



Talison Lithium Pty Ltd
GREENBUSHES LITHIUM OPERATION

ENV-MP-0009

Carlotta Offset Area Management Plan

TALISON GREENBUSHES LITHIUM OPERATION

CARLOTTA OFFSET AREA MANAGEMENT PLAN

Prepared by Onshore Environmental for

Talison Lithium Pty Ltd

ABN: 15 140 122 078

Greenbushes, Western Australia

As part of the Approval for Greenbushes Lithium Mine expansion

Australian Government Department of Energy and Environment Approval (EPBC 2018/8206)



Declaration of Accuracy

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

Signed

A handwritten signature in black ink, appearing to read 'Craig Dawson', written over a horizontal line.

Full name (please print)

Craig Dawson

Organisation (please print)

Talison Lithium Pty Ltd

Date 9/11/2023



Document Status						
Rev No.	Author	Reviewer/s	Date	Approved for Issue		
				Name	Distributed To	Date
1	D.Brearley, J.Waters	D. Brearley	05/03/20	D.Brearley	C.Griffin	06/03/20
2	D.Brearley	C.Griffin	11/03/20	D.Brearley	C.Griffin	18/03/20
3	D.Brearley	C.Griffin	13/04/20	D.Brearley	C.Griffin	14/04/20
4	D.Brearley	DBCA	04/08/20	D.Brearley	C.Griffin	11/08/20
5	D.Brearley	DBCA	01/09/20	D.Brearley	F.Browne	19/04/21



TABLE WITH EPBC APPROVAL CONDITIONS

Approval for Greenbushes Lithium Mine Expansion WA (EPBC 2018/8206)

Condition	Condition Requirement	Plan Reference	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements
6	Within six (6) months of commencement of the action the approval holder must provide to the Department and the DBCA finalised management plans for the offsets required under Conditions 4 and 5.	Page iv	This Plan outlines management actions to be implemented by Talison and DBCA for the Carlotta Offset Area. It also outlines monitoring and reporting responsibilities that will be undertaken by Talison.
6	The management plans must be prepared by a suitably qualified field ecologist in accordance with the Department's Environmental Management Plan Guidelines and the EPBC Act Environmental Offsets Policy.	Page iv	The Plan was prepared by Dr Darren Brearley and Ms Jessica Waters from Onshore Environmental. The Plan was prepared in accordance with the Department's Environmental Management Plan Guidelines and the EPBC Act Environmental Offsets Policy.
6	These plans must be initially provided in draft form for feedback by the Department and the DBCA and must include evidence of the arrangements that the approval holder has put in place to ensure that the management plans will be fully implemented.	Page iv	The DBCA was consulted during preparation of the draft Plan, with feedback from meetings, subsequent discussions and report review incorporated into the draft document. The Plan has subsequently been provided to the Department for comment.
6	The management plans for those offset sites must require management of the properties for a period of at least 20 years and deliver improvements in the ability of the offset sites to provide habitat for Protected Matters so that all properties provide very high quality black cockatoo habitat, in line with the offset calculations provided by the approval holder to the Department on 03 September 2019.	Section 3.1 & 3.2, Pages 16-19	The Plan includes requirements that the Carlotta Offset Area be managed by DBCA for a period of 20 years. The Plan will deliver improvements to the habitat quality at the Offset Area through the management of threats to existing habitats, specifically weed control, and dieback and fire management.



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Condition	Condition Requirement	Plan Reference	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements
6	The finalised management plans must be implemented.	Sections 5-7, Pages 22-25	The finalised management plan will be implemented by DBCA and Talison and includes performance indicators, monitoring, adaptive management and contingency measures to ensure that the Plan will be effectively implemented.



EXECUTIVE SUMMARY

The Carlotta Offset Management Plan (the **Plan**) was developed to satisfy Condition 6 of the Department of Agriculture, Water and the Environment's (**DAWE**) (previously the Department of Energy and Environment) approval of the Talison Lithium Pty Ltd (**Talison, Company**) Greenbushes Lithium Mine Expansion (the **Project**) (EPBC referral 2018/8206). The Project involves the clearing of 350 hectares (**ha**) of native vegetation which may impact on Protected Matters including three (3) species of Black Cockatoo, the Western Ringtail Possum and the Chuditch. The Plan was prepared to offset potential impacts to these Protected Matters from the Project.

The key impacts to Protected Matters arising from the Project are associated with the direct clearing of up to 350ha of habitat suitable for three species of Black Cockatoo within the Mine Development Envelope (**MDE**), and the possible direct loss of individuals. Additional indirect impacts include those from the alteration or fragmentation of habitats, the introduction of feral predators or new invasive weed species/infestations, and altered fire regimes, causing injury, death or loss of habitat for Protected Matters.

The objective of the Plan is to protect and enhance habitat condition at the Carlotta Offset Area in order to provide high quality habitat for Black Cockatoos. The Plan aims to:

- protect and improve the quality of existing habitat and trees at the Carlotta Offset Area that will provide nesting sites for Black Cockatoos in the future; and
- protect existing suitable hollows within the Carlotta Offset Area.

