

Potential impact of vegetation clearing and the development of a conveyor belt on fauna at the Ravensthorpe Nickel Operations



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Front Cover: Echidna (*Tachyglossus aculeatus*) which are relatively abundant in some areas on the RNO tenements



EXECUTIVE SUMMARY

Ravensthorpe Nickel Operations (RNO) is proposing to construct a conveyor belt between a-to-be constructed ROM at Shoemaker Levy and the existing main plant ('project area'). This conveyor belt, which is approximately 11km long, will bring ore from Shoemaker Levy to the main plant for processing. For the purposes of this fauna risk assessment, the corridor is 200m wide; however, the actual on-ground disturbance footprint is likely to be much narrower.

Terrestrial Ecosystems has reviewed the available fauna survey reports for RNO and has undertaken site visits in 2008, 2013 and twice in 2014. The 2013 and first visit in 2014 were to monitor the presence of conservation significant fauna on RNO tenements. The second visit in November 2014 was to undertake a targeted search of the corridor for Malleefowl mounds and to assess the potential of the conveyor belt corridor to provide foraging habitat for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and habitat for Western Whipbirds (*Psophodes nigrogularis*).

Terrestrial conservation significant fauna potentially found in the project area include the Heath Rat (*Pseudomys shortridgei*), Western Mouse (*Pseudomys occidentalis*), Chuditch (*Daysurus geoffroii*), Western Brush Wallaby (*Macropus irma*), Tammar Wallaby (*Macropus eugenii*) and the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*). Of these species, Western Brush Wallabies are known to be in the project area and there is a low probability that Heath Rat, Western Mouse, Chuditch, Tammar Wallaby and the Southern Brown Bandicoot are present. Conservation significant avian species (Carnaby's Black-Cockatoo, Crested Bellbird (*Oreoica gutturalis*), Shy Heathwren (*Hylacola cauta*), Western Whipbird, Rainbow Bee-eater (*Merops ornatus*), Australian Bustard (*Ardeotis australis*) and Rufous Fieldwren (*Calamunthus campestris*) are present on RNO tenements, however, those in the project area will readily move out of the area once vegetation clearing commences.

The search of the project area confirmed that the area supports multiple plant species that would be foraged by Carnaby's Black-Cockatoo although most of the area provided low quality foraging opportunities. There are no Malleefowl mounds in the conveyor belt corridor; however, there are patches of vegetation that may provide suitable habitat for Western Whipbirds.

If vegetation units can be used as a proxy for fauna habitats, then the fauna habitats present in the corridor are abundant in adjacent areas indicating fauna assemblages and species present in the corridor would also be present in adjacent areas. There are no unique vegetation units / fauna habitats and thus fauna species or assemblages present in the corridor. The assessed potential impact of vegetation clearing and development of a conveyor belt on all conservation significant species is low. However, vegetation clearing will result in the loss of some fauna during the clearing process and displacement of others into adjacent areas.

Clearing of vegetation in the conveyor belt corridor will trigger one of the criterion (i.e. clearing more than 1ha of Black-Cockatoo foraging habitat) for a referral to the Commonwealth Government under the EPBC Act. It is therefore recommended that the proposed action is referred to the Commonwealth Government under the EPBC Act.



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1 INTRODUCTION

1.1 Background

Ravensthorpe Nickel Operations (RNO) is proposing to construct a conveyor belt between a-to-be constructed ROM at Shoemaker Levy and the existing main plant ('project area'). This conveyor belt will bring ore from Shoemaker Levy to the main plant for processing. The location of the project area is shown in Figure 1 and the conveyor belt corridor is shown in Figure 2. For the purposes of the fauna risk assessment, the corridor width is 200m (Figure 2); however, the actual clearing footprint is likely to be much narrower.

Terrestrial Ecosystems was commissioned to undertaken a review of the existing information and to assess the potential impact that vegetation clearing and the construction of a conveyor belt and an adjacent service track would have on the fauna.

The WA Environmental Protection Authority (EPA) has published three documents that provide guidance for undertaking vertebrate fauna assessments in Western Australia, namely: Terrestrial Biological Surveys as an Element of Biodiversity Protection: Position Statement No. 3 (EPA 2002); Guidance for the Assessment of Environmental Factors. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56 (EPA 2004); and Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and Department of Environment and Conservation 2010). This assessment is in line with Terrestrial Ecosystems interpretation of these EPA statements and what is now routinely currently accepted by the Department of Mines and Petroleum (DMP) and the EPA.

1.2 Existing literature and fauna survey data

There have been numerous fauna assessments and surveys undertaken for the RNO tenements. These include:

- Biota Environmental Sciences (2000) Ravensthorpe Nickel Project Fauna Survey 2000. Unpublished report for Ravensthorpe Nickel Operations.
- Biota Environmental Sciences (2005) BHP Billiton Ravensthorpe Nickel Operations Fauna Trapping Program 2005. Unpublished report for BHP Billiton, Perth.
- Cancilla, D. and Johnson, B. (2013) The status and ecology of the *Pseudomys shortridgei* (Heath Mouse) in southern western Australia. Unpublished report for Murdoch University.
- Chapman A. (2000) Fauna Management Plan Year One 1999-2000. Unpublished report for Comet Resources, Ravensthorpe.
- Coffey Environments (2009) Terrestrial Vertebrate Fauna Risk Assessment for the Shoemaker-Levy Ore Body, Ravensthorpe Nickel Operations, Unpublished report for BHP Billiton Ravensthorpe Nickel, Ravensthorpe.
- Coffey Environments (2010) Fauna Monitoring, Ravensthorpe Nickel Operations, January 2010. Unpublished report for Ravensthorpe Nickel Operations, Ravensthorpe.
- Craig G.F. and Chapman A. (1998) Ravensthorpe Nickel Project. Comet Resources NL. Vegetation, Flora and Fauna Survey. Unpublished report for Ravensthorpe Nickel Project.
- Sinclair Knight Merz (2001b) Stygofauna Investigation in the Tamerine Limestone deposit for Ravensthorpe Nickel Operations, Ravensthorpe Nickel Project, Stygofauna Investigation Phase 2.
- Sinclair Knight Merz (2001a) Ravensthorpe Nickel Project, Stygofauna Investigation Phase 2 Ravensthorpe Nickel Project, Stygofauna Investigation Phase 2.
- Terrestrial Ecosystems (2013) Conservation Significant Vertebrate Fauna Monitoring for Ravensthorpe Nickel Operations, Ravensthorpe. Unpublished report for FQM Australia Nickel, Ravensthorpe.
- Terrestrial Ecosystems (2014) Conservation Significant Vertebrate Fauna Monitoring for Ravensthorpe Nickel Operations 2014, Ravensthorpe. Unpublished report for FQM Australia Nickel, Ravensthorpe.

The Craig and Chapman (1998) report for the fauna survey of the project area is unavailable, so it has not been possible to extract the relevant data on conservation significant fauna from this report. A brief report by Cancilla and Johnson (2013) indicated that 720 trap-nights was used in an attempt to catch the Heath Rat at Bandalup Hill; but no Heath Rats were caught in this survey. No other details of trapping sites were provided. Chapman (2000) reported on surveys undertaken between 8-23 November 1999 and 4-17 April 2000 as the first year of a long term monitoring program for three threatened mammals and two threatened bird species that were known to be present in the project area. This survey followed on from the earlier survey work undertaken by Craig and



Chapman (1998). Nine sites were established. Sites E1-E5 had 20 aluminium box traps and sites CMS1-CMS4 had one cage trap, 20 aluminium box traps and 12 pit traps. In addition, 12 cage traps were deployed in other locations. The total trapping effort was 480 pit trap-nights, 1,000 aluminium box trap nights and 200 cage trap nights. The trap type that captured the conservation significant fauna was not mentioned in the report. Conservation significant fauna recorded during these two surveys are as shown in Table 1.

Species	Common Name	Nº	Easting	Northing	Site
-			(AMG)	(AMG)	
Psophodes nigrogularis	Western Whipbird	8	254881	6272874	E1
Psophodes nigrogularis	Western Whipbird	3	254916	6273037	E2
Psophodes nigrogularis	Western Whipbird	1	256141	6273526	E3
Psophodes nigrogularis	Western Whipbird	2	256922	6272980	E4
Psophodes nigrogularis	Western Whipbird	5	256813	6274885	E5
Psophodes nigrogularis	Western Whipbird	4	258863	6271850	CMS1
Psophodes nigrogularis	Western Whipbird	6	256612	6272327	CMS2
Psophodes nigrogularis	Western Whipbird	13	254881	6272874	CMS3
Psophodes nigrogularis	Western Whipbird	1	254662	6274642	CMS4
Psophodes nigrogularis	Western Whipbird	1	256065	6272214	
Leipoa ocellata	Malleefowl	1	255832	6273571	
Leipoa ocellata	Malleefowl	1	255769	6272758	
Leipoa ocellata	Malleefowl	1	253853	6273499	
Leipoa ocellata	Malleefowl	1	254881	6272874	
Pseudomys occidentalis	Western Mouse	5	258863	6271850	CMS1
Pseudomys occidentalis	Western Mouse	4	256612	6272327	CMS2
Pseudomys occidentalis	Western Mouse	7	254916	6273037	E2
Pseudomys occidentalis	Western Mouse	1	256922	6272980	E4
Pseudomys shortridgei	Heath Rat	4	256141	6273526	E3
Pseudomys shortridgei	Heath Rat	1	256813	6274885	E5
Pseudomys shortridgei	Heath Rat	1	254881	6272874	E1
Isoodon obesulus	Southern Brown Bandicoot	1	254881	6272874	E1

Table 1. Conservation significant fauna recorded by Chapman (2000)

Biota Environmental Sciences (2000) undertook a survey for Sinclair Knight Merz as part of the preparation of an environmental impact assessment (EIA). Trapping was undertaken between 13-18 October 2000, with 20 aluminium box traps, 12 pit traps and two cage traps deployed at six sites (RNO01-06) mostly for five nights, and a seventh site (RNO07) had 12 pit-traps deployed for five nights. The total trapping effort was 600 aluminium box trap-nights, 534 pit-trap nights and 60 cage trap-nights. Conservation significant fauna recorded during this survey are shown in Table 2.



Species	Common Name	N°	Easting	Northing	Site
-			(AMG)	(AMG)	
Leipoa ocellata	Malleefowl	1	258752	6272315	Site 5
Leipoa ocellata	Malleefowl	1	251832	6278164	
Psophodes nigrogularis	Western Whipbird		251997	6280520	Site 4
Psophodes nigrogularis	Western Whipbird		258494	6272294	Site 5
Psophodes nigrogularis	Western Whipbird		258808	6270857	Site 6
Psophodes nigrogularis	Western Whipbird		258805	6271802	Site 7
Psophodes nigrogularis	Western Whipbird		254881	6272874	E1
Psophodes nigrogularis	Western Whipbird		254916	6273037	E2
Psophodes nigrogularis	Western Whipbird		256922	6272980	E4
Psophodes nigrogularis	Western Whipbird		256813	6274885	E5
Psophodes nigrogularis	Western Whipbird		250688	6278164	
Psophodes nigrogularis	Western Whipbird		258822	6272248	
Pseudomys occidentalis	Western Mouse	1	254986	6273022	
Pseudomys occidentalis	Western Mouse	1	255037	6273031	
Pseudomys shortridgei	Heath Rat	1	251997	6280520	Site 4

Table 2. Conservation significant fauna recorded by Biota Environmental Sciences (2000)

Biota Environmental Sciences (2005) undertook a survey between 23-26 August 2005 for RNO with a focus on recording short-range endemic invertebrates. Six sites (RNOE1-E5, Elliott line) had 20 aluminium box traps set for three nights, one site had 50 cage traps set for two nights and there were eight sites with 12 pit-fall traps, eight aluminium box traps and two cage traps. The total trapping effort was 672 aluminium box trap-nights, 408 pit trap-nights and 168 cage trap-nights. There is no record of the trap type that caught the conservation significant fauna. Conservation significant fauna recorded during this survey are shown in Table 3.

