation Performance Criteria

The following targets will be used to assess the performance of the rehabilitation, identify areas that require additional planting and/or weed treatment:

- 75% survival of overstorey seedlings;
- 75% of understorey seedlings;
- Species representation (acceptable survival of at least 75% of species planted in each area); and
- Presence of weeds (a 40% reduction in weed cover over two years and 50% reduction within 3 years compared to the current weed cover of 80-100%).

If these performance criteria are not met then remedial action including supplementary planting and weed control will be undertaken as required so that the targets can be satisfied. Compliance with these targets will be recorded during the quarterly monitoring and reported annually.

6.1.2 Completion Criteria

The completion criteria provided below will be used to assess the success of the Waterloo Offset Strategy.

1. Habitat available to Black-Cockatoos is created and enhanced by meeting rehabilitation targets.
2. The following has been provided:
    - Fencing to exclude grazing stock and pests;
    - Destocking of the Waterloo Offset Area;
    - Removal of unnecessary fences;
    - Pest control has been undertaken;
    - Weed control has been undertaken.
3. A conservation covenant has been placed on the area that:
    - Restricts or prohibits activities on the land that could degrade the conservation value of the land, in particular to Black-Cockatoos;
    - Is a legally binding document, and is registered on the Certificate of Title of the property;
    - Is permanent to offer protection of the covenanted land in perpetuity; and

- Any modifications in the long-term future (>8 years) shall be negotiated with the landowner and relevant regulatory authorities to ensure that the Black-Cockatoo habitat of the covenanted land is not compromised.

7 MONITORING AND MAINTENANCE

7.1 MONITORING

The objectives of monitoring are to:

- Determine whether rehabilitation performance criteria have been met;
- Evaluate the effectiveness of management measures and determine if additional work is required;
- Monitor the improvement of Black-Cockatoo habitat over time;
- Assess whether completion criteria have been met.

Monitoring will be undertaken by a suitably qualified person and will include visual assessments and photo-points. Table 10 lists the methods of assessment to monitor rehabilitation success in accordance with the rehabilitation performance criteria in Section 6.

TABLE 10: MONITORING REHABILITATION SUCCESS

ASSESSMENT PARAMETER	ASSESSMENT METHOD	PERFORMANCE CRITERIA
Seedling survival of overstorey species	Quadrats (Refer to Section 7.1.1). Requiring seedling health to be measured (% survival in each quadrat).	75% survival of overstorey seedlings.
Seedling survival of understorey species	Quadrats (Refer to Section 7.1.1). Requiring seedling health to be measured (% survival in each quadrat).	75% survival of understorey seedlings.
Height	Quadrats (Refer to Section 7.1.1). Height of trees to be estimated (within each quadrat).	Trees are to show consistent growth during monitoring and based on this either be a minimum of 3m in height after three years or show that they will attain that height in the short-term future without the need for remedial action.
Species diversity	Quadrats (Refer to Section 7.1.1). Number and species of plants counted in each quadrat.	Survival of at least 75% of species planted in each area.
Presence of Weeds	Quadrats (Refer to Section 7.1.1). Identification of any declared plants and significant environmental weed species within the rehabilitated areas.	A reduced number of weeds compared to surrounding comparable areas. Criteria to be used: • No declared weeds within the

ASSESSMENT PARAMETER	ASSESSMENT METHOD	PERFORMANCE CRITERIA
		rehabilitated area two years after implementation. • Reduction of 40% weed cover within two years after implementation and 50% reduction in weed cover after three years of implementation (compared to current weed cover of 80-100%).
Overall success of plant establishment	Subjective measure based on a visual assessment of species composition, plant density and plant condition within the rehabilitated areas. Five categories used (Excellent, Good, Satisfactory, Poor and Unacceptable). Photographic record of plant growth in each rehabilitated area (Section 7.1.3). Overall assessment of the ability of the revegetated area to attain a final required vegetation structure and composition (e.g. a habitat area might not contain 30% canopy cover but is growing well and will attain that in a few years without the need for remedial action).	Species composition and projected plant growth likely to achieve the 75% target.

7.1.1 Quadrats

Monitoring of quadrats will be undertaken on a quarterly basis during each season. Vegetation monitoring will start on completion of the first round of planting and continue for three years post completion of rehabilitation. Six 10m x 10m quadrats will be established across the four management units in order to allow for quantitative assessments of revegetation success to be undertaken. Quadrat locations will be chosen randomly.

Seedling survival, diversity, weed cover and tree height will be monitored in the monitoring program. Quadrat corners will be marked with steel droppers and tagged with flagging tape, and all are orientated such that diagonals are aligned northwest-southeast and southwest-northeast. Coordinates for the southeast and northwest corners will be recorded and all quadrat photographs will be taken from the southeast corner. Two photographs will be taken for each quadrat, one at approximately 40cm height to illustrate vegetation structure, the other at standing height to illustrate vegetation cover and condition.

7.1.2 Visual Monitoring

Visual monitoring will be undertaken on a quarterly basis during each season. Visual monitoring will start on completion of planting and continue for three years post completion of the rehabilitation. The visual assessment will be undertaken for:

- Condition of fences;
- Any signs of pest activities including diggings, burrows, scat or damage to leaf material;
- The presence of grass weeds, bulbs and woody declared weeds;
- Soil condition including observations of compacting, waterlogging or water repellent soils;
- Signs of native fauna, particularly Black Cockatoos;
- Health and survival of planted tubestock;
- Presence of any regeneration of native species within the rehabilitated area;
- Nearby vegetation that could provide seed source;
- Condition of firebreaks.

Observations from the monitoring will be recorded and compared to the targets in Section 6. These will be reviewed on an annual basis with any immediate actions required communicated to the Mine Manager.

7.1.3 Photo-points

A minimum of eight photo-points will be established in the rehabilitated areas for the Waterloo Offset Area to allow a visual comparison of changes in vegetation structure and composition over time which will aid in monitoring revegetation success as well as the rate of natural regeneration in remnant areas. Photo-points will be established prior to undertaking any works onsite so that a true baseline condition picture can be recorded. Monitoring of photo-points will continue for three years post completion of rehabilitation.

Four of the eight photo-points will be established within monitoring quadrats (see method in Section 7.1.1). The remaining four photo-points will be marked with white-tipped timber surveying pegs which are flagged with pink tape and labelled on the side from which the photograph is taken. GPS coordinates and compass bearings shall be recorded for each photo-point. Photo-points will be visited on an annual basis in Spring. Photos will be taken from behind the photo-point, from as far back as necessary to include the peg in the centre and bottom 20% of the photo. Photos will be taken from a standing position, with the camera held in front of the photographer's face, without zooming.

7.1.4 Independent Environmental Audit

An independent environmental audit of the offsets component of the Waterloo Project will be conducted in accordance with Condition 7 of EPBC Act Approval 2013/6879 as required.

To review the adequacy of the offsets plan and recommend measures to improve the environmental performance of the project in order to meet the completion criteria, an audit will be undertaken within three years of approval and every three years following up until mine closure. Results of the audit will be documented in Doral's AER.

7.1.5 Black-Cockatoo Assessment

A Black-Cockatoo assessment will be undertaken after the 8 year period when the foraging habitat in the revegetated offset areas become of benefit to the three Black-Cockatoo species.

7.2 MAINTENANCE

7.2.1 Weed Control

Weed control will be determined by site weed inspections undertaken quarterly as per 7.1.2. Each management area will be assessed individually for the presence and severity of weed re-establishment. Weed species will be removed by hand or treated with herbicide as required based on observations during site inspections.

The aim of the weed control program is to prevent weed seed set; therefore the site weed inspection schedule will be continually audited to determine whether an increase or decrease in the frequency of inspections is necessary in order to achieve this aim.

7.2.2 Pest Control

Activity post-baiting will be monitored as required and quarterly as per 7.1.2. Once existing populations have substantially declined, monitoring frequency may be reduced according to site based evidence of digging, burrows and scats.

Baiting will occur when necessary, as per Section 5.3 and destruction of warrens will be conducted as required.

7.2.3 Dieback Management

There are no protectable areas and therefore no requirements on hygiene and management of dieback within the rehabilitated areas. If susceptible species are affected in the rehabilitated areas in the first two years the species composition will be adjusted to avoid using dieback sensitive species.

7.2.4 Fire Management

A firebreak will be maintained around the perimeter of the Waterloo Offset Area.

8 TIMING

A schedule of works is provided in Table 11. The schedule of works is for three years. If, after three years (Autumn 2017), rehabilitation targets and completion criteria have not been met then the OSRMP (this plan) will be revised to extend management and monitoring until all rehabilitation targets and completion criteria have been met.

TABLE 11: SCHEDULE OF WORKS

SEASON	FENCING	PEST CONTROL				WEED CONTROL		SOIL PREPARATION		REVEGETATION		FIREBREAKS	MONITORING AND AUDITING	REPORTING
		Kangaroos	Foxes	Rabbits	Grasshoppers	Metsulfuron-methyl	Glyphosate	Ripping	Gypsum Application	Planting	Seed Collection			
Autumn 2014	Waterloo Offset Area to be destocked, unnecessary fencing removed and fencing installed around Waterloo Offset Area (except Haul Road)	Kangaroos to be removed just prior to completion of fencing	Baiting in March	Baiting in March	Baiting in March (if required)	Spray in April to May in suitable weather	Spray in April to May in suitable weather	Management Area A, C and D only (following weed control)	If required		Reconnaissance and Seed Collection			Submission of AER to DoE
Winter 2014						6 to 8 weeks after emergence				Plant one third of plants (Management Area A, B, C and D)			Quadrat and photo-point monitoring to start in Management Area A, B, C and D	
Spring 2014			Baiting in September	Baiting in October (weather permitting)			Weed Control Where required					Maintenance of Firebreaks	Quadrats and Photo-point	
Summer 2015							Weed Control Where required	Late Summer after spraying is effective			Seed Collection		Quadrats and Photo-point	
Autumn 2015			Baiting in March	Baiting in March	Baiting in March (if required)		Spray in April to May in suitable weather						Quadrats and Photo-point	Submission of AER to DoE.
Winter 2015						6 to 8 weeks after emergence				Plant one third of plants (Management Area 1)			Quadrats and Photo-point	
Spring 2015			Baiting in September	Baiting in October (weather permitting)			Weed Control Where required					Maintenance of Firebreaks	Quadrats and Photo-point	

SEASON	FENCING	PEST CONTROL				WEED CONTROL		SOIL PREPARATION		REVEGETATION		FIREBREAKS	MONITORING AND AUDITING	REPORTING
Summer 2016							Weed Control Where required	Late Summer if required			Seed Collection		Quadrats and Photo-point Independent Audit	
Autumn 2016			Baiting in March	Baiting in March	Baiting in March (if required)		Spray in April to May in suitable weather						Quadrats and Photo-point	Submission of AER to DoE.
Winter 2016						6 to 8 weeks after emergence				Plant one third of plants (Management Area 1			Quadrats and Photo-point Visual Inspections to start.	
Spring 2016			Baiting in September	Baiting in October (weather permitting)			Weed Control Where required					Maintenance of Firebreaks	Visual Inspection, quadrats and Photo-point	
Summer 2017							Weed Control Where required						Visual Inspection, quadrats and Photo-point	
Autumn 2017			Baiting in March	Baiting	Baiting in March (if required)		Spray in April to May						Visual Inspection, quadrats and Photo-point	Submission of AER to DoE Independent Audit

9 RESPONSIBILITIES

Doral's Occupational Health Safety and Environment Superintendent will be responsible for the review, monitoring and implementation of this OSRMP.

The methods of assessment of the rehabilitation activities provided in this plan will be undertaken by a qualified ecologist or suitably experienced environmental scientist in accordance with Condition 3h of EPBC Act Approval 2013/6879.

This OSRMP will be reviewed following recommendations made by the independent environmental audit.

10 RISKS AND CONTINGENCY MEASURES

Potential risks to the successful management and rehabilitation within the Waterloo Offset Area and management measures to mitigate these risks are described in Table 12 below.

TABLE 12: CONTINGENCY MEASURES

RISK	MANAGEMENT ACTION	SECTION OF THIS PLAN
Revegetation efforts hampered by rabbits	1. Tubestock to be planted with protective barrier. 2. Baiting for rabbits. 3. Infill planting. 4. Warren destruction as appropriate.	5.3.2
Revegetation efforts hampered by kangaroos	5. Waterloo Offset Area to be fenced following removal of kangaroos from offset area. 6. Fence will be maintained. 7. Infill planting.	5.3.3
Revegetation efforts hampered by dry conditions	8. Seedlings will be planted at the start of winter. 9. Infill planting.	5.5
Revegetation efforts hampered by weeds	10. Weed control plan.	5.4
Revegetation efforts hampered by grasshoppers	11. Implement grasshopper control program.	5.3.4
Fire	12. A firebreak will be maintained around the perimeter of the Waterloo Offset Area.	7.2.4

11 REPORTING

Doral will notify the DoE within 30 days of the commencement of the action in writing to advise the DoE of the actual date of commencement in accordance with Condition 4 of EPBC Act Approval 2013/6879. Should the action not be commenced within five years from the date of approval, Doral will not commence the action without written agreement of the DoE Minister in accordance with Condition 10 of EPBC Act Approval 2013/6879.

The OSRMP will be published on Doral's website within 1 month of being approved in accordance with Condition 11 of EPBC Act Approval 2013/6879.

Should any revision of the OSRMP be requested by the DoE Minister, Doral will revise the OSRMP and implement upon the Minister's written approval in accordance with Condition 9 of EPBC Act Approval 2013/6879.

Doral will publish their AER on their website by 1 March annually. The AER will include a compliance report against all conditions of EPBC Act Approval 2013/6879 over the previous 12 month period. As a minimum the AER will include:

- A description of management actions completed within the Waterloo Offset Area;
- Milestones achieved;
- Results of monitoring and compliance with rehabilitation performance criteria and completion criteria in accordance with Condition 5 of EPBC Act Approval 2013/6879;
- Results of independent audit (every three years only) in accordance with Condition 5 of EPBC Act Approval 2013/6879;
- Identification of any adaptive management actions required in order to meet rehabilitation and completion criteria; and
- Compliance against conditions of EPBC Act Approval 2013/6879.

Non-compliance with any conditions of EPBC Act Approval 2013/6879 will be reported to the DoE at the same time as the compliance report is published.

Final documentation reporting on completion criteria and future management of the Offset Area will be documented in Doral's Dardanup Mineral Sands Mine Closure Plan.

In accordance with Condition 8 of EPBC 2013/6879 any activity undertaken otherwise in accordance with the OSRMP and conditions of EPBC 2013/6879 will be provided to the Minister and will not be conducted without the revision of the OSRMP and the written approval of the Mister for the DoE

11.1 COMMUNICATION/PROMOTION OF RESULTS

Doral is committed to communicating and sharing knowledge of its rehabilitation activities for the Waterloo Project. Doral will also involve the local community with implementation of the rehabilitation and celebrations of success where possible. To realise this, a variety of communication methods are currently used, including:

- Newspaper and newsletter articles as significant milestones or other events worthy of celebration are reached (these will include the Dardanup District Times, South Western Times and others as appropriate);
- Poster and / or other displays at local events such as the Doral sponsored Dardanup Bull and Barrel Festival;
- Field days based around learning events, such as seed picking or planting workshops;
- Articles in other media avenues such as Farm Weekly and local radio; and
- Stories and articles on the Doral company website (Howe and Strang, 2010).

These communications will include news about the rehabilitation site in the Waterloo Project area.

12 REFERENCES

Doral Mineral Sands (2012). *Dardanup Mine Closure Plan (including the Dardanup Mine, Burekup Western Extension and the Dardanup Southern Extension).* DMP-EMP-6.3, Version 3. March 2013.

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DSEWPaC (20012b). *Environment Protection and Biodiversity Conservation Act 1999* referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii* and Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

Ecoedge Environmental (2013). Level 2 Flora and Vegetation Survey – Lot 110 Simpson Road, Waterloo. Unpublished report prepared for Doral Mineral Sands. February 2013.

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Harewood, G (2012). Fauna Assessment of Lot 110 Simpson Road, Dardanup. Unpublished report prepared for Doral Minerals. October 2012.

Johnstone, R.E & C and Kirkby, T (2007). Black Cockatoos on the Swan Coastal Plain. Report for the Department of Planning Western Australia.

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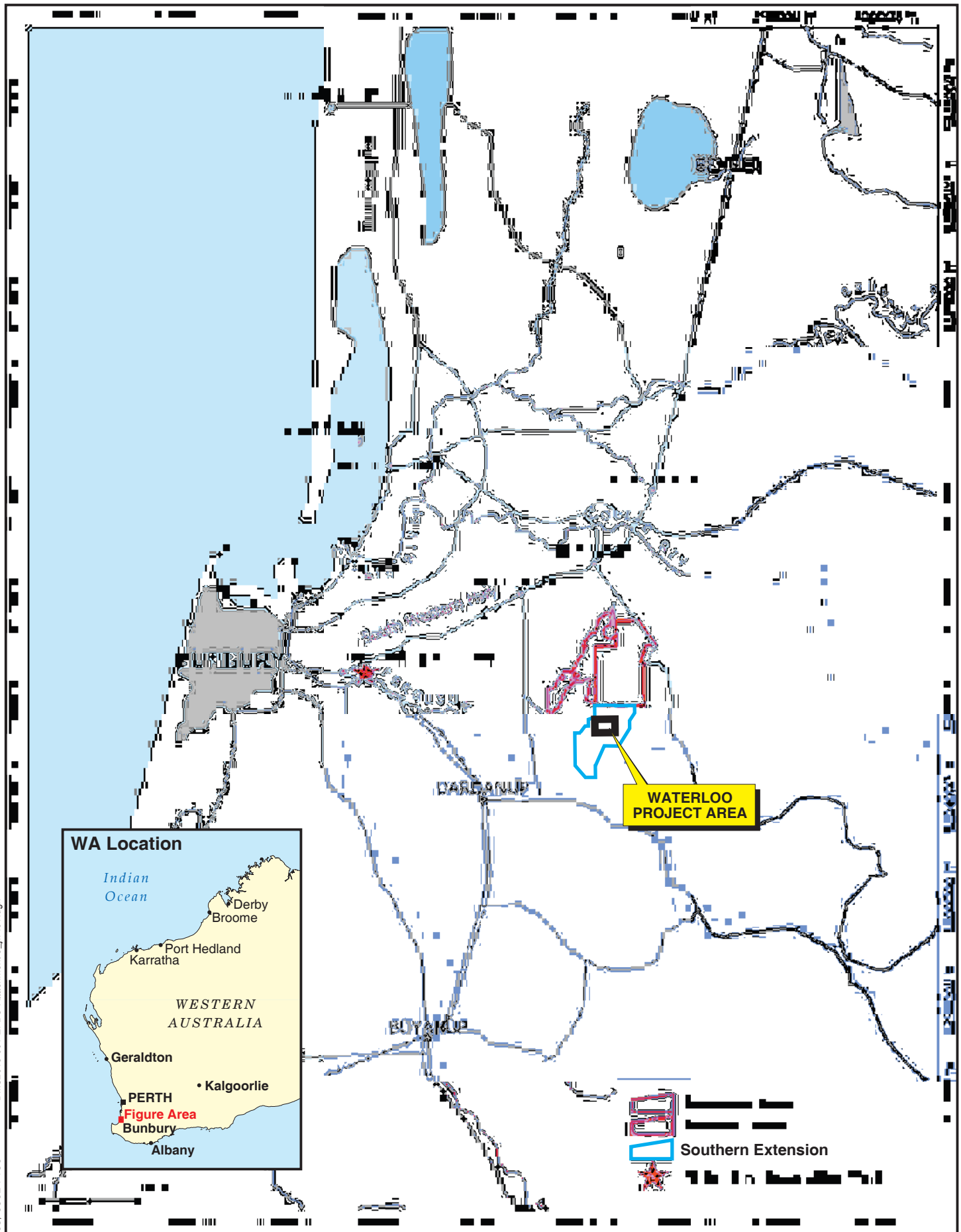
FIGURES



Aurora environmental

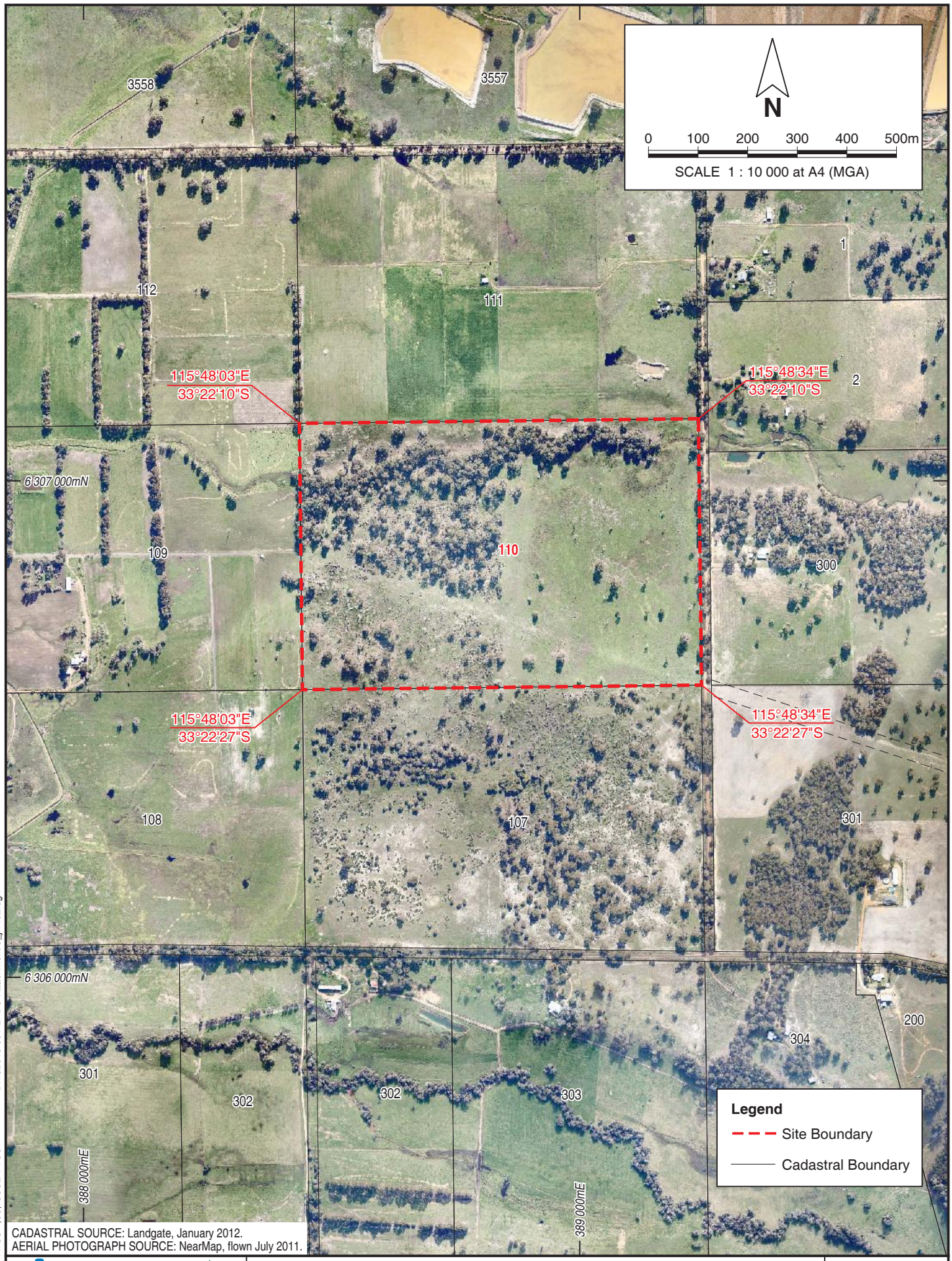
Doral
OFFSETS MANAGEMENT STRATEGY
DARDANUP MINERAL SANDS WATERLOO PROJECT

Figure 1

LOCALITY PLAN

Drawn: D. Bourke | Date: 15 May 2013 | Job: DMS2013-001

PINPOINT CARTOGRAPHICS (08) 9562 7136 DMS2013-001-EPBC-Attachment 8_jw-f01.dgn



CADASTRAL SOURCE: Landgate, January 2012.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown July 2011.

PINPOINT CARTOGRAPHICS (08) 9562 7136 DMS2013-001-EPBC-Attachment 8_jw-f02.dgn

Aurora environmental

Doral
OFFSETS MANAGEMENT STRATEGY
DARDANUP MINERAL SANDS WATERLOO PROJECT

Figure 2

WATERLOO PROJECT AREA

Drawn: D. Bourke | Date: 15 May 2013 | Job: DMS2013-001

388 500mE
388 750mE
389 000mE
389 250mE
111
6 307 000mN
6 306 750mN
6 306 500mN
109
110
108
107
SIMPSON
ROAD

N

0 20 40 60 80 100m

SCALE 1 : 3 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Mine Pit
- Existing Haul Road
- Approximate Creekline
- Black Cockatoo Habitat to be Cleared

Habitat Trees

- Tree >50cm DBH, No Hollows Seen
- Tree >50cm DBH, One or More Hollows Seen
- Tree >50cm DBH, One or More Hollows Possibly Suitable for a Black Cockatoo

Fauna Habitat

- CcEmEr
- CcXp
- EmXp

CADASTRAL SOURCE: Landgate, January 2012.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown July 2011.

Aurora environmental

Drawn: D. Bourke | Date: 22 Oct 2013

Doral
OFFSETS MANAGEMENT STRATEGY
DARDANUP MINERAL SANDS WATERLOO PROJECT

BLACK COCKATOO HABITAT

Figure 3

Job: DMS2013-001

DMS2013-001-EPBC-Attachment 8_jw-f03.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

388 500mE
388 750mE
389 000mE
389 250mE
6 307 000mN
6 306 750mN
6 306 500mN
109
110
108
107
SIMPSON
ROAD

N

0 20 40 60 80 100m

SCALE 1 : 3 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Mine Pit
- Existing Haul Road
- Waterloo Offset Area
- Approximate Creekline
- Management Area A
- Management Area B
- Management Area C
- Management Area D

Habitat Trees

- Tree >50cm DBH, No Hollows Seen
- Tree >50cm DBH, One or More Hollows Seen
- Tree >50cm DBH, One or More Hollows Possibly Suitable for a Black Cockatoo

CADASTRAL SOURCE: Landgate, January 2012.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown July 2011.

Aurora environmental

Drawn: D. Bourke | Date: 23 Oct 2013

Doral
OFFSETS MANAGEMENT STRATEGY
DARDANUP MINERAL SANDS WATERLOO PROJECT

WATERLOO OFFSET AREA

Figure 4

Job: DMS2013-001

DMS2013-001-EPBC-Attachment 8_jw-f04.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

APPENDIX A

Fauna Assessment of Lot 110 Simpson Road, Dardanup

Fauna Assessment

of

Lot 110 Simpson Road

Dardanup

OCTOBER 2012

Version 1

On behalf of:
Doral Mineral Sands Pty Ltd
Lot 7 Harris Road
PICTON WA 6229

Prepared by:
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DISCLAIMER

This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy of completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

The Author will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

SUMMARY

This report details the results of a fauna assessment of Lot 110 Simpson Road, Dardanup (the study site). The site is located about 16 kms east of the Bunbury central business district in south west Western Australia and has a total area of about 43 ha, most of which is cleared or partly cleared of native remnant vegetation (Figures 1 and 2).