The Department of Biodiversity, Conservation and Attractions (**DBCA**) will use the DBCA Disturbance Approval System (**DAS**) or an approved Prescribed Fire Plan (**PFPP**) as the planning and control mechanisms for management operations at the Carlotta Offset Area. Any operations undertaken at the Carlotta Offset Area will be planned and managed in accordance with these documents and processes.

Talison is responsible for undertaking, or providing agreed funds to the DBCA to contribute to the management of the Carlotta Offset Area. Talison will also undertake monitoring at Spring 2022, and then at six (6) year intervals for the lifetime of the plan (20 years), i.e. Spring 2028, Spring 2034 and Spring 2040. An Environmental Offset Report will be published by the company following each monitoring event.



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1.0 INTRODUCTION

1.1 Background

Talison owns and operates the Greenbushes Lithium Operation (**Site, Mine**) within Greenbushes State Forest 20 (**SF20**) in the Shire of Bridgetown-Greenbushes Western Australia, approximately 250 kilometres (**km**) south of Perth and 80km southeast of the port of Bunbury (Figure 1).

On 19 August 2019 the WA Minister for Environment authorised the implementation of an expansion of the Mine under section 45 of the *Environmental Protection Act 1986* (WA) (**EP Act, Ministerial Statement 1111**). Condition 8 of Ministerial Statement 1111 requires the provision of environmental offsets to counterbalance the significant residual impact to threatened and specially protected species listed under the *Biodiversity Conservation Act 2016* (**BC Act**).

The Project was also approved under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**) on 14 November 2019 (EPBC 2018/8206). Conditions 4 to 8 of EPBC 2018/8206 require the provision of environmental offsets to counterbalance impacts on Protected Matters.

As part of its implementation of the environmental offset requirements in Ministerial Statement 1111 and EPBC 2018/8206, Talison has identified and facilitated the provision of suitable land (**Offset Lands**) to the State of WA for management and future reservation as State Forest and classification as a forest conservation area under the *Conservation and Land Management Act 1984* (**CALM Act**). Talison will also provide funds to contribute to the DBCA for the management of the Offset Lands.

The DBCA will assist Talison by administering the provision of the Offset Lands to the State of WA and facilitating the future reservation of the Offset Lands as State Forest and classification as forest conservation areas under section 62 of the CALM Act.

A Memorandum of Understanding (**MOU**) is in preparation and sets out how Talison and the DBCA will fulfil the above understandings.