Table 3. Conservation significant fauna recorded by Biota Environmental Sciences (2005)

Species	Common Name	Nº	Easting	Northing	Site
			(AMG)	(AMG)	
Psophodes nigrogularis	Western Whipbird		256780	6272585	RNOCMS2
Psophodes nigrogularis	Western Whipbird		256922	6272980	RNOE4
Psophodes nigrogularis	Western Whipbird		257142	6273254	
Pseudomys occidentalis	Western Mouse	4	256922	6272980	RNOE4

Biota Environmental Sciences (2005) reported undertaking a fauna survey in December 2001 that has not been reported. Lines of 20 aluminium box traps were set at RNOE1, RNOE2, RNOE3, RNOE4 and RNOE5, and these were the same sites used by Chapman (2000). In addition, pit traps, cage traps and aluminium box traps were deployed at RNOCTS01, RNOCTS02, RNOCTS03, RNOCTS04, RNOCMS01, RNOCMS02, RNOCMS03, RNOCMS04 and cage traps were deployed at a cage trapping line.

Coffey Environments (2009) undertook a vertebrate fauna survey of the Halley's pit surrounds and Shoemaker– Levy area. In part, this survey was to meet the Ministerial conditions for on-going monitoring of conservation significant fauna and to provide analogue sites for when fauna monitoring was undertaken in the rehabilitated areas. Pit-traps, aluminium box traps and cage traps were deployed. Conservation significant fauna recorded during this survey are shown in Table 4. This report also indicated that a Chuditch had been killed on the access road into the mine, but no coordinates were available.



Species	Common Name	Nº	Easting (WGS84)	Northing (WGS84)	Sites
Isoodon obesulus	Southern Brown Bandicoot	1	249835	6281541	CK5
Psophodes nigrogularis	Western Whipbird		257482	6276271	CK3
Psophodes nigrogularis	Western Whipbird		251701	6281945	ML1
Psophodes nigrogularis	Western Whipbird		257631	6276419	ML2

Table 4. Conservation significant fauna	recorded by Coffey Environments (200)9)
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Coffey Environments (2010) undertook a second vertebrate fauna monitoring survey to comply with Ministerial conditions. Survey sites included those used in 2009 plus 14 additional sites (N1-N10 and C1-C4). These additional sites were used to provide a comparison with the existing 20 Shoemaker-Levy and Halley's pit sites. Pit-traps, aluminium box traps and cage traps were deployed at N1-N10, and cage traps where deployed at C1-C4. Chuditch were caught in cage traps, and the Western Mouse and Heath Rat were caught in pipe pit-traps. Conservation significant fauna recorded during this survey are as shown in Table 5. A malleefowl was also recorded during the survey.

Table 5.	Conservation	significant fauna	recorded by	Coffey	Environments	(2010)
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Species	Common Name	Nº	Easting (WGS84)	Northing (WGS84)	Sites
Dasyurus geoffroii	Chuditch	9	256130	6272352	Cage 1
Dasyurus geoffroii	Chuditch	1	256872	6271544	Cage 2
Pseudomys occidentalis	Western Mouse	1	256777	6272598	N1
Pseudomys occidentalis	Western Mouse	1	258940	6272024	N8
Pseudomys shortridgei	Heath Rat	1	257631	6276419	ML2
Leipoa ocellata	Malleefowl	1	257482	6276271	

The Terrestrial Ecosystems (2013) survey established six trapping sites in 2013. Sites A, C, D and E each had 100 aluminium box traps and 20 wire cage traps, and sites B and F had 50 aluminium box traps and 10 wire cage traps. The location of all trapping sites was marked with a star picket. In addition, eleven sites that were also marked with a star picket were established to monitor the presence of Western Whipbird. Conservation significant species recorded during the survey are shown in Table 6.

Species	Common Name	Latitude	Longitude	Sites
		(WGS84)	(WGS84)	
Psophodes nigrogularis	Western Whipbird	-33.65867	120.37700	WW1
Psophodes nigrogularis	Western Whipbird	-33.66189	120.36875	WW2
Psophodes nigrogularis	Western Whipbird	-33.65492	120.35710	WW3
Psophodes nigrogularis	Western Whipbird	-33.65511	120.36774	WW4
Psophodes nigrogularis	Western Whipbird	-33.66835	120.38095	WW5
Psophodes nigrogularis	Western Whipbird	-33.66422	120.39415	WW6
Psophodes nigrogularis	Western Whipbird	-33.58585	120.32676	WW8
Psophodes nigrogularis	Western Whipbird	-33.57381	120.32512	WW9
Psophodes nigrogularis	Western Whipbird	-33.57637	120.30493	WW10
Psophodes nigrogularis	Western Whipbird	-33.65216	120.35047	WW11
Macropus irma	Western Brush Wallabies	-33.670120	120.36669	

Table 6. Conservation significant fauna recorded by Terrestrial Ecosystems (2013)

The Terrestrial Ecosystems (2014) survey established a new trapping site to replace Site B (Terrestrial Ecosystems 2013) which had been removed due to mining activity as had Western Whipbird site 7. In addition, 50 motion sensitive cameras were deployed as follows: site A – 6 cameras, site D – 9 cameras, site E – 10 cameras, site F – 5 cameras, Coffey Environments' (2010) Chuditch trapping site on the 'hill' – 10 cameras and Coffey Environments' (2010) Chuditch trapping site in the 'gully' – 10 cameras. Conservation significant species recorded during the survey are shown in Table 7.



Table 7. Conservation significant fauna recorded by Terrestrial Ecosystems (2014)

Species	Common Name	Latitude (WGS84)	Longitude (WGS84)	Sites
Psophodes nigrogularis	Western Whipbird	-33.65867	120.37700	WW1
Psophodes nigrogularis	Western Whipbird	-33.66189	120.36875	WW2
Psophodes nigrogularis	Western Whipbird	-33.65492	120.35710	WW3
Psophodes nigrogularis	Western Whipbird	-33.65511	120.36774	WW4
Psophodes nigrogularis	Western Whipbird	-33.66835	120.38095	WW5
Psophodes nigrogularis	Western Whipbird	-33.58585	120.32676	WW8
Psophodes nigrogularis	Western Whipbird	-33.57381	120.32512	WW9
Psophodes nigrogularis	Western Whipbird	-33.57637	120.30493	WW10
Psophodes nigrogularis	Western Whipbird	-33.65216	120.35047	WW11
Psophodes nigrogularis	Western Whipbird	-33.65615	120.36006	E48
Psophodes nigrogularis	Western Whipbird	-33.65719	120.36232	E86
Leipoa ocellata	Malleefowl	-33.65697	120.36716	
Leipoa ocellata	Malleefowl	-33.57621	120.30501	A5
Leipoa ocellata	Malleefowl	-33.62572	120.38631	F25
Macropus irma	Western Brush Wallaby	-33.57282	120.30511	A1
Macropus irma	Western Brush Wallaby	-33.66275	120.39666	A3
Macropus irma	Western Brush Wallaby	-33.65966	120.37452	A5
Macropus irma	Western Brush Wallaby	-33.65620	120.36020	A57
Macropus irma	Western Brush Wallaby	-33.66828	120.38003	A60
Macropus irma	Western Brush Wallaby	-33.66815	120.37653	Creek
Macropus irma	Western Brush Wallaby	-33.66023	120.36961	D30
Macropus irma	Western Brush Wallaby	-33.65949	120.37502	D40
Macropus irma	Western Brush Wallaby	-33.66003	120.37360	D70
Macropus irma	Western Brush Wallaby	-33.66023	120.37305	D80
Macropus irma	Western Brush Wallaby	-33.66044	120.37252	D90
Macropus irma	Western Brush Wallaby	-33.65495	120.35716	E1
Macropus irma	Western Brush Wallaby	-33.65516	120.35769	E10
Macropus irma	Western Brush Wallaby	-33.65745	120.36322	E100
Macropus irma	Western Brush Wallaby	-33.65543	120.35830	E20
Macropus irma	Western Brush Wallaby	-33.65567	120.35891	E30
Macropus irma	Western Brush Wallaby	-33.65609	120.35988	E45
Macropus irma	Western Brush Wallaby	-33.65646	120.36082	E60
Macropus irma	Western Brush Wallaby	-33.65668	120.36141	E70
Macropus irma	Western Brush Wallaby	-33.65694	120.36199	E80
Macropus irma	Western Brush Wallaby	-33.65719	120.36259	E90
Macropus irma	Western Brush Wallaby	-33.62590	120.38587	F26
Macropus irma	Western Brush Wallaby	-33.62622	120.38396	F48
Macropus irma	Western Brush Wallaby	-33.65961	120.36997	Hill
Oreoica gutturalis	Crested Bellbird	-33.66321	120.39620	A60
Oreoica gutturalis	Crested Bellbird	-33.65961	120.36997	Hill

1.3 Assessment objectives

The purpose of this risk assessment was to review the available literature and data from a site visit undertaken to search for Malleefowl mounds and to assess the potential of the conveyor belt corridor to provide foraging habitat for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and habitat for Western Whipbirds (*Psophodes nigrogularis*) and to assess the potential impact that vegetation clearing and construction activities might have on the fauna, in particular conservation significant fauna.



2 METHODS

Terrestrial Ecosystems reviewed the reports listed above that are available, undertook site visits in 2008, 2013 and twice in 2014. The 2013 and first visit in 2014 were to monitor the presence of conservation significant fauna on RNO tenements. The second visit in November 2014 was to search the conveyor belt corridor for Malleefowl mounds and to assess the potential of the area to provide foraging habitat for Carnaby's Black-Cockatoo and for Western Whipbirds.

The on-the-ground assessment of the conveyor belt corridor was undertaken by Dr S. Thompson, Ray Turnbull and Caitlin Couch of Terrestrial Ecosystems, and Luc Cotte and Lizzie von Perger from RNO. These five people walked up-and-back the length of the corridor approximately 15m apart until the entire area was searched.

This assessment has been prepared by Dr G. Thompson and reviewed by Dr S. Thompson. The qualifications and experience of Terrestrial Ecosystems staff are shown in Table 8.

Table 8. 0	Qualifications and	experience of	neonle that	prepared and	reviewed t	his report
Lable 0.	Quantications and	caperience of	people that	prepareu anu	i concorcu c	ms report

Name	Qualifications	Experienced
Dr Graham Thompson	PhD (Zoology)	> 20 years
Dr Scott Thompson	BSc, MSc, PhD (Env Sci/Man)	> 15 years
Ray Turnbull	B Nat Sc, G.Dip Ornithology	> 6 years
Caitlin Couch	BSc	3 years

2.1 Limitations

As with all risk assessments, this assessment has its limitations. These are listed below:

- Terrestrial Ecosystems has relied on the fauna and vegetation data provided in other reports;
- There has been no classification of fauna habitats across the RNO tenements, so it has been necessary to use vegetation units as a proxy for fauna habitats;
- Woodman Environmental has undertaken a flora and vegetation survey of the proposed conveyor belt corridor and has then mapped the corridor and adjacent area using the vegetation units prepared by Western Botanical (see Figure 3a);
- Vegetation units across the RNO tenements have been mapped based on sample sites and inference from aerial photography. As with any inference, and in particular from aerial photography, boundaries for vegetation units are not always exact. This could have resulted in some trapping sites being placed in the wrong vegetation unit;
- Fauna survey sites are typically represented by a single coordinate, but for many of the surveys undertaken by Coffey Environments (2009, 2010), Biota Environmental Sciences (2000, 2005) and others, traps are deployed over a wide area and are not always in the same vegetation unit in which the coordinate for the site is located; and
- Traps and cameras deployed by Terrestrial Ecosystems (2013, 2014) are mostly in a linear pattern and stretch over a couple of hundred metres, and in some cases across multiple vegetation units. In this situation it has not been possible to extract the exact location of fauna records relative to particular vegetation units.



3 RESULTS

3.1 Vegetation units

Western Botanical (2005) listed the following 16 vegetation units for the RNO tenements (with the acronyms) that have been used in this report.