It is understood that the study area contains a mineral sands resource which Doral Mineral Sands Pty Ltd are proposing to mine as part of their existing operations in the area. Any proposed mining may require the clearing of some of the existing vegetation form the site which has the potential to impact on fauna species that may be present. The main aim of the assessment is to provide information on the fauna values of this area. It is anticipated that the information presented will be used by regulatory authorities to assess the potential impact of the proposal on fauna and fauna habitats as part of any required approval process.

The scope of works was to conduct a level 1 fauna survey as defined by the Environmental Protection Authority (EPA 2004). Because some listed threatened species (i.e. western ringtail possums, southern brush-tailed phascogales and several species of black cockatoo) are known to occur in the general area, the scope of the survey work was expanded to include targeted assessment of the site's significance to these species.

The assessment has included a desktop study and a series of site surveys. Daytime field survey work at the site was carried out on the 29 and 30 September, 2012. Nocturnal survey work was carried out on the 3 October 2012.

Descriptions of the broadly defined fauna habitats within the study area (based on vegetation units) are given below. The extent of each of the defined habitats is shown in Figure 3. Plates 1 to 4 illustrate the nature of the vegetation units/habitats present inside the boundary of the study area.

- **Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) and Flooded Gum (*E. rudis*) Parkland Cleared Woodland over Grassland of introduced species bordering ephemeral creek.** This unit has a total area of about 4.6 ha. The area has been parkland cleared and left open to grazing livestock for many years and as a consequence there is no native midstorey or groundcover present. Canopy connectivity is relatively good (Plate 1).

- **Marri (*C. calophylla*) and Jarrah (*E. marginata*) Parkland Cleared Open Woodland over a very open shrubland of *Xanthorrhoea preissii* over a Grassland of introduced species**: This unit occurs in two areas split by a power line easement and in total has a area of about 13.3 ha. The unit is characterised by the presence of *Xanthorrhoea preissii* which has

presumably regrown after a historical clearing event. There are a small number of *Nuytsia floribunda* (christmas tree) and *Xylomelum occidentalis* (woody pear) specimens but in general midstorey vegetation is absent. Canopy connectivity varies from being relatively good to totally discontinuous. The area is open to livestock grazing and there is no native ground cover species present (Plate 2 and 3).

- **Unnamed Ephemeral Creek:** A small seasonally inundated creek runs across the northern section of the study area. The creek is bordered by marri, jarrah and flooded gum but no other native riparian vegetation is present. Coffey (2011a) noted that the watercourse channel was characterised by bank slumping (poor bank stability with extensive erosion), channel widening, points of undercutting and extensive sedimentation. The environmental rating for the Unnamed Creek was rated Very Poor due to the lack of riparian vegetation (Coffey 2011a) (Plate 4).

- **Totally Cleared (Pasture):** Over half of the Lot (estimated 25ha) of study area is cleared of all vegetation and now contains only grassland with widely scattered trees (Plate 5).

Opportunistic fauna observations are listed in Appendix B. A total of 36 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area during the day and night time surveys. Evidence of one introduced species utilising the area was also seen.

Evidence of four listed threatened species was observed (the forest red-tailed black cockatoo – individuals and foraging evidence (chewed marri fruits), Carnaby's black cockatoos - foraging evidence (chewed marri fruits), Baudin's black cockatoo (chewed marri fruits), and the southern brush-tailed phascogale (one individual)). No evidence of any migratory or Department of Environment and Conservation (DEC) priority species using the area was found.

No evidence of western ringtail possums using vegetation within the study area was found during the daytime or night time surveys of the site. The apparent absence of this species from the study area can be attributed to the marginal quality of the habitat present. The vegetation present has a distinct lack of a midstorey component which is favoured by WRPs. WRPs have been recorded in nearby areas (Coffey 2008, Coffey 2011b, G. Harewood pers. obs.) where habitat of a better quality exists and individuals may on occasions move into the study area but in the Authors opinion the vegetation present does not represent significant habitat for the species and would be unlikely to support a population.

No evidence of southern brush-tailed phascogales using vegetation within the study area was found during the daytime survey, however a single individual was sighted during the nocturnal survey (see Figure 4). The study area was also found to contain numerous trees with hollows (Figure 3 and 5), a high percentage of which would be

suitable for southern brush-tailed phascogales to utilise as daytime refuge and breeding sites.

The tree assessment identified 472 specimens within the study area that fit the federal Department of Sustainability, Environment, Water, Population and Communities' (DSEWPaC's) criteria for black cockatoo breeding habitat (i.e. suitable tree species with a diameter at breast height (DBH) of >50cms) (Figure 5).

One hundred and two of the 472 trees were observed to contain hollows of some type with 13 determined to possibly have large enough hollows for black cockatoos to use for nesting though this assessment was based on the size of the entrance into an apparent hollow only. Two of these trees showed evidence of use (rub and chew marks) but it was not clear if these were caused by nesting black cockatoos or other parrot species such as galahs, corellas or Australian ringnecks which also frequent the area. Additional details on each observed "potential black cockatoo breeding tree" can be found in Appendix D.

Foraging evidence left by black cockatoos in the form of chewed marri fruits was common and widespread. Almost all was attributed to the forest red-tailed black cockatoo, individuals and small groups of which were observed several times foraging throughout the study area during the survey period. A few examples of chewed marri fruits attributed to Carnaby's and Baudin's black cockatoo were also observed.

The total extent of native vegetation onsite is about 18 ha and almost all can be regarded to represent foraging habitat for black cockatoos due to the dominance of marri and to a lesser extent jarrah. The density of these respective tree species does however vary considerable, for example the area of remnant vegetation in the south west corner of the study area contains only a very sparse scattering of live trees and is therefore of less foraging habitat value compared to the denser woodland present along the ephemeral creek.

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the day or night surveys.

With respect to native vertebrate fauna, 13 mammals (includes nine bat species), 79 bird, 16 reptile, eight frog and two fish species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the study area at times.

Of the 118 native animals that are listed as potentially occurring in the area, six are considered to be endangered/vulnerable or in need of special protection under State and/or Federal law. In addition, three migratory species and two DEC priority species also may frequent the area at times.

In summary, four vertebrate fauna species of conservation significance (listed as State or Federal threatened/migratory species or as DEC priority species) were positively

identified as utilising the study area for some purpose during the survey period, these being:

- *Calyptorhynchus latirostris* Carnaby`s Black Cockatoo – S1 (*WC Act*), Endangered (*EPBC Act*)
  A small amount of foraging evidence attributed to this species found. About 18 ha of the native remnant vegetation within the study area represents potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

- *Calyptorhynchus baudinii* Baudin`s Black Cockatoo - S1 (*WC Act*), Vulnerable (*EPBC Act*)
  A small amount of foraging evidence attributed to this species found. About 18 ha of the native remnant vegetation within the study area represents potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo – S1 (*WC Act*), Vulnerable (*EPBC Act*)
  A significant amount of foraging evidence attributed to this species found. About 18 ha of the native remnant vegetation within the study area represents potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

- *Phascogale tapoatafa ssp* Southern Brush-tailed Phascogale - S1 (*WC Act*)
  An individual southern brush-tailed phascogale was observed within the study area during the night survey indicating the site is supporting a small population of the species.

An additional seven species of conservation significance may possibly utilise the study area for some purpose at times but their current status on-site and/or in the general area is, in some cases, difficult to determine because they were not sighted during the survey period, or evidence of use of the study area was not found. These species are listed below.

Note: Habitat for some of these species on-site, while considered possibly suitable, may be marginal in extent/quality and species listed below may only visit the area for short periods, or as rare/uncommon vagrants.

- *Ardea alba* Great Egret – S3 (WC Act), Migratory (*EPBC Act*)
  May utilise the seasonal creek and low lying paddocks areas during wetter months of the year, in small numbers. Would not breed on site.

- *Ardea ibis* Cattle Egret – S3 (WC Act), Migratory (*EPBC Act*)
  May utilise the seasonal creek and low lying paddocks areas during wetter months of the year, in small numbers. Would not breed on site.

- *Tyto novaehollandae* Masked Owl – P3 (DEC Priority Species)

May very occasionally reside in general area though status onsite uncertain.

- *Merops ornatus* Rainbow Bee-eater – S3 (*WC Act*), Migratory (*EPBC Act*)
  Common seasonal visitor to south west. During summer months a small number of individuals of this species may occasionally forage and roost onsite.

- *Falco peregrinus Peregrine Falcon - S4 (WC Act)*
  Uncommon so unlikely to be resident in area but study site may form part of larger home range.

- *Pseudocheirus occidentalis* Western Ringtail Possum - S1 (*WC Act*), Vulnerable (*EPBC Act*)
  No evidence of this species being present was found during the survey period and habitat appears marginal. Potential for occasional transient individuals and therefore listed as a potential species. The area does not however appear to represent significant habitat for this species.

- *Falsistrellus mackenziei* Western False Pipistrelle - P4 (DEC Priority Species)
  May utilise the site for foraging. Some of the hollow trees may also represent suitable roost sites (deep hollows).

A number of other species of conservation significance, while possibly present in the general area, are not listed as potential species due to known localised extinction (and no subsequent recruitment from adjoining areas) and/or lack of suitable habitat and/or the presence of feral predators. Details on these species and reasons for their omission are provided in Appendix E and Table 2.

A series of recommendations aimed at mitigating and minimising potential impacts on fauna and fauna habitat in general and specific management of impacts with respect to black cockatoos are provided in Section 7.2. Subject to the proposal gaining final approval; from regulatory authorities, these recommendations should be implemented as part of any proposed management plans where considered reasonable and practicable.

Constraints on proposed clearing within the study area will largely be centred on the presence of habitat used or potentially used by threatened fauna species in particular those listed under the *EPBC Act*, namely all three species of black cockatoo, habitat of which were confirmed as being present within the study area. The potential impact on these fauna values will be taken into consideration during the state and federal approval process.

Given the potential impacts clearing of sections of the site may have on fauna species listed under the *EPBC Act*, it is recommended that a referral to DSEWPaC be made once specific mining plans are further advanced.

1. INTRODUCTION

This report details the results of a fauna assessment of Lot 110 Simpson Road, Dardanup (the study site). The site is located about 16 kms east of the Bunbury central business district in south west Western Australia and is centred at approximately 33.372081°S and 115.804848°E. The study area has a total area of about 43 ha, most of which is cleared or partly cleared of native remnant vegetation (Figures 1 and 2).

It is understood that the study area contains a mineral sands resource which Doral Mineral Sands Pty Ltd are proposing to mine as part of their existing operations in the area. Any proposed mining may require the clearing of some of the existing vegetation form the site which has the potential to impact on fauna species that may be present.

The main aim of the proposed fauna assessment is to provide relevant regulatory authorities with information that will enable them to assess the impacts the clearing may have on fauna utilising the site and areas nearby. The assessment will also provide guidance on which state and federal environmental agencies will require notification of the propose clearing to ensure compliance with relevant laws and acts.

2. SCOPE OF WORKS

The scope of works was to conduct a level 1 fauna survey as defined by the EPA (EPA 2004). Because some listed threatened species (i.e. western ringtail possums, southern brush-tailed phascogales and several species of black cockatoo) are known to occur in the general area, the scope of the survey work was expanded to include targeted assessment of the site's significance to these species. The fauna assessment has therefore included:

1. Level 1 Fauna Survey (to EPA standard).

2. Targeted searches for evidence of western ringtail possums (WRPs – dreys, scats and individuals) including a single nocturnal counts.

3. Targeted searches for evidence of southern brush-tailed phascogales (tree hollows, scats and individuals) including a single nocturnal count (concurrent with WRP survey work).

4. Targeted searches for black cockatoo foraging, nesting and roosting habitat.

5. Preparation of a report detailing results.

Note: For the purposes of this report the term black cockatoo is in reference to Baudin's black cockatoo *Calyptorhynchus baudinii*, Carnaby's black cockatoo *Calyptorhynchus latirostris* and the forest red-tailed black cockatoo *Calyptorhynchus banksii naso*.

3. METHODOLOGY

3.1 POTENTIAL FAUNA INVENTORY - DESKTOP STUDY

3.1.1 Database Searches

Searches of the following databases were undertaken to aid in the compilation of a list of vertebrate fauna potentially occurring within the study area:

- DEC's NatureMap Database Search (combined data from DEC, Western Australian Museum and Birds Australia) (DEC 2012): and
- Protected matters search tool (Department of Sustainability, Environment, Water, Population and Communities – DSEWPaC 2012b).

It should be noted that these databases contain records based on observations from a broader area than the study site and therefore may include species that would only ever occur as vagrants in the actual study area due to a lack of suitable habitat or the presence of only marginal habitat. The databases also often included very old records and in some cases the species in question have become locally or regionally extinct.

Information from these sources should therefore be taken as indicative only and local knowledge and information needs also to be taken into consideration when determining what actual species may be present within the specific area being investigated.

3.1.2 Previous Fauna Surveys in the Area

Fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publically available and could not be referenced. The most significant of those available have been used as the primary reference material for compiling the potential fauna assemblage for the general area. Those reports referred to included, but were not limited to:

- Coffey Environments Pty Ltd (Coffey) (2008). Doral Mineral Sands Western Expansion. Level 1 Fauna Assessment. Unpublished Report for Doral Mineral Sands Pty Ltd. November 2008.

- Coffey Environments Australia Pty Ltd (Coffey) (2011a). Baseline Aquatic Fauna Assessment and Water Quality Study. Southern Extension of the Dardanup Mineral Sands Project. Unpublished Report for Doral Mineral Sands Pty Ltd. March 2011.

- Coffey Environments Australia Pty Ltd (Coffey) (2011b). Level 1 Fauna Assessment. Southern Extension of the Dardanup Mineral Sands Project. Unpublished Report for Doral Mineral Sands Pty Ltd. June 2011.

- ENV Australia (2004). North Boyanup District Structure Plan. Unpublished report for the DPI (Level 1 fauna survey results).

- ENV Australia (2008). Edith Cowan University, South West Campus. Fauna Assessment (Level 2). Unpublished report for ECU.

- Environmental Protection Authority (EPA) (2008). Advice on areas of conservation significance in the Preston Industrial Park. Bulletin 1282, March 2008.

- HGM (2002). Natural Values of 12 Sites of the Greater Bunbury Region Scheme. Tasks 1, 2 and 3. Unpublished report for WAPC (Muddy Lakes Level 2 fauna survey results).

- Harewood, G. (2008). Fauna Assessment Survey (Level 2) Lot 187 Stratham. Unpublished report for MBS Environmental.

- Harewood, G. (2010). Fauna Survey (Level 2). Kemerton Industrial Core. Unpublished report for Cardno (WA) Pty Ltd.

- Ninox Wildlife Consulting (Ninox) (2006). A vertebrate Fauna Assessment of the Burekup Mineral Sands Project Area. Unpublished Report for Iluka Resources Ltd.

As with the databases searches some reports refer to species that would not occur in the study area due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential fauna species list for the study area. It should also be noted that the NatureMap database is likely to include some records from previous fauna surveys in the area including some of those listed above.

3.1.3 Existing Publications

The following represent the main publications used to identify and refine the potential fauna species list for the study area:

- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.
- Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin.
- Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.
- Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.
- Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.
- Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.
- Van Dyck, S. & Strahan, R. Eds (2008) The Mammals of Australia. Third edition. Queensland Museum.

- Wilson, S. and Swan, G. (2010) A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.

3.1.4 Fauna of Conservation Significance

The conservation significance of fauna species has been assessed using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Administered by the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC);

- *Wildlife Conservation Act 1950 (WC Act).* Administered by the Western Australian Department of Environment and Conservation (DEC);

- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and the

- DEC Priority Fauna list. A non-legislative list maintained by the DEC for management purposes.

The *EPBC Act* also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);

- China Australia Migratory Bird Agreement 1998 (CAMBA);

- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and

- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note - Species listed under JAMBA are also protected under Schedule 3 of the *WC Act*.)

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (NES) under the *EPBC Act*.

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the study area has been assessed using the

most recent lists published in accordance with the above-mentioned instruments and is indicated as such in the fauna listings of this report. A full listing of conservation codes are provided in Appendix A.

A number of other species not listed in official lists can also be considered of local or regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

While not classified as rare, threatened or vulnerable under any State or Commonwealth legislation, a number of bird species have been listed as of significance on the Swan Coastal portion of the Perth Metropolitan Region (Bush Forever - Government of Western Australia 1998 and 2000). The bird species are often referred to as Bush Forever Decreaser Species. The three categories used for birds within the Bush Forever documents are:

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh)
- Wide ranging Species with reduced population's on the Swan Coastal Plain. (code Bp)
- Extinct in the Perth region (code Be)

Other fauna species of regional significance due to declining populations on the Swan Coastal Plain, especially between Mandurah and Busselton, include the honey possum and pygmy possum (Dell 2000).

The presence of Bush Forever species should be taken into consideration when determining the fauna values. Bush Forever decreaser species are indicated as such within the species list held in Appendix B.

3.1.5 Invertebrates

It can be difficult to identify what may be significant invertebrate species (e.g. Short Range Endemics - SREs) as there are uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

For this project, the assessment for conservation significant invertebrates has been limited to those listed by the DEC and *EPBC Act* database searches

(which rely on distribution records and known habitat preferences). No assessment of the potential for SREs to be present has been made.

3.1.6 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report is generally taken from the DEC's WA Fauna Census Database which is assumed to follow Aplin and Smith (2001) for amphibians and reptiles, How *et al*. (2001) for mammals and Johnstone (2001) for birds.

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided they have been acquired from other publications. Sources include Van Dyck & Strahan (2008), Bush *et al.* (2007), Wilson and Swan (2010), Bush *et al* (2002), Tyler *et al*. (2000), Christidis and Boles (2008) and Glauret (1961). Not all common names are generally accepted.

3.2 SITE SURVEYS

Daytime field survey work at the site was carried out on the 29 and 30 September, 2012. Nocturnal survey work was carried out on the 3 October 2012. All survey work was carried out by Greg Harewood (B.Sc. Zoology).

3.2.1 Fauna Habitat Assessment

Vegetation units and landforms observed during the site reconnaissance survey have been used to define broad fauna habitat types across the site.

The main aim of the habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that maybe impacted on as a consequence of development at the site. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the desktop literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey the habitats within the study area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

3.2.2 Opportunistic Fauna Observations

Opportunistic observations of fauna species was made during all field survey work which involved a series of transects across the site during the day and night while searching microhabitats such as logs, rocks, leaf litter, observations of bird species with binoculars and head torching at night.

3.2.3 Western Ringtail Possum Assessment

To determine if western ringtail possums were utilising the study area the following was carried out:

- Daytime survey of the site searching for dreys, obvious tree hollows (and other potential daytime refuge habitat), scats and individual WRPs;
- One night time survey to locate and record the distribution and abundance of WRPs; and
- Determination of the amount and quality of WRP habitat within the study area.

3.2.4 Southern Brush-tailed Phascogale Assessment

To determine if southern brush-tailed phascogales were utilising the study area the following was carried out:

- Daytime survey of the site searching for obvious tree hollows (and other potential daytime refuge habitat) and scats;
- One night time survey to locate and record the distribution and abundance of southern brush-tailed phascogales; and
- Determination of the amount and quality of southern brush-tailed phascogales habitat within the study area.

3.2.5 Black Cockatoo Habitat Assessment

The black cockatoo habitat assessment included a:

- Habitat tree survey: This involved the identification of all suitable trees species within the study area that have a Diameter at Breast Height (DBH) of over 50cm (irrespective of the presence/absence of suitable hollows – DSEWPaC (2012) criteria). The location of each tree identified was recorded with a GPS and details on tree species, number and size

of hollows (if any) noted. Trees with hollows were marked with "H" using spray paint.

Target tree species included marri and jarrah or any other suitable *Corymbia/Eucalyptus* species of a suitable size that may be present. Peppermints, banksia, sheoak and melaleuca tree species (for example) were not assessed as they typically do not develop hollows that are used by black cockatoos.

For the purposes of this study a potential cockatoo nest hollow was defined as:

Generally any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for occupation by any of the three black cockatoo species for the purpose of nesting/breeding. Hollows that had an entrance greater than about 12cm in diameter and would allow the entry of a cockatoo (white tailed or red-tailed) into a suitably orientated and sized branch/trunk, were recorded as a "potential nest hollow".

Identified hollows (if any) were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Trees with possible nest hollows were also scratched and raked with a large stick/pole to flush any sitting birds from hollows and calls of chicks were also listened for.

- Black cockatoo foraging assessment: The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around base of trees) observed during the field survey was recorded.
- Roosting habitat survey: Direct and indirect evidence of black cockatoos roosting within trees on site was noted if observed (e.g. branch clippings, droppings or moulted feathers).

4. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. It should be recognised that site conditions can change with time.

Some fauna species are reported as potentially occurring within the study area based on there being suitable habitat (quality and extent) within the study area or immediately adjacent. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

- seasonal inactivity during the field survey;
- species present within micro habitats not surveyed;
- cryptic species able to avoid detection; and
- transient wide-ranging species not present during the survey period.

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the site.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitat or microhabitat within the study area. As a consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that actually utilise the study area for some purpose. Some species may be present in the general area but may only use the study area itself on rare occasions or as vagrants.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the study area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author, has been assumed to potentially occur in the study area.

During the habitat survey trees with hollows were recorded. It should be noted that identifying hollows suitable for fauna species from ground level has

limitations. Generally the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

The location of habitat trees was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 metres, though it should be noted that in some circumstance the accuracy can be worse or better than this.

5. RESULTS

5.1 POTENTIAL FAUNA INVENTORY - DESKTOP STUDY

A list of expected fauna species likely to occur in the study area was compiled from information obtained during the desktop study and is presented in Appendix B. This listing was refined after information gathered during the site reconnaissance survey was assessed. The results of some previous fauna surveys carried out in the general area are summarised in this species listing as are the DEC NatureMap database search results. The raw database search results from NatureMap (DEC 2012) and the Protected Matters Search Tool (DSEWPaC 2012b) are contained within Appendix C.

The list of potential fauna takes into consideration that firstly the species in question is not known to be locally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the study area, though compiling an accurate list has limitations (see Section 4 above).

5.2 SITE SURVEYS

5.2.1 Fauna Habitat Assessment

Descriptions of the broadly defined fauna habitats within the study area (based on vegetation units) are given below. The extent of each of the defined habitats is shown in Figure 3. Plates 1 to 5 illustrate the nature of the vegetation units/habitats present inside the boundary of the study area.

- **Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) and Flooded Gum (*E. rudis*) Parkland Cleared Woodland over Grassland of introduced species bordering ephemeral creek.** This unit has a total area of about 4.6 ha. The area has been parkland cleared and left open to grazing livestock for many years and as a consequence there is

no native midstorey or groundcover present. Canopy connectivity is relatively good (Plate 1).

- **Marri (*C. calophylla*) and Jarrah (*E. marginata*) Parkland Cleared Open Woodland over a very open shrubland of *Xanthorrhoea preissii* over a Grassland of introduced species**: This unit occurs in two areas split by a power line easement and in total has a area of about 13.3 ha. The unit is characterised by the presence of *Xanthorrhoea preissii* which has presumably regrown after a historical clearing event. There are a small number of *Nuytsia floribunda* (christmas tree) and *Xylomelum occidentalis* (woody pear) specimens but in general midstorey vegetation is absent. Canopy connectivity varies from being relatively good to totally discontinuous. The area is open to livestock grazing and there is no native ground cover species present (Plate 2 and 3).

- **Unnamed Ephemeral Creek:** A small seasonally inundated creek runs across the northern section of the study area. The creek is bordered by marri, jarrah and flooded gum but no other native riparian vegetation is present. Coffey (2011a) noted that the watercourse channel was characterised by bank slumping (poor bank stability with extensive erosion), channel widening, points of undercutting and extensive sedimentation. The environmental rating for the Unnamed Creek was rated Very Poor due to the lack of riparian vegetation (Coffey 2011a) (Plate 4).

- **Totally Cleared (Pasture):** Over half of the Lot (estimated 25ha) of study area is cleared of all vegetation and now contains only grassland with widely scattered trees (Plate 5).

5.2.2 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix B. A total of 36 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area during the day and night time surveys. Evidence of one introduced species utilising the area was also seen.

Evidence of four listed threatened species was observed (the forest red-tailed black cockatoo – individuals and foraging evidence (chewed marri fruits), Carnaby's black cockatoos - foraging evidence (chewed marri fruits), Baudin's black cockatoo (chewed marri fruits), and the southern brush-tailed phascogale

(one individual)). No evidence of any migratory or DEC priority species using the area was found.

5.2.3 Western Ringtail Possum Assessment

No evidence of western ringtail possums using vegetation within the study area was found during the daytime or night time surveys of the site.

The apparent absence of this species from the study area can be attributed to the marginal quality of the habitat present. The vegetation present has a distinct lack of a midstorey component which is favoured by WRPs. The vegetation present is dominated by marri and jarrah trees and due to historical clearing and ongoing livestock grazing associated midstorey species are almost totally absent.

WRPs have been recorded in nearby areas (Coffey 2008, Coffey 2011b, G. Harewood pers. obs.) where habitat of a better quality exists and individuals may on occasions move into the study area but in the Authors opinion the vegetation present does not represent significant habitat for the species and would be unlikely to support a population.

5.2.4 Southern Brush-tailed Phascogale Assessment

No evidence of southern brush-tailed phascogales using vegetation within the study area was found during the daytime survey, however a single individual was sighted during the nocturnal survey (see Figure 4).

The study area was also found to contain numerous trees with hollows (Figure 3 and 5), a high percentage of which would be suitable for southern brush-tailed phascogales to utilise as daytime refuge and breeding sites.

It is difficult to estimate how many phascogales may be present within the study area at any one time as they are typically elusive and hard to detect. The males and females maintain large home ranges with females excluding unrelated females from their range and therefore their distribution is usually sparse (Van Dyck & Strahan (2008). This would suggest that the site only supports a few individuals given that the home range for a female brush-tailed phascogale is estimated at between 20 and 70 ha, whilst that for males is given as twice that of females (Soderquist 1995).

5.2.5 Black Cockatoo Habitat Assessment

The tree assessment identified 472 specimens within the study area that fit DSEWPaC's (2012) criteria for black cockatoo breeding habitat (i.e. suitable

tree species with a diameter at breast height (DBH) of >50cms) (Figure 5). Most of the trees were marri (*C. calophylla*) (343 specimens), while the balance were comprised of jarrah (*E. marginata*) (60 specimens), flooded gum (*E. rudis*) (16 specimens), wandoo (*E. wandoo*) (1 specimen) and dead unknown species (52 specimens).

One hundred and two of the 472 trees were observed to contain hollows of some type with 13 determined to possibly have large enough hollows for black cockatoos to use for nesting though this assessment was based on the size of the entrance into an apparent hollow only. Two of these trees showed evidence of use (rub and chew marks) but it was not clear if these were caused by nesting black cockatoos or other parrot species such as galahs, corellas or Australian ringnecks which also frequent the area.

Additional details on each observed "potential black cockatoo breeding tree" can be found in Appendix D.

Foraging evidence left by black cockatoos in the form of chewed marri fruits was common and widespread. Almost all was attributed to the forest red-tailed black cockatoo, individuals and small groups of which were observed several times foraging throughout the study area during the survey period. A few examples of chewed marri fruits attributed to Carnaby's and Baudin's black cockatoo were also observed.