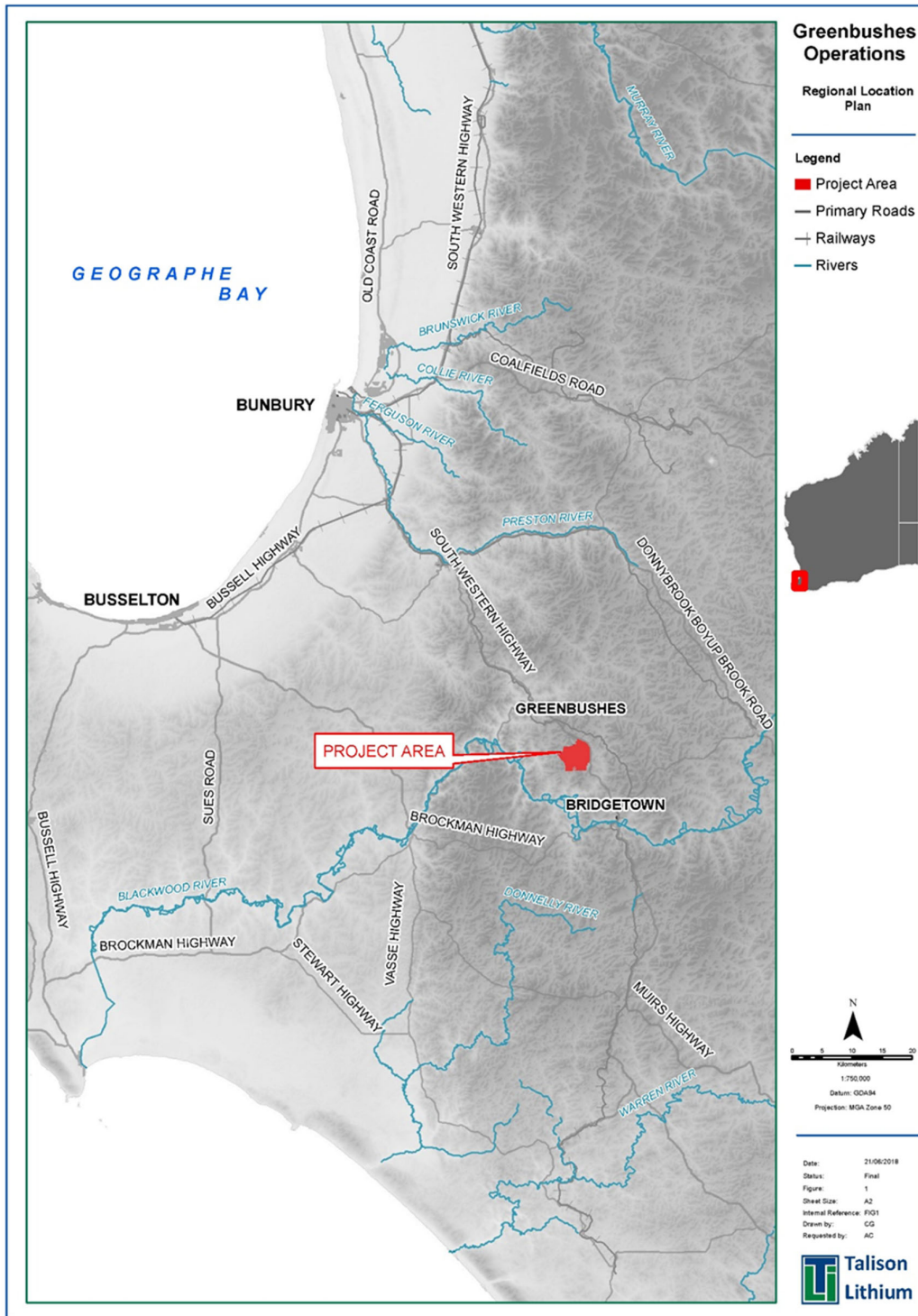


Figure 1: Location of Talison Greenbushes Lithium Operation.



1.2 Environmental Offset

Talison has identified a significant residual impact to five (5) threatened species listed under the EPBC Act (three (3) Black Cockatoo species, Western Ringtail Possum and Chuditch), associated with the proposed clearing of native vegetation for the Project. Talison will counteract these impacts through the implementation of an environmental offset in accordance with the Principles of the WA Government's Environmental Offset Policy (GoWA 2011) and the Australian Government's EPBC Act Environmental Offsets Policy (the **Policy**) (DSEWPAC 2012a).

Talison has been working to identify measures that, in combination, would constitute an acceptable and cost-effective package of environmental offsets that would satisfy the requirements of the Policy, as per the acceptance criteria. The *Offsets Assessment Guide* (DSEWPac 2012b) was used to characterise and quantify the residual impacts that require offsetting under the policy. The policy requires that a minimum of 90% of the offset package go towards directly offsetting residual impacts to the attribute of the protected matter that will be affected (**'direct offsets'**), with the remainder having the option of including offsets that are less directed towards the specific nature of the impact (**'indirect offsets'**).

Efforts by Talison to identify suitable environmental offsets has included regular liaison with the DBCA. DBCA has a land acquisition program for adding suitable areas of environmental value that meet its selection criteria, to its conservation estate. The criteria include the suitable area being contiguous with existing estate or sufficiently large in its own right relative to the environmental values that the site contains. Potential synergies may arise in circumstances where DBCA's acquisition program and requirements under the Policy coincide. Talison and DBCA have identified four (4) areas of land that in combination satisfy both DBCA's criteria and those of the policy:

- Carlotta: Part Lot 11189 On Deposited Plan (DP) 204910, Mount Leewin Loop Road, Carlotta and Part Lot 11215 On DP 204910, Mount Leewin Loop Road, Carlotta (145.6ha);
- Tone Bridge: Part of Lot 12416 and Part of Lot 12372 On Deposited Plan 206989 Cootayerup Road, Chowerup (411ha);
- Wellington Mills: Lot 153 On Deposited Plan (DP) 72265 South Road, Wellington Mills (81ha); and
- Bowelling: Part of Lot 4095 (CT1892/724) Bowelling-McAlinden Road, Bowelling (1,160ha).

This Plan details the management measures for the Carlotta Offset Area with separate management plans prepared for the other Offset Lands at Tone Bridge, Wellington Mills and Bowelling. The Plan was prepared in accordance with the DAWE's Environmental Management Plan Guidelines and the EPBC Act Environmental Offsets Policy (2012).



1.3 Purpose of the Offset Management Plan

The purpose of the Offset Management Plan is to:

- outline the management measures to be undertaken to improve the quality of habitat at the Offset Area;
- describe monitoring procedures to determine the success of the habitat improvement measures;
- describe reporting requirements for the actions to be implemented in the Plan;
- describe the risks associated with the implementation of the Plan; and
- outline contingency measures and an adaptive management approach that can be utilised to minimise the risks associated with the Plan.



2.0 EXISTING ENVIRONMENT

2.1 Location

The Carlotta Offset Area is located at Lots 11189 and 11215, Mount Leewin Loop Road, Carlotta. The site is situated 12km south-southeast of Nannup and 30km southwest of the Mine (Figure 2). The Carlotta Offset Area boundary is shown in Figure 2 and comprises 145.6ha of native vegetation. The Carlotta Offset Area is bounded by the Beaton Forest Block of the North Donnelly State Forest.