Hills and upper slopes	Acronym
Mallee shrublands or mallet woodlands, impeded vertical drainage	
Laterite mallee shrubland	LMS
Lateritic saprolite breakaway	LSBr
Mallee heath on Komatite	MHK
Rocky calcareous loam woodland	RCLW
Mallee shrublands, free draining	
Sandy silcrete thicket	SST
Carbonate influenced soils, free draining	
Magnesite mallee shrubland	MMS
Magnesite mallet woodland (with Eucalyptus purpurata)	WMp
Heaths, relatively free draining	
Heath on granite	HG
Heath on silcrete	HS
Heath on Kromatite	HK
Lower slopes and plains, gently undulating to flat	
Mallee shrublands or mallee woodlands impeded vertical drainage	
Mallee heath on duplex clayey sand	MHD
Mallee woodlands on red clay	WC
Drainage line woodland	DrW
Sand sheets, free drainage	
Sand sheet over laterite mallee shrubland	SLMS
Sand sheet mallee shrubland in depressions	SSMS
Sand sheet mallee shrubland over paleosol clay	SCMS
Sand sheet heath in depression	SSH
Carbonate influences soils, free drainage	
Magnesite mallee shrubland	MMS
Calcrete mallee shrublands	CMS

3.2 Vegetation units in the conveyor belt corridor

Within the proposed convey belt corridor, Woodman Botanical have mapped (Figure 3a) the following vegetation units:

Hills and upper slopes	Acronym
Mallee shrublands or mallet woodlands, impeded vertical drainage	
Laterite mallee shrubland	LMS
Heaths, relatively free draining	
Heath on granite	HG
Lower slopes and plains, gently undulating to flat	
Mallee shrublands or mallee woodlands impeded vertical drainage	
Mallee heath on duplex clayey sand	MHD
Drainage line woodland	DrW
Sand sheets, free drainage	
Sand sheet over laterite mallee shrubland	SLMS
Sand sheet mallee shrubland in depressions	SSMS
Sand sheet mallee shrubland over paleosol clay	SCMS

Laterite mallee shrubland (LMS) has vegetation dominated by mallee from 3-5m high and a wide range of shrubs to around 1m high, typical of the Barrens Ranges thicket.



Sand over laterite mallee shrublands (SLMS) has a yellow sand sheet and is dominated by *Eucalyptus pleurocarpa* and is superficially similar to LMS, but the understorey species are more typical of sand sheet mallee shrublands.

Sand sheet mallee shrublands (SSMS) has deep sands and is dominated by *E. pleurocarpa* to 4m over a range of typical sand plain shrubs to 2m.

Sand sheet over paleosol clay (SCMS) has heavy clays and the dominant species are *Eucalyptus concinna*, *E. flocktoniaea*, *E. incrassata* and *Melaleuca uncinata* (Broombush).

Heaths on granite (HG) includes non-granite materials such as schists and other volcanic rocks. It has a scattered shrub layer mostly of *Melaleuca unicata*, *Calothamnus quadrifidus*, *Melaleuca elliptica*, *Grevillea fastigiata*, *Allocasuarina campestris*, *Leucopogon cuneifolius* and *Leucopogon conostephioides* over ground covers.

Mallee heaths on duplex soils (MHD) contain heterogeneous and variable soils and the vegetation is often dominated by *E. suggrandis* from 1.5-3m and a mid-storey of *Melaleuca* sp. and *Leucopogon* sp. to about 1m.

Drainage lines in woodlands (DrW) are more densely vegetated areas with higher trees and are found in linear depressions across the site. Some of these drainage lines carry water for the winter and well into late spring and early summer, others only flow or contain pooled water for a couple of weeks after it has rained.

Figures 1-8 show the diversity of fauna habitats in the proposed conveyor belt corridor.



Plate 1. Habitat in the conveyor belt corridor



Plate 3. Habitat in the conveyor belt corridor



Plate 2. Habitat in the conveyor belt corridor



Plate 4. Habitat in the conveyor belt corridor





Plate 5. Habitat in the conveyor belt corridor



Plate 7. Habitat in the conveyor belt corridor



Plate 6. Habitat in the conveyor belt corridor



Plate 8. Habitat in the conveyor belt corridor

3.3 Stygofauna

Sinclair Knight Merz (2001b, a) prepared two reports. One of these was the stygofauna in the Tamerine limestone deposit (Sinclair Knight Merz Pty Ltd 2001b). One limestone deposit is 15km south-west of the mine and the other is closer to the Jerdacuttup Lakes Nature Reserve. These areas will not be impacted by the proposed conveyor belt corridor. This report found no evidence of stygofauna in the limestone deposits which were to be exploited for mine processing activity, but recommended a further investigation is undertaken. This subsequent investigation (Sinclair Knight Merz Pty Ltd 2001a) examined 14 bores across the RNO tenements and found no evidence of stygofauna.

3.4 Short range endemic invertebrates

Biota Environmental Sciences (2005) undertook a survey in 2005 that targeted short range endemic invertebrates (SREs). Specifically, the survey targeted mygalomorph spiders, millipedes (i.e. Diplopoda) and land snails (i.e. Pulmonata). Trapdoor spiders were collected from pit-traps and by excavating burrows, millipedes from pit-traps and raking the leaf litter and other debris and land snails by searching beneath rocks and debris. All specimens were stored in 70% ethanol.

Trapping grids were in vegetation units DrW, MHK, WC, SLMS, LMS, MHK, LMS/SST and MHD. Several millipedes from the genus *Antechiropus* were collected from RNOCTS02 which is in vegetation unit MHD. Four species of land snails were recorded: *Bothriembryon melos* (n = 4) and *B. dux* (n = 44), and Biota Environmental Sciences (2005) indicated both that both of these species were widespread based on snail shells found elsewhere in the RNO tenements. The two other species were retained and provided to the Western Australian Museum.

Sixteen species of mygalomorph spiders were recorded, with only one species belonging to a described species (i.e. *Chenistonia tepperi*). Seven of the species were recorded from different vegetation units. If the geographic



distribution of species can be inferred from the abundance of the vegetation units (e.g. habitat) in which they occurred (e.g. CMS01 – LMS, CMS02 – MHK, CTS01 – LMS/SST, CTS02 – MHD, CTS03 – SLMS, CTS04 – MHD) then all species of mygalomorph spiders are likely to be widespread.

There was no evidence to indicate any of these species were likely to be short range endemics.

3.5 Amphibians

Based on all the available records, it is likely that up to 10 species of amphibians could be caught in the general area (Table 9). However, there is only a narrow drainage line in the corridor that supports pools of water for a short period after rain (Plate 7). None of these amphibian species are of conservation significance and all a widespread.

Table 9. Amphibian species potentially found in the project area, with an indication of habitats where that species has been recorded in previous surveys on RNO tenements or surrounds

Family	Species	Common Name	DrW	LMS	MHD	SSMS	SST	WM p
Hylidae	Litoria cyclorhyncha	Spotted-thighed Frog			Х		Х	
Limnodynastidae	Heleioporus albopunctatus	Western Spotted Frog		Х	Х	Х		
	Heleioporus eyrei	Moaning Frog						
	Heleioporus psammophilus	Sand Frog						Х
	Limnodynastes dorsalis	Western Banjo Frog	Х	Х	Х	Х	Х	Х
	Neobatrachus albipes	White-footed Trilling Frog			Х	Х		Х
	Neobatrachus kunapalari	Kunapalari Frog						
Myobatrachidae	Crinia pseudinsignifera	Bleating Froglet						
	Myobatrachus gouldii	Turtle Frog			Х			

3.6 Birds

A diversity of habitats across the RNO tenements provides foraging opportunities for numerous species of birds. Table 10 lists birds that are potentially found on RNO tenements. Of these species Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*; Endangered and Schedule 1), Malleefowl (*Leipoa ocellata*; Vulnerable and Schedule 1), Rainbow Bee-eater (*Merops ornatus*; migratory and P3), Western Whipbird (*Psophodes nigrogularis*; P4), Shy Heathwren (*Hylacola cauta*; P4), Crested Bell-bird (*Oreoica gutturalis*; P4), Australian Bustard (*Ardeotis australis*; P4) and Rufous Fieldwren (*Calamanthus campestris*; P4) are of conservation significance.

Table 10. Avian species potentially found in the project area, with an indication of habitats where that species has been recorded in previous surveys on RNO tenements or surrounds

Family	Species	Common Name	DrW	LMS	MHD	SSMS	SST	WMp
Accipitridae	Elanus axillaris	Black-shouldered Kite						
	Lophoictinia isura	Square-tailed Kite						
	Haliastur sphenurus	Whistling Kite						
	Accipiter fasciatus	Brown Goshawk						
	Accipiter cirrocephalus	Collared Sparrowhawk						
	Aquila audax	Wedge-tailed Eagle						
	Hieraaetus morphnoides	Little Eagle						
Anatidae	Chenonetta jubata	Australian Wood Duck						
	Malacorhynchus membranaceus	Pink-eared Duck						
	Anas rhynchotis	Australasian Shoveler						
	Anas gracilis	Grey Teal						
	Anas castanea	Chestnut Teal						
	Anas superciliosa	Pacific Black Duck						
	Aythya australis	Hardhead						
Aegothelidae	Aegotheles cristatus	Australian Owlet-nightjar						
Podargidae	Podargus strigoides	Tawny Frogmouth						
Casuariidae	Dromaius novaehollandiae	Emu	Х		Х			
Charadriidae	Elseyornis melanops	Black-fronted Dotterel						
Scolopacidae	Tringa nebularia	Common Greenshank						
Turnicidae	Turnix varius	Painted Button-quail			Х			
Phalacrocoracidae	Microcarbo melanoleucos	Little Pied Cormorant						
Ardeidae	Egretta novaehollandiae	White-faced Heron						



Family	Species	Common Name	DrW	LMS	MHD	SSMS	SST	WMp
Columbidae	Phaps chalcoptera	Common Bronzewing	Х	Х	Х			Х
	Phaps elegans	Brush Bronzewing			Х			
	Ocyphaps lophotes	Crested Pigeon			Х			
Meropidae	Merops ornatus	Rainbow Bee-eater						
Cuculidae	Chalcites basalis	Horsfield's Bronze-Cuckoo	Х			Х		Х
	Chalcites lucidus	Shining Bronze-Cuckoo						
	Cacomantis flabelliformis	Fan-tailed Cuckoo	Х		Х			
Caprimulgidae	Eurostopodus argus	Spotted Nightjar						
Falconidae	Falco cenchroides	Nankeen Kestrel			Х	X		
	Falco berigora	Brown Falcon	Х					
Megapodiidae	Leipoa ocellata	Malleefowl			X			
Phasianidae	Coturnix ypsilophora	Brown Quail						-
Rallidae	Fulica atra	Eurasian Coot						
Acanthizidae	Sericornis frontalis	White-browed Scrubwren			X			X
	Hylacola cauta	Shy Heathwren			X			
	Calamanthus campestris	Rufous Fieldwren				X		
	Smicrornis brevirostris	Weebill	X		X			X
	Gerygone fusca	Western Gerygone						
	Acanthiza chrysorrhoa	Yellow-rumped I hornbill	v		V			
A / 1	Acanthiza apicalis	Inland I nornbill	X		X			
Artamidae	Artamus cyanopterus	Dusky woodswallow	v	v	V	v		
	Cracticus torquatus	Grey Butcherbird	X	X	X	X		
	Cracticus tibicen	Australian Magpie		X	X			
G 1 11	Strepera versicolor	Grey Currawong		X	X	37		
Campephagidae	Coracina novaehollandiae	Black-faced Cuckoo-Shrike	v	X	v	X		1
Corvidae	Corvus coronoides	Australian Raven	X	X	X			1
Hirundinidae	Hirundo neoxena	welcome Swallow						
N 1 1	Petrochelidon nigricans	Tree Martin	v					v
Maluridae	Malurus pulcherrimus	Blue-breasted Fairy-wren	X					X
	Stipiturus malachurus	Southern Emu-wren	X	v	V			
Meliphagidae	Acanthorhynchus superciliosus	Western Spinebill	v	X	X			
Meliphagidae	Lichenostomus leucotis	White-eared Honeyeater	X		X			v
	Lichenostomus cratitius	Purple-gaped Honeyeater						X
	Manorina flavigula	Yellow-throated Miner	v	v	v			v
	Anthochaera lunulata	Red Wattlebird		A V	A V			A V
	Aninochaera carunculala	Terrer and Henevester				v		Λ
	Lishwang in distincts	Provin Longuage						v
	Dividentia neurophilandiae	New Hellend Honeyeater		Λ		Λ		
	Phylidonyris novaenollanalae	White sheeked Honeyeater	Λ	v				Λ
	Malithraptus bravirostris	Brown headed Honeyeater		Λ	A V			
	Melithroptus lupatus	White_naped Honeyeater			Λ			x
Monarchidae	Myjagra inquieta	Restless Elycatcher						Λ
Wonarchidae	Gralling evanoleuca	Magnie-Lark						-
Motacillidae	Anthus novaeseelandiae	Australasian Pinit						-
Neosittidae	Danhoenositta chrysontera	Varied Sittella						
Pachycenhalidae	Pachycenhala pectoralis	Golden Whistler	x					x
- active copitatione	Colluricincla harmonica	Grev Shrike-thrush		1	х			X
	Oreoica gutturalis	Crested Bellbird	x	x	X	X		
Pardalotidae	Pardalotus punctatus	Spotted Pardalote	X		X			X
	Pardalotus striatus	Striated Pardalote	1	1				-
Petroicidae	Eopsaltria griseogularis	Western Yellow Robin						
	Drymodes brunneopygia	Southern Scrub-robin			Х			
Pomatostomidae	Pomatostomus superciliosus	White-browed Babbler	Х	1	Х			1
Psophodidae	Psophodes nigrogularis	Western Whipbird		Х				Х
Rhipiduridae	Rhipidura albiscapa	Grey Fantail	1	1	1			1
· · · · ·	Rhipidura leucophrys	Willie Wagtail		1				1
Timaliidae	Zosterops lateralis	Silvereye	Х		Х			Х
Phalacrocoracidae	Phalacrocorax varius	Pied Cormorant						
Podicipedidae	Poliocephalus poliocephalus	Hoary-headed Grebe		1				
Cacatuidae	Calyptorhynchus latirostris	Carnaby's Black-Cockatoo		1				
	Eolophus roseicapillus	Galah						
Psittacidae	Glossopsitta porphyrocephala	Purple-crowned Lorikeet		Х	Х			
	Barnardius zonarius	Australian Ringneck						Х
	Purpureicephalus spurius	Red-capped Parrot	Х					
Strigidae	Ninox novaeseelandiae	Southern Boobook						
Tytonidae	Tyto alba	Barn Owl						