The total extent of native vegetation onsite is about 18 ha and almost all can be regarded to represent foraging habitat for black cockatoos due to the dominance of marri and to a lesser extent jarrah. The density of these respective tree species does however vary considerable, for example the area of remnant vegetation in the south west corner of the study area contains only a very sparse scattering of live trees and is therefore of less foraging habitat value compared to the denser woodland present along the ephemeral creek.

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the day or night surveys. Given the numbers of red-tailed black cockatoos observed during the day survey period roost sites must exist in the near vicinity (not necessarily on site) but at this stage there location has not been confirmed.

5.3 FAUNA INVENTORY – SUMMARY

5.3.1 Vertebrate Fauna

Table 1 summarises the number of fauna species potentially occurring within the study area, based on results from the desktop study and observations made

during the field assessment. A complete list of vertebrate fauna possibly inhabiting or frequenting the study area is located in Appendix B. Results from searches of DEC's NatureMap database and the *EPBC Act* database are located in Appendix C.

Not all species listed as potentially occurring within the study area in existing databases and publications (i.e. *EPBC Act* Threatened Fauna and Migratory species lists, DEC's NatureMap database, various reports and publications) are shown in the expected listing in Appendix B. Some species have been excluded from this list based largely on the lack of suitable habitat at the study site and in the general area or known local extinction even if suitable habitat is present.

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment.

Table 1: Summary of Potential Fauna Species (as listed in Appendix B)

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species	Number of species observed field survey 2012
Fish	3	0	0	0	0
Amphibians	8	0	0	0	3
Reptiles	16	0	0	0	1
Birds	82[3]	4	3	1	31[1]
Non-Volant Mammals	9[5]	2	0	0	2
Volant Mammals (Bats)	9	0	0	1	0
Total	**127[9]**	**6**	**3**	**2**	**37[1]**

Superscript = number of introduced species included in total.

A review of the *EPBC Act* threatened fauna list, DEC's Threatened Fauna Database and Priority List, unpublished reports and scientific publications

identified about 30 specially protected, priority or migratory fauna species as potentially occurring in the general vicinity of the study area.

Species that have no potential whatsoever (under normal circumstances) to utilise the study area for any purpose are not listed or discussed, despite appearing in the DEC or *EPBC Act* database searches (Appendix C – e.g. seabirds). Based on the habitats present and documented distributions it is considered possible that 11 of these species may use the study area for some purpose at times. Species have been omitted from the potential list for the site (Appendix B), principally due to lack of suitable habitat on-site (including extent or quality) or known local extinction.

Additional details on significant species that potentially utilise the study area are given in Appendix E.

In summary, four vertebrate fauna species of conservation significance (listed as State or Federal threatened/migratory species or as DEC priority species) were positively identified as utilising the study area for some purpose during the survey period, these being:

- *Calyptorhynchus latirostris* Carnaby`s Black Cockatoo – S1 (*WC Act*), Endangered (*EPBC Act*)
  A small amount of foraging evidence attributed to this species found. About 18 ha of the native remnant vegetation within the study area represents potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

- *Calyptorhynchus baudinii* Baudin`s Black Cockatoo - S1 (*WC Act*), Vulnerable (*EPBC Act*)
  A small amount of foraging evidence attributed to this species found. About 18 ha of the native remnant vegetation within the study area represents potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo – S1 (*WC Act*), Vulnerable (*EPBC Act*)
  A significant amount of foraging evidence attributed to this species found. About 18 ha of the native remnant vegetation within the study area represents potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

- *Phascogale tapoatafa ssp* Southern Brush-tailed Phascogale - S1 (*WC Act*)
  An individual southern brush-tailed phascogale was observed within the study area during the night survey indicating the site is supporting a small population of the species.

An additional seven species of conservation significance may possibly utilise the study area for some purpose at times but their current status on-site and/or in the general area is, in some cases, difficult to determine because they were not sighted during the survey period, or evidence of use of the study area was not found. These species are listed below.

Note: Habitat for some of these species on-site, while considered possibly suitable, may be marginal in extent/quality and species listed below may only visit the area for short periods, or as rare/uncommon vagrants.

- *Ardea alba* Great Egret – S3 (WC Act), Migratory (*EPBC Act*)
  May utilise the seasonal creek and low lying paddocks areas during wetter months of the year, in small numbers. Would not breed on site.

- *Ardea ibis* Cattle Egret – S3 (WC Act), Migratory (*EPBC Act*)
  May utilise the seasonal creek and low lying paddocks areas during wetter months of the year, in small numbers. Would not breed on site.

- *Tyto novaehollandae* Masked Owl – P3 (DEC Priority Species)
  May very occasionally reside in general area though status onsite uncertain.

- *Merops ornatus* Rainbow Bee-eater – S3 (*WC Act*), Migratory (*EPBC Act*)
  Common seasonal visitor to south west. During summer months a small number of individuals of this species may occasionally forage and roost onsite.

- *Falco peregrinus Peregrine Falcon - S4 (WC Act)*
  Uncommon so unlikely to be resident in area but study site may form part of larger home range.

- *Pseudocheirus occidentalis* Western Ringtail Possum - S1 (*WC Act*), Vulnerable (*EPBC Act*)
  No evidence of this species being present was found during the survey period and habitat appears marginal. Potential for occasional transient individuals and therefore listed as a potential species. The area does not however appear to represent significant habitat for this species.

- *Falsistrellus mackenziei* Western False Pipistrelle - P4 (DEC Priority Species)
  May utilise the site for foraging. Some of the hollow trees may also represent suitable roost sites (deep hollows).

A number of other species of conservation significance, while possibly present in the general area, are not listed as potential species due to known localised

extinction (and no subsequent recruitment from adjoining areas) and/or lack of suitable habitat and/or the presence of feral predators. Details on these species and reasons for their omission are provided in Appendix E and Table 2.

Twenty five bird species that potentially frequent or occur in the study area are noted as Bush Forever Decreaser Species in the Perth Metropolitan Region (seven species were sighted/identified as having used the study area during the survey). Decreaser species are a significant issue in biodiversity conservation in the Perth section of the coastal plain as there have been marked reductions in range and population levels of many sedentary bird species as a consequence of disturbance and land clearing (Dell & Hyder-Griffiths 2002). Potential impacts on decreaser species in other areas of their range outside of the Perth area should also be taken into consideration when assessing the consequences of developments on fauna biodiversity.

5.3.2 Invertebrate Fauna

One conservation significant invertebrate species appeared in the DEC and/or *EPBC Act* database searches (DEC 2012, DSEWPC 2012b), Carter's Freshwater Mussel (*Westralunio carteri*) which is listed as Priority 4 by the DEC.

Habitat at the study area appears unsuitable for this species based on a comparison with documented descriptions and it is therefore considered unlikely that any would be present on-site. Additional details on the Carter's Freshwater Mussel are provided in Appendix E.

6. FAUNA VALUES

6.1 CONSERVATION SIGNIFICANCE OF THE STUDY AREA

The conservation significance of the study area has been determined by applying site specific criteria such as:

- Fauna species and/or habitat present that is poorly represented in the general study area;
- Fauna habitat within the general study area supporting species of conservation or other significance;
- Fauna habitat in better condition than other similar locations in general study area.

Natural areas within the south west of Western Australia have been significantly altered since European settlement in the 1830's and a variety of environmental factors, in particular habitat fragmentation and fire, will continue to threaten

many species of fauna with local extinction. As the local development of land progresses the significance of any remnant vegetation increases.

With respect to the Bunbury - Dunsborough area little is known about the current status and conservation requirements of most faunal species in the region (Dell & Hyder-Griffiths, 2002). It can be expected that with increasing pressures on land use that species currently common will decline unless preventative measures are implemented.

The results of the fauna assessment indicate that the study site potentially hosts a range of fauna species some of which are of special conservation significance. The diversity of fauna species has however been greatly reduced as a result of habitat degradation due to previous land uses such as clearing, ongoing livestock grazing and predation by introduced predators. These impacts are likely to have resulted in the localised extinction of many species from the site that can be assumed to have been formally present.

Overall the remnant vegetation on the site can be considered to have little regional or local significance when compared to larger remnants in the area (e.g. state forest reserves). The site does however have some value in supporting species of conservation or other significance to some degree such as the three black cockatoo species and the southern brush-tailed phascogale in an otherwise cleared landscape.

6.2 VALUE OF THE STUDY AREA AS AN ECOLOGICAL LINKAGE/WILDLIFE CORRIDOR

Linkage with adjacent bushland areas has been identified as a natural attribute of high priority in the assessment of a sites regional significance (EPA 2002a, Molloy *et al.* 2009). Two types of linked (or potentially linked) sequences of ecological communities were identified in the EPA's Strategy, vegetated sequences and river corridors. The vegetated sequences are further divided into two groups – those that link North-South predominantly along landforms and vegetation complexes; and those that link East-West across landform and vegetation complexes (EPA 2003a).

The Greater Bunbury Region (GBR) ecological linkages plan (Appendix 4, EPA 2003) and plans produced by Molloy *et al.* (2009) shows the study area as not contributing to any regionally significant linkage. On a more localised scale the site also provides no direct connectivity between any adjoining bush land but does have some value as a “stepping stone” and facilitates to a certain degree the maintenance of ecological processes and the movement of organisms within and across an otherwise totally cleared landscape.

7. POTENTIAL IMPACTS AND MANAGEMENT

7.1 POTENTIAL IMPACTS

The extract extent of any required clearing of fauna habitat has not as yet been defined however the most likely impacts at the site will be related to:

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal by some species of conservation significance; and
- Death or injury of fauna during clearing.

A summary of possible impact on specific species of conservation significance previously recorded in the general area is provided in Table 2 below. Additional information on specific fauna species is provided in Appendix E.

Table 2: Likelihood of Occurrence and Possible Impacts – Fauna Species of Conservation Significance (continues on following pages).

Common Name	Genus & Species	Conservation Status (See Appendix A for codes)	Habitat Present	Likelihood of Occurrence	Possible Impacts
Carter's Freshwater Mussel	*Westralunio carteri*	P4	No	Unlikely	No impact.
Balston's Pygmy Perch	*Nannatherina balstoni*	S1 VU	No	Unlikely. Study area is outside of current known range	No impact.
Perth Lined Lerista	*Lerisita lineata*	P3	No	Unlikely.	No impact.
The Bunbury Skink	*Hemiergis 'koontoolasi'*	P1	No	Unlikely	No Impact.
Southern Carpet Python	*Morelia spilota imbricata*	S4 P4	No	Unlikely	No impact.
Malleefowl	*Leipoa ocellata*	S1, VU, Mig	No	Unlikely - species locally extinct.	No Impact.
Fairy Tern (Australasian)	*Sternula nereis nereis*	VU	No	Unlikely	No impact.
Great Egret	*Ardea alba*	S3 Mig	Yes	Possible	No significant impact likely.
Cattle Egret	*Ardea ibis*	S3 Mig	Yes	Possible	No significant impact likely.
Australasian Bittern	*Botaurus poiciloptilus*	S1 EN	No	Unlikely	No impact.
Little Bittern	*Ixobrychus minutus*	P4	No	Unlikely	No impact.

Common Name	Genus & Species	Conservation Status (See Appendix A for codes)	Habitat Present	Likelihood of Occurrence	Possible Impacts
Black Bittern	*Ixobrychus flavicollis*	P3	No	Unlikely	No impact.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	S3 Mig	No	Unlikely	No impact.
Peregrine Falcon	*Falco peregrinus*	S4	Yes	Possible	No significant impact likely.
Migratory shorebirds	*Various*	Mig	No	Unlikely	No impact.
Carnaby`s Black Cockatoo	*Calyptorhynchus latirostris*	S1 EN	Yes	Known to occur	Loss of some habitat.
Baudin`s Black Cockatoo	*Calyptorhynchus baudinii*	S1 VU	Yes	Known to occur	Loss of some habitat.
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	S1 VU	Yes	Known to occur	Loss of some habitat.
Barking Owl (SW population)	*Ninox connivens connivens*	P2	No	Unlikely	No impact.
Masked Owl (SW population)	*Tyto n. novaehollandiae*	P3	Yes	Possible	Loss of some habitat.
Fork-tailed Swift	*Apus pacificus*	S3 Mig	Yes	Flyover only	No impact.
Rainbow Bee-eater	*Merops ornatus*	S3 Mig	Yes	Possible	No significant impact likely.
Western Whipbird	*Psophodes nigrogularis nigrogularis*	S1, EN	No	Unlikely - species locally extinct.	No Impact.
Chuditch	*Dasyurus geoffroii*	S1 VU	No	Unlikely - species locally extinct.	No Impact.
Southern Brush-tailed Phascogale	*Phascogale tapoatafa ssp*	S1	Yes	Known to occur	Loss of some habitat.
Southern Brown Bandicoot	*Isoodon obesulus fusciventer*	P5	No	Unlikely	No Impact.
Western Ringtail Possum	*Pseudocheirus occidentalis*	S1 VU	No/Marginal	Possible but only rarely	No significant impact likely.
Western Brush Wallaby	*Macropus irma*	P4	No	Unlikely	No Impact.
Quokka	*Setonix brachyurus*	S1 VU	No	Unlikely	No impact.
Western False Pipistrelle	*Falsistrellus mackenziei*	P4	Yes	Possible	Loss/modification of some habitat
Water Rat	*Hydromys chrysogaster*	P4	No	Unlikely	No impact.

7.2 MINIMISING IMPACTS

The following recommendations are provided for guidance for the formulation of management plans that should aim to reduce the impact on fauna and fauna habitat as much as reasonable and practicable. This listing is not exhaustive and management plans and possible offsets for habitat loss will need to be finalised after liaison with relevant regulatory authorities (e.g. DEC and DSEWPaC).

7.2.1 Fauna in General

With respect to minimising the impact on fauna and fauna habitat in general during clearing and construction, it is recommended that:

- A suitably experienced 'fauna spotter' should be onsite when clearing is being undertaken. The 'fauna spotter' is to provide advice and direction to contractors undertaking the clearing in relation to fauna matters.
- Prior to clearing, clearing contractors should be properly inducted by the 'fauna spotter' about the identification and protection of vegetation to be retained, vegetation to be cleared and about the likely presence of fauna among trees and other vegetation that will be cleared.
- During site works areas requiring clearing should be clearly marked and access to other areas restricted to prevent accidental clearing of areas to be retained.
- Trees containing hollows or potential hollows should be felled in a manner that minimises the chance of any fauna species possibly inhabiting the hollows being injured or killed. Hollows should be examined where possible for fauna species prior to the trees removal from the site.
- If contractors encounter injured fauna during clearing operations, then the 'fauna spotter' needs to be notified immediately so that arrangements can be made for the welfare of the injured animal. Native fauna injured during clearing or normal site operations should be taken to a designated veterinary clinic or a DEC nominated wildlife carer.
- No dead, standing or fallen timber should be removed unnecessarily. Logs (hollow or not) and other debris resulting from land clearing should be used to enhance fauna habitat in untouched and rehabilitated areas if possible. Where possible, logs are to be retained either by pushing the logs into the surrounding forest, when significant disturbance to the

forest can be avoided, or the logs cut so that the length of log outside the clearing area remains insitu.

- All staff working on site should be made aware that native fauna is protected. Personnel working on the project should not be allowed to bring firearms, other weapons or pets onsite.

- Any holes, pits or trenches required for services should be kept open for only as long as necessary and suitable escape ramps (45° batter) and bridging provided if the site is to be left unattended for extended periods. Significant sized holes, pits or trenches should be inspected for fauna immediately prior to filling.

7.2.2 Western Ringtail Possum Management

It is considered unlikely that western ringtail possums would be utilising vegetation within the study area under normal circumstance and therefore no specific management plan above those methods employed for fauna in general are considered necessary.

7.2.3 Southern Brush-tailed Phascogale Management

The extent of clearing is as yet not defined so exact impacts on phascogales are difficult to predict. If a high percentage of the existing vegetation will require removal, the implementation of a targeted phascogale trapping and relocation/translocation program should be considered. The viability and effectiveness of this strategy should be discussed with the DEC.

7.2.4 Black Cockatoo Management

Management of impacts on black cockatoos are likely to be the same as already implemented for other stages of mining carried out by Doral in the past which have included the following:

Prior to undertaking clearance of native vegetation, the person taking the action must undertake pre-clearance surveys. The surveys must:

a) Be undertaken by a qualified ecologist with previous experience in surveys of this type;

b) Be conducted in accordance with DSEWPaC Survey guidelines for Australia's threatened bird species (2010) and DSEWPaC Survey Guidelines for Australia's threatened mammal species (2011); and

c) Be undertaken during likely breeding season for black cockatoos (August to November).

8. LEGISLATIVE IMPLICATIONS

8.1 ENVIRONMENTAL PROTECTION ACT 1986

The purpose of the Environmental Protection Act (1986) is "...*to provide for an Environmental Protection Authority, for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection enhancement and management of the environment and for matters incidental to or connected with the foregoing*".

The powers of the Environmental Protection Act 1986 are administered by the Department of Environment and Conservation (DEC), which in relevant cases advises to the Environmental Protection Authority (EPA).

Legislation proclaimed on 8 July 2004 protects all native vegetation in Western Australia. Under the law, clearing native vegetation is prohibited, unless a clearing permit is granted by the DEC, or the clearing is for an exempt purpose. These exemptions ensure that low impact day to day activities involving clearing can be undertaken. People that wish to clear are required to submit an application if an exemption does not apply.

Any future clearing at the site will require a clearing permit, approval of which includes an assessment against the ten clearing principles related to native vegetation in the *EP Act*. These principles provide a guide for when native vegetation should not be cleared. The DEC must consider these principles in making a decision on whether or not to issue a clearing permit. The DEC has set out the minimum requirements and standards for addressing each of the ten principles in detail in its assessment methodology:

Native vegetation should not be cleared if

(a) it comprises a high level of biological diversity;

(b) it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;

(c) it includes, or is necessary for the continued existence of, rare flora;

(d) it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community;

(e) it is significant as a remnant of native vegetation in an area that has been extensively cleared;

(f) it is growing in, or in association with, an environment associated with a watercourse or wetland;

(g) the clearing of the vegetation is likely to cause appreciable land degradation;

(h) the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;

(i) the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or

(j) clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

One purpose of the assessment reported on here is to provide information relevant to principle (a) & (b).

Native vegetation should not be cleared if it comprises a high level of biological diversity

The results of the desktop study and based on fauna habitats present at the site, it is estimated that up to 118 native fauna species have the potential or are likely to utilise the study for some purpose at times. Thirty six (~28%) of the predicted native species were observed within the study area during the daytime and night time site reconnaissance surveys.

With respect to fauna alone the site probably does not qualify as having a high level of biodiversity as the predicted species list is relatively low and most likely an overestimation, with the number of species actually present being be much lower than this figure. Based on this it is considered unlikely to be considered in variance to this principle by the DEC.

The number of fauna species potentially using the site is constrained by the limited number habitats present at the site (mainly parkland jarrah and marri woodland and open paddocks) and there is a lack of diversity with respect to microhabitats fallen hollow logs and dense leaf litter. The assessment of this criterion by the DEC also needs to take into account plant community and flora diversity which are beyond the scope of this fauna report.

Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia

The study area contains habitat that is used or is potentially used for some purpose by an estimated eleven fauna species of conservation significance (state or federally listed threatened, migratory or DEC priority species). Four species (three species of black cockatoos and the southern brush-tailed phascogale) were confirmed as using the site. The use of the site by these species facts suggest that clearing of the site may be in variance to this principle though the extent of vegetation to be cleared is as yet not defined and all is highly degraded, factors which may lessen the significance of this criteria in the DEC decision making process.

The DEC will need to consider all available information relating to all 10 clearing principles including those relating to fauna. The demonstrated use of the study area by several species of conservation significance and the potential presence of several others will influence the DEC decision making process. It is however difficult to predict a specific outcome in this case as some discretion is exercised by the DEC when assessing specific projects, and decisions are made on a case by case basis. The results of any vegetation and flora surveys and any proposed offsets that may be provided by the proponent will also be taken into consideration.

8.2 COMMONWEALTH ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT 1999

A number of fauna species known to or potentially present within the study area are listed under the federal *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. The objective of the *EPBC Act* is to provide for the protection of the environment, especially those aspects that are of national significance, promote ecologically sustainable development, the conservation of biodiversity and a cooperative approach to the protection and management of the environment.

EPBC Act listed threatened fauna species (or their habitat) identified as being present in the study area were:

- *Pseudocheirus occidentalis* Western Ringtail Possum - Vulnerable
- *Calyptorhynchus latirostris* Carnaby's Black Cockatoo – Endangered
- *Calyptorhynchus baudinii* Baudin's Black Cockatoo – Vulnerable

- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo – *Vulnerable*

EPBC Act listed migratory fauna species identified as possibly using the study area were:

- *Ardea alba* Great Egret – Migratory
- *Ardea ibis* Cattle Egret – Migratory
- *Merops ornatus* Rainbow Bee-eater – Migratory

The following *EPBC Act* listed threatened/migratory fauna species (or their habitat) were determined during the fauna assessment not to be present in the study area despite appearing in database searches. Their exclusion from the potential species list is primarily justified by an obvious lack of suitable habitat or known local extinction. It is also very unlikely that vegetation at the site represents habitat critical for the recovery of the respective threatened species in the area. These species will not be discussed further:

- *Nannatherina balstoni* Balston's Pygmy Perch – Vulnerable
- *Leipoa ocellata* Malleefowl – Vulnerable
- *Sternula nereis nereis* Fairy Tern (Australasian) – Vulnerable
- *Botaurus poiciloptilus* Australasian Bittern – Endangered
- *Haliaeetus leucogaster* White-bellied Sea-Eagle – Migratory
- *Apus pacificus* Fork-tailed Swift – Migratory
- *Psophodes nigrogularis nigrogularis* Western Whipbird– Endangered
- *Dasyurus geoffroii* Chuditch - Vulnerable
- *Setonix brachyurus* Quokka – Vulnerable

If an action (i.e. the potential need to clear sections the site) is deemed to have a potential "significant impact" on listed species a referral to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) is required to ensure compliance with the *EPBC Act*. Currently, for the species

in question, "significant impact" is defined within one or more of the following four documents, these being:

- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Background Paper to the *EPBC Act* Policy Statement 3.10 – Nationally Threatened Species and Ecological Communities. "Significant Impact Guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia".

- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009a). *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* Policy Statement 3.10 "Significant Impact Guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia; and

- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009b). Matters of National Environmental Significance. Significant Impact Guidelines 1.1, EPBC Act 1999.

- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012a). EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

An assessment of significant impact on federally listed threatened fauna species and the possible need to refer the project to DSEWPaC using criteria within the abovementioned documents are provided below.

8.2.1 WESTERN RINGTAIL POSSUMS

Western ringtail possums have been listed as a potential species for the site but the habitat present is very marginal in quality for this species and it is anticipated only to occur on rare occasions as transient individuals, given the known use of better quality habitat in nearby areas.

It has therefore been concluded that clearing at the site at any scale will not have any likely significant impact on WRPs (habitat, individuals or populations) and therefore no specific referral to DSEWPaC relating to WRPs is considered necessary.

8.2.2 BLACK COCKATOOS

The recently released DSEWPaC document titled "EPBC Act referral guidelines for three threatened black cockatoo species" (DSEWPaC 2012a) summarises what scale of actions would be considered likely to have a significant impact on listed endangered and vulnerable fauna species.

The following points provide general guidance on what, in DSEWPaC's view, may be at high and low risk of requiring a referral to ensure compliance with the *EPBC Act* as well as providing some guidance on uncertainty.

Actions that have a high risk of significant impacts

- Clearing of any known nesting tree.
- Clearing or degradation of any part of a vegetation community known to contain breeding habitat.
- Clearing of more than 1 ha of quality foraging habitat.
- Clearing or degradation (including pruning the top canopy) of a known night roosting site.
- Creating a gap of greater than 4 km between patches of black cockatoo habitat (breeding, foraging or roosting).

Actions that have and uncertain risk of significant impacts

- Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.
- Clearing or disturbance in areas surrounding black cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire.
- Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.
- Actions with the potential to introduce known plant diseases such as Phytophthora spp. to an area where the pathogen was not previously known.

Actions that have a low risk of significant impacts

- Actions that do not affect black cockatoo habitat or individuals.
- Actions whose impacts occur outside the modelled distribution of the three black cockatoos

As detailed in *Section 5.2.4*, 472 trees with a DBH of greater than 50cm were identified within the study area. All these trees, by DSEWPaCs definition of the term, are potential black cockatoo breeding habitat (i.e. DBH >50cm). The "clearing or degradation of any part of a vegetation community known to contain breeding habitat" has the potential to be deemed by DSEWPaC as having a "high risk of significant impacts". The study area also contains black cockatoo foraging habitat. The removal or degradation of more than 1.0ha of this vegetation will also be seen by DSEWPaC as having "high risk of significant impacts".

While the exact extent of clearing has as yet not been defined it is likely that vegetation removal at any scale will be regarded by DSEWPaC as having a high risk of significant impact for one reason or other. It is therefore recommended that a referral detailing the proposed action (clearing) be submitted to DSEWPaC to ensure compliance with the *EPBC Act* with respect to impacts on black cockatoos.

8.2.3 LISTED MIGRATORY SPECIES

The DSEWPaC document titled "Matters of National Environmental Significance. Significant Impact Guidelines 1.1, *EPBC Act* 1999 (DEWHA 2009b) summarises what scale of actions would be considered likely to have a significant impact on listed migratory species.

Within this document an action has, will have, or is likely to have a significant impact on migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or
- result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species; or

- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- habitat that is of critical importance to the species at particular life-cycle stages;
- habitat utilised by a migratory species which is at the limit of the species range; or
- habitat within an area where the species is declining.

To have a significant impact on a migratory species as defined under the DSEWPaC Significant Impact Guidelines (DEWHA 2009b) any proposed development would need to trigger at least one of the abovementioned significant impact criteria thresholds.

It is considered extremely unlikely that any of these thresholds relating to migratory species will be compromised by development at the site at any scale. The habitat within the study area likely to be used by migratory species does not represent “important habitat” and the number of individuals utilising the study area at any time would not, under any circumstances, represent “an ecologically significant proportion of the population” of any of the migratory species considered likely to utilise the study area.

9. CONCLUSION & RECOMMENDATIONS

The fauna assessment within the study area was undertaken for the purposes of categorising the fauna assemblages and identifying fauna habitats present. Targeted searches for western ringtail possums, southern brush-tailed phascogales and black cockatoo habitat were also carried out.

With respect to native vertebrate fauna, 13 mammals (includes nine bat species), 79 bird, 16 reptile, eight frog and two fish species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the study area at times.

Of the 118 native animals that are listed as potentially occurring in the area, six are considered to be endangered/vulnerable or in need of special protection under State and/or Federal law. In addition, three migratory species and two DEC priority species also may frequent the area at times.

A series of recommendations aimed at mitigating and minimising potential impacts on fauna and fauna habitat in general and specific management of impacts with respect to black cockatoos are provided in Section 7.2. Subject to the proposal gaining final approval; from regulatory authorities, these recommendations should be implemented as part of any proposed management plans where considered reasonable and practicable.

Constraints on proposed clearing within the study area will largely be centred on the presence of habitat used or potentially used by threatened fauna species in particular those listed under the EPBC Act, namely all three species of black cockatoo, habitat of which were confirmed as being present within the study area. The potential impact on these fauna values will be taken into consideration during the state and federal approval process.