2.2 Flora and Vegetation

2.2.1 Regional Vegetation Mapping

The Carlotta Offset Area is located within the Southern Jarrah Forest (JF2) sub-region within the Jarrah Forest bioregion. The Southern Jarrah Forest subregion is described as “*Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. Eluvial and alluvial deposits support Agonis shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands.*”

The vegetation of the subregion is described as “*Jarrah-Marri forest in the west grading to Marri and Wandoo woodlands in the east. There are extensive areas of swamp vegetation in the southeast, dominated by Paperbarks and Swamp Yate. The understory component of the forest and woodland reflects the more mesic nature of this area. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions*” (Hearn *et al.* 2002).

Vegetation complexes of the southern jarrah forest have most recently been defined by Hedde *et al.* (1980) and updated by Mattiske and Havel (1998). Mattiske and Havel (1998) describe vegetation of the Offset Area as a “*mixture of open forest of Eucalyptus marginata-Corymbia calophylla with some Eucalyptus patens on slopes*”.

2.2.2 Vegetation Types

Onshore Environmental (**Onshore**) completed a reconnaissance flora and vegetation survey of the Carlotta Offset Area as part of Talison’s investigation into suitable offset sites in 2019 (Onshore Environmental 2019a, Appendix 1). A total of six (6) vegetation types from four (4) broad landforms were described and mapped (**Error! Reference source not found.**3) with vegetation types classified into three (3) broad floristic formations according to dominant vegetation strata (Table 1). These are *Eucalyptus* forest, *Bossiaea* dense thicket and *Taxandra* Heath A. Native vegetation was broadly described as Jarrah-Marri forest on uplands, and Yarri-Bullich-Flooded Gum forest along gullies and drainage lines. Native vegetation was consolidated in the southern and eastern sectors of the study area, where it bordered on to the Beaton Forest Block of the North Donnelly State Forest. Vegetation condition within the Carlotta Offset Area was predominantly rated as *excellent* (130.8ha), with a smaller portion rated as *very good* (9.8ha) (Figure 4). Disturbance within these areas was restricted to historical logging and a few environmental weed species.