3.7 Reptiles

Reptiles caught or potentially found in the RNO tenements are shown in Table 11. Only *Lerista viduata* (P1) is of conservation significance and it has not been recorded in the RNO tenements.

Family	Species	Common Name	DrW	LMS	MHD	SSMS	SST	WMp
Agamidae	Amphibolurus norrisi		Х	Х	Х			
	Ctenophorus adelaidensis	Southern Heath Dragon		Х	Х	Х		
	Ctenophorus maculatus	Spotted Military Dragon		Х	Х			
	Pogona minor	Bearded Dragon		Х	Х			
Carphodactylidae	Underwoodisaurus milii	Barking Gecko			Х			
Diplodactylidae	Crenadactylus ocellatus	Clawless Gecko	Х		Х		Х	
* *	Diplodactylus granariensis		Х	Х	Х		Х	Х
	Oedura marmorata	Marbled Velvet Gecko						
	Strophurus spinigerus				Х	Х		
Elapidae	Echiopsis curta	Bardick						
	Elapognathus coronatus	Crowned Snake	Х	Х	Х		Х	
	Notechis scutatus	Tiger Snake			Х			
	Parasuta gouldii				Х			
	Pseudonaja affinis	Dugite	Х		Х	Х		
Gekkonidae	Christinus marmoratus	Marbled Gecko			Х			
Pygopodidae	Aprasia repens		Х	Х	Х			
	Delma australis				Х		Х	
	Delma fraseri		Х		Х		Х	
	Pygopus lepidopodus	Common Scaly Foot	Х		Х			
	Pygopus nigriceps	ž			Х			
Scincidae	Acritoscincus trilineatum		Х		Х	Х	Х	
	Cryptoblepharus pulcher		Х	Х				
	Ctenotus gemmula			Х		Х		Х
	Ctenotus impar		Х	Х	Х	Х		
	Ctenotus labillardieri				Х			
	Egernia multiscutata							
	Egernia richardi							
	Hemiergis initialis		Х		Х		Х	
	Hemiergis peronii				Х	Х		
	Lerista distinguenda		Х	Х	Х	Х	Х	Х
	Lerista viduata							
	Menetia greyii		Х	Х	Х	Х	Х	Х
	Morethia obscura		Х	Х	Х	Х	Х	Х
	Tiliqua occipitalis	Western Bluetongue		Х	Х			
	Tiliqua rugosa		Х	Х	Х	Х	Х	Х
Typhlopidae	Ramphotyphlops australis			Х	Х	Х		
-	Ramphotyphlops sp.		Х		Х	Х		
Varanidae	Varanus rosenbergi	Heath Monitor	Х	Х	Х			Х

Table 11. Reptile species potentially found in the project area, with an indication of habitats where that species has been recorded in previous surveys on RNO tenements or surrounds

3.8 Mammals

Mammals caught or potentially found in the RNO tenements are shown in Table 12. Of these species Chuditch (*Dasyurus geoffroii*; Vulnerable and Schedule 1), Heath Rat (*Pseudomys shortridgei*; Vulnerable and Schedule 1), Tammar Wallaby (*Macropus eugenii*; P5), Western Brush Wallaby (*Macropus irma*; P4), Western Mouse (*Pseudomys occidentalis*; P4) and Southern Brown Bandicoots (*Isoodon obesulus fusciventer*; P5) are of conservation significance and are potentially in the project area.



Family	Species	Common Name	DrW	LMS	MHD	SSMS	SST	WMp
Canidae	Vulpes vulpes	Red Fox			Х			Х
Felidae	Felis catus	House Cat	Х		Х			
Emballonuridae	Taphozous australis	Coastal Sheath-tail Bat						
Molossidae	Austronomus australis	White-striped Free-tail Bat						
Vespertilionidae	Chalinolobus gouldii	Gould's Wattled Bat						
	Chalinolobus morio	Chocolate Wattled Bat						
	Vespadelus regulus	Southern Forest Bat						
Dasyuridae	Dasyurus geoffroii	Western Quoll	Х		Х			
Dasyuridae	Phascogale calura	Red-tailed Phascogale						
	Sminthopsis crassicaudata	Fat-tailed Dunnart						
	Sminthopsis granulipes	White-tailed Dunnart		Х	Х	Х		
	Sminthopsis griseoventer	Grey-bellied Dunnart	Х	Х	Х	Х		
Burramyidae	Cercartetus concinnus	Southwestern Pygmy Possum	Х	Х	Х		Х	Х
Macropodidae	Macropus fuliginosus	Western Grey Kangaroo			Х			Х
	Macropus irma	Western Brush Wallaby			Х			
	Macropus eugenii.	Tammar Wallaby			Х			
Tarsipedidae	Tarsipes rostratus	Honey Possum	Х	Х	Х	Х		Х
Leporidae	Oryctolagus cuniculus	European Rabbit			Х			
Tachyglossidae	Tachyglossus aculeatus	Short-beaked Echidna			Х			Х
Peramelidae	Isoodon obesulus	Southern Brown Bandicoot	Х		Х			
Muridae	Mus musculus	House Mouse	Х	Х	Х	Х	Х	Х
	Notomys mitchellii	Mitchell's Hopping Mouse			Х			Х
	Pseudomys albocinereus	Ash-grey Mouse	Х	Х	Х	Х	Х	Х
	Pseudomys occidentalis	Western Mouse			Х			Х
	Pseudomys shortridgei	Heath Mouse						Х
	Rattus fuscipes	Bush Rat	Х	Х	Х		Х	Х
	Rattusrattus	Black Rat						

Table12. Mammal species potentially found in the project area, with an indication of habitats where that species has been recorded in previous surveys on RNO tenements or surrounds

3.9 Carnaby's Black-Cockatoo foraging habitat

The search of the conveyor belt corridor confirmed the project area supports multiple plant species that are foraged by Carnaby's Black-Cockatoo (*C. latirostris*). Vegetation in the conveyor belt conveyor belt corridor is similar to that in the adjacent areas (see Figure 3a) and was assessed to provide relatively low quality foraging opportunities for Black-Cockatoos. Carnaby's Black-Cockatoos were seen during most surveys of the RNO tenements and move throughout the general area foraging on a wide variety of vegetation.

3.10 Malleefowl mounds

The proposed conveyor belt corridor was searched for Malleefowl and their mounds and none were present. Much of the area had been burnt in the last 10 years; so much of the vegetation was still relatively open and quite sparse in places. Given time, this area will regenerate and patches could provide suitable habitat for Malleefowl.

3.11 Western Whipbird foraging habitat

Western Whipbirds have a preference for dense vegetation to about 2m. Recent fires had left most of the vegetation in the project area relatively open, however there were a few small areas that provided suitable habitat for Western Whipbirds. Based on the on-site survey, Figure 5 indicates those areas in the conveyor belt corridor that could support Western Whipbirds.



4 **DISCUSSION**

4.1 Corridor fauna habitats

The proposed conveyor belt corridor is a circular arc approximately 11 km long and 200m wide. The corridor supports seven vegetation units:

- laterite mallee shrubland (LMS);
- sand over laterite mallee shrublands (SLMS);
- sand sheet mallee shrublands (SSMS);
- sand sheet over paleosol clay (SCMS);
- heaths on granite (HG);
- mallee heaths on duplex (MHD); and
- drainage lines in woodlands (DrW).

These vegetation units are abundant in adjacent areas. Presuming these vegetation units are a reasonable proxy for fauna habitat types, it can be concluded that any fauna assemblages and species found within the 200m wide corridor are also likely to be abundant in the adjacent areas.

When disturbed by vegetation clearing and construction activity birds and large mammals (e.g. Western Grey Kangaroos and Western Brush Wallabies) will readily move into adjacent areas, and the abundance of similar habitat in this area would indicate that vegetation clearing is unlikely have a significant impact on any of these species.

Small mammals, amphibians and reptiles in the corridor are likely to be lost during clearing activity, but again this loss is unlikely to be significant because of the abundance of similar habitat in adjacent areas.

4.2 Conservation significant species

Table 13 indicates vegetation units in which conservation significant species have been recorded during fauna surveys in the RNO tenements. This Table should not be interpreted to indicate these species are only found in the nominated vegetation units, just that is where they have been recorded.

Table 14 indicates the conservation status of each of these species and the probability of them being present in the project area. This is followed by a brief summary of the species ecology and an indication of the likelihood of it being present and impacted in the project area.



Table 13. Conservation significant species potentially present in the project area, with an indication of habitats where that species has been recorded during previous surveys on site or in the project surrounds

Family	Species	Common Name	DrW*	LMS*	MHD*	SSMS	SST	WMp	RCLW	SLMS*	MHK	WC
Accipitridae	Haliaeetus leucogaster	White-bellied Sea-eagle										
Accipitridae	Pandion haliaetus	Osprey										
Apodidae	Apus pacifus	Fork-tailed Swift										
Ardeidae	Ardea alba	Great Egret										
Ardeidae	Ardea ibis	Cattle Egret										
Ardeidae	Botaurus poiciloptilus	Australian Bittern										
Cacatuidae	Calyptorhynchus latirostris	Carnaby's Black-Cockatoo										
Charadriidae	Thinornis rubricollis	Hooded Plover										
Megapodiidae	Leipoa ocellata	Malleefowl			Х							Х
Meropidae	Merops ornatus	Rainbow Bee-eater										
Psophodidae	Psophodes nigrogularis	Western Whipbird	Х	Х				Х			Х	Х
Dasyuridae	Dasyurus geoffroii	Chuditch	Х		Х							
Dasyuridae	Panabtechinus apicalis	Dibbler										
Dasyuridae	Phascogale calura	Red-tailed Phascogale										
Muridae	Pseudomys occidentalis	Western Mouse	Х		Х			Х			Х	
Muridae	Pseudomys shortridgei	Heath Mouse	Х					Х				Х
Peramelidae	Isoodon obesulus	Southern Brown Bandicoot	Х		Х							
Macropodidae	Macropus eugenii	Tammar Wallaby										
Macropodidae	Macropus irma	Western Brush Wallaby	Х		Х				X	Х	Х	
Acanthizidae	Hylacola cauta whitlocki	Shy Heathwren										
Acanthizidae	Calamanthus campestris	Rufous Fieldwren										
Pachycephalidae	Oreoica gutturalis	Crested Bellbird										
Otidadae	Ardeotis australis	Australian Bustard										
Boidae	Morelia spilota imbricata	Carpet Python										