Given the potential impacts clearing of sections of the site may have on fauna species listed under the *EPBC Act*, it is recommended that a referral to DSEWPaC be made once specific mining plans are further advanced.

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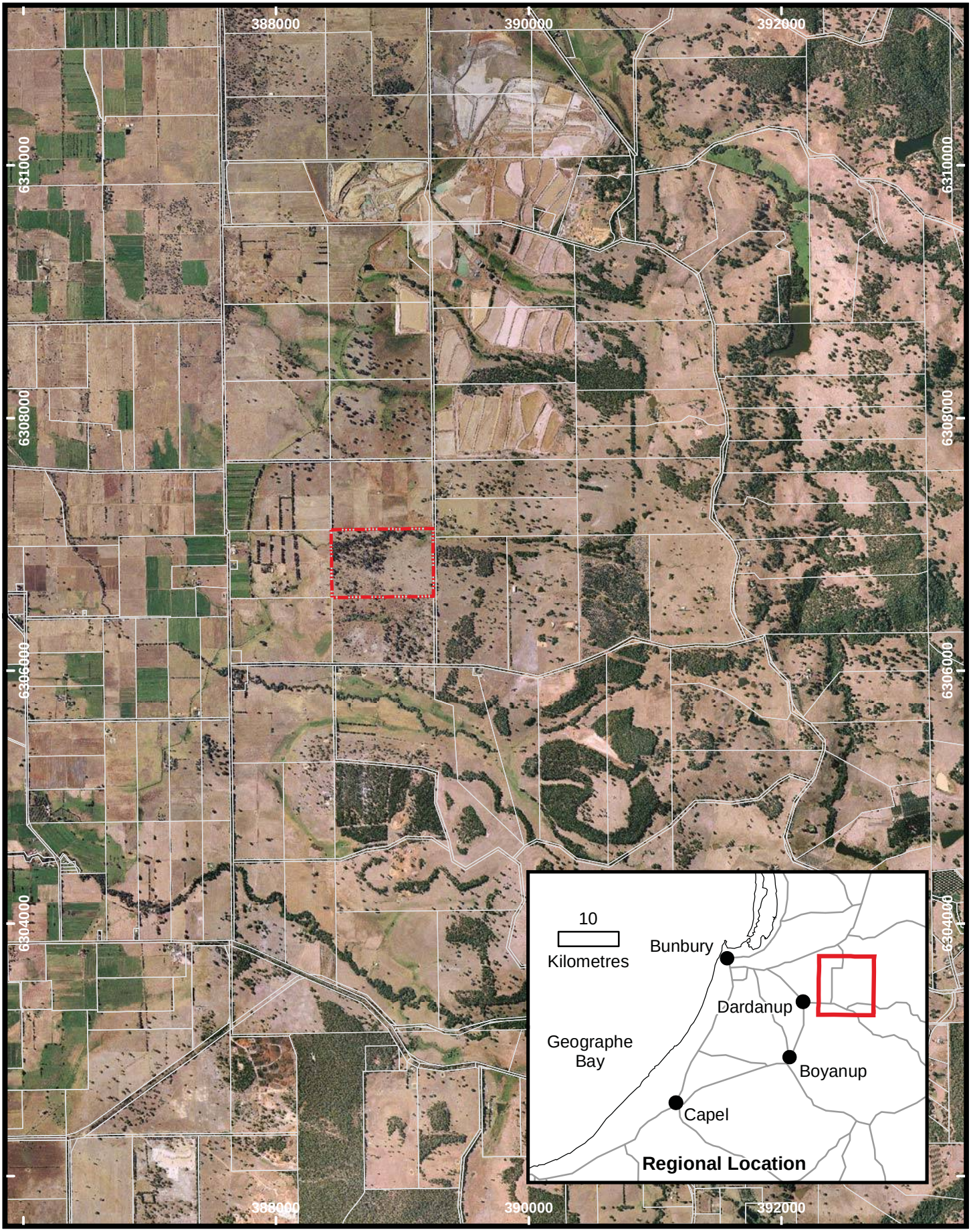
FIGURES



Legend

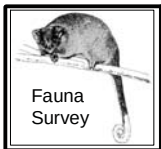
- Lot 110 Boundary
- Cadastral Boundaries (Existing)

N

0 0.5 1 1.5 2

Kilometres

MGA Zone 50



DRAWN: G Harewood

DATE : Oct 2012

SCALE: 1:40,000

Lot 110 Simpson Road
Dardanup

Study Area and Surrounds

Figure: 1

Legend

Lot 110 Boundary

0 40 80 120 160 200

Metres

MGA Zone 50

DRAWN:G Harewood

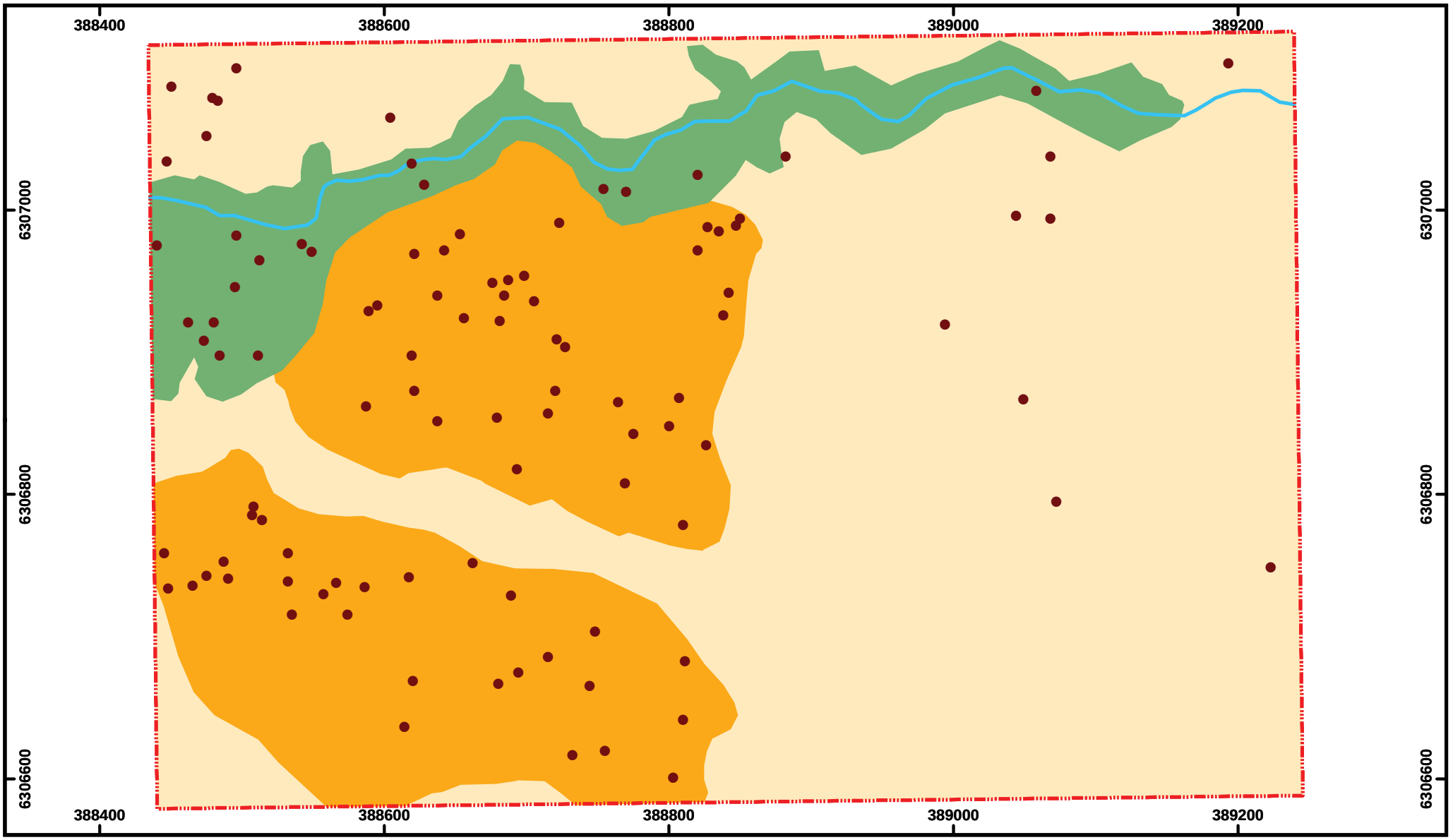
DATE : Oct 2012

SCALE: 1:3,750

Lot 110 Simpson Road
Dardanup

Study Area
Air Photo

Figure: 2



Legend

- Lot 110 Boundary
- Parkland Cleared - Marri, Jarrah and Flooded Gum Woodland
- Parkland Cleared - Marri and Jarrah Woodland over *Xanthorrhoea preissii*
- Cleared - Grassland with widely scattered trees
- Unnamed Ephemeral Creek
- Tree with one or more hollows

0 40 80 120 160 200
Metres

DRAWN:G Harewood
DATE : Oct 2012
SCALE: 1:3,750
MGA Zone 50

Lot 110 Simpson Road
Dardanup

Fauna Habitats

Figure: 3

Legend

- Lot 110 Boundary
- Common Brushtail Possum
- Southern Brush-tailed Phascogale

0 40 80 120 160 200

Metres

MGA Zone 50

DRAWN:G Harewood

DATE : Oct 2012

SCALE: 1:3,750

Lot 110 Simpson Road Dardanup

Nocturnal Observations 3 October 2012

Figure: 4

Legend

- Lot 110 Boundary
- Tree >50cm DBH, no hollows seen
- Tree >50cm DBH, one or more hollows seen
- Tree >50cm DBH, one or more hollows possibly suitable for a Black Cockatoo

0 40 80 120 160 200

Metres

MGA Zone 50

Fauna Survey

DRAWN:G Harewood

DATE : Oct 2012

SCALE: 1:3,750

Lot 110 Simpson Road Dardanup

Habitat Trees (DBH >50cm)

Figure: 5

PLATES

Plate 1: Parkland Cleared Open Woodland of Marri, Jarrah and Flooded Gum over Grassland of introduced species bordering ephemeral creek.

Plate 2: Parkland Cleared Open Woodland of Marri and Jarrah and over a very open shrubland of *Xanthorrhoea preissii* over a Grassland of introduced species.

Plate 3: Parkland Cleared Open Woodland of Marri and Jarrah and over a very open shrubland of Xanthorrhoea preissii over a Grassland of introduced species.

Plate 4: Ephemeral creek.

Plate 5: Totally Cleared (Pasture)

APPENDIX A

CONSERVATION CATEGORIES

EPBC Act (1999) Threatened Fauna Categories

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the EPBC Act

Note: Only species in those categories marked with an asterix are matters of national environmental significance under the *EPBC Act*.

Western Australian Wildlife Conservation Act (1950) Threatened Fauna Categories

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct Threatened fauna (Schedule 1) are further ranked by the DEC according to their level of threat using IUCN Red List criteria: **CR: Critically Endangered** - considered to be facing an extremely high risk of extinction in the wild. **EN: Endangered** - considered to be facing a very high risk of extinction in the wild. **VU: Vulnerable** - considered to be facing a high risk of extinction in the wild.
Schedule 2	S2	Fauna which is presumed extinct
Schedule 3	S3	Birds which are subject to an agreement between the governments of Australia and Japan (JAMBA) relating to the protection of migratory birds and birds in danger of extinction
Schedule 4	S4	Fauna that is otherwise in need of special protection

Western Australian DEC Priority Fauna Categories

Category	Code	Description
Priority 1	P1	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes..
Priority 2	P2	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
Priority 3	P3	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
Priority 4	P4	(a) **Rare**. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) **Near Threatened**. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Priority 5	P5	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

IUCN Red List Threatened Species Categories

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A full list of categories and their meanings are available at:

http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

APPENDIX B

FAUNA OBSERVED OR POTENTIALLY IN STUDY AREA

Fauna Observed or Potentially in Study Area

Lot 110 Simpson Road, Dardanup, W.A.

Approx. centroid = -33.37184°S and 115.80516°E
Compiled by Greg Harewood - Oct 2012
Recorded (Captured/Sighted/Heard/Signs) = X

A = Harewood, G (2012). Fauna Assessment of Lot 110 Simpson Road, Dardanup. Unpublished report for Doral Mineral Sands Pty Ltd.
B= EPA (2008). Advice on areas of conservation significance in the Preston Industrial Park. Bulletin 1282 March 2008. List of vertebrate species recorded from Investigation Areas - Appendix 5
C= Harewood, G. (2010). Fauna Survey (Level 2). Kemerton Industrial Core. Unpublished report for Cardno (WA) Pty Ltd.
D = ENV Australia (2007). Edith Cowan University South West Campus, Bunbury, Fauna Assessment (Level 2). Unpublished report for ECU.
E = Harewood, G. (2008). Fauna Assessment Survey (Level 2), Lot 187, Stratham. Unpublished report for MBS Environmental.
F = ENV Australia (2004). North Boyanup District Structure Plan. Unpublished report for the DPI. (Level 1 survey results - G Harewood)
G = HGM (2002). Natural Values of 12 Sites of the Greater Bunbury Region Scheme. Tasks 1, 2 and 3. Unpublished report for WAPC (Muddy Lakes Fauna Survey (Level 2) results).
H = DEC (2012). NatureMap Database search. “By Circle” 115°48' 19" E, 33°22' 18" S – Study area (plus 5km buffer). 20 September 2012.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Osteichthyes										
Basses and Cods										
Bostockia porosa	Nightfish									
Poeciliidae Livebearers										
Gambusia holbrooki	Mosquito Fish	Introduced								
Pygmy Perches										
Edelia vittata	Western Pygmy Perch									

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Amphibia										
Myobatrachidae Ground or Burrowing Frogs										
Crinia georgiana	Quacking Frog	LC		X						X
Crinia glauerti	Clicking Frog	LC	X	X				X	X	X
Crinia insignifera	Squelching Froglet	LC		X	X	X	X			X
Geocrinia leai	Ticking Frog	LC	X						X	
Heleioporus eyrei	Moaning Frog	LC		X	X		X			X
Limnodynastes dorsalis	Western Banjo Frog	LC			X	X	X		X	X
Hylidae Tree or Water-Holding Frogs										
Litoria adelaidensis	Slender Tree Frog	LC	X	X	X	X	X		X	X
Litoria moorei	Motorbike Frog	LC		X	X		X		X	X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Reptilia										
Cheluidae Side-necked Freshwater Turtles										
Chelodina oblonga	Oblong Turtle	LC						X		X
Gekkonidae Geckoes										
Christinus marmoratus	Marbled Gecko			X	X	X	X		X	X
Varanidae Monitor's or Goanna's										
Varanus gouldii	Sand Monitor				X		X	X		
Varanus rosenbergi	Heath Monitor			X	X					

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Scincidae Skinks										
Acritoscincus trilineatum	Southwestern Cool Skink			X	X	X			X	
Cryptoblepharus buchananii	Fence Skink		X	X	X	X	X			
Egernia kingii	King's Skink					X	X		X	X
Egernia napoleonis	Salmon-bellied Skink			X	X	X	X		X	
Hemiergis peronii tridactyla	Three-toed Earless Skink									
Hemiergis quadrilineata	Three-toed Mulch Skink				X	X	X			X
Lerista elegans	West Coast Four-toed Lerista				X		X			
Menetia greyii	Dwarf Skink			X	X		X			X
Morethia lineoocellata	West Coast Pale-flecked Morethia				X	X	X			X
Tiliqua rugosa	Bobtail			X	X	X	X	X	X	

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Elapidae Elapid Snakes										
Notechis scutatus	Tiger Snake				X		X	X	X	
Pseudonaja affinis	Dugite			X	X		X	X	X	X
Aves										
Phasianidae Quails, Pheasants										
Coturnix pectoralis	Stubble Quail	LC						X		X
Anatidae Geese, Swans, Ducks										
Anas gracilis	Grey Teal	LC		X				X	X	X
Anas superciliosa	Pacific Black Duck	LC	X	X				X	X	X
Chenonetta jubata	Australian Wood Duck	LC	X	X	X			X	X	X
Tadorna tadornoides	Australian Shelduck	LC		X				X	X	X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Ardeidae Herons, Egrets, Bitterns										
Ardea alba	Great Egret	S3 Mig CA JA						X		
Ardea ibis	Cattle Egret	S3 Mig CA JA								
Ardea novaehollandiae	White-faced Heron	LC	X	X	X			X	X	
Ardea pacifica	White-necked Heron	LC						X	X	X
Threskiornithidae Iibises, Spoonbills										
Threskiornis molucca	Australian White Ibis	LC	X	X	X			X	X	X
Threskiornis spinicollis	Straw-necked Ibis	LC		X	X			X		X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Accipitridae Kites, Goshawks, Eagles, Harriers										
Accipiter cirrocephalus	Collared Sparrowhawk	Bp LC		X						X
Accipiter fasciatus	Brown Goshawk	Bp LC		X	X	X	X	X		
Aquila audax	Wedge-tailed Eagle	Bp LC	X	X	X		X	X		X
Aquila morphnoides	Little Eagle	Bp LC		X						
Circus approximans	Swamp Harrier	LC			X			X	X	X
Elanus caeruleus	Black-shouldered Kite	LC		X	X				X	
Haliastur sphenurus	Whistling Kite	Bp LC			X	X	X	X	X	X
Hamirostra isura	Square-tailed Kite	Bp LC			X					

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Falconidae Falcons										
Falco berigora	Brown Falcon	Bp LC								X
Falco cenchroides	Australian Kestrel	LC	X	X	X		X	X		X
Falco longipennis	Australian Hobby	LC					X		X	X
Falco peregrinus	Peregrine Falcon	S4 Bp LC								X
Columbidae Pigeons, Doves										
Columba livia	Domestic Pigeon	Introduced								
Ocyphaps lophotes	Crested Pigeon	LC		X	X			X	X	X
Phaps chalcoptera	Common Bronzewing	Bh LC		X	X	X	X	X	X	X
Streptopelia senegalensis	Laughing Turtle-Dove	Introduced		X		X		X		X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Psittacidae Parrots										
Cacatua roseicapilla	Galah	LC	X	x	X	X	X		X	
Cacatua sanguinea	Little Corella	LC	X	X	X	X				
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	S1 VU Be VU LC	X	X	X		X			X
Calyptorhynchus baudinii	Baudin's Black Cockatoo	S1 VU Bp VU C2a(ii)	X	X	X					X
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	S1 EN Bp EN A2bcd+3bcd	X	X	X	X	X			X
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC							X	
Neophema elegans	Elegant Parrot	LC		X	X			X		X
Platycercus icterotis icterotis	Western Rosella (western ssp)	Bp LC		X		X		X	X	
Platycercus spurius	Red-capped Parrot	LC	X	X	X	X	X	X	X	
Platycercus zonarius	Australian Ringneck	LC	X	X	X	X	X	X	X	

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Polytelis anthopeplus	Regent Parrot	LC			X	X	X	X	X	
Cuculidae Parasitic Cuckoos										
Cacomantis flabelliformis	Fan-tailed Cuckoo	LC		X			X		X	X
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC		X					X	
Chrysococcyx lucidus	Shining Bronze Cuckoo	LC		X	X				X	X
Cuculus pallidus	Pallid Cuckoo	LC							X	
Strigidae Hawk Owls										
Ninox novaeseelandiae	Boobook Owl	LC	X		X					X
Tytonidae Barn Owls										
Tyto alba	Barn Owl	LC	X							
Tyto n. novaehollandiae	Masked Owl (SW pop)	P3 Bp								

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Podargidae Frogmouths										
Podargus strigoides	Tawny Frogmouth	LC			X			X		X
Aegothelidae Owlet-nightjars										
Aegotheles cristatus	Australian Owlet-nightjar	LC								X
Halcyonidae Tree Kingfishers										
Dacelo novaeguineae	Laughing Kookaburra	Introduced	X	X	X	X	X	X	X	X
Todiramphus sanctus	Sacred Kingfisher	LC	X	X	X	X		X	X	X
Meropidae Bee-eaters										
Merops ornatus	Rainbow Bee-eater	S3 Mig JA LC		X	X		X	X	X	X
Maluridae Fairy Wrens, GrassWrens										
Malurus splendens	Splendid Fairy-wren	Bh LC	X	X	X	X	X	X	X	X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces										
Acanthiza apicalis	Broad-tailed Thornbill	Bh LC		X	X	X	X	X	X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Bh LC	X		X	X	X	X	X	X
Gerygone fusca	Western Gerygone	LC	X	X	X	X	X	X	X	X
Smicrornis brevirostris	Weebill	Bh LC		X	X	X	X		X	
Pardalotidae Pardalotes										
Pardalotus punctatus	Spotted Pardalote	LC		X						X
Pardalotus striatus	Striated Pardalote	LC	X	X	X	X	X	X	X	X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Meliphagidae Honeyeaters, Chats										
Anthochaera carunculata	Red Wattlebird	LC	X	X	X	X	X	X	X	X
Lichenostomus virescens	Singing Honeyeater	LC				X				
Lichmera indistincta	Brown Honeyeater	LC		X	X	X		X	X	X
Melithreptus chloropsis	Western White-naped Honeyeater	Bp LC				X				
Phylidonyris novaehollandiae	New Holland Honeyeater	Bp LC		X	X	X			X	X
Petroicidae Australian Robins										
Petroica multicolor	Scarlet Robin	Bh LC		X	X	X	X	X		
Neosittidae Sitellas										
Daphoenositta chrysoptera	Varied Sittella	Bh LC							X	X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers										
Pachycephala pectoralis	Golden Whistler	Bh LC		X	X	X	X	X	X	X
Pachycephala rufiventris	Rufous Whistler	LC	X	X		X	X		X	X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo										
Grallina cyanoleuca	Magpie-lark	LC	X	X	X	X	X	X	X	X
Rhipidura fuliginosa	Grey Fantail	LC		X	X	X	X	X	X	X
Rhipidura leucophrys	Willie Wagtail	LC	X	X	X	X	X	X	X	X
Campephagidae Cuckoo-shrikes, Trillers										
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC	X	X	X	X	X	X	X	X
Lalage tricolor	White-winged Triller	LC		X				X	X	

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Artamidae Woodswallows, Butcherbirds, Currawongs										
Artamus cinereus	Black-faced Woodswallow	Bp LC	X	X	X		X	X	X	X
Artamus cyanopterus	Dusky Woodswallow	Bp LC		X						X
Cracticidae Currawongs, Magpies & Butcherbirds										
Cracticus tibicen	Australian Magpie	LC	X	X	X	X	X	X	X	X
Cracticus torquatus	Grey Butcherbird	LC	X	X	X	X	X	X	X	X
Corvidae Ravens, Crows										
Corvus coronoides	Australian Raven	LC	X	X	X	X	X	X	X	X
Motacillidae Old World Pipits, Wagtails										
Anthus australis	Australian Pipit	LC		X	X					

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Hirundinidae Swallows, Martins										
Hirundo neoxena	Welcome Swallow	LC	X	X	X	X	X	X	X	X
Hirundo nigricans	Tree Martin	LC		X	X	X	X	X	X	
Sylviidae Old World Warblers										
Cincloramphus cruralis	Brown Songlark	LC								
Cincloramphus mathewsi	Rufous Songlark	LC								
Zosteropidae White-eyes										
Zosterops lateralis	Grey-breasted White-eye	LC		X	X	X	X		X	X

Mammalia

Dasyuridae Carnivorous Marsupials										
Phascogale tapoatafa ssp	Southern Brush-tailed Phascogale	S1 VU LC/NT	X		X		X			X

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Phalangeridae Brushtail Possums, Cuscuses										
Trichosurus vulpecula vulpecula	Common Brushtail Possum	LC	X	X	X	X	X	X		
Pseudocheiridae Ringtail Posssums										
Pseudocheirus occidentalis	Western Ringtail Possum	S1 VU VU C2a		X	X	X	X	X	X	X
Macropodidae Kangaroos, Wallabies										
Macropus fuliginosus	Western Grey Kangaroo	LC		X	X	X	X	X	X	X
Molossidae Freetail Bats										
Mormopterus planiceps	Southern Freetail-bat	LC			X					
Tadarida australis	White-striped Freetail-bat	LC			X				X	

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Vespertilionidae Ordinary Bats										
Chalinolobus gouldii	Gould's Wattled Bat	LC			X		X			
Chalinolobus morio	Chocolate Wattled Bat	LC			X					
Falsistrellus mackenziei	Western False Pipistrelle	P4 VU A2c			X		X			
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC			X		X			
Nyctophilus gouldi	Gould's Long-eared Bat	LC					X			
Nyctophilus major	Western Long-eared Bat	LC			X					
Vespadelus regulus	Southern Forest Bat	LC			X		X			
Muridae Rats, Mice										
Mus musculus	House Mouse	Introduced				X			X	
Rattus rattus	Black Rat	Introduced				X	X	X	X	

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Canidae Dogs, Foxes										
Vulpes vulpes	Red Fox	Introduced			X	X	X	X		
Felidae Cats										
Felis catus	Cat	Introduced			X	X	X			
Leporidae Rabbits, Hares										
Oryctolagus cuniculus	Rabbit	Introduced			X	X	X	X		

WC Act Status - S1 to S4, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P5, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

APPENDIX C

DEC & EPBC DATABASE SEARCH RESULTS

NatureMap - Dardanup - Invertebrates

Created By Greg Harewood on 20/09/2012

Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Invertebrates
Method	'By Circle'
Centre	115°48' 19" E,33°22' 18" S
Buffer	10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		P4	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap - Dardanup - Frogs

Created By Greg Harewood on 20/09/2012

Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Amphibians
Method	'By Circle'
Centre	115°48' 19" E,33°22' 18" S
Buffer	10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	25398	*Crinia georgiana (Quacking Frog)*			
2.	25399	*Crinia glauerti (Clicking Frog)*			
3.	25400	*Crinia insignifera (Squelching Froglet)*			
4.	25410	*Heleioporus eyrei (Moaning Frog)*			
5.	25411	*Heleioporus inornatus (Whooping Frog)*			
6.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
7.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
8.	25388	*Litoria moorei (Motorbike Frog)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap - Dardanup - Reptiles

Created By Greg Harewood on 20/09/2012

Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Reptiles
Method	'By Circle'
Centre	115°48' 19" E,33°22' 18" S
Buffer	10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	25337	*Chelodina oblonga (Oblong Turtle)*			
2.	24980	*Christinus marmoratus (Marbled Gecko)*			
3.	25047	*Ctenotus impar*			
4.	25096	*Egernia kingii (King's Skink)*			
5.	25119	*Hemiergis quadrilineata*			
6.	25184	*Menetia greyii*			
7.	25191	*Morethia lineoocellata*			
8.	30941	*Nephrurus milii (Barking Gecko)*			
9.	25253	*Parasuta gouldii*			
10.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
11.	25285	*Ramphotyphlops pinguis*			
12.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap - Dardanup - Birds