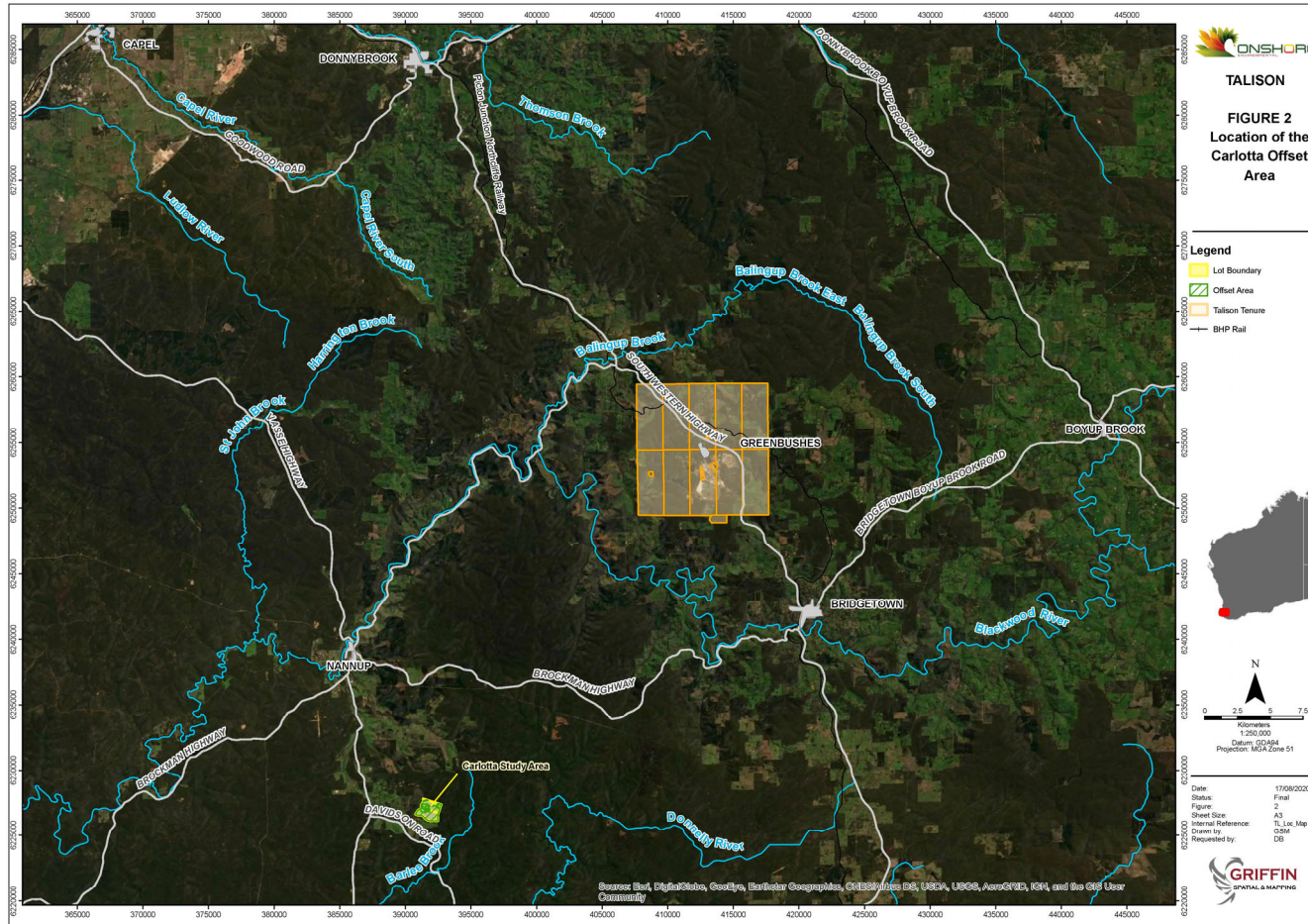


Figure 2: Location of the Carlotta Offset Area.



Table 1: Vegetation types present within the Carlotta Offset Area.

Code	Broad Floristic Formation and Vegetation Type	Area (ha)	Black Cockatoo Habitat Values
	<i>Eucalyptus</i> Forest		
HC EmCc PdMr	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Low Scrub B of <i>Podocarpus drouynianus</i> and <i>Macrozamia riedlei</i> (<i>Xanthorrhoea preissii</i> and <i>Hovea elliptica</i>) with Open Low Woodland B of <i>Banksia grandis</i> , Open Dwarf Scrub D of <i>Leucopogon capitellatus</i> , <i>Tremandra stelligera</i> and <i>Patersonia occidentalis</i> on brown sandy loam on lateritic hill crests	4.9	Foraging, roosting, potentially nesting
HS EmCc Bg Ba	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Thicket of <i>Bossiaea aquifolium</i> and <i>Acacia browniana</i> over Low Scrub B of <i>Taxandria parviceps</i> , <i>Bossiaea aquifolium</i> , <i>Podocarpus drouynianus</i> and <i>Macrozamia riedlei</i> with Open Low Woodland A of <i>Banksia grandis</i> and <i>Persoonia longifolia</i> on black sandy clay loam on lateritic hill slopes	90.7	Foraging, roosting, potentially nesting
DL EpEmCc BaAd LtGd	Forest of <i>Eucalyptus patens</i> , <i>Eucalyptus megacarpa</i> and <i>Corymbia calophylla</i> over Thicket of <i>Bossiaea aquifolium</i> and <i>Acacia divergens</i> (<i>Callistachys lanceolata</i> and <i>Trymalium odoratissimum</i>) over Tall Sedges of <i>Lepidosperma tetraquetrum</i> and <i>Gahnia decomposita</i> over Low Scrub B of <i>Pteridium esculentum</i> , <i>Bossiaea aquifolium</i> , <i>Hypocalymma cordifolium</i> and <i>Thomasia paniculata</i> on orange loam in broadly unincised gullies	19.2	Foraging, roosting, potentially nesting
WE Ep Mm GdLt	Forest of <i>Eucalyptus patens</i> over Low Forest A of <i>Melaleuca microphylla</i> over Tall Sedges of <i>Gahnia decomposita</i> and <i>Lepidosperma tetraquetrum</i> with Open Scrub of <i>Acacia divergens</i> and <i>Taxandria linearifolia</i> over Open Dwarf Scrub D of <i>Hypocalymma cordifolium</i> on white medium clay in wetland	1.5	Foraging and Roosting
	<i>Bossiaea</i> Dense Thicket		
HS Ba EmCc PePd	Dense Thicket of <i>Bossiaea aquifolium</i> (<i>Trymalium odoratissimum</i> and <i>Xanthorrhoea preissii</i>) with Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> and Open Low Scrub A of <i>Pteridium esculentum</i> and <i>Podocarpus drouynianus</i> on brown sandy loam on lateritic hill slopes	27.0	Foraging, roosting, potentially nesting



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Code	Broad Floristic Formation and Vegetation Type	Area (ha)	Black Cockatoo Habitat Values
	<i>Taxandria</i> Heath A		
HS Tp EmCc	Heath A of <i>Taxandria parviceps</i> with Woodland of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Dwarf Scrub C of <i>Bossiaea pulchella</i> and <i>Taxandria parviceps</i> on grey sand on lateritic hill slopes	2.3	Foraging and Roosting