* Vegetation units within the conveyor belt corridor



Species	Common Name	EPBC	WA Wildlife Conservatio	DPaW Priority	Probability of being in the project area
			n Act	species	
Botaurus poiciloptilus	Australian Bittern	En	Sch 1		Very low due to a lack of suitable habitat
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	En	Sch 1		Present
Panabtechinus apicalis	Dibbler	En	Sch 1		Very low, as it has not been recorded in the area
Phascogale calura	Red-tailed Phascogale	En	Sch 1		Very low, as it has not been recorded in the area
Leipoa ocellata	Malleefowl	Vu	Sch 1		Low, but present in adjacent areas
Dasyurus geoffroii	Western Quoll	Vu	Sch 1		Low, but present in adjacent areas
Pseudomys shortridgei	Heath Mouse	Vu	Sch 1		Low, as there is very little suitable habitat
Haliaeetus leucogaster	White-bellied Sea-eagle	Migratory	Sch 3		Low, may infrequently be seen flying over the area
Pandion haliaetus	Osprey	Migratory	Sch 3		Very low, may infrequently be seen flying over the area
Apus pacifus	Fork-tailed Swift	Migratory	Sch 3		Low, may infrequently be seen flying over the area
Ardea alba	Great Egret	Migratory	Sch 3		Very low due to a lack of suitable habitat
Ardea ibis	Cattle Egret	Migratory	Sch 3		Very low due to a lack of suitable habitat
Thinornis rubricollis	Hooded Plover	Migratory	Sch 3		Very low due to a lack of suitable habitat
Merops ornatus	Rainbow Bee-eater	Migratory	Sch 3		Present, but seasonal
Morelia spilota imbricata	Carpet Python		Sch 4		Very low, but possibly present in adjacent areas
Pseudomys occidentalis	Western Mouse			P4	Low, as there is very little suitable habitat
Psophodes nigrogularis	Western Whipbird			P4	Possibly present
Macropus irma	Western Brush Wallaby			P4	Present. Observed during the Malleefowl searches in 2014
Hylacola cauta whitlocki	Shy Heath Wren			P4	Possibly present
Oreoica gutturaliss gutturalis	Crested Bellbird			P4	Possibly present
Isoodon obesulus	Southern Brown Bandicoot			P5	Low, but present in adjacent areas
Macropus eugenii	Tammar Wallaby			P5	Low, but possibly present in adjacent areas
Ardeotris australis	Australian Bustard			P4	Low, and the species is nomadic
Calamanthus campestris	Rufous Fieldwren			P4	Possibly present

Table 14. Conservation significant species status and their probability of being in the project area

En Endangered under the EPBC Act Vu Vulnerable under the EPBC Act

Sch Schedule under the Wildlife Conservation Act

P Priority species recorded by DPaW



Australasian Bittern (*Botaurus poiciloptilus*) - Endangered under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act*

The Australasian Bitterns' preferred habitat is beds of tall dense *Typha*, *Baumea* and sedges in the shallows of freshwater swamps (Johnstone and Storr 1998). Johnstone and Storr (1998) reported its distribution from Moora east to Cape Arid and the south-west of Western Australia. Johnstone and Storr (1998) reported it as locally common in the wetter parts of the south-west. Garnett et al. (2011) more recently indicated that the sub-population in Western Australia is restricted to a few records away from the south coast and Lake Muir wetlands, with few confirmed records from the Swan Coastal Plain since 1992.

Threats include drainage of permanent and ephemeral swamps for agriculture and urban development (Garnett et al. 2011). There is no suitable habitat for this species in the project area, so it is unlikely to be present.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is classified as Schedule 1 under the *WA Wildlife Conservation Act 1950* and as Endangered under the *EPBC Act 1999*.

Carnaby's Black-Cockatoo is found in the south-west of Australia from Kalbarri through to Ravensthorpe. It has a preference for feeding on the seeds of *Banksia, Dryandra, Hakea, Eucalyptus, Grevillea, Pinus* and *Allocasuarina* spp.. It is nomadic often moving toward the coast after breeding. It breeds in tree hollows that are 2.5–12m above the ground and has an entrance 23-30cm with a depth of 1-2.5m. Nesting mostly occurs in smooth-barked trees (e.g. Salmon Gum, Wandoo, Red Morrell). Loss of habitat, in particular, feeding areas near breeding sites is considered to be a major threat to this species. Eggs are laid from July to October, with incubation lasting 29 days.

Biota Environmental Sciences (2000) and Coffey Environments (2009) recorded them on the RNO tenements, as did Terrestrial Ecosystems in its 2013 and 2014 surveys. Carnaby's Black-Cockatoo were frequently seen feeding in October 2008 (Coffey Environments 2009) in roadside vegetation near the RNO mine village. The DPaW's threatened and priority species database recorded Carnaby's Black-Cockatoo at Hopetoun, Munglinup, Oldfield, Kundip and Overshot Hill Nature Reserve. No large trees with suitable hollows were found in the project area that would provide appropriate nesting sites for Carnaby's Black-Cockatoo. Clearing of vegetation that contains *Banksia, Dryandra* and *Hakea* may impact on foraging opportunities for Carnaby's Black-Cockatoo, however, given the abundance of habitat types to be cleared in the general area, the proposed clearing is not considered to have a significant impact on Carnaby's Black-Cockatoo, as individuals can shift their feeding into adjacent areas when disturbed.

Table 15 provides a summary of the assessed potential impact on Carnaby's Black-Cockatoo associated with the action of clearing the vegetation based on the criteria set out in the Department of Sustainability, Environment, Water, Population and Communities (2012) referral guidelines for Black-Cockatoos. This is followed by a more detailed assessment to support this summary table. Commonwealth referral guidelines (Department of Sustainability Environment Water Population and Communities 2011) are vague on what is quality foraging habitat for Black-Cockatoos, so the criterion of clearing or degrading more than 1ha of *quality foraging habitat* is difficult to assess.



Table 15. Summary assessment of whether an action will have a significant impact on the two species of Black-Cockatoos

High risk of significant impacts: referral	Carnaby's Black-Cockatoo
recommended	
Clearing of any known nesting tree.	No nesting trees were recorded on the project area.
Clearing or degradation of any part of a	The project is approximately 30km east of DPaWs mapped known
vegetation community known to contain	breeding habitat, but there are no nesting opportunities in the
breeding habitat.	project area.
Clearing of more than 1ha of quality	The corridor includes Banksia and Hakea species, and Carnaby's
foraging habitat.	Black-Cockatoos have been seen foraging in adjacent areas of
	similar vegetation.
Clearing or degradation (including	Clearing will not impact on a known roosting site.
pruning the top canopy) of a known	
night roosting site.	
Creating a gap of greater than 4 km	Clearing will not create a gap of greater than 4km between patches
between patches of black cockatoo	of Black-Cockatoo habitat.
habitat (Breeding, foraging or roosting).	
Uncertainty: referral recommended or	
contact the department	
Degradation (such as through altered	Clearing will impact on more than 1ha of low quality foraging
hydrology or fire regimes) of more than	habitat.
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	Vegetation clearing and the construction of a conveyor belt will
surrounding black-cockatoo breeding,	increase human visitation to the area.
foraging or night roosting habitat that	
has the potential to degrade habitat	
through introduction of invasive species,	
edge effect, hydrological changes,	
increased human visitation or fire.	
Actions that do not directly affect the	No known actions that would potentially indirectly affect this
listed species but that have a potential	species.
for indirect impacts such as increasing	
competitors for nest hollows.	
Actions with the potential to introduce	With the implementation of appropriate hygiene standards during
known plant disease such as	vegetation clearing, diseases are unlikely to be introduced to the
Phytophthora spp. To an area where the	site.
pathogen was not previously known.	

Clearing of any known nesting tree (high risk)

The project area is about 30km east of a circular area drawn on DPaW maps representing known nesting sites for Carnaby's Black-Cockatoo. However, there are no suitable trees with nesting hollows in the project area.

Clearing of any part or degradation of breeding habitat (high risk)

The project area does not contain breeding habitat for Carnaby's Black-Cockatoo.

Clearing of more than 1ha of quality foraging habitat (high risk)

The definition of what is 'quality habitat' is unknown, but some of the trees and shrubs in the project area are on the Commonwealth governments' list of foraging species for Carnaby's Black-Cockatoos. The project area contains in excess of 1ha of vegetation recorded as potential foraging habitat for Black-Cockatoos.



Clearing or degradation including pruning the top canopy of a known roosting site (high risk)

There is no evidence to indicate that Carnaby's Black-Cockatoos roost in the project area. The lack of tall trees in the project area (see Plate 1-8) would strongly suggest that Black-Cockatoos are unlikely to roost in the project area.

Degradation (such as through altered hydrology or fire regimes) of more than 1ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat (uncertainty)

It is proposed that in excess of 1ha of Black-Cockatoo foraging habitat will be disturbed or cleared.

Clearing or disturbance in areas surrounding black cockatoo habitat that has the potential to degrade habitat through the introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire (uncertainty)

The area to be cleared will be used for the development of a conveyor belt and access track. This development will increase human visitation to the area as the conveyor belt is likely to operate 24 hours per day.

Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows (uncertainty)

There are no obvious indirect actions that will impact on Black-Cockatoos other than those already discussed.

Action with the potential to introduce know plant diseases such as Phytophthora spp. (uncertainty)

Clearing of the vegetation is only likely to spread diseases such as *Phytophthora* spp., if appropriate standards of hygiene are not maintained in the equipment used to clear the vegetation. This aspect is able to be effectively managed and controlled by the mine.

Dibbler (*Parantechinus apicalis*) - Endangered under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act*

The Dibbler is a small dasyurid with males growing to about 100g and females to about 75g (Van Dyck and Strahan 2008). Van Dyck and Strahan (2008) described the Dibbler's geographic distribution as including the Fitzgerald River National Park, east of Cheyne Beach and Torndirrup National Park. It is also found on Boullanger and Whitlock Islands off the Western Australian coast near Jurien and the DPaW's threatened and priority species database also recorded Dibblers in the Fitzgerald River National Park, plus Jerdacuttup and Kundip.

Dibblers have not been caught in any of the fauna surveys around RNO and its current known distribution does not include the RNO project area, so it is Terrestrial Ecosystems' view that it is unlikely to be impacted on by the proposed development.

Red-tailed Phascogale (*Phascogale calura*) - Endangered under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act*

This small, nocturnal, arboreal marsupial lives mostly in unburnt eucalypt woodlands such as wandoo in areas that receive 350 - 600mm of rain per year. It is an opportunistic predator, preying on insects, spiders, small birds and small mammals. It constructs a small nest either in a tree fork or tree hollow of leaves and twigs. It is currently found in remnant bushland in the Western Australia wheatbelt between Brookton and the Fitzgerald River National Park. It is threatened by habitat loss and fragmentation associated with clearing for agriculture, and possibly by predation by foxes and cats. Altered fire regimes resulting in a loss of old, long-unburnt vegetation is also considered a primary reason for the contraction in its geographic distribution.



The DPaW's threatened and priority species database recorded a single individual dead on the road at Jerdacuttup in 1997. The habitat at this location is very different to that around RNO. Red-tailed Phascogales has not been caught in any of the fauna surveys around RNO, its current known distribution does not include the RNO project area, and the project does not support wandoo woodland, so it is Terrestrial Ecosystems' view that it is unlikely to be impacted on by the proposed development.

Malleefowl (Leipoa ocellata) is classified as Schedule 1 under the WA Wildlife Conservation Act 1950 and as Vulnerable under the EPBC Act 1999

Malleefowl is a large, ground-dwelling bird that rarely flies unless it is alarmed or is perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. The species' range has contracted due to fox predation and land clearing. Their abundance in the eastern Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated. Malleefowl build distinctive nests that comprise a large mound of soil/rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous and, once breeding commences, they pair for life. The presence of nest mounds provides an indication of the presence of Malleefowl in the area.