Created By Greg Harewood on 20/09/2012

Current Names Only Yes
Core Datasets Only Yes
Species Group Birds
Method 'By Circle'
Centre 115°48' 19" E,33°22' 18" S
Buffer 10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24262	*Acanthiza inornata (Western Thornbill)*			
4.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
5.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
6.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
7.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
8.	24310	*Anas castanea (Chestnut Teal)*			
9.	24312	*Anas gracilis (Grey Teal)*			
10.	24313	*Anas platyrhynchos (Mallard)*			
11.	24315	*Anas rhynchotis (Australasian Shoveler)*			
12.	24316	*Anas superciliosa (Pacific Black Duck)*			
13.	24561	*Anthochaera carunculata (Red Wattlebird)*			
14.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
15.	24285	*Aquila audax (Wedge-tailed Eagle)*			
16.	24341	*Ardea pacifica (White-necked Heron)*			
17.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
18.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
19.	24318	*Aythya australis (Hardhead)*			
20.	24319	*Biziura lobata (Musk Duck)*			
21.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
22.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
23.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
24.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
25.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo))*		T	
26.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo))*		T	
27.	24321	*Chenonetta jubata (Australian Wood Duck)*			
28.	24432	*Chrysococcyx lucidus subsp. plagosus*			
29.	24288	*Circus approximans (Swamp Harrier)*			
30.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
31.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
32.	25592	*Corvus coronoides (Australian Raven)*			
33.	24671	*Coturnix pectoralis (Stubble Quail)*			
34.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
35.	25595	*Cracticus tibicen (Australian Magpie)*			
36.	25596	*Cracticus torquatus (Grey Butcherbird)*			
37.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*			
38.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
39.	24470	*Dromaius novaehollandiae (Emu)*			
40.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
41.	25621	*Falco berigora (Brown Falcon)*			
42.	25622	*Falco cenchroides (Australian Kestrel)*			
43.	24472	*Falco cenchroides subsp. cenchroides*			
44.	25623	*Falco longipennis (Australian Hobby)*			
45.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
46.	25727	*Fulica atra (Eurasian Coot)*			
47.	24765	*Gallirallus philippensis subsp. mellori*			
48.	25530	*Gerygone fusca (Western Gerygone)*			
49.	24443	*Grallina cyanoleuca (Magpie-lark)*			
50.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
51.	24295	*Haliastur sphenurus (Whistling Kite)*			
52.	24491	*Hirundo neoxena (Welcome Swallow)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
53.	25661	*Lichmera indistincta (Brown Honeyeater)*			
54.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
55.	25654	*Malurus splendens (Splendid Fairy-wren)*			
56.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
57.	25610	*Myiagra inquieta (Restless Flycatcher)*			
58.	24738	*Neophema elegans (Elegant Parrot)*			
59.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
60.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
61.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
62.	25679	*Pachycephala pectoralis (Golden Whistler)*			
63.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
64.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
65.	25682	*Pardalotus striatus (Striated Pardalote)*			
66.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
67.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
68.	25699	*Phalacrocorax varius (Pied Cormorant)*			
69.	24409	*Phaps chalcoptera (Common Bronzewing)*			
70.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
71.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
72.	25720	*Platycercus icterotis (Western Rosella)*			
73.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
74.	25703	*Podargus strigoides (Tawny Frogmouth)*			
75.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
76.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
77.	24771	*Porzana tabuensis (Spotless Crake)*			
78.	25613	*Rhipidura fuliginosa (Grey Fantail)*			
79.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
80.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
81.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*			
82.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
83.	24331	*Tadorna tadornoides (Australian Shelduck)*			
84.	24844	*Threskiornis molucca (Australian White Ibis)*			
85.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
86.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
87.	24309	*Todiramphus sanctus subsp. sanctus*			
88.	24386	*Vanellus tricolor (Banded Lapwing)*			
89.	25765	*Zosterops lateralis (Grey-breasted White-eye)*			
90.	24856	*Zosterops lateralis subsp. gouldi*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap - Dardanup - Mammals

Created By Greg Harewood on 20/09/2012

Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Mammals
Method	'By Circle'
Centre	115°48' 19" E,33°22' 18" S
Buffer	10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24086	*Cercartetus concinnus (Western Pygmy-possum)*			
2.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
3.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
4.	24099	*Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale, Wambenger)*		T	
5.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum)*		T	
6.	24145	*Setonix brachyurus (Quokka)*		T	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

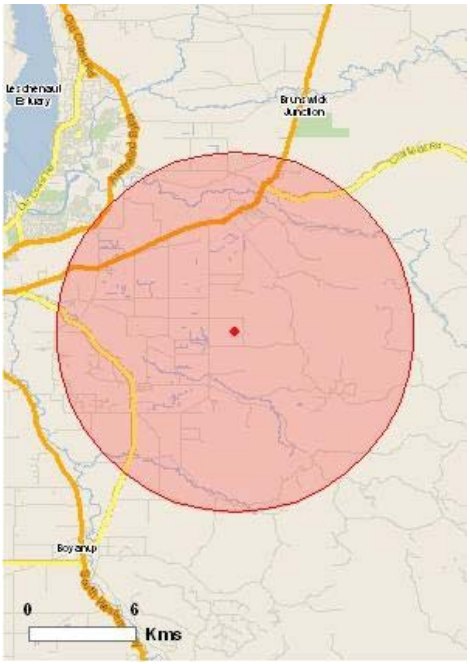
EPBC Act Protected Matters Report

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

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

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

Report created: 19/09/12 21:11:40



Coordinates
Buffer: 10.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	24
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

Place on the RNE:	5
State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	14
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Claypans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding likely to occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Fairy Tern (Australian) [82950]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum [25911]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia winfieldii Majestic Spider-orchid [64504]	Endangered	Species or species habitat may occur within area
Centrolepis caespitosa [6393]	Endangered	Species or species habitat likely to occur within area
Chamelaucium sp. C Coast Plain (R.D.Royce 4872) Royce's Waxflower [82023]	Vulnerable	Species or species habitat may occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat may occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D.Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Dardanup Management Priority Area	WA	Indicative Place
Lennard Management Priority Area	WA	Indicative Place
Lower Brunswick, Collie and Wellesley Rivers	WA	Indicative Place
South West Irrigation Area	WA	Indicative Place
Historic		
Dardanup Park Homestead	WA	Indicative Place

State and Territory Reserves

[Resource Information]

Name	State
Dardanup	WA
Unnamed WA46108	WA
Wellington	WA

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species

[Resource Information]

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

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Coordinates

-33.37184 115.80516

Caveat

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

- migratory and
- marine

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

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

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

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

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

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

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

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

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APPENDIX D

HABITAT TREE DETAILS

Habitat Trees
Datum - GDA 94

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001	50H	389193	6307103	Dead Unknown	20+	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt002	50H	389164	6307096	Dead Unknown	15-20	0											No Signs	No Signs	No	
wpt003	50H	389163	6307081	Marri	20+	0											No Signs	No Signs	No	
wpt004	50H	389147	6307070	Marri	20+	0											No Signs	No Signs	No	
wpt005	50H	389145	6307071	Marri	20+	0											No Signs	No Signs	No	
wpt006	50H	389139	6307071	Marri	20+	0											No Signs	No Signs	No	
wpt007	50H	389135	6307075	Marri	20+	0											No Signs	No Signs	No	
wpt008	50H	389129	6307079	Marri	20+	0											No Signs	No Signs	No	
wpt009	50H	389125	6307085	Marri	20+	0											No Signs	No Signs	No	
wpt010	50H	389122	6307084	Marri	20+	0											No Signs	No Signs	No	
wpt011	50H	389120	6307080	Marri	20+	0											No Signs	No Signs	No	
wpt012	50H	389105	6307085	Marri	20+	0											No Signs	No Signs	No	
wpt013	50H	389089	6307114	Marri	20+	0											No Signs	No Signs	No	
wpt014	50H	389086	6307090	Marri	20+	0											No Signs	No Signs	No	
wpt015	50H	389085	6307088	Marri	20+	0											No Signs	No Signs	No	
wpt016	50H	389075	6307090	Marri	20+	0											No Signs	No Signs	No	
wpt017	50H	389069	6307087	Marri	20+	0											No Signs	No Signs	No	
wpt018	50H	389035	6307111	Marri	20+	0											No Signs	No Signs	No	
wpt019	50H	389028	6307115	Marri	20+	0											No Signs	No Signs	No	
wpt020	50H	389005	6307110	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt021	50H	389012	6307110	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt022	50H	389010	6307112	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt023	50H	388992	6307113	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt024	50H	388972	6307092	Marri	20+	0											No Signs	No Signs	No	
wpt025	50H	388963	6307087	Marri	20+	0											No Signs	No Signs	No	
wpt026	50H	388945	6307088	Marri	20+	0											No Signs	No Signs	No	
wpt027	50H	388933	6307095	Marri	20+	0											No Signs	No Signs	No	
wpt028	50H	388942	6307074	Marri	20+	0											No Signs	No Signs	No	
wpt029	50H	388948	6307068	Marri	20+	0											No Signs	No Signs	No	
wpt030	50H	388931	6307069	Marri	20+	0											No Signs	No Signs	No	
wpt031	50H	388919	6307085	Jarrah	15-20	0											No Signs	No Signs	No	
wpt032	50H	388905	6307092	Marri	20+	0											No Signs	No Signs	No	
wpt033	50H	388903	6307101	Marri	20+	0											No Signs	No Signs	No	
wpt034	50H	388898	6307108	Marri	20+	0											No Signs	No Signs	No	
wpt035	50H	388895	6307108	Marri	20+	0											No Signs	No Signs	No	
wpt036	50H	388862	6307110	Marri	20+	0											No Signs	No Signs	No	
wpt037	50H	388835	6307107	Marri	20+	0											No Signs	No Signs	No	
wpt038	50H	388841	6307100	Marri	20+	0											No Signs	No Signs	No	
wpt039	50H	388840	6307098	Marri	20+	0											No Signs	No Signs	No	
wpt040	50H	388841	6307087	Marri	20+	0											No Signs	No Signs	No	
wpt041	50H	388852	6307087	Marri	20+	0											No Signs	No Signs	No	
wpt042	50H	388817	6307102	Marri	20+	0											No Signs	No Signs	No	
wpt043	50H	388811	6307079	Marri	20+	0											No Signs	No Signs	No	
wpt044	50H	388811	6307071	Marri	20+	0											No Signs	No Signs	No	
wpt045	50H	388810	6307058	Marri	20+	0											No Signs	No Signs	No	
wpt046	50H	388804	6307059	Marri	20+	0											No Signs	No Signs	No	
wpt047	50H	388770	6307041	Marri	20+	0											No Signs	No Signs	No	
wpt048	50H	388764	6307036	Marri	20+	0											No Signs	No Signs	No	
wpt049	50H	388746	6307049	Marri	20+	0											No Signs	No Signs	No	
wpt050	50H	388737	6307043	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt051	50H	388722	6307061	Marri	20+	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt052	50H	388719	6307071	Marri	20+	0											No Signs	No Signs	No	
wpt053	50H	388701	6307073	Marri	20+	0											No Signs	No Signs	No	
wpt054	50H	388693	6307068	Marri	20+	0											No Signs	No Signs	No	
wpt055	50H	388687	6307083	Marri	20+	0											No Signs	No Signs	No	
wpt056	50H	388687	6307101	Marri	20+	0											No Signs	No Signs	No	
wpt057	50H	388668	6307069	Marri	20+	0											No Signs	No Signs	No	
wpt058	50H	388663	6307074	Marri	20+	0											No Signs	No Signs	No	
wpt059	50H	388657	6307069	Marri	20+	0											No Signs	No Signs	No	
wpt060	50H	388643	6307105	Marri	20+	0											No Signs	No Signs	No	
wpt061	50H	388641	6307105	Marri	20+	0											No Signs	No Signs	No	
wpt062	50H	388635	6307109	Marri	20+	0											No Signs	No Signs	No	
wpt063	50H	388657	6307078	Dead Marri	20+	0											No Signs	No Signs	No	
wpt064	50H	388652	6307059	Marri	20+	0											No Signs	No Signs	No	
wpt065	50H	388652	6307051	Marri	20+	0											No Signs	No Signs	No	
wpt066	50H	388645	6307041	Marri	20+	0											No Signs	No Signs	No	
wpt067	50H	388642	6307043	Marri	20+	0											No Signs	No Signs	No	
wpt068	50H	388634	6307043	Marri	20+	0											No Signs	No Signs	No	
wpt069	50H	388630	6307041	Marri	20+	0											No Signs	No Signs	No	
wpt070	50H	388624	6307041	Marri	20+	0											No Signs	No Signs	No	
wpt071	50H	388604	6307065	Marri	20+	1	Branch	5-12									No Signs	No Signs	No	
wpt072	50H	388614	6307038	Marri	20+	0											No Signs	No Signs	No	
wpt073	50H	388612	6307037	Marri	20+	0											No Signs	No Signs	No	
wpt074	50H	388607	6307032	Marri	20+	0											No Signs	No Signs	No	
wpt075	50H	388605	6307029	Marri	20+	0											No Signs	No Signs	No	
wpt076	50H	388583	6307026	Marri	20+	0											No Signs	No Signs	No	
wpt077	50H	388583	6307025	Marri	20+	0											No Signs	No Signs	No	
wpt078	50H	388578	6307023	Marri	20+	0											No Signs	No Signs	No	
wpt079	50H	388571	6307022	Marri	20+	0											No Signs	No Signs	No	
wpt080	50H	388566	6307026	Marri	20+	0											No Signs	No Signs	No	
wpt081	50H	388561	6307038	Marri	20+	0											No Signs	No Signs	No	
wpt082	50H	388552	6307029	Marri	20+	0											No Signs	No Signs	No	
wpt083	50H	388550	6307040	Marri	20+	0											No Signs	No Signs	No	
wpt084	50H	388544	6307070	Marri	20+	0											No Signs	No Signs	No	
wpt085	50H	388491	6307089	Marri	20+	0											No Signs	No Signs	No	
wpt086	50H	388496	6307100	Dead Jarrah	15-20	3	Fissure	5-12	Spout Branch	5-12	Spout Branch	5-12					No Signs	No Signs	No	
wpt087	50H	388483	6307077	Marri	20+	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt088	50H	388479	6307079	Jarrah	20+	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt089	50H	388450	6307087	Dead Unknown	15-20	5+	Knot Hole	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt090	50H	388475	6307052	Marri	20+	1	Branch	5-12									No Signs	No Signs	No	
wpt091	50H	388447	6307034	Dead Unknown	15-20	5+	Knot Hole	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt092	50H	388446	6307018	Marri	20+	0											No Signs	No Signs	No	
wpt093	50H	388447	6307015	Marri	20+	0											No Signs	No Signs	No	
wpt094	50H	388471	6307021	Marri	20+	0											No Signs	No Signs	No	
wpt095	50H	388473	6307010	Marri	20+	0											No Signs	No Signs	No	
wpt096	50H	388476	6307010	Marri	20+	0											No Signs	No Signs	No	
wpt097	50H	388482	6307007	Marri	20+	0											No Signs	No Signs	No	
wpt098	50H	388489	6307006	Marri	20+	0											No Signs	No Signs	No	
wpt099	50H	388495	6307004	Marri	20+	0											No Signs	No Signs	No	
wpt100	50H	388516	6307008	Marri	20+	0											No Signs	No Signs	No	
wpt101	50H	388509	6307015	Marri	20+	0											No Signs	No Signs	No	
wpt102	50H	388516	6307007	Marri	20+	0											No Signs	No Signs	No	
wpt103	50H	388519	6307020	Marri	20+	0											No Signs	No Signs	No	
wpt104	50H	388526	6307029	Marri	20+	0											No Signs	No Signs	No	
wpt105	50H	388531	6307008	Marri	20+	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt106	50H	388534	6307008	Marri	20+	0											No Signs	No Signs	No	
wpt107	50H	388540	6307005	Marri	20+	0											No Signs	No Signs	No	
wpt108	50H	388542	6307012	Marri	20+	0											No Signs	No Signs	No	
wpt109	50H	388550	6307012	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt110	50H	388591	6307017	Marri	20+	0											No Signs	No Signs	No	
wpt111	50H	388579	6307013	Marri	20+	0											No Signs	No Signs	No	
wpt112	50H	388570	6307002	Marri	20+	0											No Signs	No Signs	No	
wpt113	50H	388563	6307004	Marri	20+	0											No Signs	No Signs	No	
wpt114	50H	388547	6306988	Dead Jarrah	15-20	0											No Signs	No Signs	No	
wpt115	50H	388549	6306971	Marri	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt116	50H	388558	6306965	Marri	20+	0											No Signs	No Signs	No	
wpt117	50H	388537	6306969	Marri	20+	0											No Signs	No Signs	No	
wpt118	50H	388530	6306966	Marri	20+	0											No Signs	No Signs	No	
wpt119	50H	388521	6306981	Marri	20+	0											No Signs	No Signs	No	
wpt120	50H	388526	6306986	Jarrah	15-20	0											No Signs	No Signs	No	
wpt121	50H	388542	6306976	Dead Jarrah	10-15	3	Spout Branch	20+	Spout Branch	12-20	Spout Branch	12-20					No Signs	No Signs	No	Too shallow
wpt122	50H	388512	6306965	Marri	20+	5+	Branch	5-12	Branch	12-20	Branch	5-12	Branch	12-20	Branch	5-12	No Signs	No Signs	No	
wpt123	50H	388500	6306984	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt124	50H	388496	6306982	Marri	15-20	1	Knot Hole	12-20									No Signs	No Signs	No	Too small
wpt125	50H	388500	6306993	Marri	20+	0											No Signs	No Signs	No	
wpt126	50H	388488	6306997	Marri	20+	0											No Signs	No Signs	No	
wpt127	50H	388485	6306999	Marri	20+	0											No Signs	No Signs	No	
wpt128	50H	388471	6306998	Marri	20+	0											No Signs	No Signs	No	
wpt129	50H	388464	6307001	Marri	20+	0											No Signs	No Signs	No	
wpt130	50H	388459	6307006	Marri	20+	0											No Signs	No Signs	No	
wpt131	50H	388447	6307003	Marri	20+	0											No Signs	No Signs	No	
wpt132	50H	388441	6307010	Marri	20+	0											No Signs	No Signs	No	
wpt133	50H	388439	6307005	Marri	20+	0											No Signs	No Signs	No	
wpt134	50H	388442	6306991	Marri	20+	0											No Signs	No Signs	No	
wpt135	50H	388452	6306985	Marri	20+	0											No Signs	No Signs	No	
wpt136	50H	388440	6306975	Flooded Gum	10-15	2	Knot Hole	<5	Knot Hole	<5							No Signs	No Signs	No	
wpt137	50H	388452	6306964	Marri	20+	0											No Signs	No Signs	No	
wpt138	50H	388462	6306960	Marri	20+	0											No Signs	No Signs	No	
wpt139	50H	388468	6306972	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt140	50H	388473	6306985	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt141	50H	388486	6306969	Marri	20+	0											No Signs	No Signs	No	
wpt142	50H	388481	6306964	Marri	20+	0											No Signs	No Signs	No	
wpt143	50H	388488	6306955	Marri	20+	0											No Signs	No Signs	No	
wpt144	50H	388476	6306949	Marri	20+	0											No Signs	No Signs	No	
wpt145	50H	388474	6306954	Marri	20+	0											No Signs	No Signs	No	
wpt146	50H	388469	6306964	Marri	20+	0											No Signs	No Signs	No	
wpt147	50H	388463	6306962	Marri	20+	0											No Signs	No Signs	No	
wpt148	50H	388564	6306984	Jarrah	10-15	0											No Signs	No Signs	No	
wpt149	50H	388585	6306984	Marri	20+	0											No Signs	No Signs	No	
wpt150	50H	388606	6306984	Jarrah	15-20	0											No Signs	No Signs	No	
wpt151	50H	388591	6307005	Jarrah	15-20	0											No Signs	No Signs	No	
wpt152	50H	388628	6306997	Marri	20+	0											No Signs	No Signs	No	
wpt153	50H	388609	6307016	Marri	20+	0											No Signs	No Signs	No	
wpt154	50H	388628	6307018	Marri	20+	1	Knot Hole	<5									No Signs	No Signs	No	
wpt155	50H	388619	6307033	Marri	20+	3	Fissure	12-20	Branch	12-20	Branch	12-20					No Signs	No Signs	No	
wpt156	50H	388652	6307033	Marri	20+	0											No Signs	No Signs	No	
wpt157	50H	388662	6307043	Marri	20+	0											No Signs	No Signs	No	
wpt158	50H	388660	6307048	Marri	20+	0											No Signs	No Signs	No	
wpt159	50H	388667	6307056	Marri	20+	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt160	50H	388667	6307057	Marri	20+	0											No Signs	No Signs	No	
wpt161	50H	388671	6307060	Marri	20+	0											No Signs	No Signs	No	
wpt162	50H	388678	6307068	Marri	20+	0											No Signs	No Signs	No	
wpt163	50H	388686	6307065	Marri	20+	0											No Signs	No Signs	No	
wpt164	50H	388703	6307045	Marri	20+	0											No Signs	No Signs	No	
wpt165	50H	388723	6307046	Marri	20+	0											No Signs	No Signs	No	
wpt166	50H	388734	6307043	Marri	20+	0											No Signs	No Signs	No	
wpt167	50H	388737	6307041	Marri	20+	0											No Signs	No Signs	No	
wpt168	50H	388738	6307028	Marri	20+	0											No Signs	No Signs	No	
wpt169	50H	388724	6307009	Marri	20+	0											No Signs	No Signs	No	
wpt170	50H	388732	6307006	Marri	20+	0											No Signs	No Signs	No	
wpt171	50H	388754	6307015	Marri	20+	5+	Knot Hole	<5	Knot Hole	5-12	Knot Hole	12-20	Knot Hole	20+	Fissure	20+	Bees	No Signs	Yes	
wpt172	50H	388757	6306999	Marri	20+	0											No Signs	No Signs	No	
wpt173	50H	388760	6306996	Marri	20+	0											No Signs	No Signs	No	
wpt174	50H	388761	6306998	Marri	20+	0											No Signs	No Signs	No	
wpt175	50H	388763	6306999	Marri	20+	0											No Signs	No Signs	No	
wpt176	50H	388770	6307013	Dead Jarrah	15-20	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt177	50H	388771	6307018	Marri	20+	0											No Signs	No Signs	No	
wpt178	50H	388776	6307027	Marri	20+	0											No Signs	No Signs	No	
wpt179	50H	388785	6307026	Marri	20+	0											No Signs	No Signs	No	
wpt180	50H	388791	6307031	Marri	20+	0											No Signs	No Signs	No	
wpt181	50H	388794	6307039	Marri	20+	0											No Signs	No Signs	No	
wpt182	50H	388800	6307030	Marri	20+	0											No Signs	No Signs	No	
wpt183	50H	388797	6307025	Marri	20+	0											No Signs	No Signs	No	
wpt184	50H	388802	6307019	Marri	20+	0											No Signs	No Signs	No	
wpt185	50H	388806	6307018	Marri	20+	0											No Signs	No Signs	No	
wpt186	50H	388820	6307025	Marri	20+	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt187	50H	388827	6307040	Marri	20+	0											No Signs	No Signs	No	
wpt188	50H	388838	6307039	Marri	20+	0											No Signs	No Signs	No	
wpt189	50H	388838	6307047	Marri	20+	0											No Signs	No Signs	No	
wpt190	50H	388827	6307055	Marri	20+	0											No Signs	No Signs	No	
wpt191	50H	388826	6307061	Marri	20+	0											No Signs	No Signs	No	
wpt192	50H	388826	6307060	Marri	20+	0											No Signs	No Signs	No	
wpt193	50H	388822	6307070	Marri	20+	0											No Signs	No Signs	No	
wpt194	50H	388828	6307072	Marri	20+	0											No Signs	No Signs	No	
wpt195	50H	388845	6307062	Marri	20+	0											No Signs	No Signs	No	
wpt196	50H	388847	6307062	Marri	20+	0											No Signs	No Signs	No	
wpt197	50H	388827	6306988	Marri	20+	1	Fissure	20+									No Signs	Chew Marks	Yes	Rub and mild chew marks
wpt198	50H	388835	6306985	Marri	20+	1	Spout Branch	20+									No Signs	No Signs	Yes	
wpt199	50H	388847	6306989	Marri	20+	1	Spout Branch	20+									No Signs	No Signs	Yes	
wpt200	50H	388850	6306994	Marri	20+	2	Knot Hole	12-20	Spout Branch	20+							No Signs	No Signs	Yes	
wpt201	50H	388860	6307030	Marri	20+	0											No Signs	No Signs	No	
wpt202	50H	388867	6307046	Marri	20+	0											No Signs	No Signs	No	
wpt203	50H	388857	6307070	Marri	20+	0											No Signs	No Signs	No	
wpt204	50H	388867	6307068	Marri	20+	0											No Signs	No Signs	No	
wpt205	50H	388873	6307080	Marri	20+	0											No Signs	No Signs	No	
wpt206	50H	388872	6307087	Marri	20+	0											No Signs	No Signs	No	
wpt207	50H	388880	6307088	Marri	20+	0											No Signs	No Signs	No	
wpt208	50H	388887	6307093	Marri	20+	0											No Signs	No Signs	No	
wpt209	50H	388896	6307098	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt210	50H	388901	6307096	Marri	20+	0											No Signs	No Signs	No	
wpt211	50H	388900	6307082	Marri	20+	0											No Signs	No Signs	No	
wpt212	50H	388882	6307038	Marri	10-15	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt213	50H	388920	6307064	Marri	20+	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt214	50H	388924	6307057	Marri	20+	0											No Signs	No Signs	No	
wpt215	50H	388940	6307059	Marri	20+	0											No Signs	No Signs	No	
wpt216	50H	388947	6307052	Marri	20+	0											No Signs	No Signs	No	
wpt217	50H	388972	6307033	Marri	20+	0											No Signs	No Signs	No	
wpt218	50H	388966	6307060	Marri	20+	0											No Signs	No Signs	No	
wpt219	50H	388968	6307061	Marri	20+	0											No Signs	No Signs	No	
wpt220	50H	388972	6307062	Marri	20+	0											No Signs	No Signs	No	
wpt221	50H	388982	6307077	Marri	20+	0											No Signs	No Signs	No	
wpt222	50H	388988	6307085	Marri	20+	0											No Signs	No Signs	No	
wpt223	50H	389006	6307089	Marri	20+	0											No Signs	No Signs	No	
wpt224	50H	389037	6307087	Marri	20+	0											No Signs	No Signs	No	
wpt225	50H	389050	6307090	Marri	20+	0											No Signs	No Signs	No	
wpt226	50H	389055	6307089	Marri	20+	0											No Signs	No Signs	No	
wpt227	50H	389058	6307084	Marri	15-20	1	Spout Trunk	20+									No Signs	No Signs	Yes	
wpt228	50H	389065	6307078	Marri	20+	0											No Signs	No Signs	No	
wpt229	50H	389081	6307082	Marri	20+	0											No Signs	No Signs	No	
wpt230	50H	389100	6307061	Marri	20+	0											No Signs	No Signs	No	
wpt231	50H	389115	6307060	Marri	20+	0											No Signs	No Signs	No	
wpt232	50H	389117	6307058	Marri	20+	0											No Signs	No Signs	No	
wpt233	50H	389139	6307044	Marri	20+	0											No Signs	No Signs	No	
wpt234	50H	389229	6307063	Marri	20+	0											No Signs	No Signs	No	
wpt235	50H	389229	6307062	Wandoo	20+	0											No Signs	No Signs	No	
wpt236	50H	389042	6306602	Marri	15-20	0											No Signs	No Signs	No	
wpt237	50H	388968	6306650	Marri	20+	0											No Signs	No Signs	No	
wpt238	50H	388965	6306651	Marri	15-20	0											No Signs	No Signs	No	
wpt239	50H	388899	6306642	Marri	15-20	0											No Signs	No Signs	No	
wpt240	50H	388913	6306731	Marri	15-20	0											No Signs	No Signs	No	
wpt241	50H	388841	6306643	Marri	20+	0											No Signs	No Signs	No	
wpt242	50H	388819	6306645	Jarrah	15-20	0											No Signs	No Signs	No	
wpt243	50H	388810	6306642	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Spout Branch	12-20	No Signs	No Signs	Yes	
wpt244	50H	388813	6306618	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt245	50H	388803	6306601	Dead Unknown	15-20	4	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12			No Signs	No Signs	No	
wpt246	50H	388804	6306589	Jarrah	15-20	0											No Signs	No Signs	No	
wpt247	50H	388755	6306620	Jarrah	15-20	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt248	50H	388734	6306614	Jarrah	15-20	0											No Signs	No Signs	No	
wpt249	50H	388732	6306617	Dead Unknown	15-20	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt250	50H	388744	6306666	Dead Unknown	20+	3	Branch	5-12	Branch	5-12	Branch	5-12					No Signs	No Signs	No	
wpt251	50H	388748	6306704	Dead Unknown	15-20	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt252	50H	388767	6306683	Jarrah	15-20	0											No Signs	No Signs	No	
wpt253	50H	388809	6306677	Jarrah	15-20	0											No Signs	No Signs	No	
wpt254	50H	388811	6306683	Dead Jarrah	5-10	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt255	50H	388715	6306686	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt256	50H	388694	6306675	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt257	50H	388680	6306667	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt258	50H	388689	6306729	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt259	50H	388662	6306752	Dead Jarrah	15-20	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt260	50H	388617	6306742	Dead Jarrah	10-15	1	Spout Branch	5-12									No Signs	No Signs	No	
wpt261	50H	388607	6306708	Marri	20+	0											No Signs	No Signs	No	
wpt262	50H	388608	6306709	Marri	20+	0											No Signs	No Signs	No	
wpt263	50H	388611	6306709	Marri	20+	0											No Signs	No Signs	No	
wpt264	50H	388612	6306710	Marri	20+	0											No Signs	No Signs	No	
wpt265	50H	388610	6306706	Marri	20+	0											No Signs	No Signs	No	
wpt266	50H	388613	6306706	Marri	20+	0											No Signs	No Signs	No	
wpt267	50H	388611	6306699	Marri	20+	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt268	50H	388609	6306698	Marri	20+	0											No Signs	No Signs	No	
wpt269	50H	388604	6306701	Marri	20+	0											No Signs	No Signs	No	
wpt270	50H	388611	6306696	Marri	20+	0											No Signs	No Signs	No	
wpt271	50H	388597	6306696	Marri	20+	0											No Signs	No Signs	No	
wpt272	50H	388618	6306683	Marri	20+	0											No Signs	No Signs	No	
wpt273	50H	388620	6306680	Marri	20+	0											No Signs	No Signs	No	
wpt274	50H	388620	6306669	Dead Unknown	15-20	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt275	50H	388611	6306652	Marri	20+	0											No Signs	No Signs	No	
wpt276	50H	388591	6306649	Marri	20+	0											No Signs	No Signs	No	
wpt277	50H	388575	6306637	Marri	20+	0											No Signs	No Signs	No	
wpt278	50H	388603	6306627	Marri	20+	0											No Signs	No Signs	No	
wpt279	50H	388611	6306624	Marri	20+	0											No Signs	No Signs	No	
wpt280	50H	388614	6306637	Dead Jarrah	20+	1	Branch	12-20									No Signs	No Signs	No	
wpt281	50H	388586	6306611	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt282	50H	388561	6306619	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt283	50H	388553	6306620	Marri	20+	0											No Signs	No Signs	No	
wpt284	50H	388552	6306634	Marri	20+	0											No Signs	No Signs	No	
wpt285	50H	388543	6306634	Marri	20+	0											No Signs	No Signs	No	
wpt286	50H	388534	6306628	Marri	20+	0											No Signs	No Signs	No	
wpt287	50H	388533	6306631	Marri	20+	0											No Signs	No Signs	No	
wpt288	50H	388533	6306642	Marri	20+	0											No Signs	No Signs	No	
wpt289	50H	388489	6306652	Marri	20+	0											No Signs	No Signs	No	
wpt290	50H	388465	6306682	Marri	20+	0											No Signs	No Signs	No	
wpt291	50H	388467	6306699	Marri	20+	0											No Signs	No Signs	No	
wpt292	50H	388525	6306664	Jarrah	15-20	0											No Signs	No Signs	No	
wpt293	50H	388555	6306646	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt294	50H	388567	6306703	Marri	20+	0											No Signs	No Signs	No	
wpt295	50H	388574	6306716	Dead Jarrah	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt296	50H	388586	6306735	Dead Unknown	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt297	50H	388566	6306738	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt298	50H	388557	6306730	Dead Unknown	20+	2	Knot Hole	12-20	Knot Hole	12-20							No Signs	No Signs	No	
wpt299	50H	388535	6306716	Dead Unknown	15-20	2	Spout Branch	20+	Spout Branch	20+							No Signs	No Signs	Yes	Possibly too shallow
wpt300	50H	388532	6306739	Dead Unknown	20+	4	Knot Hole	12-20	Knot Hole	12-20	Branch	5-12	Branch	5-12			No Signs	No Signs	Yes	
wpt301	50H	388539	6306749	Dead Unknown	15-20	0											No Signs	No Signs	No	
wpt302	50H	388551	6306760	Dead Jarrah	15-20	0											No Signs	No Signs	No	
wpt303	50H	388532	6306759	Dead Unknown	20+	5+	Knot Hole	12-20	Branch	5-12	Branch	12-20	Branch	5-12	Branch	12-20	No Signs	No Signs	No	
wpt304	50H	388514	6306782	Marri	20+	2	Knot Hole	20+	Branch	5-12							Bees	No Signs	Yes	
wpt305	50H	388507	6306786	Dead Unknown	10-15	1	Knot Hole	<5									Bees	No Signs	No	
wpt306	50H	388508	6306792	Dead Unknown	10-15	1	Spout Branch	5-12									No Signs	No Signs	No	
wpt307	50H	388490	6306741	Marri	15-20	3	Knot Hole	5-12	Branch	5-12	Spout Branch	5-12					No Signs	No Signs	No	
wpt308	50H	388487	6306753	Dead Unknown	20+	2	Spout Branch	5-12	Spout Branch	5-12							No Signs	No Signs	No	
wpt309	50H	388475	6306743	Dead Unknown	20+	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt310	50H	388465	6306736	Dead Unknown	20+	3	Knot Hole	5-12	Knot Hole	5-12	Branch	5-12					No Signs	No Signs	No	
wpt311	50H	388448	6306734	Dead Unknown	20+	2	Knot Hole	5-12	Knot Hole	5-12							No Signs	No Signs	No	
wpt312	50H	388445	6306759	Dead Unknown	20+	1	Knot Hole	20+									No Signs	No Signs	No	Too shallow
wpt313	50H	388441	6306769	Marri	20+	0											No Signs	No Signs	No	
wpt314	50H	388449	6306783	Marri	20+	0											No Signs	No Signs	No	
wpt315	50H	388459	6306791	Marri	20+	0											No Signs	No Signs	No	
wpt316	50H	388440	6306802	Marri	20+	0											No Signs	No Signs	No	
wpt317	50H	388443	6306883	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt318	50H	388441	6306895	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt319	50H	388439	6306905	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt320	50H	388443	6306917	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt321	50H	388462	6306921	Flooded Gum	20+	1	Knot Hole	<5									No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt322	50H	388441	6306939	Flooded Gum	20+	0											No Signs	No Signs	No	
wpt323	50H	388445	6306953	Marri	20+	0											No Signs	No Signs	No	
wpt324	50H	388442	6306941	Marri	20+	0											No Signs	No Signs	No	
wpt325	50H	388440	6306940	Marri	20+	0											No Signs	No Signs	No	
wpt326	50H	388441	6306934	Marri	20+	0											No Signs	No Signs	No	
wpt327	50H	388444	6306928	Marri	20+	0											No Signs	No Signs	No	
wpt328	50H	388444	6306913	Marri	20+	0											No Signs	No Signs	No	
wpt329	50H	388445	6306910	Marri	20+	0											No Signs	No Signs	No	
wpt330	50H	388444	6306908	Marri	20+	0											No Signs	No Signs	No	
wpt331	50H	388440	6306908	Marri	20+	0											No Signs	No Signs	No	
wpt332	50H	388442	6306899	Marri	20+	0											No Signs	No Signs	No	
wpt333	50H	388467	6306886	Marri	20+	0											No Signs	No Signs	No	
wpt334	50H	388488	6306875	Marri	20+	0											No Signs	No Signs	No	
wpt335	50H	388473	6306908	Marri	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt336	50H	388484	6306898	Dead Unknown	20+	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt337	50H	388480	6306921	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt338	50H	388495	6306946	Dead Unknown	20+	3	Fissure	<5	Branch	5-12	Branch	5-12					Bees	No Signs	No	
wpt339	50H	388517	6306932	Marri	20+	0											No Signs	No Signs	No	
wpt340	50H	388539	6306937	Marri	20+	0											No Signs	No Signs	No	
wpt341	50H	388542	6306935	Marri	20+	0											No Signs	No Signs	No	
wpt342	50H	388546	6306932	Jarrah	15-20	0											No Signs	No Signs	No	
wpt343	50H	388519	6306900	Marri	20+	0											No Signs	No Signs	No	
wpt344	50H	388511	6306898	Marri	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt345	50H	388538	6306899	Jarrah	15-20	0											No Signs	No Signs	No	
wpt346	50H	388557	6306870	Marri	20+	0											No Signs	No Signs	No	
wpt347	50H	388559	6306862	Marri	20+	0											No Signs	No Signs	No	
wpt348	50H	388587	6306862	Marri	20+	1	Spout Trunk	12-20									No Signs	No Signs	No	
wpt349	50H	388598	6306849	Marri	10-15	0											No Signs	No Signs	No	
wpt350	50H	388597	6306859	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt351	50H	388578	6306880	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt352	50H	388607	6306857	Marri	20+	0											No Signs	No Signs	No	
wpt353	50H	388621	6306873	Dead Unknown	20+	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt354	50H	388637	6306852	Jarrah	15-20	1	Fissure	20+									No Signs	No Signs	No	Too low/shallow
wpt355	50H	388619	6306898	Dead Unknown	15-20	2	Knot Hole	5-12	Knot Hole	5-12							No Signs	No Signs	No	
wpt356	50H	388636	6306902	Marri	20+	0											No Signs	No Signs	No	
wpt357	50H	388609	6306910	Marri	20+	0											No Signs	No Signs	No	
wpt358	50H	388595	6306915	Marri	20+	0											No Signs	No Signs	No	
wpt359	50H	388602	6306926	Marri	20+	0											No Signs	No Signs	No	
wpt360	50H	388588	6306915	Marri	20+	0											No Signs	No Signs	No	
wpt361	50H	388589	6306929	Marri	20+	2	Knot Hole	<5	Fissure	12-20							Bees	No Signs	No	
wpt362	50H	388595	6306933	Jarrah	15-20	2	Fissure	12-20	Branch	5-12							No Signs	No Signs	No	
wpt363	50H	388637	6306940	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt364	50H	388621	6306969	Jarrah	15-20	1	Spout Trunk	20+									No Signs	No Signs	No	
wpt365	50H	388642	6306972	Marri	20+	1	Branch	5-12									No Signs	No Signs	No	
wpt366	50H	388637	6306988	Marri	20+	0											No Signs	No Signs	No	
wpt367	50H	388653	6306983	Marri	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt368	50H	388666	6306982	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt369	50H	388671	6307010	Marri	20+	0											No Signs	No Signs	No	
wpt370	50H	388677	6307009	Marri	20+	0											No Signs	No Signs	No	
wpt371	50H	388703	6306999	Marri	20+	0											No Signs	No Signs	No	
wpt372	50H	388699	6306983	Marri	20+	0											No Signs	No Signs	No	
wpt373	50H	388693	6306986	Jarrah	15-20	0											No Signs	No Signs	No	
wpt374	50H	388723	6306991	Jarrah	15-20	3	Knot Hole	5-12	Knot Hole	5-12	Knot Hole	5-12					No Signs	No Signs	No	
wpt375	50H	388698	6306954	Marri	20+	1	Knot Hole	12-20									No Signs	Chew Marks	Yes	Rub/chew marks