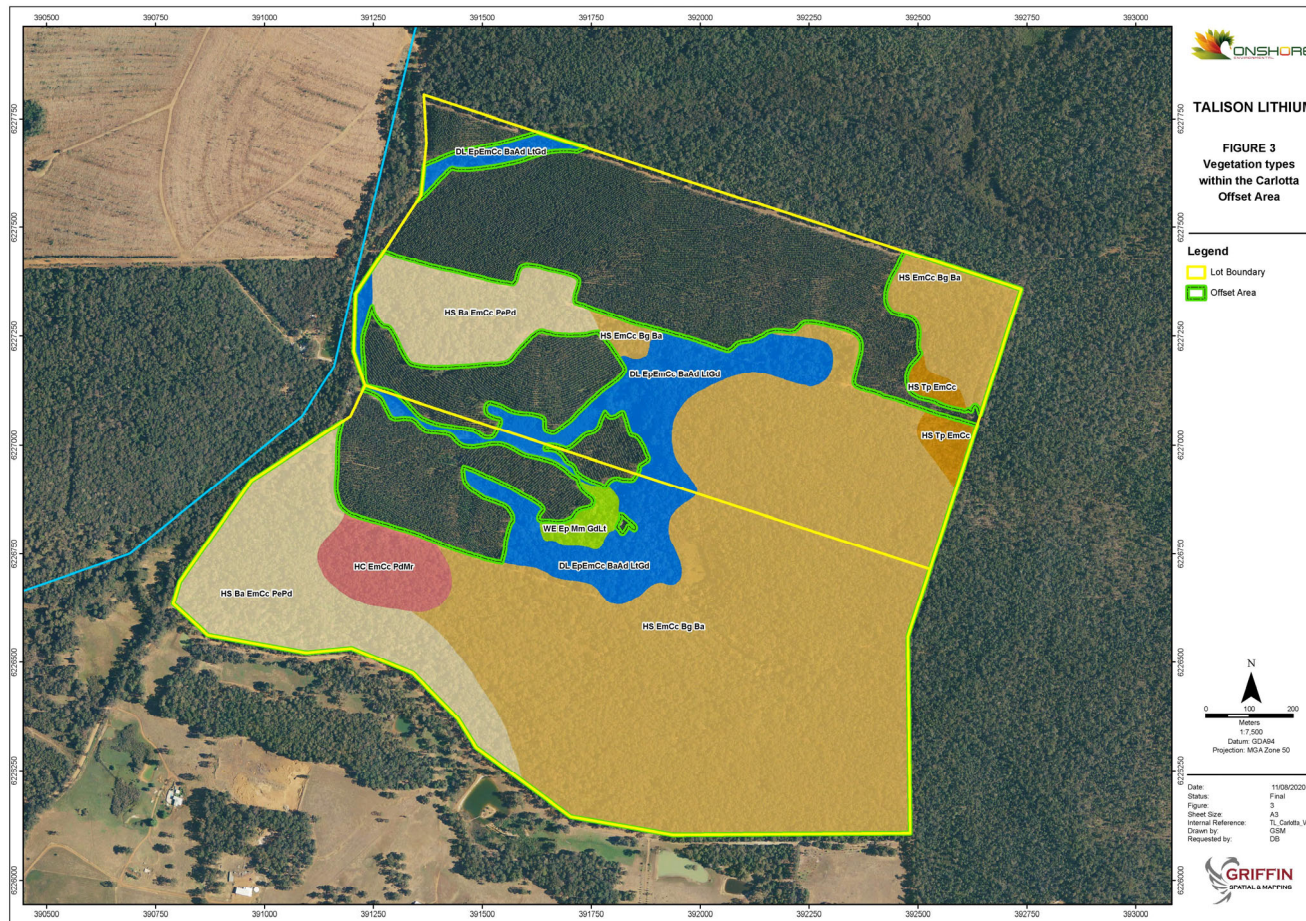


Figure 3: Vegetation types within the Carlotta Offset Area.



Figure 4: Vegetation types legend.



Figure 4: Vegetation condition within the Carlotta Offset Area.



2.3 Fauna Habitats

Onshore completed a Level 1 vertebrate fauna survey of the Carlotta Offset Area (Onshore Environmental 2019b, Appendix 2). Two (2) fauna habitats were mapped; hillslopes/ hillcrests and drainage lines/wetlands (Table 2, Figure 5). The majority of the Carlotta Offset Area was mapped as hillslopes and hillcrests supporting Jarrah/Marri Forest and a dense shrub mid-storey. The wetland/drainage line habitat occurred in the central part of the Carlotta Offset Area and supported large trees of Yarri (*Eucalyptus patens*), Bullich (*Eucalyptus megacarpa*) and Marri (*Corymbia calophylla*), with a dense understorey of shrubs and sedges.

Table 2: Fauna habitat mapped within the Carlotta Offset Area.