A search of sections of the RNO site by Chapman in 2000 located five disused Malleefowl mounds and a few birds. Biota Environmental Sciences (2000) commented that they saw between one and nine Malleefowl foraging on the highway verge between the RAV8 mine and Ravensthorpe on most nights during their survey of RNO in October 2000 and saw two Malleefowl on the RNO project area; one on the access track to their site 5 in dense mallee and the other on their circuit track. A Coffey Environments' (2009) search of all habitats considered suitable for Malleefowl in the Shoemaker-Levy project area failed to find any active or inactive mounds but its staff saw a single Malleefowl in the 2010 survey. Terrestrial Ecosystems (2014) saw a Malleefowl crossing Mason Bay Road and recorded three individuals by motion sensitive cameras at various locations. The search of the conveyor belt corridor in 2014 found no evidence of Malleefowl mounds and there was very little suitable habitat in this area.

It is Terrestrial Ecosystems' assessment that this species occurs in low abundance in RNO tenements but is unlikely to be significantly impacted by vegetation clearing or during development activities.

Western Quoll or Chuditch (*Dasyurus geoffroii*) is listed as Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *WA Wildlife Conservation Act 1950*

Formally known from over 70% of Australia, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA. Its habitat is described by Van Dyck and Strahan (2008) as sclerophyll forest or dried woodland and mallee shrub land. It dens in hollow logs and burrows and has also been recorded in tree hollows and cavities. Smith *et al.* (2004) reported predation and competition for food by feral cats and foxes, and vegetation clearing as the primary factors that have contributed to a reduction in the population.

The DPaW's threatened and priority species database recorded Chuditch at Ravensthorpe, Kundip, Jerramungup and Hopetoun since 1990. A Chuditch was killed on the road between the RNO village and the mine in January 2009 and another was killed on the highway closer to Ravensthorpe (date unknown), 10 were caught by Coffey Environment in 2010 and there are reports of one living in the mine infrastructure. Motion sensitive cameras located in the vicinity of the Coffey Environment (2010) captures in 2014 failed to record any Chuditch; however, there was an abundance of cats and foxes at those locations. It is Terrestrial Ecosystems' view that Chuditch could be found in the RNO tenements, however there is very little habitat in the conveyor belt corridor that would be suitable for Chuditch, so it is unlikely to be in the corridor.

Heath Rat (*Pseudomys shortridgei*) is classified as Vulnerable under the *EPBC Act 1999 and* Schedule 1 under the *WA Wildlife Conservation Act*.

The Heath Rat has a body mass of 55-80g, and is similar in appearance to the native rat *Rattus fuscipes*. It was once present from Shark Bay in the north of WA to Eucla in the east. It is now only known in WA from a population around Ravensthorpe, Lake Magenta Nature Reserve and Fitzgerald River National Park (Smith et



al. 2007). It prefers long unburnt dry heath land that is floristically rich. Land clearing and fragmentation, and feral predators are thought to be the primary reason for the contraction in its geographic distribution (Smith et al. 2007).

The DPaW's threatened and priority species database recorded the Heath Rat being caught at Ravensthorpe and Jerdacuttup between 1993 and 1998. Chapman (2000) recorded this species at sites E1, E3 and E5. Biota Environmental Sciences (2000) caught a single individual at its Site 4 and Coffey Environments (2010) caught a single individual at site ML2 in 2010. It is therefore Terrestrial Ecosystems' view that there is a low probability it could be present in the unburnt areas of the conveyor belt project area in relatively low numbers.

White-bellied Sea Eagle (*Haliaeetus leucogaster*) – Migratory under the *EPBC Act* 1999 and Schedule 3 under the *Wildlife Conservation Act* 1950

White-bellied Sea Eagles are most commonly seen around the coastline; however, they have been reported many kilometres inland. White-bellied Sea Eagle may infrequently be seen flying in the area, however, as the project area provides no particular resource that would attract this species, the clearing of vegetation is unlikely to significantly impact on this species.

Osprey (*Pandion haliaetus*) – Migratory under the *EPBC Act* 1999 and Schedule 3 under the *Wildlife Conservation Act* 1950

This relatively large bird of prey is mostly found in coastal areas and lower reaches of rivers and also on offshore islands. It feeds predominantly on fish and seanakes when living in a coastal environment, but will also take birds and reptiles. It may infrequently be seen in the vicinity of the project area, but will not be significantly impacted by the proposed vegetation clearing and construction activities.

Fork-tailed Swift (Apus pacificus) - Migratory under the Commonwealth EPBC Act 1999 and Schedule 3 with DPaW

The Fork-tailed Swift breeds in north-east and mid-east Asia and northern Australia and winters in Australia and New Guinea. It arrives in the Kimberley in late September and in central and southern WA in November and leaves in late April. The Fork-tailed Swift may be an infrequent visitor to the area although it has not been recorded in previous surveys.

Given that the Fork-tailed Swift is highly mobile and rarely lands and that the proposed land clearing represents a very small fraction of habitat in the general area, it is Terrestrial Ecosystems' assessment that the proposed clearing in the project area is unlikely to have a significant impact on this species.

Great Egret (Ardea alba) – Migratory under the EPBC Act 1999 and Schedule 3 under the Wildlife Conservation Act 1950

Herons and egrets all depend to some extent upon surface water for hunting. The Great Egret is the largest of the Australian egrets, and is an elegant, white wader dependent upon floodwaters, rivers, shallow wetlands and intertidal mud flats. It is also found in wet pastures and estuarine mangroves. Its diet consists of a range of small, aquatic invertebrates and small vertebrates (Firth 1976). McKilligan (2005) reported it as common and widespread in Australia, and it is most abundant in northern Australia.

Given a lack of suitable habitat in the conveyor belt corridor it is unlikely to be seen in the area and therefore significantly impacted on by vegetation clearing and the proposed development.

Cattle Egret (*Ardea ibis*) – Migratory under the *EPBC Act 1999* and Schedule 3 under the *Wildlife Conservation Act 1950*

The smallest of the Australian egrets, this species has undertaken an invasion of Australia from the north, where it was originally more common in the Indonesian archipelago than Australia (Simpson and Day 2004). This invasion may have been assisted by the opening up of farming land and irrigation schemes, providing the



pasturelands and shallow wetlands in which it prefers to forage (McKilligan 2005). Johnstone and Storr (1998) noted the species' distribution in Western Australia as being mostly confined to the irrigation areas surrounding Kununurra, however, its migratory nature and current invasive tendencies suggest that it may occur elsewhere in the state, and may still be expanding its distribution.

Given a lack of suitable habitat in the conveyor belt corridor it is unlikely to be seen in the area and therefore significantly impacted on by vegetation clearing and the proposed development.

Hooded Plover (Charadrius rubricollis) - Priority 4 with DPaW

This species frequents the margins and shallows of salt lakes, and also along coastal beaches, where it forages for invertebrates. It is found along the southern coast and salt lakes north to Port Gregory, Three Springs, Mt Gibson, Lake Brown, Lake Barlee, Lake Cowan and Eyre. It is an uncommon to common resident on the southern sea beaches from Cape Naturaliste east to Eyre. It probably breeds in the samphire habitat along the boundary of some of the salt lakes in the bioregion.

The DPaW's threatened and priority database recorded a Hooded Plover at Munglinup Beach and Jerdacuttup Lakes Nature Reserve. It was not recorded in any other surveys for RNO. It is Terrestrial Ecosystems' view that it is unlikely to be in the conveyor belt corridor due to a lack of suitable habitat.

Rainbow Bee-eater (*Merops ornatus*) – Migratory under the *EPBC Act 1999* and Schedule 3 under the *Wildlife Conservation Act 1950*

The Rainbow Bee-eater is widespread during late spring and summer in the southern section of WA, particularly in sandy areas that have access to water. Given that the proposed land clearing represents a very small fraction of similar habitat in the general area, it is Terrestrial Ecosystems' assessment that the proposed clearing in the project area is unlikely to have a significant impact on this species and it will also readily move to other areas if it is disturbed.

Carpet Python (Morelia spilota imbricata) - Schedule 4 under the Wildlife Conservation

Carpet Pythons are a large snake found across the south-west of WA, north to Geraldton and Yalgoo, and east to Kalgoorlie, Fraser Range and Eyre. It inhabits forest, heath or wetland areas and shelters in hollow logs or in hollow branches of large trees. It feeds on a variety of vertebrates including small mammals and reptiles. Carpet Pythons are generally found in low numbers and are dispersed across a relatively large area, except during the breeding season when aggregations have been recorded.

DPaW's threatened and priority species database recorded a Carpet Python at Munglinup Beach in 2001. Anecdotal information suggests that Carpet Pythons are seldom seen closer to the coast, but it has not been recorded on the RNO tenements during recent surveys or in adjacent areas. It is therefore Terrestrial Ecosystems' view that there is a very low probability of it being found in the project area.

Western Mouse (*Pseudomys occidentalis*) is classified as Priority 4 under the WA Wildlife Conservation Act 1950.

Kitchener and Chapman (1977) described the Western Mouse's preferred habitat as tall shrub land with mallee eucalypts and a heath understorey on a substrate of gravelly loam. Van Dyck and Strahan (2008) reported its geographic distribution to being confined to unburnt areas on sandy clay loam or sandy loam in dense vegetation.

The DPaW's threatened and priority species database recorded the Western Mouse at Ravensthorpe, Jerdacuttup and Bandalup Hill. Chapman (2000) caught at CMS1, CMS2, E2 and E4, Coffey Environments (2010) caught it at sites N1 and N2 in 2010, Biota Environmental Sciences (2000) caught two in 2000 and another at RNOE4 in 2005 (Biota Environmental Sciences 2005). It was not caught by Coffey Environments' (2009), nor in Terrestrial Ecosystems (2013, 2014) fauna surveys of the RNO project area. There is a low probability that the Western Mouse is present in the conveyor belt corridor, but if this is the case, its distribution is patchy and it is in low abundance and it is also likely to be present in adjacent areas.



Western Whipbird – sthn WA ssp. (*Psophodes nigrogularis oberon*) - Vulnerable under the *EPBC Act 1999* and as a Priority 4 species with DPaW

Johnstone and Storr (2004) reported the Western Whipbird to be confined to the south-west of WA, in semi-arid and sub-humid zones from Gnowangerup, upper Fitzgerald River and Ravensthorpe Range to Albany and Hopetoun. It prefers mainly mallee and *Banksia* scrublands with heath to 1-2m high, and is often seen or heard in dense regrowth areas. It has an unmistakable call and is easily identified on its call even if it is not seen.

The DPaW's threatened and priority species database recorded Western Whipbirds at Ravensthorpe Range, Hopetoun, Fitzgerald River National Park, Jerdacuttup, Munglinup and Kundip. The Western Whipbird was recorded by Biota Environmental Sciences (2000) within the RNO tenements. Calls were recorded at Biota's sites 4, 5, 6, 7, E1, E2 and E4 and Biota made the comment that it was common in the area. Chapman (2000) reported hearing 109 calls from 18 individuals on RNO tenements. Western Whipbirds were recorded at sites CK3, ML1 and ML2 during the Coffey Environments (2009) survey. Terrestrial Ecosystems (2013, 2014) recorded Western Whipbirds at multiple locations (see Tables 6 and 7) in the RNO tenements. During the search of the conveyor belt corridor for Malleefowl mounds, areas likely to support Western Whipbirds were mapped (see Figure 5). Western Whipbirds will readily move to adjacent areas when vegetation clearing commences as they do not like to be in open or sparsely vegetated areas. This re-establishment of a territory will require a period of adjustment but the impact is not considered significant.

Western Brush Wallaby (Macropus irma) - Priority 4 species with DPaW

Western Brush Wallabies had previously been recorded on the RNO tenements (Chapman 2000, Biota Environmental Sciences 2005, Coffey Environments 2009) and in the 2014 it was recorded at all Terrestrial Ecosystems' trapping sites (Table 7) and often on multiple occasions. It was seen in the more dense vegetation when the conveyor belt corridor was searched for Malleefowl mounds. It is Terrestrial Ecosystems' assessment the Western Brush Wallaby will move from any disturbance activity into adjacent areas and there is adequate foraging habitat in adjacent areas, so it is unlikely to be significantly impacted by vegetation clearing or the proposed development.

Shy Heathwren - western ssp. (Hylacola cauta whitlocki) - Priority 4 species with DPaW

The Shy Heathwren is mostly found in dense shrub and heath undergrowth of mallee woodlands. Disturbance of dense scrub and heath habitats will impact on this species most probably causing them to move to adjacent areas.