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt376	50H	388687	6306951	Jarrah	15-20	1	Spout Branch	5-12									No Signs	No Signs	No	
wpt377	50H	388684	6306940	Marri	20+	5+	Knot Hole	20+	Branch	5-12	Branch	12-20	Branch	5-12	Branch	12-20	No Signs	No Signs	Yes	
wpt378	50H	388676	6306949	Marri	5-10	1	Spout Trunk	20+									No Signs	No Signs	Yes	
wpt379	50H	388656	6306924	Jarrah	15-20	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt380	50H	388681	6306922	Jarrah	15-20	3	Knot Hole	5-12	Branch	5-12	Branch	5-12	Branch	5-12			No Signs	No Signs	No	
wpt381	50H	388683	6306922	Jarrah	15-20	0											No Signs	No Signs	No	
wpt382	50H	388705	6306936	Marri	20+	1	Spout Trunk	20+									Bees	No Signs	No	Bees
wpt383	50H	388715	6306914	Marri	20+	0											No Signs	No Signs	No	
wpt384	50H	388716	6306887	Marri	20+	0											No Signs	No Signs	No	
wpt385	50H	388733	6306884	Marri	20+	0											No Signs	No Signs	No	
wpt386	50H	388742	6306877	Marri	20+	0											No Signs	No Signs	No	
wpt387	50H	388747	6306881	Marri	20+	0											No Signs	No Signs	No	
wpt388	50H	388750	6306885	Marri	20+	0											No Signs	No Signs	No	
wpt389	50H	388756	6306890	Marri	20+	0											No Signs	No Signs	No	
wpt390	50H	388760	6306894	Marri	20+	0											No Signs	No Signs	No	
wpt391	50H	388750	6306900	Marri	20+	0											No Signs	No Signs	No	
wpt392	50H	388745	6306899	Marri	20+	0											No Signs	No Signs	No	
wpt393	50H	388751	6306912	Marri	20+	0											No Signs	No Signs	No	
wpt394	50H	388754	6306943	Marri	20+	0											No Signs	No Signs	No	
wpt395	50H	388765	6306958	Marri	20+	0											No Signs	No Signs	No	
wpt396	50H	388775	6306961	Marri	20+	0											No Signs	No Signs	No	
wpt397	50H	388777	6306962	Marri	20+	0											No Signs	No Signs	No	
wpt398	50H	388800	6306996	Marri	20+	0											No Signs	No Signs	No	
wpt399	50H	388798	6307009	Jarrah	15-20	0											No Signs	No Signs	No	
wpt400	50H	388822	6306979	Marri	20+	0											No Signs	No Signs	No	
wpt401	50H	388878	6306983	Marri	20+	0											No Signs	No Signs	No	
wpt402	50H	388820	6306972	Jarrah	5-10	1	Spout Trunk										No Signs	No Signs	No	Too shallow
wpt403	50H	388794	6306967	Jarrah	15-20	0											No Signs	No Signs	No	
wpt404	50H	388842	6306942	Dead Unknown	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt405	50H	388838	6306926	Dead Unknown	15-20	2	Knot Hole	<5	Knot Hole	5-12							No Signs	No Signs	No	
wpt406	50H	388817	6306921	Marri	20+	0											No Signs	No Signs	No	
wpt407	50H	388808	6306906	Marri	20+	0											No Signs	No Signs	No	
wpt408	50H	388820	6306892	Marri	20+	0											No Signs	No Signs	No	
wpt409	50H	388824	6306895	Marri	20+	0											No Signs	No Signs	No	
wpt410	50H	388831	6306901	Marri	20+	0											No Signs	No Signs	No	
wpt411	50H	388831	6306890	Marri	20+	0											No Signs	No Signs	No	
wpt412	50H	388815	6306892	Marri	20+	0											No Signs	No Signs	No	
wpt413	50H	388789	6306887	Marri	20+	0											No Signs	No Signs	No	
wpt414	50H	388785	6306895	Marri	20+	0											No Signs	No Signs	No	
wpt415	50H	388788	6306900	Jarrah	15-20	0											No Signs	No Signs	No	
wpt416	50H	388798	6306896	Jarrah	15-20	0											No Signs	No Signs	No	
wpt417	50H	388800	6306897	Jarrah	15-20	0											No Signs	No Signs	No	
wpt418	50H	388795	6306884	Jarrah	15-20	0											No Signs	No Signs	No	
wpt419	50H	388807	6306868	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt420	50H	388819	6306872	Marri	20+	0											No Signs	No Signs	No	
wpt421	50H	388813	6306859	Jarrah	15-20	0											No Signs	No Signs	No	
wpt422	50H	388805	6306857	Marri	20+	0											No Signs	No Signs	No	Wedge-tailed Eagle nest
wpt423	50H	388800	6306848	Jarrah	15-20	1	Knot Hole	12-20									No Signs	No Signs	No	
wpt424	50H	388826	6306835	Dead Jarrah	15-20	4	Knot Hole	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt425	50H	388830	6306816	Marri	20+	0											No Signs	No Signs	No	
wpt426	50H	388805	6306813	Marri	20+	0											No Signs	No Signs	No	
wpt427	50H	388810	6306779	Dead Unknown	5-10	3	Branch	5-12	Branch	5-12	Branch	5-12					No Signs	No Signs	No	
wpt428	50H	388769	6306808	Marri	20+	1	Branch	5-12									28 Parrot	No Signs	No	
wpt429	50H	388759	6306801	Jarrah	15-20	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt430	50H	388747	6306799	Marri	20+	0											No Signs	No Signs	No	
wpt431	50H	388732	6306837	Marri	20+	0											No Signs	No Signs	No	
wpt432	50H	388730	6306836	Marri	20+	0											No Signs	No Signs	No	
wpt433	50H	388722	6306839	Marri	20+	0											No Signs	No Signs	No	
wpt434	50H	388721	6306844	Marri	20+	0											No Signs	No Signs	No	
wpt435	50H	388719	6306857	Marri	20+	0											No Signs	No Signs	No	
wpt436	50H	388702	6306867	Marri	20+	0											No Signs	No Signs	No	
wpt437	50H	388687	6306872	Marri	20+	0											No Signs	No Signs	No	
wpt438	50H	388670	6306890	Marri	20+	0											No Signs	No Signs	No	
wpt439	50H	388661	6306868	Marri	20+	0											No Signs	No Signs	No	
wpt440	50H	388679	6306854	Jarrah	5-10	1	Fissure	<5									Bees	No Signs	No	
wpt441	50H	388693	6306844	Marri	20+	0											No Signs	No Signs	No	
wpt442	50H	388702	6306840	Marri	20+	0											No Signs	No Signs	No	
wpt443	50H	388707	6306847	Marri	20+	0											No Signs	No Signs	No	
wpt444	50H	388715	6306857	Dead Jarrah	15-20	1	Branch	5-12									No Signs	No Signs	No	
wpt445	50H	388711	6306825	Marri	20+	0											No Signs	No Signs	No	
wpt446	50H	388693	6306818	Jarrah	15-20	5+	Knot Hole	<5	Knot Hole	12-20	Branch	20+	Branch	5-12	Branch	5-12	No Signs	No Signs	No	Too small
wpt447	50H	388720	6306873	Jarrah	15-20	3	Branch	5-12	Branch	5-12	Branch	5-12					No Signs	No Signs	No	
wpt448	50H	388727	6306904	Jarrah	20+	1	Spout Branch	12-20									No Signs	No Signs	No	
wpt449	50H	388721	6306909	Jarrah	15-20	2	Knot Hole	5-12	Knot Hole	5-12							No Signs	No Signs	No	
wpt450	50H	388749	6306873	Jarrah	15-20	0											No Signs	No Signs	No	
wpt451	50H	388760	6306880	Marri	20+	0											No Signs	No Signs	No	
wpt452	50H	388764	6306865	Dead Jarrah	15-20	1	Branch	5-12									No Signs	No Signs	No	
wpt453	50H	388762	6306866	Marri	20+	0											No Signs	No Signs	No	
wpt454	50H	388758	6306861	Marri	20+	0											No Signs	No Signs	No	
wpt455	50H	388775	6306843	Jarrah	15-20	5+	Knot Hole	5-12	Knot Hole	5-12	Knot Hole	5-12	Knot Hole	5-12	Branch	5-12	No Signs	No Signs	No	
wpt456	50H	388780	6306859	Jarrah	15-20	0											No Signs	No Signs	No	
wpt457	50H	388794	6306856	Marri	20+	0											No Signs	No Signs	No	
wpt458	50H	388926	6306791	Jarrah	15-20	0											No Signs	No Signs	No	
wpt459	50H	388994	6306920	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt460	50H	389044	6306996	Dead Unknown	20+	1	Spout Branch	5-12									No Signs	No Signs	No	
wpt461	50H	389068	6306994	Dead Unknown	20+	1	Knot Hole	5-12									No Signs	No Signs	No	
wpt462	50H	389068	6307038	Dead Unknown	20+	5+	Fissure	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Spout Branch	5-12	No Signs	No Signs	No	
wpt463	50H	389049	6306867	Dead Unknown	20+	5+	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	
wpt464	50H	389072	6306795	Marri	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	
wpt465	50H	389133	6306799	Jarrah	20+	0											No Signs	No Signs	No	
wpt466	50H	389221	6306812	Jarrah	20+	0											No Signs	No Signs	No	
wpt467	50H	389136	6306743	Jarrah	20+	0											No Signs	No Signs	No	
wpt468	50H	389161	6306738	Jarrah	20+	0											No Signs	No Signs	No	
wpt469	50H	389242	6306823	Marri	20+	0											No Signs	No Signs	No	
wpt470	50H	389223	6306749	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	
wpt471	50H	389214	6306688	Marri	20+	0											No Signs	No Signs	No	
wpt472	50H	388776	6306930	Marri	20+	0											No Signs	No Signs	No	

APPENDIX E

SIGNIFICANT SPECIES PROFILES

Carter's Freshwater Mussel *Westralunio carteri*

Status and Distribution: Listed as Priority 4 by DEC and as Vulnerable under ICUN. Carter's freshwater Mussel is the only freshwater mussel species endemic to south-western WA, ranging from the Moore River to the south coast, west of Esperance (Graf and Cummings, 2009).

Habitat: Freshwater mussels seem to prefer inland rivers and streams with sandy bottoms and flowing water, although habitat preferences have not been precisely determined (Lymbery *et al*. 2008).

Likely presence in study area: The ephemeral nature of the small creek that passes through the study area appears to represent unsuitable habitat for this species and it would therefore be unlikely to be present. Survey work by Coffey (2011b) found no evidence of this species in this creek which also supports this conclusion.

Potential impact of proposed development: No impact on this species or its preferred habitat is considered likely.

Balston's Pygmy Perch *Nannatherina balstoni*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* and as Vulnerable under the *EPBC Act*. Morgan *et al.* (1996) states that this fish is the rarest of all the endemic fish of the south west. Status is defined as fairly secure by Allen *et al.* (2003) presumably given that, on the south coast, significant areas of habitat are within national parks. Confined to drainages and wetlands near the coast from between Margaret River and Two Peoples Bay. Historical records from Moore River.

Habitat: Acidic, tannin stained freshwater pools, streams and lakes within 30km of the coast, typically situated amongst peat flats. Prefers shallow water and is commonly found in association with tall sedge thickets (Allen *et al.* 2003). Morgan (1996) found them most common in shallow pools and creeks that often dry up in summer. Lower numbers were observed in the permanent major rivers surveyed.

Likely presence in study area: Outside of know documented range. This species has never been recorded in the Preston River catchment or nearby catchments and it would therefore be unlikely to be present. Survey work by Coffey (2011b) found no evidence of this species in this creek which also supports this conclusion.

Potential impact of development: No impact on this species or its habitat will occur.

Perth Lined Lerista *Lerista lineata*

Status and Distribution: Listed as Priority 3 by DEC. Found in the lower west coast from Perth south to Leschenault Peninsula/Kemerton. It has also been found at Rottnest Island and Garden Island (Storr *et al.* 1999). Found in the southern suburbs of Perth (Bush *et al.* 2002).

Habitat: This small species of skink inhabits white sands (Storr *et al*. 1999) under areas of shrubs and heath where it inhabits loose soil and leaf litter (Nevill 2005) particularly in association with banksias (Bush *et al.* 2002).

Likely presence in study area: No suitable habitat and therefore this species is considered unlikely to be present in the study area.

Potential impact of development: No impact on this species is anticipated.

The Bunbury Skink *Hemiergis 'koontoolasi'*

Status and Distribution: Listed as Priority 1 by the DEC. This species has only been collected four times between 1963 and 1984 from near Bunbury, Collie and Karridale (Bush *et al.* 2007).

Habitat: Low lying or swampy areas (Dell and Hyder-Griffiths 2002). Previously specimens have been captured in low "saltlake" vegetation (on the edge of the Preston River) and in a "swamp" (near Collie) (Bush *et al.* 2007).

Likely presence in study area: No suitable habitat and therefore this species is considered unlikely to be present in the study area.

Potential impact of development: No impact on this species is anticipated.

Southern Carpet Python *Morelia spilota imbricata*

Status and Distribution: The south western population is classified as Priority 4 by the DEC and is also listed in Schedule 4 under the *WC Act*. This subspecies has wide distribution within the south west but is uncommon. Occurs north to Geraldton and Yalgoo and east to Pinjin, Kalgoorlie, Fraser Range and Eyre (Storr *et al*, 2002). Records from Dalyellup (2007 Perkins Brothers Builders pers. comm.) and Peppermint Grove Beach (2006 Eleanor Bennett pers. comm.). Also know from Leschenault Conservation Park and in coastal dunes northwards including Yalgorup National Park (G Harewood pers. obs.).

Habitat: This species has been recorded from semi-arid coastal and inland habitats, Banksia woodland, Eucalypt woodlands, and grasslands. Most often found utilising hollow logs in addition the burrows of other animals for shelter. Often arboreal and will use tree hollows for refuge.

Likely presence in study area: It is considered unlikely that individuals of this species would be present in the study site as overall, remnant's in the wider area are too small and/or fragmented to support a viable population of this species.

Potential impact of development: No impact on this species will occur as it is unlikely to occur.

Malleefowl *Leipoa ocellata*

Status and Distribution: This species is listed as Schedule 1 under the WC *Act* and as Vulnerable and Migratory under the *EPBC Act (1999)*. Originally common, but now generally rare to uncommon and patchily distributed.

Current distribution mainly southern arid and semi-arid zones, north to Shark Bay, Jingemarra, Colga Downs and Yeelirrie, east to Earnest Giles Range, Yeo Lake, lower Ponton Creek and to Eucla and west and south to Cockleshell Gully, the Wongan Hills, Stirling Range, Beaufort Inlet, Hatters Hill, Mt Ragged and Point Malcolm (Johnstone and Storr 1998).

Habitat: Mainly scrubs and thickets of mallee *Eucalyptus* spp., boree *Melaleuca lanceolata* and bowgada *Acacia linophylla*, also dense litter forming shrublands.

Likely presence in study area: This species is regionally extinct and would never, under normal circumstances occur anywhere on the Swan Coastal Plain.