Habitat Type	Description
Hillcrest/Hillslopes	Jarrah/Marri with open scrubs on loamy sands with laterite
Drainage Lines/Wetland	Yarri (and some Marri) forest over sedges on orange/white loams and clay

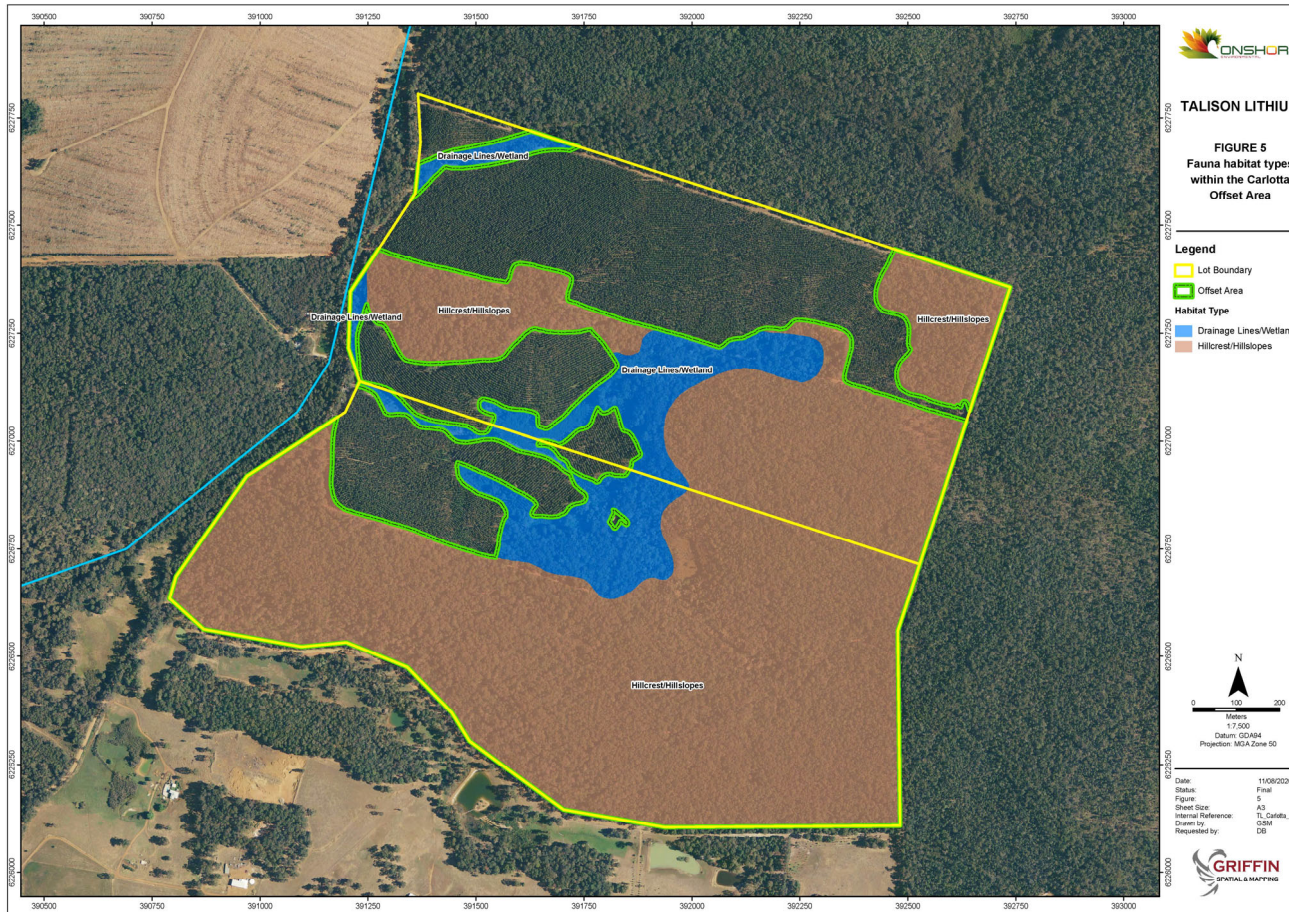


Figure 5: Fauna habitat types within the Carlotta Offset Area.



2.4 Presence of Protected Matters within the Offset Area

2.4.1 Black Cockatoos

Existing native vegetation at the Carlotta Offset Area provides suitable habitat for the three (3) species of Black Cockatoos. Vegetation types consisting of Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*) and Bull Banksia (*Banksia grandis*) present suitable foraging and roosting habitat (Table 1). To assess the potential for future nesting trees within the study area, suitable tree species (i.e. *Corymbia/Eucalyptus* species) that had a diameter at breast height of equal to or greater than 50 centimetres (cm) were counted within defined areas at the two (2) habitat types. Trees with a diameter at breast height of over 50cm were relatively common at the Carlotta Offset Area with an estimated density of 83 trees per ha on hillslopes, and 438 trees per ha within the wetland. A total of six (6) trees with suitable nesting hollows suitable for Black Cockatoos were identified (Onshore Environmental 2019b, Appendix 2).

2.4.2 Western Ringtail Possum

The Carlotta Offset Area has relatively high mid-storey connectivity on hillslopes but is considered unlikely to support Western Ringtail Possum. The remaining wetland and drainage line habitat type within the study area (Figure 5) provides some areas of suitable habitat for the Western Ringtail Possum within the dense tree canopy and moderate mid-storey.