The DPaW's threatened and priority database recorded the Shy Heathwren at Ravensthorpe in 1983 and Kundip in 2004. It was recorded by Biota Environmental Sciences (2000) at sites E5, 5 and 6 and it was seen by Terrestrial Ecosystems (2014) during its conservation significant species monitoring program. This small bird could be seen in the dense heath along the conveyor belt corridor; however it is likely to move once the area is disturbed and there is plenty of foraging habitat in adjacent areas. It is Terrestrial Ecosystems' view that it is unlikely to be significantly impacted by vegetation clearing or the subsequent development.

Crested Bellbird – southern spp. (Oreoica gutturalis gutturalis) – Priority 4 species with DPaW

Johnstone and Storr (2004) reported the geographic distribution for the Crested Bellbird to include the greater part of WA. Its preferred habitat is scrub and thickets (but not near edges). In the south-west of WA it is found mostly in wooded areas, including open Banksia scrub and heathland. The Crested Bellbird has been recorded in a fauna survey near the project area.

This species is classified as a Priority 4 species as a result of habitat loss due to clearing in the wheatbelt region as its preferred habitat is woodlands and shrub lands. Outside of the wheatbelt, threats to this species are generally not significant as the habitat utilised by this species is widespread across the project area.

The DPaW's threatened and priority species database recorded the Crested Bellbird at Munglinup and Kundip, Biota Environmental Sciences (2000) recorded it in October 2000 at RNO at its sites 2, 3 and 4. It was recorded at sites CK3, CK5, H2, H3, H4, H5, M1, M3, M5, ML1, Ml2 and ML3 during Coffey Environments' (2009)



survey and by Terrestrial Ecosystems (2014). It is therefore relatively abundant across RNO tenements. It will readily move away from any disturbance, so it is Terrestrial Ecosystems' view that the proposed vegetation clearing and development is unlikely to significantly impact on this species.

Southern Brown Bandicoot or Quenda (Isoodon obesulus fusciventer) – Priority 5 species with DPaW

Quenda prefer dense scrub (up to one metre high), often in or near swampy or wetland vegetation. It will often feed in adjacent forest and woodland that is burnt and in areas of pasture and cropland lying close to dense cover. Major threats to Quenda include habitat fragmentation and loss of habitat on the Swan Coastal Plain and Wheatbelt, fire in fragmented habitat, predation by foxes, predation of young by cats and predation around residential areas by dogs.

The DPaW's threatened and priority species database recorded a Southern Brown Bandicoot at Jerdacuttup in 2000. Biota Environmental Sciences (2000) reported the scratchings of a Southern Brown Bandicoot at their site 6, and Chapman (2000) caught a female at site E1 during the monitoring program. Coffey Environments (2009) caught a juvenile at its ML5 site. There are only a few locations within the proposed conveyor belt corridor with habitat suitable for Southern Brown Bandicoots and these are very similar to habitat suitable for Western Whipbirds (see Figure 5).

Southern Brown Bandicoots will quickly move away from disturbance activity into adjacent areas, so they are unlikely to be significantly impacted by the proposed vegetation clearing and development.

Tammar Wallaby (Macropus eugenii derbianus) - Priority 5 species with DPaW

Van Dyck and Strahan (2008) reported the Tammar Wallaby retreats to dense low vegetation during the day and feeds in open grassy areas at night. It inhabits coastal scrub, heath, dry sclerophyll forest and thickets of mallee and woodlands.

The Tammar Wallaby was recorded in the DPaW's threatened and priority database at Jerdacuttup and Kundip between 1970 and 1994. It has not recorded in surveys of RNO, however, Terrestrial Ecosystems had a fleeting glance of one on Mason Bay Road during the 2014 survey, but as it was not confirmed, it was not formally reported. If present in RNO's tenements it is in low abundance and it is unlikely to be present in the conveyor belt corridor due to a lack of sufficiently dense vegetation.

Australian Bustard (Ardeotris australis) - Priority 4 species with DPaW

Australian Bustards are tall birds that live in wooded grasslands (including spinifex), chenopod flats, low heath land and farmed areas and are widely distributed across WA. It is nomadic and moves through the landscape in search of resources.

Australian Bustards have been seen in the RNO project area. Given that the proposed land clearing represents a very small fraction of similar habitat in adjacent areas and it will readily move when disturbed, it is Terrestrial Ecosystems' assessment that the proposed clearing in the project area is unlikely to have a significant impact on this species.

Rufous Fieldwren (Calamanthus campestris) - Priority 4 species with DPaW

This is a small wren found in heaths and low shrubland of the southern arid zone on sand plains and lateritic ridges (Johnstone and Storr 2004). Likely most similar birds it feeds on insects, grubs, small snails and seeds, foraging in the low vegetation and on the ground. It has been recorded in the RNO tenements. Given that the proposed land clearing represents a very small fraction of similar habitat in adjacent areas and it will readily move when disturbed, it is Terrestrial Ecosystems' assessment that the proposed clearing in the project area is unlikely to have a significant impact on this species.



4.3 Physical and environmental impacts

The proposed disturbance area is approximately 11km long and much less than the 200m wide corridor assessed here, with the 3km south of the South Coast Highway running through farming land and areas that have already been cleared for mining activity (see Figure 2). There is a large tract of land immediately to the north of the corridor and more to the west of the corridor that is relatively undisturbed. These areas are likely to support similar fauna assemblages to that in the corridor.

The 2003 a Section 46 amendment under the Environmental Protection Act was approved (EPA Bulletin 1093) which included the construction of a conveyor belt from the proposed Shoe-maker Levy mine to the main mine. The current proposal is a re-routing of this conveyor belt corridor. The EPA in its review of this Section 46 application indicated the relevant factors to be considered in the assessment were:

- priority flora and significant vegetation communities;
- Bandalup corridor (including fauna issues); and
- community liaison.

The EPA indicated that the raised conveyor belt in a linear corridor as proposed in the Section 46 application would not impose a substantial barrier to the movement of fauna or connection of flora. Shifting the route of the conveyor belt should not alter the EPA's view if the conveyor belt is again to be raised off the ground and of a similar design to that envisaged in 2003. However, if the conveyor belt is to be located on the ground then it will create a significant barrier to the movement of fauna north on the South Coast Highway.

There are numerous potential direct and indirect impacts associated with vegetation clearing and the development of infrastructure that could have a significant impact on the vertebrate fauna if appropriate management measures are not implemented. Potential direct and indirect un-mitigated impacts are described below.

4.3.1 Animal deaths during the clearing process and the destruction of burrows and retreat sites

Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place, resulting in these individuals being lost in their burrows, or when attempting to escape. Therefore, it is likely that clearing of vegetation and construction activities will result in the loss of most small fauna that retreat to burrows, such as reptiles and mammals in areas to be cleared.

Ground dwelling conservation significant species potentially impacted during vegetation clearing include the Western Mouse, Heath Rat and Southern Brown Bandicoot. The Southern Brown Bandicoot will only be found in densely vegetated areas, if it is present and will almost certainly move to an adjacent area before it is directly impacted by vegetation clearing. The response of Western Mice and Heath Rats to vegetation clearing activities is unknown, but if they are surface active they will endeavour to escape into adjacent areas. However, there is only a very low probability that they are present in the conveyor belt corridor because of a lack of substantial long-unburnt dense vegetation.

Malleefowl, Chuditch, Western Brush Wallabies and Tammar Wallabies, if in the project area, will readily move into adjacent areas when vegetation clearing commences and are therefore unlikely to be directly impacted. Carpet Pythons, if present are likely to be injured or killed during the clearing process as they are slow to avoid disturbance activity. It is highly improbable that Carpet Pythons are present in the project area.

Vegetation clearing and associated construction activities are likely to destroy reptile and mammal burrows that are currently in use, or could be used again. Loss of vegetation that forms part of the activity area or home range of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation.

Although vegetation clearing seldom results in the death of avian species (except eggs and chicks), clearing of vegetation reduces and alters their foraging areas. The loss of foraging areas shifts individuals into adjacent areas and increases completion for resources, with the inevitable result that some of the migrants and some of the residents fail to thrive in the altered environment and some could be lost. However, in this circumstance



there is an abundance of vegetation in adjacent areas that are similar to that in the conveyor belt corridor, so potential impacts on avian species are unlikely to be significant.

4.3.2 Habitat fragmentation

Clearing vegetation for the conveyor belt corridor will fragment the habitat. While clearing and construction are in progress and when the conveyor belt commences operation, this disturbance in the form of vehicle and machinery movement, lighting, noise and dust all have the potential to fragment habitat.

Clearing linear corridors increases habitat edges. Small mammals can respond both positively and negatively to edges depending on their ecological traits (Laurance 1991, 1994, Goosem and Marsh 1997, Goosem 2000). Edge and disturbance effects can lead to altered levels of predation, restricting or increasing fauna movements and altering assemblage structure (Oxley et al. 1974, Paton 1994, Baker et al. 1998, Temple 1998, Luck et al. 1999, Goosem 2001). Goldingay and Whelan (1997) and Clarke and Oldland (2007) reported that edge effects can extend 150-200m from the edge, meaning the impact area is therefore likely to be larger than the cleared footprint.

4.3.3 Dust

Dust generated from vegetation and construction activities can potentially degrade surrounding vegetation, reducing their ability to absorb sunlight and thus influencing photosynthetic rates. Degradation of these areas could make the habitat unsuitable for some fauna. The volume of traffic and speed of vehicles on the conveyor belt access track will largely determine the impact of dust in any area.

4.3.4 Altered fire regimes

A change in fire regimes is often associated with increased human activity, leading to degradation of natural ecosystems. Linear infrastructures, such as conveyor belts, provide a barrier to naturally occurring fires and may alter the natural fire regimes that the fauna have evolved to accommodate. Recruitment of fauna into regenerating burnt areas can also be affected by wide cleared linear barriers.

4.3.5 Introduced fauna

There is an abundance of foxes (*Vulpes vulpes*) and feral cats (*Felis catus*) in the project area. Tracks and other linear clearings in the natural vegetation provide movement corridors for foxes and cats through the landscape, which can increase predation on native species in adjacent areas.

4.3.6 Anthropogenic activity

Unnatural noises, vibrations, artificial light sources and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from an area, or alter their activity periods. This form of disturbance is likely to occur around site that have night lighting and are operational 24 hours per day.

4.3.7 Cumulative effects of vegetation clearing

Clearing the vegetation in the proposed conveyor belt corridor when viewed in isolation is unlikely to have a significant impact on vertebrate fauna. However, this development needs to be viewed in the context of other areas that have already been cleared and those that have been approved for clearing in the future (e.g. Shoe-maker Levy).

In this particular situation clearing a corridor and constructing a conveyor belt was considered by the EPA in the Section 46 application in 2003. The corridor route being assessed here is a replacement for the original corridor, so impacts are likely to be similar to those that were assessed in 2003.



4.4 Risk assessment

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity of a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 16, 17 and 18 provide a summary of the risk assessment associated with vertebrate fauna for this project.

The assessment contained in Table 18 is supported by more detailed discussion in sections above. Only those species that were assessed as being potentially impacted during the construction and operation of the conveyor belt are included in the assessment in Table 18.

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment.



Likelih	ood		
Level	Descriptio	Criteria	
А	Rare	The environmental event may occur or one or more conservation significant species ma exceptional circumstances.	y be present in
В	Unlikely	The environmental event could occur or one or more conservation significant species co sometime.	ould be present at
С	Moderate	The environmental event should occur or one or more conservation significant species s sometime.	hould be present at
D	Likely	The environmental event will probably occur or one or more conservation significant sp most circumstances.	ecies will be present in
Е	Almost cer	The environmental event is expected to occur or one or more conservation significant sp present in most circumstances.	becies is expected be
Conseq	uences		
Level	Descriptio	Criteria	
1	Insignifica	t Insignificant impact on fauna of conservation significance or regional biodiversity, and will be insignificant in the context of the availability of similar fauna or fauna assembla	the loss of individuals ges in the area.
2	Minor	Impact on fauna localised and no significant impact on species of conservation significat Loss of species at the local scale.	nce in the project area.
3	Moderate	An appreciable loss of fauna in a regional context or a limited impact on species of const the project area.	servation significance in
4	Major	Significant impact on conservation significant fauna or their habitat in the project area a biodiversity and/or a significant loss in the biodiversity at the landscape scale.	nd/or regional
5	Catastroph	Loss of species at the regional scale and/or a significant loss of species categorised as 'v 'endangered' under the <i>EPBC Act (1999)</i> at a regional scale.	ulnerable' or
Accepta	ability of Risl		
Level of	f risk	Management Action Required	
Low		No action required.	
Moderat	te	Avoid if possible, routine management with internal audit and review of monitoring results annu	ally.
High		Externally approved management plan to reduce risks, monitor major risks annually with externa management plan outcomes annually. Will require a referral to the Commonwealth under the EF	al audit and review of <i>BC Act 1999</i> .
Extreme Unacceptable, project should be redesigned or not proceed.			