Potential impact of development: No impact on this species will occur as it is unlikely to be present.

Fairy Tern (Australian) *Sternula nereis nereis*

Status and Distribution: Classified as Vulnerable under the *EPBC Act.* The total number of mature individuals of the Fairy Tern is estimated to be less than 5,000 individuals. The subspecies' occurs along the coasts of New South Wales, Victoria, Tasmania, South Australia and Western Australia. (Birdlife International 2008).

Habitat: Fairy Terns utilise a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands, beaches and spits. Fairy Terns nest above the high water mark often in clear view of the water and on sites where the substrate is sandy and the vegetation low and sparse (Birdlife International 2008).

Likely presence in study area: The study area contains no suitable habitat for this species to utilise.

Potential impact of development: No impact on this species will occur.

Australasian Bittern *Botaurus poiciloptilus*

Status and Distribution: Classified as Schedule 1 under the *WC Act* and as Endangered under the *EPBC Act*. The species is uncommon to rare (Morcombe 2004), but locally common in wetter parts of south west (Johnstone and Storr 1998). Occurs north to Moora and east to Mt Arid (Johnstone and Storr 1998).

Habitat: Freshwater wetlands, occasionally estuarine; prefers heavy vegetation (Morcombe 2003) such as beds of tall dense *Typha*, *Baumea* and sedges in freshwater swamps (Johnstone and Storr 1998).

Likely presence in study area: The study area contains no suitable habitat for this species to utilise.

Potential impact of development: No impact on this species will occur.

Black Bittern *Ixobrychus flavicollis*

Status and Distribution: Listed as Priority 3 by DEC. Occurs north to Yanchep and Northam and east to Albany (Johnstone and Storr 1998).

Habitat: Freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense waterside vegetation (Johnstone and Storr 1998).

Likely presence in study area: The study area contains no suitable habitat for this species to utilise.

Potential impact of development: No impact on this species will occur.

Little Bittern *Ixobrychus minutus*

Status and Distribution: Listed as Priority 4 by DEC. Occurs north to Moora and east to Two Peoples Bay; accidental or on migration further north and east and on Rottnest Island and central district (Condingup district) (Johnstone and Storr 1998).

Habitat: Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of *Typha*, *Baumea* and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).

Likely presence in study area: The study area contains no suitable habitat for this species to utilise.

Potential impact of development: No impact on this species will occur.

Great Egret *Ardea alba*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The Great Egret is common and very widespread in any suitable permanent or temporary habitat (Morcombe 2004).

Habitat: Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs (Morcombe 2004).

Likely presence in study area: May utilise the seasonal creek and low lying paddocks areas during wetter months of the year, in small numbers. Would not breed on site.

Potential impact of development: Development at the site may result in the temporary loss of existing degraded habitat areas used by this species for foraging

but similar habitat is widespread in cleared sections of the coastal plain. No significant impact on this species is therefore anticipated.

Cattle Egret *Ardea ibis*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The Cattle Egret is common in the north sections of its range but is an irregular visitor to the better watered parts of the state (Johnstone and Storr 1998). The population is expanding (Morcombe 2004).

Habitat: Moist pastures with tall grasses, shallow open wetlands and margins, mudflats (Morcombe 2004). As its name suggests, most often seen in association with cattle.

Likely presence in study area: May utilise the seasonal creek and low lying paddocks areas during wetter months of the year, in small numbers. Would not breed on site.

Potential impact of development: Development at the site may result in the temporary loss of existing degraded habitat areas used by this species for foraging but similar habitat is widespread in cleared sections of the coastal plain. No significant impact on this species is therefore anticipated.

Migratory Shorebirds

A number of migratory shorebirds species are listed as potentially occurring in the general area. Specific species are not discussed.

Status and Distribution: Migratory shorebirds are listed under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. All species are either widespread summer migrants to Australia or residents. State and Federal conservation status varies between species.

Habitat: Varies between species but includes beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats sandbars, pastures, airfields, sports fields and lawns.

Likely presence in study area: Some nearby beaches, estuaries and open wetlands maybe used by some of the *EPBC Act* listed migratory species but the study site represents unsuitable habitat for all migratory shorebirds species and the area cannot be regarded as having any significant value to any species. None listed as a potential species.

Potential impact of development: No significant impact on migratory shorebirds will occur as the result of development within the study area.

White-bellied Sea Eagle *Haliaeetus leucogaster*

Status and Distribution: This species is listed as Schedule 3 under the *WC Act* and as migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. White-bellied sea eagles are moderately common to common on Kimberley and Pilbara islands, coasts and estuaries, on Bernier, Dorre and Dirk Hartog Is., in Houtman Abrolhos and in the Archipelago of the Recherche; rare to uncommon elsewhere (Johnstone and Storr 1998). Also found in New Guinea, Indonesia, China, southeast Asia and India. Scarce near major coastal cities (Morcombe 2004).

Habitat: They nest and forage usually near the coast over islands, reefs, headlands, beaches, bays, estuaries, mangroves, but will also live near seasonally flooded inland swamps, lagoons and floodplains, often far inland on large pools of major rivers. Established pairs usually sedentary, immatures dispersive (Morcombe 2004). White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession.

Likely presence in study area: No suitable habitat and under normal circumstance this species would not utilise the study area for any purpose.

Potential impact of development: No impact on this species or its preferred habitat will occur.

Peregrine Falcon *Falco peregrinus*

Status and Distribution: This species is listed as Schedule 4 under the *WC Act*. Individuals of this species are uncommon/rare but wide ranging across Australia. Moderately common at higher levels of the Stirling Range, uncommon in hilly, north west Kimberley, Hamersley and Darling Ranges; rare or scarce elsewhere (Johnstone and Storr 1998).

Habitat: Diverse from rainforest to arid shrublands, from coastal heath to alpine (Morcombe 2004). Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Johnstone and Storr 1998). The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey.

Likely presence in study area: The species is widespread but uncommon and may utilise some sections of the study area as part of a much larger home range. It is however unlikely to be specifically relying on the study area to any significant degree.

Potential impact of development: No impact anticipated. This species will continue to utilise the area, if it does now, despite any proposed development.

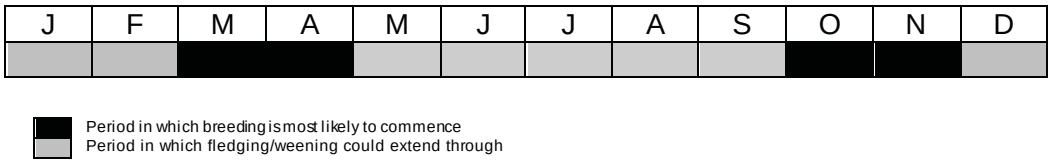
Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* and as Vulnerable under the *EPBC Act*. Found in the humid and subhumid south west, mainly hilly

interior, north to Gingin and east to Mt Helena, Christmas Tree Well, North Bannister, Mt Saddleback, Rock Gully and the upper King River (Johnstone and Storr 1998).

Habitat: Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble. The forest red-tailed black cockatoo nests in the large hollows of marri, jarrah and karri (Johnstone and Kirkby 1999). In marri, the nest hollows of the forest red-tailed black cockatoo range from 8-14m above ground, the entrance is 12 – 41cm in diameter and the depth is one to five metres (Johnstone and Storr 1998).

Breeding commences in winter/spring. There are few records of breeding in the forest red-tailed black cockatoo (Johnstone and Storr 1998), but eggs are laid in October and November (Johnstone 1997; Johnstone and Storr 1998). Recent data however indicates that breeding in all months of the year occurs with peaks in spring and autumn–winter (Ron Johnstone pers comms). Incubation period 29 – 31 days. Young fledge at 8 to 9 weeks (Simpson and Day 2004).



Likely presence in study area: Several individuals and small groups observed and foraging evidence attributed to this species was also found to be common during the day survey (chewed marri fruit and to a lesser extent chewed jarrah fruits). The majority of the remnant trees on site represents existing or potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

Potential impact of development: Potential for the loss of existing and potential foraging, breeding and roosting habitat. Any proposed clearing within the site will need to take into consideration that the removal of habitat used by this species may constitute a high risk of significant impact as defined by DSEWPaC criteria (DSEWPaC 2012).

Baudin's Black- Cockatoo *Calyptorhynchus baudinii*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* and as Vulnerable under the *EPBC Act*. Confined to the south-west of Western Australia, north to Gidgegannup, east to Mt Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury (Johnstone and Storr 1998). On the southern Swan Coastal Plain this cockatoo is in some areas resident but mainly a migrant moving from the deep south-west to the central and northern Darling Range. Between March and September most flocks move north and are concentrated in the northern parts of the Darling Range. During this period birds forage well out onto the southern Swan Coastal Plain to areas such as Harvey, Myalup, Bunbury, Capel, Dunsborough and Meelup. While generally more common in the Darling Range this species can also be common on parts of the southern Swan

Coastal Plain especially in mid-August – September when flocks begin to return to their breeding quarters (Johnstone 2008).

Habitat: Mainly eucalypt forests where it feeds primarily on the Marri seeds, (Morcombe, 2003), Banksia, Hakeas and *Erodium* sp. Also strips bark from trees in search of beetle larvae (Johnstone and Storr 1998). This species of cockatoo nests in large tree hollows, 30–40 cm in diameter and more than 30 cm deep (Saunders 1974).

Baudin's Black-Cockatoo breeds in late winter and spring, from August to November or December (Gould 1972; Johnstone 1997; Saunders 1974; Saunders *et al*. 1985). Eggs laid in October (Johnstone and Storr 1998). Based on observations at currently known nest sites breeding mainly occurs within the October-December period (Ron Johnstone pers comms). Incubation is 28 – 30 days. Young fledge at 8 to 9 weeks (Simpson and Day 2004).

J	F	M	A	M	J	J	A	S	O	N	D

Period in which breeding is most likely to commence
Period in which fledging/weening could extend througho

Likely presence in study area: Known to frequent the general area. A small amount of foraging evidence attributed to this species was also found during the day survey (chewed marri fruit). A high percentage of the remnant trees on site represents existing or potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

Potential impact of development: Potential for the loss of existing and potential foraging, breeding and roosting habitat. Any proposed clearing within the site will need to take into consideration that the removal of habitat used by this species may constitute a high risk of significant impact as defined by DSEWPaC criteria (DSEWPaC 2012).

Carnaby's Black- Cockatoo *Calyptorhynchus latirostris*

Status and Distribution: Carnaby's black cockatoo is listed as Scheduled 1 under the *WC Act* and as Endangered under the *EPBC Act*. Confined to the south-west of Western Australia, north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Condingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998).

Habitat: Forests, woodlands, heathlands, farms; feeds on Banksia, Hakeas and Marri. Carnaby's cockatoo has specific nesting site requirements. Nests are mostly in smoothed-barked eucalypts with the nest hollows ranging from 2.5 to 12m above the ground, an entrance from 23-30cm diameter and a depth of 0.1-2.5m (Johnstone and Storr, 1998).

Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe, 2003). Judging from records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into the Jarrah – Marri forest of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain including the region between Mandurah and Bunbury. Carnaby's black cockatoo has been known to breed close to the town of Mandurah, as well as at Dawesville, Lake Clifton and Baldivis (pers. comm., Ron Johnstone, WA Museum) and there are small resident populations on the southern Swan Coastal Plain near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone 2008).

Carnaby's black-cockatoo lays eggs from July or August to October or November, with most clutches being laid in August and September (Saunders 1986). Birds in inland regions may begin laying up to three weeks earlier than those in coastal areas (Saunders 1977). The female incubates the eggs over a period of 28-29 days. The young depart the nest 10–12 weeks after hatching (Saunders 1977; Smith & Saunders 1986).

J	F	M	A	M	J	J	A	S	O	N	D

Period in which breeding is most likely to commence
Period in which fledging/weening could extend through

Likely presence in study area: Known to frequent the general area. A small amount of foraging evidence attributed to this species was also found during the day survey (chewed marri fruit). A high percentage of the remnant trees on site represents existing or potential foraging habitat for this species. Larger trees (>50cm DBH) can be considered potential breeding habitat.

Potential impact of development: Potential for the loss of existing and potential foraging, breeding and roosting habitat. Any proposed clearing within the site will need to take into consideration that the removal of habitat used by this species may constitute a high risk of significant impact as defined by DSEWPaC criteria (DSEWPaC 2012).

Barking Owl *Ninox connivens connivens*

Status and Distribution: Listed as Priority 2 by DEC. Found north to Perth (formerly) and east to Northam, Katanning and nearly to Bremer Bay. Declining in south west (Johnstone and Storr 1998).

Habitat: Dense vegetation, especially forest and thickets of waterside vegetation such as melaleucas (Johnstone and Storr 1998). Roosts in tree hollows.

Likely presence in study area: The study area does not contain the preferred habitat of this species and therefore it is unlikely to occur.

Potential impact of development: No impact on this species is anticipated.

Masked Owl *Tyto novaehollandae novaehollandae*

Status and Distribution: Listed as Priority 3 by DEC. Found north to Yanchep and east to Yealering, Gnowangerup and Albany, casual further north. Locally common in south west but generally uncommon (Johnstone and Storr 1998).

Habitat: Roosts and nests in heavy forest, hunts over open woodlands and farmlands (Morcombe 2004). Probably breeding in forested deep south west with some autumn–winter wanderings northwards (Johnstone and Storr 1998).

Likely presence in study area: May occasionally reside in general area though status uncertain. It is unlikely to be specifically attracted to the site. Listed as a potential species but would most probably only ever occur rarely.

Potential impact of development: Loss of some potential habitat but no significant impact on this species is anticipated.

Fork-tailed Swift *Apus pacificus*

Status and Distribution: The Fork-tailed Swift is listed as Schedule 3 under the *WC Act* and as migratory under the *EPBC Act* as migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. It is a summer migrant (Oct-Apr) to Australia (Morcombe 2004).

Habitat: Low to very high airspace over varied habitat from rainforest to semi desert (Morcombe 2004).

Likely presence in study area: It is potentially a very occasional summer visitor to the south west but is entirely aerial and largely independent of terrestrial habitats. Not listed as a potential species.

Potential impact of development: No impact on this species will occur.

Rainbow Bee-eater *Merops ornatus*

Status and Distribution: This species is listed as Schedule 3 under the *WC Act* and as migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The Rainbow Bee-eater is a common summer migrant to southern Australia but in the north they are resident (Morcombe 2004).

Habitat: Open country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands (Morcombe 2004). Breeds underground in burrows where areas of suitable soft soil, firm enough to support tunnel building exist.

Likely presence in study area: Common seasonal visitor to south west. During summer months a small number of individuals of this species may occasionally forage and roost onsite. Area appears unsuitable for construction of breeding burrows.

Potential impact of development: Loss or modification of some natural roosting and foraging opportunities but this species can be expected to continue to utilise the area, as it does now, despite any future development as they often use modified environments. No significant impact on this species is anticipated.

Western Whipbird *Psophodes nigrogularis nigrogularis*

Status and Distribution: This subspecies of the Western Whipbird is classified as Schedule 1 under the *WC Act* and as Endangered under the *EPBC Act*. Originally found in South-west Western Australia along the west coast from Perth to Augusta and on the south coast from King Georges Sound east to at least Two People's Bay. Now restricted to a small area east of Albany between Mt Taylor and Cheyne Beach/Waychinicup R., notably Two People's Bay Nature Reserve and Mt Manypeaks.

Habitat: At Two Peoples Bay, the Western Whipbird occurs in dense shrubland with an open overstorey, the structure of the vegetation being more important than the floristics. All of the domed nests found have been in dense bushes in heath adjacent to thickets. On Mt Manypeaks, the subspecies also occurs in dense low mallee and shrubland. The birds feed mostly on or near the ground.

Likely presence in study area: This species is generally accepted as being regionally extinct.

Potential impact of development: No impact on this species will occur.

Chuditch *Dasyurus geoffroii*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* and as Vulnerable under the *EPBC Act.* Formerly occurred over nearly 70 per cent of Australia. The Chuditch now has a patchy distribution throughout the jarrah forest and mixed karri/marri/jarrah forest of southwest Western Australia. Also occurs in very low numbers in the Midwest, Wheatbelt and South Coast Regions with records from Moora to the north, Yellowdine to the east and south to Hopetoun.

Habitat: Chuditch are known to have occupied a wide range of habitats from woodlands, dry sclerophyll (leafy) forests, riparian vegetation, beaches and deserts. Riparian vegetation appears to support higher densities of Chuditch, possibly because food supply is better or more reliable and better cover is offered by dense vegetation. Chuditch appear to utilise native vegetation along road sides in the wheatbelt (CALM 1994). The estimated home range of a male Chuditch is over 15 km^2 whilst that for females is 3-4 km^2 (Sorena and Soderquist 1995).

Likely presence in study area: Can be considered to be locally extinct. This species is rarely recorded on the coastal plain (Dell 2000) and is only likely to pass through the area on very rare occasions at best. The nearest, most recent record in the DEC database is from Eaton in 2000 and previous to this, Leschenault in 1997. An individual was also captured in Yalgorup National Park in 2007 (Nowicki 2007). Other records are from large state forest areas of the Whicher Range (e.g. Bamford

and Bamford 2000, DEC 2007). While its presence in the general area cannot be totally discounted the fragmented nature of the bushland would make it very difficult for a population of this species to persist and any observations made would most likely be of transient individuals. Not listed as a potential species.

Potential impact of development: No significant impact on this species is anticipated as it is unlikely to utilise the study area for any significant purpose.

Southern Brush-tailed Phascogale *Phascogale tapoatafa ssp*

Status and Distribution: Listed as Scheduled 1 under the *WC Act*. Present distribution is believed to have been reduced to approximately 50 per cent of its former range. Now known from Perth and south to Albany, west of Albany Highway. Occurs at low densities in the northern jarrah forest. Highest densities occur in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (DEC information pamphlet). Records are less common from wetter forests. Can also persist in floristically degraded areas such as relatively dense and continuous, but parkland cleared woodland in farmland. Local records from Kemerton, Dardanup and College Grove (G. Harewood pers. obs.).

Habitat: This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. A nocturnal carnivore relying on tree hollows as nest sites. The home range for a female brush-tailed phascogale is estimated at between 20 and 70 ha, whilst that for males is given as twice that of females. In addition, they tend to utilise a large number (approximately 20) of different nest sites throughout their range (Soderquist 1995).

Likely presence in study area: An individual of this species was observed during the nocturnal survey and it has been previously recorded nearby by Coffey (2011b).

Potential impact of development: Loss of existing habitat. Potential for individuals to be killed or injured during clearing.

Quenda *Isoodon obesulus fusciventer*

Status and Distribution: Listed as Priority 5 by DEC. Widely distributed in the south west from near Cervantes north of Perth to east of Esperance, patchy distribution through the Jarrah and Karri forest and on the Swan Coastal Plain, and inland as far as Hyden. Has been translocated to Julimar State Forest, Hills Forest Mundaring, Tutanning Nature Reserve, Boyagin Nature Reserve, Dongolocking Nature Reserve, Leschenault Conservation Park, and Karakamia and Paruna Sanctuaries (DEC information pamphlet) and Nambung and Yalgorup National Parks (DEC pers. coms.).

Habitat: Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. Quendas can

thrive in more open habitat subject to exotic predator control (DEC information pamphlet).

Likely presence in study area: The study area contains no suitable habitat for this species to utilise.

Potential impact of development: No impact on this species will occur.

Western Ringtail Possum *Pseudocheirus occidentalis*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* and as Vulnerable under the *EPBC Act.* Common in suitable habitat (de Tores 2008). The highest densities of this species are recorded in Peppermint habitat near Busselton area; relatively high densities are found in Jarrah/Marri forest at Perup (de Tores 2008).

The Western Ringtail Possum has a restricted distribution in south-western Western Australia. Most known populations (natural and translocated) are now restricted to near coastal areas of the south west from the Dawesville area to the Waychinicup National Park. Inland, it is also known to be relatively common in a small part of the lower Collie River valley, the Perup Nature Reserve and surrounding forest blocks near Manjimup. It has also been recorded in stands of Peppermint near the Harvey River and in Jarrah/Marri forest near Collie; however, the long term persistence of the species in these areas is not confirmed (de Tores *et al.* 2004). The Western Ringtail was formerly more widespread: in the 1970s it was known from Casuarina woodlands in the wheatbelt near Pingelly (south-east of Perth), and it is thought to have once occurred throughout much of south-western Western Australia (but not necessarily continuously distributed) (Maxwell *et al.* 1996; de Tores 2008).

The species is widespread and relatively common in vegetated remnants within the Swan Coastal Plain and along the Whicher Scarp between Bunbury and Busselton (G. Harewood pers. obs.).

Habitat: The Western Ringtail Possum was once located in a variety of habitats including Coastal Peppermint, Coastal Peppermint-Tuart, Jarrah-Marri associations, Sheoak woodland, and eucalypt woodland and mallee. Coastal populations mostly inhabit Peppermint-Tuart associations with highest densities in habitats with dense, relatively lush vegetation. In these areas the main determinants of suitable habitat for WRPs appears to be the presence of *Agonis flexuosa* either as the dominant tree or as an understorey component of Eucalypt forest or woodland (Jones *et al*. 1994a). Inland, the largest known populations occur in the Upper Warren area east of Manjimup (Wayne *et al.* 2005). In this area the peppermint tree is naturally absent and jarrah-marri associations constitute the species refuge and foraging habitat.

Likely presence in study area: No evidence of this species utilising vegetation within the study area found during the day or night survey. Habitat is marginal in quality with a distinct lack of coherent midstorey structure. Known from nearby areas where habitat of a better quality exists and individuals may on occasions move into the study area but in the Authors opinion it does not represent significant habitat.

Potential impact of development: No significant impact on this species is anticipated as a consequence of any development within the study area.

Quokka *Setonix brachyurus*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* and as Vulnerable under the *EPBC Act*. Rare and restricted in south west W.A. from south of Perth to Two Peoples Bay. The distribution of the Quokka includes Rottnest and Bald Islands, and at least 25 known sites on the mainland, including Two Peoples Bay Nature Reserve, Torndirrup National Park, Mt Manypeaks National Park, Walpole-Nornalup National Park, and various swamp areas through the south-west forests from Jarrahdale to Walpole. Known population just south of Bunbury.

Habitat: Mainland populations of this species are currently restricted to densely vegetated coastal heaths, swamps, riverine habitats including tea-tree thickets on sandy soils along creek systems where they are less vulnerable to predation. The species is nocturnal.

Likely presence in study area: There is no potential habitat onsite for this species.

Potential impact of development: No impact on this species or its preferred habitat will occur.

Western Brush Wallaby *Macropus irma*

Status and Distribution: Listed as Priority 4 by DEC. The Western Brush Wallaby is distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid (DEC information pamphlet).

Habitat: The species optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest (DEC information pamphlet).

Likely presence in study area: It is considered unlikely that individuals of this species would be present in the study site as overall, remnant's in the wider area are too small, degraded and/or fragmented to support a viable population of this species.

Potential impact of development: No impact on this species will occur as it is unlikely to occur.

Western False Pipistrelle *Falsistrellus mackenziei*

Status and Distribution: Listed as Priority 4 by DEC and as Vulnerable by the ICUN. Confined to south west W.A. south of Perth and east to the wheat belt. Most records from Karri forests but also recorded in wetter stands of jarrah and tuart and woodlands on the Swan Coastal Plain (Menkhorst and Knight 2011). Range appears to be contracting southwards, presumably due to drying climate.

Habitat: This species of bat occurs in high forest and coastal woodlands. It roosts in small colonies in tree hollows and forages at canopy level and in the cathedral-like spaces between trees.

Likely presence in study area: Recorded in Stratham and at Kemerton (Harewood 2008b, 2010b). May utilise the site for foraging. Some of the hollow trees may also represent suitable roost sites (deep hollows).

Potential impact of development: Loss/modification of an area of potential foraging habitat and possibly roosting habitat. Status of the species in the general area is however unlikely to be significantly affected.

Water Rat *Hydromys chrysogaster*

Status and Distribution: Listed as Priority 4 by DEC. The water rat is widely distributed around Australia and its offshore islands, New Guinea and some adjacent islands. It occurs in fresh brackish water habitats in the south-west of Western Australia, but occurs in marine environments along the Pilbara coastline and offshore islands. Previous survey work in the south west suggested this species was relatively common and widespread though difficult to capture (Christensen *et al.* 1985, How *et al.* 1987).

Habitat: The water rat occupies habitat in the vicinity of permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south west (Christensen *et al.* 1985).

Likely presence in study area: The seasonal creek line that passes through the study area represents very marginal habitat for this species and it is considered unlikely to frequent the area.

Potential impact of development: No impact on this species is anticipated.

APPENDIX B

Black Cockatoo Hollow Assessment

Greg Harewood
Zoologist
PO Box 755
BUNBURY WA 6231
7 August 2013

Doral Mineral Sands Pty Ltd
Lot 7 Harris Road
PICTON WA 6229

Attention: Craig Bovell

Dear Craig

RE: Additional Information Request – Waterloo Heavy Mineral Mining Project, Henty, Western Australia (EPBC 2013/6879): Potential black cockatoo breeding trees.

The following letter provides information relating to DSEWPaC's abovementioned request which relates to two specific "potential black cockatoo breeding trees" identified within Lot 110, Simpson Road during the course of a fauna survey undertaken and reported on by myself in September/October 2012 (Harewood 2012). DSEWPaC (email dated 11 July 2013 – Jena Harrap to Doral personnel) have specifically request the following be provided:

1. A map clearly depicting which of these trees are those showing signs of use, as discussed in the Fauna Survey (Greg Harewood, October 2012) at page iv and page 14.

2. Clear evidence that these trees are not utilised for breeding by any species of threatened black cockatoo.

1: Map

A map showing the relative location of the trees in question (Habitat Tree waypoint 197 and waypoint 375) is attached. The location coordinates and other details of the trees recorded at the time are provided in the original report (Harewood 2012) within Appendix D.

2: Evidence of Use

At the time of the original survey in September 2012 it was evident that the trees in question were in use by fauna of some type, a conclusion based on some signs of wear around the entrance to some hollows (i.e. "rub and "chew" marks). The specific fauna using each hollow could not be determined by the Author as the observed evidence was not indicative of any one particular species. Both hollows were rated as potentially suitable for black

cockatoos based solely on the size and orientation of the entrance to an apparent hollow. No other evidence suggesting actual use specifically by black cockatoos was seen.

Both trees were revisited on the 23 July 2013 by Greg Harewood and Craig Bovell with the main aims of confirming the location of the trees and also to provide an opportunity to re-assess the status and current use of the hollows in question. Observations are detailed below.

Habitat Tree Waypoint 197: The main hollow previously identified in this tree (a "fissure" with an entrance >20 cm) has since been partly destroyed as a consequence of the large branch harbouring the bulk of this hollow (including the original entrance) snapping off and falling to the ground (see picture below left). It appeared that this had only happened in the last few weeks given the presence of browning leaves on the fallen branch. A small part of the original hollow still appears to be present and tapers off into the trunk of the tree though its depth could not be determined from ground level.

Evidence observed during the most recent site visit strongly suggested that the original hollow was used by Australian Wood Ducks as a nest site just prior to snapping off. Downy feathers seen near the snapped off hollow (indicated by the red arrow in picture above left) and those found on the ground (picture above right) were independently identified by Ron Johnstone of the WA Museum and Rick Dawson of DPaW (pers. comms. 24 July 2013) as those from nestlings of this duck species which utilised tree hollows for breeding.

The potential suitability of this hollow as a nest site for black cockatoos would appear to have been significantly reduced as a consequence of the branch snapping off and in the Authors opinion it is probably no longer likely to be used for this purpose given the reduced entrance size (now ~ 10 to 12cm) and the significant reduction in the internal size of the hollow itself.

Habitat Tree Waypoint 375: This tree was noted in 2012 as having a knot hole of between 12 and 20cm in size with evidence of use (i.e. “rub and “chew” marks) (Harewood 2012). Observations made during the July 2013 site visit were consistent with those made previously and suggest that fauna have or are using the hollow for some purpose, though the species in question is still unclear. The hollow in this tree is shown in the picture below.

Conclusion & Recommendations

Observations made during the most recent site inspection suggest that one of the trees (Habitat Tree Waypoint 197) previously showing signs of use by fauna is probably no longer suitable for black cockatoos for nesting given the branch harbouring the main part of this hollow has fallen off the tree.

The status of the other hollow within Habitat Tree Waypoint 375 has not changed since the initial assessment in 2012 and it appears to have been used or is in use by fauna of some type. The probability that it is actually used by black cockatoos for nesting can be considered to be low, however its use for this purpose cannot be totally discounted and a precautionary approach should therefore be adopted.

Doral have indicated that it will be difficult to avoid the need to remove this tree given its location within the central section of the proposed mining area and therefore it is recommended that the actual use of the hollow by black cockatoos be determine by way of a monitoring program up till the time of clearing (~January 2014). If no evidence of actual use is found then the tree can be cleared in line with DSEWPaC approvals. If at some stage the tree is found to be in use by black cockatoos then liaison with DSEWPaC will need to be undertaken to determine the most suitable course of action.

Taking into account breeding, brooding and fledgling times of all three species of black cockatoos known to frequent the area it is recommended that the tree be examined for use

once per month up until the proposed clearing, with the final assessment being carried out the day before proposed clearing. Each monitoring event should be undertaken from about one hour prior to sunset till about one hour after sunset with the main aim of detecting male cockatoos returning to the nest site to feed the female during the initial stages of the brooding process. At the same time other evidence of use can be searched for such as noise made by nestlings or other activity indicative of black cockatoos being in residence.

If you have any questions or queries relating the information provided here please contact the undersigned on 0402 141 197 / gharewood@iinet.net.au

Greg Harewood
Zoologist

Attachments:

Figure 1: Habitat Trees (DBH >50cm) - Lot 110 Simpson Road Dardanup

References Cited:

Harewood, G. (2012). Fauna Assessment of Lot 110 Simpson Road Dardanup. Unpublished report for Doral Mineral Sands Pty Ltd. October 2012.

Legend

- Lot 110 Boundary
- Tree >50cm DBH, no hollows seen
- Tree >50cm DBH, one or more hollows seen
- Tree >50cm DBH, one or more hollows possibly suitable for a Black Cockatoo

0 10 20 30 40 50

Metres

MGA Zone 50

Fauna Survey

DRAWN:G Harewood

DATE : July 2013

SCALE: 1:700

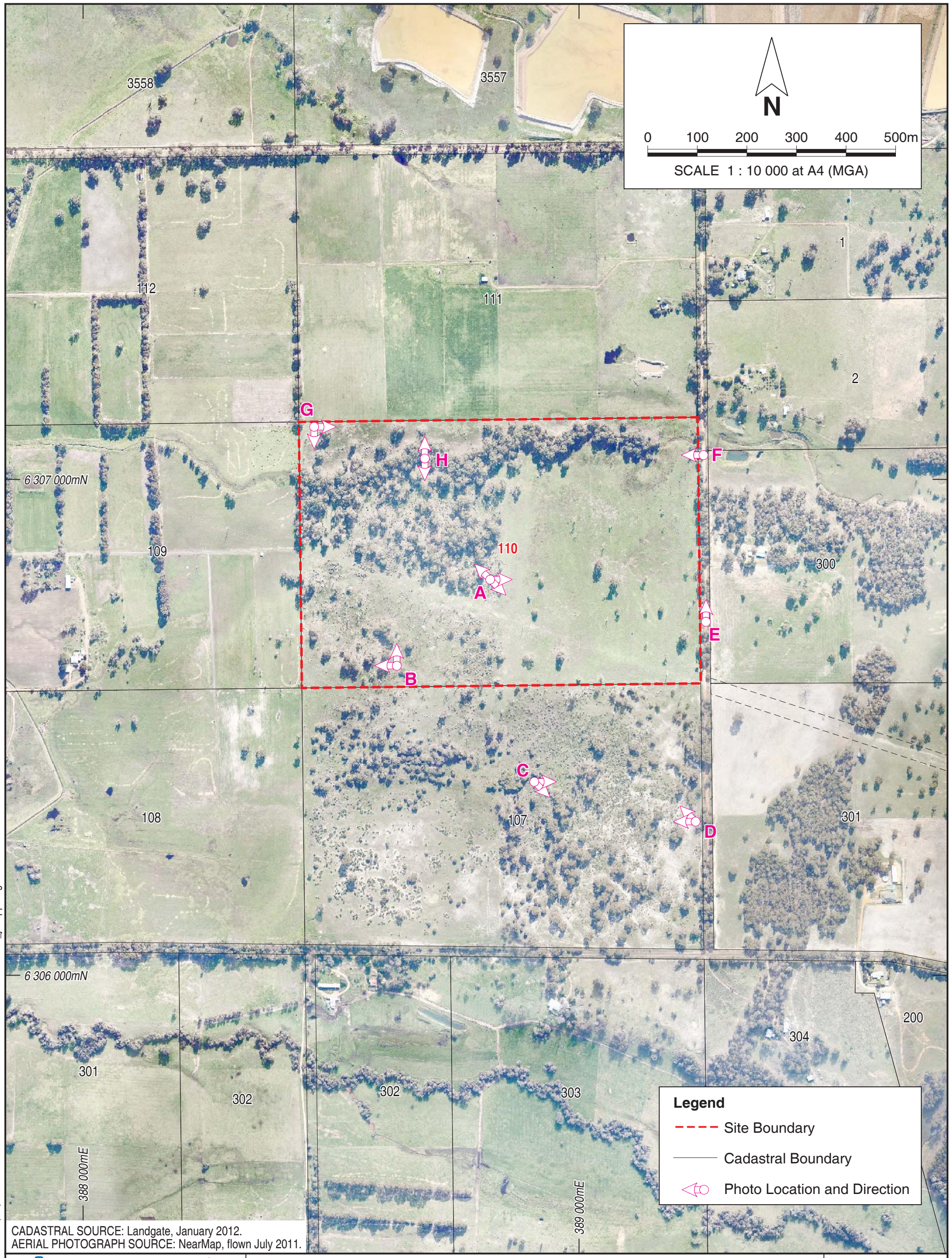
Lot 110 Simpson Road Dardanup

Habitat Trees (DBH >50cm)

Figure: 1

APPENDIX C

Plates of Habitat Condition within Waterloo Project Area



PINPOINT CARTOGRAPHICS (08) 9562 7136 DMS2013-001-EPBC-Attachment 8_jw-appB.dgn

Aurora environmental

Doral
OFFSETS MANAGEMENT STRATEGY
DARDANUP MINERAL SANDS WATERLOO PROJECT

Appendix B

PHOTOPOINTS - WATERLOO PROJECT

Drawn: J. Wilshaw | Date: 16 May 2013 | Job: DMS2013-001

Photograph 1 - Location A looking East away from the proposed disturbance area in CcXp

Photograph 2 - Location A looking Southeast away from the proposed disturbance area in CcXp

Photograph 3 – Location A looking Northwest in proposed disturbance area in CcXp

Photograph 4 – Location B looking North in proposed disturbance area in EmXp (existing Haul Road in foreground)

Photograph 5 – Location B looking West in proposed disturbance area in EmXp

Photograph 6 – Location C looking East near existing Woodland Habitat Rehabilitation and Offset Area

Photograph 7 - Location C looking Southeast into existing Woodland Habitat Rehabilitation and Offset Area

Photograph 8 – Location D looking West into existing Woodland Habitat and Rehabilitation and Offset Area

Photograph 9 - Location D looking Northwest into existing Woodland Habitat and Rehabilitation and Offset Area

Photograph 10 – Location E looking north into Proposed Waterloo Offset Area (Management Area A).

Photograph 11 – Location F looking West into Proposed Waterloo Offset Area (Management Area A is cleared in the foreground and Management Area B is CcEmEr). This is also the Unnamed Creek.

Photograph 12 – Location G looking East in Proposed Waterloo Offset Area (Management Area A is cleared in the foreground and Management Area B is CcEmEr).

Photograph 13 – Location G looking South into Proposed Waterloo Offset Area (Management Area A is cleared in the foreground and Management Area B is CcEmEr).

Photograph 14 – Location H looking North within Proposed Waterloo Offset Area in CcEmEr (Management Area B).

Photograph 15 – Location H looking South within Proposed Waterloo Offset Area in CcEmEr (Management Area B).

APPENDIX D

Perched Groundwater, Soil Moisture and Vegetation Health Monitoring Program

Operating Procedure

DMS -EP10.7

Perched Groundwater, Soil Moisture and Vegetation Health Monitoring Procedure Dardanup Southern Extension

Purpose

The Department of Sustainability, Environment, Water, Population and Conservation (DSEWPaC) requires Doral to comply with Condition 6 of the proposed approval decision for the Dardanup Southern Extension (DSE) project:

> ***The person taking the action must develop a Perched Groundwater and Tree Health Monitoring Program (the program) to be conducted for the life of the project, including the rehabilitation phase, to ensure mining excavations do not reduce water availability. The program, including trigger values and contingency measures, must be developed in consultation with local DEC officers. The program must be provided to the Department within 30 days of establishment of the program.***

In addition, to ensure that mining excavations and dewatering do not reduce water availability so as to adversely affect groundwater dependent vegetation the following commitments by Doral have been made:

- ***Monitoring perched groundwater levels, soil moisture and vegetation health in Threatened Ecological Communities (TECs) CCKa and CcXp and the vegetation type ErMp within the proposed Woodland Habitat Rehabilitation and Offset Area (WHROA);***
- ***Monitor vegetation health on a monthly basis in groundwater dependent areas at risk when dewatering activity is occurring; and***
- ***The monitoring shall be carried out before, during and for at least 12 months after dewatering and mining has ceased, on a monthly basis.***

Procedures

1. PERCHED GROUNDWATER

Perched groundwater in the DSE is unconfined and occurs above impervious layers such as clays and silts which form an unsaturated zone. Perched groundwater is generally separate from the underlying Superficial Aquifer. In the DSE, perched groundwater occurs between 1 to 4metres below ground level (mBGL) depending on the nature of the impervious clay layer.

Mattiske Consulting Pty Ltd (2010) noted that the TECs CcXp and CcKa occur on soils with high clay and loam content and inferred that the low permeability of these soils was likely to slow groundwater movement through these profiles. More detailed investigation into soil profiles and groundwater dynamics across the DSE show that the TECs and other groundwater dependent ecosystems (GDEs) are underlain by shallow sands over a lens of clay (at an average depth of 1-4mBGL), upon which ground water perches as a result of rainfall. The clay layer ensures that

groundwater is relatively constant for these communities as it is not likely to be affected by changes in the Superficial Aquifer (PB, 2012).

1.1 Perched Groundwater Monitoring Methodology

Perched groundwater levels will be monitored in Perched Water Dip Wells (PWDW) PWDW6, PWDW7, PWDW8 and PWDW9 which are located in TECs CcXp and CcKa and within vegetation type ErMp and AfEr, as shown in Figure 1. Monitoring will be undertaken on a monthly basis before, during and for at least 12 months post mining. Monitoring will commence (prior to dewatering) in July 2012.

Monitoring will be undertaken by inserting a depth to water indicator into the relevant PWDW and recording the water level in mm.

1.2 Perched Groundwater Trigger Values

The following trigger values have been applied for the four PWDW's based on perched groundwater information recorded over several seasons in Burekup West:

- PWDW6 – Less than 3mBGL (outside of February to April);
- PWDW7 – Less than 3mBGL (outside of February to April); and
- MB29s – Less than 4mBGL (outside of February to April).

It is anticipated that trigger levels will be revised following the collection of 12 months of data.

1.3 Perched Groundwater Contingency Measures

In the event that monitoring demonstrates adverse trends, in consultation with the DEC, the following actions will be implemented:

- The sequence of mining may be altered to reduce drawdown impacts;
- Short term cessation of activities until such time as conditions allow for recommencement (e.g. soil moisture recharge due to rainfall, or alternatively via irrigation); and
- Artificial irrigation of the affected areas and/or modification of mining activities.

1.4 Perched Groundwater Reporting

Trend graphs for each PWDW including any contingency measures implemented will be reported and discussed in the Annual Environmental Report (AER) submitted annually on the 1st March.

2. SOIL MOISTURE MONITORING

Soil moisture monitoring will be undertaken for soil moisture access tubes SM007, SM008 and SM009 which are located within TECs CcXp and CcKa and within vegetation type ErMp (Figure 1). Soil moisture monitoring will be conducted on a monthly basis before, during and for at least 12 months post mining. Monitoring will commence (prior to dewatering) in July 2012. Monitoring will be conducted using a Neutron Hydroprobe which consists of a radioactive neutron emitting source which records the density of hydrogen atoms (present in water) thus measuring the moisture density of the surrounding soil.

2.1 Soil Moisture Methodology

Monitoring of soil moisture in the access tubes will be conducted using the following methodology:

1. Prior to conducting soil moisture monitoring in the access tubes, three sets of Neutron Hydroprobe readings (dry, medium and high) need to be calibrated against soil samples collected next to soil access tubes and analysed by a NATA accredited laboratory for soil moisture. "Dry" calibration samples will be collected during late summer/early autumn (late March/early April),"high" calibration samples will be collected in late winter / early spring (late August/September) and "medium" calibration samples will be collected in late spring / early summer (late November/December).
2. Calibration soil samples need to be collected within a 10 meter radius of all three soil moisture access tubes (SM007, SM008 and SM009). The calibration samples (soil profile) should ideally be collected using a push probe drilling technique. If ground conditions require use of an auger drilling technique, the auger flights need to be separated according to change in profile and stored in zip locked bags.
3. All calibration soil samples will be separated into distinct soil horizons and placed into ziplock bags to ensure moisture levels do not change. If samples cannot be delivered to the NATA accredited laboratory within 24 hours, samples will be frozen and sent to the laboratory on the next most suitable day.
4. On a monthly basis the Neutron Hydroprobe is then lowered down each of the soil moisture access tubes (SM007, SM008 and SM009) to measure and record the soil moisture using a neutron moderation technique.
5. Soil moisture results for the calibration soil samples and results obtained from the Neutron Hydroprobe are calibrated from the readings collected by the Neutron Hydroprobe.

2.2 Soil Moisture Trigger Values

Soil moisture access tube SM007 was installed in November 2010, with the soil moisture profile showing a seasonal variation and as such, baseline data for this location will be used as a trigger value for SM007, SM008 and SM009 in the absence of specific data for each soil moisture access tube location. Trigger values for each location will be subject to review after 12 months of monitoring.

2.3 Soil Moisture Contingency Methods

In the event that monitoring demonstrates adverse trends, in consultation with the DEC, the following actions will be implemented:

- The sequence of mining may be altered to reduce drawdown impacts;
- Short term cessation of activities until such time as conditions allow for recommencement (e.g. soil moisture recharge due to rainfall, or alternatively via irrigation); and
- Artificial irrigation of the affected areas and/or modification of mining activities.

2.4 Soil Moisture Reporting

Trend graphs for each soil moisture access tube will be reported and discussed in the AER.

3. VEGETATION HEALTH MONITORING

A vegetation health monitoring program will be established for groundwater dependent areas within the DSE which are potentially at risk of reduced water availability during dewatering activities. Vegetation monitoring transects will be established at four sites to monitor vegetation health. Transects will be located within TECs CcKa and CcXp, vegetation type ErMp and AfEr. Transect locations are shown on Figure 1 and a description of the vegetation type for each transect is provided in Table 1. Transect 10 and 11 located with TECs CcKa and CcXp are outside of the Superficial Aquifer drawdown and are considered to represent control sites.

Table 1: Description of Vegetation Monitoring Transects

Transect #	Location Description	Vegetation Community Description
10	Simpson Road (Control site)	**CcKa** - *Corymbia calophylla – Kingia australis* woodlands and shrublands, Swan Coastal Plain. This community has values in common with SCP3b (*Corymbia calophylla – Kingia australis* woodlands and shrublands) though demonstrates less than 17% floristic similarity with the TEC community (Mattiske Consulting, 2011a).
11	Simpson Road (Control site)	**CcXp** - Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain. This community has values in common with TEC SCP3a (Corymbia calophylla and Xanthorrhoea preissii woodlands) though demonstrates less than 17% floristic similarity with the TEC community (Mattiske Consulting, 2011).
12	Located within the Woodland Habitat Rehabilitation and Offset Area.	**ErMp** - Open Woodland of Eucalyptus rudis and Melaleuca preissiana over pasture grasses.
13	Along Paradise Creek adjacent to the mine pit.	**AfEr** - Open Forest of Agonis flexuosa with scattered Eucalyptus rudis over Pennisetum clandestinum.
14	Waterloo Offset Area	**CcEmEr-** Parkland cleared woodland over grassland and introduced species bordering ephemeral Creek.

Vegetation health monitoring will consist of the following:

- Visual assessment of tree health;
- Monitoring of formal photo-monitoring sites;
- Analysis of tree health data using graphing and basic statistics; and
- Report the overall tree health of vegetation.

Monitoring will be conducted on a monthly basis before, during and for at least 12 months post-mining.

3.1 Vegetation Health Monitoring Methodology

The following equipment will be required to undertake the monthly vegetation health assessment for each of the five transects:

- Aerial map of transect locations (refer to Figure 1);
- Vegetation health monitoring field data sheets (DMS-EF46) (Refer to Attachment 1);
- Tape measure;
- Camera;
- Compass;
- GPS.
- Cow tags;
- Flagging tape;
- Paint; and
- Stakes.

3.2 Visual Assessment

Each individual tree for each transect will be tagged (a numbered cow tag held on with wire) for identification and tree characteristics will be measured in accordance with the guidelines established during the initial assessment to ensure consistency. These characteristics will include:

- Diameter at breast height (DBH) - measured with a tape measure at approximately 1.3m from ground level around the trunk. If numerous trunks are present, typically the largest trunk is measured (not for all trees). DBH will only be measured quarterly.
- Canopy vigour is ranked from 1 (poor) to 5 (excellent) according to the proportion of canopy that is alive;
- Canopy density is recorded as the percentage of canopy observed compared to the 100% density possible;
- Height is measured by approximation from ground level;
- Presence of new growth is assessed by checking for the softer leaves at the apical ends of lower branches;
- Stress is ranked as D (dead), VS (very stressed), S (stressed) or NS (not stressed) according to a combination of defoliation and leaf health measures;
- Presence of leaf stress can usually only be obtained from lower branches which are able to be closely observed. Leaf stress is indicated by leaves showing signs of desiccation, chlorosis or dying at the tips; and
- Flowering.

Additional notes will be taken for each tree to summarise whether they could be described as;

- Healthy (health considered normal);
- Having epicormic growth (new growth from main stems);
- A small canopy (relative to the size of the tree);
- Presence of insects or pathogens, defoliating (leaf shed evident by bare branches);
- Dying (high level of defoliation to a critical point), or

- Dead (no photosynthesizing leaves evident).

In addition trees will be observed for signs of flowering (Yes/No).

3.3 Photopoints

Photopoints will be established for each transect (Figure 1) to allow a visual comparison of changes to the vegetation condition over the life of the project.

Appropriate photopoints will be set up in the July 2012 round of monitoring. Photopoints will be chosen with consideration to access and best representation of canopy health.

3.4 Vegetation Health Analysis and Reporting

Trend graphs for overall tree health for each tree in the four transects will be created by combining a score for each of three parameters (canopy vigour, canopy density and water stress). It should be noted however that this is a summary developed for ease of displaying general tree health trends over time. The following criteria will be used:

- A score from 0-5 will be used for canopy vigour;
- Canopy density (%) will be converted to a score of 0-10; and
- The level of water stress will be converted to a score of 0-6 (Dead=0, Very Stressed-Dead=1, Very Stressed=2, Very Stressed=3, Stressed=4, Stressed-Not Stressed=5 and Not Stressed=6).

Each tree will then receive a combined score out of a maximum possible score of 21. The overall tree health score will then be grouped into the following 'health levels':

- Level 1: An overall score of 0-5 (i.e. trees in poor condition);
- Level 2: An overall score of 6-10;
- Level 3: An overall score of 11-15;
- Level 4: An overall score of 16 to 18; and
- Level 5: An overall score of 19-21 (i.e. trees in the healthiest condition).

Trend graphs of the overall tree health ratings will be reported and discussed in the AER.

3.5 Vegetation Health Trigger Values

Should any trees within the four transects show signs of decreasing health likely to be due to groundwater drawdown (i.e. comparison with control sites), contingency measures will be implemented.

3.6 Vegetation Health Contingency Measures

In the event that monitoring demonstrates adverse trends, in consultation with the DEC, the following actions will be implemented:

- The sequence of mining may be altered to reduce drawdown impacts;
- Short term cessation of activities until such time as conditions allow for recommencement (e.g. soil moisture recharge due to rainfall, or alternatively via irrigation); and
- Artificial irrigation of the affected areas and/or modification of mining activities.

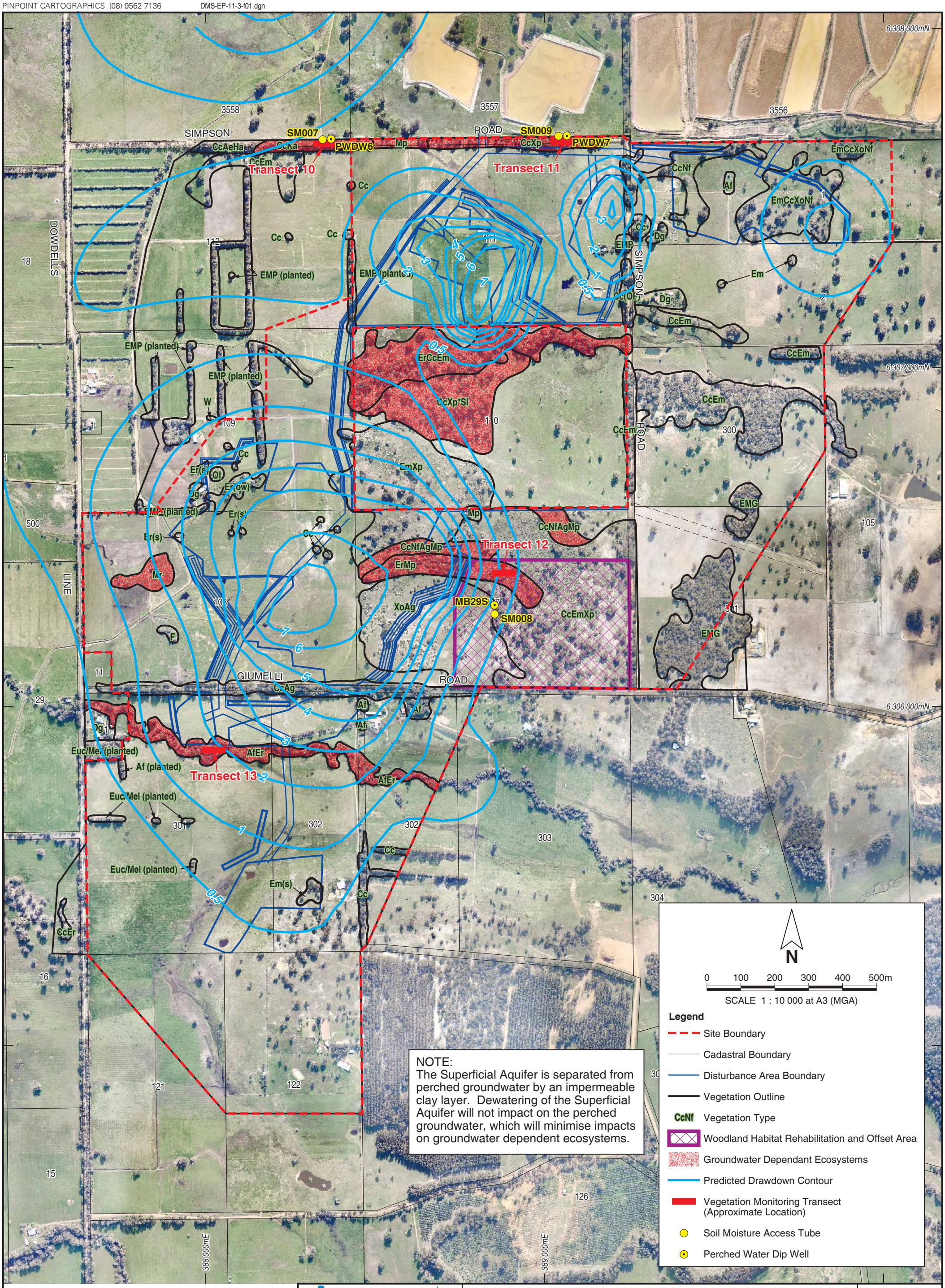
Responsibilities

The OHS&E Superintendent shall be responsible for ensuring regular monitoring is conducted by competent persons and results are reported as required.

Approved By:

OHS&E Superintendent Date

PINPOINT CARTOGRAPHICS (08) 9562 7136 DMS-EP-11-3-f01.dgn



NOTE:
The Superficial Aquifer is separated from perched groundwater by an impermeable clay layer. Dewatering of the Superficial Aquifer will not impact on the perched groundwater, which will minimise impacts on groundwater dependent ecosystems.

CADASTRAL SOURCE: Landgate, January 2012.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown July 2011.
DRAWDOWN SOURCE: Parsons Brinckerhoff, Job No. 2162455A, Figure B-10, 03-01-12.

Aurora environmental

Drawn: J. Wilshaw | Date: 25 Jul 2012

Doral
VEGETATION MONITORING
DARDANUP SOUTHERN EXTENSION

LOCATION OF PERCHED WATER DIP WELLS, SOIL MOISTURE ACCESS TUBES AND VEGETATION HEALTH TRANSECTS

Figure 1

Job: DMS2011-002

TREE HEALTH MONITORING
FIELD ECOLOGISTS:
DATE:
LOCATION:
TRANSECT #:

Tree I.D.	Species	Diameter at Breast Height	Canopy Vigour (1 - 5)	Canopy Density (%)	Height (m)	New Growth (Present	Water Stress (D,VS,S,N	Leaf Stress (Present/A	Flowering (Y/N)	MARK IF PRESENT								
										Healthly	Epicormic growth	Small Canopy	Pathogens	Defoliating	Dying	Dead	Easting	Northing

TREE HEALTH MONITORING
FIELD ECOLOGISTS:
DATE:
LOCATION:
TRANSECT #:

Tree I.D.	Species	Diameter at Breast Height (cm)	Canopy Vigour (1 - 5)	Canopy Density (%)	Height (m)	New Growth (Present %/Absent)	Water Stress (D,VS,S,NS)	Leaf Stress (Present/Absent)	Flowering (Y/N)	MARK IF PRESENT								
										Healthly	Epicormic growth	Small Canopy	Pathogens	Defoliating	Dying	Dead	Easting	Northing