Table 16. Fauna impact risk assessment descriptors



				Likelihood		
		Rare or very low (A)	Unlikely or low (B)	Moderate (C)	Likely (D)	Almost certain (E)
Consequences	Insignificant (1)	Low	Low	Low	Low	Low
	Minor (2)	Low	Low	Low	Moderate	Moderate
	Moderate (3)	Low	Moderate	Moderate	High	High
	Major (4)	Moderate	Moderate	High	High	Extreme
	Catastrophic (5)	Moderate	High	High	Extreme	Extreme

Table 17. Levels of acceptable risk



Table 18. Risk assessment

Factor	Potential Impact	Inherent Risk		erent Risk
		Likelihood	Consequence	Significance
Inadequate fauna survey data.	Unknown loss of fauna, fauna of conservation significance, fauna assemblage(s) in development site.	В	2	Low
Inadequate knowledge of potential impacts.	Unknown or poorly assessed impact(s) on fauna assemblage and conservation significant species.	В	2	Low
Inadequate bioregional data for contextual purposes.	Incomplete analysis of data and appreciation of impacts on biodiversity values in a regional context.	В	2	Low
Removal of habitat – site scale.	Almost complete loss of terrestrial fauna in cleared areas, severe impact on local fauna assemblage.	Е	2	Moderate
Significant reduction of habitats – local scale.	Loss of fauna and fauna habitat and impacts on local fauna assemblage (excluding conservation significant species).	А	2	Low
Significant reduction of habitats – landscape scale.	Loss of fauna and fauna habitat and impacts on fauna in a landscape context (excluding conservation significant species).	А	1	Low
Significant reduction of habitats – regional scale.	Loss of fauna and fauna habitat and impacts on fauna in a bioregional context (excluding conservation significant species).	А	1	Low
	Loss of a localised population or a few individuals – Calyptorhynchus latirostris (Carnaby's Black-Cockatoo)	Α	3	Low
	Loss of a localised population or a few individuals - Leipoa ocellata (Malleefowl)	Α	3	Low
	Loss of a localised population or a few individuals - Dasyurus geoffroii (Chuditch)	Α	2	Low
	Loss of a localised population or a few individuals – Pseudomys shortridgei (Heath Rat)	В	3	Low
	Loss of a localised population or a few individuals – Pseudomys occidentalis (Western Mouse)	В	2	Low
Impact on resident conservation	Loss of a localised population or a few individuals – Psophodes nigrogularis (Western Whipbird)	Α	1	Low
significant terrestrial species.	Loss of a localised population or a few individuals – Macropus irma (Western Brush Wallaby)	Α	1	Low
	Loss of a localised population or a few individuals – Hylacola cauta whitlocki (Shy Heath Wren)	Α	1	Low
	Loss of a localised population or a few individuals – Oreoica gutturalis gutturalis (Crested Bellbird)	Α	1	Low
	Loss of a localised population or a few individuals - Isoodon obesulus fusciventer (Southern Brown Bandicoot)	Α	1	Low
	Loss of a localised population or a few individuals – Macropus eugenii (Tammar Wallaby)	Α	1	Low
	Loss of a localised population or a few individuals – Morelia spilota imbricata (Carpet Python)	Α	1	Low
Migratory avian species.	Loss of a localised population or a few individuals – Merops ornatus	Α	1	Low
	Loss of a localised population or a few individuals – <i>Apus pacificus</i>	Α	1	Low
Anthropogenic activity.	Altered fire regimes adversely affecting fauna assemblages	В	2	Low
	Introduced fauna populations increasing	С	2	Low
	Road killed fauna	E	1	Low



5 CONCLUSIONS AND RECOMMENDATION

It is proposed that vegetation is cleared along a corridor that is approximately 11km with a maximum width of 200m wide for the construction of a conveyor belt that will carry ore from the Shoe-maker Levy mine to the main mine. This assessment is for a modified route to the originally proposed conveyor belt. The Section 46 approval in 2003 assessed the potential impacts of a similar corridor to the west.

Terrestrial fauna potentially at risk include the Heath Rat, Western Mouse, Chuditch, Western Brush Wallaby, Tammar Wallaby and the Southern Brown Bandicoot. Of these species the Western Brush Wallaby is known to be in the project area and there is a low probability that the Heath Rat, Western Mouse, Chuditch, Tammar Wallaby and the Southern Brown Bandicoot are also present in low abundance. Of these species the Chuditch, Western Brush Wallaby, Tammar Wallaby and the Southern Brown Bandicoot, if present in the project area, would almost certainly move into adjacent habitat before being directly impacted by vegetation clearing and only the Heath Rat and Western Mouse would be directly impacted by vegetation clearing. The project area had been burnt a number of years ago and the vegetation is still recovering. There are only a few areas with dense vegetation and these are marked as possible habitat for Western Whipbirds in Figure 5. Avian species will readily move out of an area once vegetation clearing commences. Sedentary avian species with relatively small home ranges within the corridor would be most affected as they will be required to leave and re-establish new territories. This often initially results in competition for resources and territorial disputes, but the abundance of similar vegetation in adjacent areas would suggest the adjustment would be quite quick.

There are no Malleefowl mounds in the corridor and no Malleefowl were seen in the search of the project area, so any impacts on this species are likely to be very low. Linear vegetation clearing enables predators such as foxes and cats greater access to densely vegetated areas, with the consequence that the clearing can increase predation pressure on species such as Malleefowl, Chuditch and Southern Brown Bandicoots.

If vegetation units can be used as a proxy for fauna habitats, then the abundance of vegetation units present in the corridor and in adjacent areas would indicate fauna assemblages and species present in the corridor would also be present and abundant in adjacent areas. There are no unique vegetation units / fauna habitats and thus fauna species or assemblages present in the corridor.

The assessed potential impact of vegetation clearing and conveyor belt construction on all conservation significant species is assessed as low.

Clearing of more than one hectare of foraging habitat triggers one of the criterion in the Commonwealth Government (Department of Sustainability Environment Water Population and Communities 2011) referral guidelines on Black-Cockatoos. The initial mining development was referred to the Commonwealth Government in 2001 (EPBC 2001/172) and was assessed as a Controlled Action. Issues of concern to the Commonwealth Government under the EPBC Act included potential impact on Heath Rat and Western Whipbirds. The assessed potential impact on Heath Rats and Western Whipbirds is low, due the small disturbance footprint, the small quantity of suitable habitat for these species in the project area and the vast quantity of suitable habitat in adjacent areas, and for the Western Whipbird its abundance in adjacent areas and the very high probability of it not being directly impacted by vegetation clearing because of its ability to rapidly move to an adjacent area.

It is recommended that the proposed action is referred to the Commonwealth Government under the EPBC Act.



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Australian Government

Department of the Environment

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 <u>Environment Assessments</u> and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/01/15 18:05:16

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



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates Buffer: 30.0Km

Frank Hann



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 <u>Administrative Guidelines on Significance</u>.

World Heritage Properties:	None
National Heritage Places:	2
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	25
Listed Migratory Species:	5

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 <u>heritage values</u> 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 <u>permit</u> 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:	7
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	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:	3
State and Territory Reserves:	8
Regional Forest Agreements:	None
Invasive Species:	13
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Fitzgerald River-Ravensthorpe Range Area	WA	Nominated place
Great Western Woodlands of Western Australia	WA	Nominated place

[Resource Information]

Listed Threatened Ecological Communities

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
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	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 may occur within area
Calyptorhynchus latirostris		
Carnaby's Black-Cockatoo Short-hilled Black-	Endangered	Breeding likely to occur

Cockatoo [59523] Leipoa ocellata	Lindangered	within area
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Parantechinus apicalis		
Dibbler [313]	Endangered	Species or species habitat likely to occur within area
Phascogale calura		
Red-tailed Phascogale [316]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Pseudomys shortridgei		
Dayang, Heath Rat [77]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Acacia rhamphophylla		
Kundip Wattle [64659]	Endangered	Species or species habitat known to occur within area
Anigozanthos bicolor subsp. minor		
Little Kangaroo Paw, Two-coloured Kangaroo Paw, Small Two-colour Kangaroo Paw [21241]	Endangered	Species or species habitat known to occur within area
Caladenia hoffmanii		
Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Centrolepis caespitosa		
[6393]	Endangered	Species or species habitat likely to occur within area
Conostylis lepidospermoides		
Sedge Conostylis [9254]	Endangered	Species or species habitat likely to occur within area
<u>Darwinia oxylepis</u>		
Gillham's Bell [13188]	Endangered	Species or species habitat may occur within area
Darwinia wittwerorum		
Wittwer's Mountain Bell [15626]	Endangered	Species or species habitat may occur within area
Daviesia megacalyx		
Long-sepalled Daviesia [56785]	Endangered	Species or species habitat known to occur within area
Eremophila denticulata subsp. denticulata		
Fitzgerald Eremophila [64569]	Vulnerable	Species or species habitat likely to occur within area
Lako King Fromonbilo [56702]	Endongered	Spacios or aposico
	Liuanyereu	habitat likely to occur within area

Eremophila verticillata Whorled Eremophila [7032]

Eucalyptus merrickiae Goblet Mallee [13119]

Grevillea involucrata Lake Varley Grevillea [4631]

Kennedia glabrata Northcliffe Kennedia [16452]

Marianthus mollis Hairy-fruited Billardiera [82825]

Ricinocarpos trichophorus Barrens Wedding Bush [19931]

Roycea pycnophylloides Saltmat [21161]

Endangered

Vulnerable

Endangered

Vulnerable

Endangered

Endangered

Endangered

Species or species habitat may occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat may occur within area

Name	Status	Type of Presence
Thelymitra psammophila		
Sandplain Sun-orchid [4908]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on t	he EPBC Act - Threatened	Species list.
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
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 area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Aluea IDIS Cottle Earet [E0542]		Spacing or appairs
Calle Egrel [59542]		habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

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

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

[Resource Information]

[Resource Information]

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<u>Ardea ibis</u>		
Cattle Egret [59542]		Species or species habitat likely to 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 area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur

Name	Threatened	Type of Presence	
		within area	
Thinornis rubricollis			
Hooded Plover [59510]		Species or species	

habitat known to occur within area

Extra Information

Places on the RNE		[Resource Information]
Note that not all Indigenous sites may be listed.		
Name	State	Status
Natural		
<u>The South Coast Reserves</u> <u>Jerdacuttup River Komatiites</u> <u>Ravensthorpe Range Area</u>	WA WA WA	Indicative Place Registered Registered
State and Territory Reserves		[Resource Information]
Name		State
Cheadanup		WA
Kundip		WA
Lake Shaster		WA
Ravensthorpe Range		WA
Unnamed WA26662		WA
Unnamed WA27177		WA
Unnamed WA43060		WA
Unnamed WA49742		WA

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.

NameStatusType of PresenceBirdsColumba livia

Rock Pigeon, Rock Dove, Domestic Pigeon [803]

<u>Streptopelia senegalensis</u> Laughing Turtle-dove, Laughing Dove [781]

<u>Sturnus vulgaris</u> Common Starling [389]

Mammals Canis lupus familiaris Domestic Dog [82654]

Capra hircus Goat [2] Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Name	Status	Type of Presence
<u>Felis catus</u>		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
<u>Mus musculus</u>		
House Mouse [120]		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
<u>Vulpes vulpes</u>		
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
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur

Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]

Species or species habitat likely to occur within area

within area

Coordinates

-33.6447 120.38279

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 <u>Contact Us</u> page.

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