2.4.3 Chuditch

The Chuditch was assessed during a desktop assessment as likely to occur within the Carlotta Offset Area based on the presence of suitable habitat and previous records in the area (Onshore Environmental 2019b). The Chuditch inhabits Jarrah forest, in moist densely vegetated and steeply sloping forest, and drier open, gently sloping forest particularly in riparian vegetation (Orell and Morris 1994). Chuditch may utilise the drainage/wetland habitat types at the Carlotta Offset Area which provides denser undergrowth and litter suitable for dens and refuge sites. They may also forage and disperse through the hillslope habitat types throughout the area.



3.0 ENVIRONMENTAL MANAGEMENT MEASURES

3.1 Management Objectives

Key threats to Black Cockatoos include the loss of suitable habitat for breeding, night roosting and foraging. Therefore, the objective of the Plan is to protect and maintain the habitat condition at the Carlotta Offset Area by undertaking prescribed burning to reduce the likelihood of catastrophic wildfire impacting on habitat. Management actions are discussed further in Section 3.2.

The Plan will be implemented for a period of 20 years and reviewed every five (5) years so that operational targets and budgets can be revised and customised to management priorities over the forward period. Monitoring and reporting will continue until the condition requirements are achieved. The successful completion of the condition requirements within the timeframes are subject to natural conditions and unexpected events, and the risks identified in Section 4.

As part of the process for formalising the Carlotta Offset Area as an environmental offset, the land title will be transferred to DBCA. After the completion of the Plan, providing the conditions of approval in relation to the site are met, the Carlotta Offset Area will be managed by DBCA as State Forest (Forest Conservation Area). The transfer of the land rights from a private owner to the DBCA and reservation as agreed by DBCA ensures that the habitat within the site will be formally protected in perpetuity.

3.2 Management Actions for Existing Habitat

The DBCA will use the DBCA Disturbance Approval System (**DAS**) or an approved Prescribed Fire Plan (**PFP**) as the planning and control mechanisms for management operations at the Carlotta Offset Area. The DAS is an online portal used to assess, approve and manage proposed activities (other than prescribed fire) on CALM Act lands where vegetation, the environment or values that the DBCA is responsible will be altered and/or disturbed. All proposals are managed in accordance with departmental objectives, associated management plans, and land use categories with an objective to remove and/or minimise disturbance impacts to As Low As is Reasonably Practicable (**ALARP**). Similarly, the PFP is a detailed planning document for prescribed burns to identify the value within and adjoining the burn area, fuel types, fuel quantities, appropriate weather and fuel moisture conditions for the required burn purpose and intensity. Any operations undertaken at the Carlotta Offset Area will be planned and managed in accordance with these documents and processes.

Management actions that will be implemented to protect and maintain the existing habitat for Protected Matters with particular focus on Black Cockatoos within the Carlotta Offset Area are described below. A summary of these actions, the associated performance indicators and timing of the actions are presented in Table 3.



Table 3 : Management actions to be implemented to protect existing habitat within the Carlotta Offset Area.

Management Objectives	Threats	Management Actions	Performance Indicator	Timing	Responsibility
Protect, maintain and manage existing habitat for Protected Matters including the Black Cockatoo at the Carlotta Offset Area to deliver improvements in habitat. Protect and maintain existing suitable foraging habitat and hollows within the Carlotta Offset Area, to deliver improvements in habitat. Protect and maintain suitable habitat that will provide suitable future nesting sites for Black Cockatoos, to deliver improvements in habitat.	Fire	Maintenance of fire breaks and tracks within the property. Fire management for the site will be integrated with management of the surrounding Beaton Forest Block of the North Donnelly State Forest by DBCA. This is likely to involve one (1) or two (2) control burns over a 20 year period.	Compliance with DBCA Fire Management strategy.	Ongoing	DBCA
	Weeds	Implement weed control programs aligned with adjoining Beaton Forest Block of the North Donnelly State Forest.	Compliance with SW regions in priority setting for weed management on DBCA-managed lands.	Ongoing	Talison/DBCA
	Dieback	Those undertaking monitoring/management activities will have regard to: <ul style="list-style-type: none"> Policy Statement 3: Management of Phytophthora and disease caused by it (Department of Parks and Wildlife [DPaW] (2015); and Phytophthora Dieback Management Manual (DBCA 2017). Dieback management by DBCA at the Carlotta Offset Area will be integrated with wider management currently being implemented within the adjoining Beaton Forest Block of the North Donnelly State Forest.	Compliance with DBCA Dieback Management Procedures.	Ongoing	DBCA/Talison



3.2.1 Fire Management

Management at the Carlotta Offset Area will use and respond to fire in a manner that mitigates the risk of adverse impacts of bushfire. Fire management will have consideration for Black Cockatoos and other protected species, specifically the impact on significant habitats including tree hollows, as well as the availability of food for Black Cockatoos in the local area (foraging value).

Fire management for the Carlotta Offset Area will be integrated with management of the adjoining Beaton Forest Block of the North Donnelly State Forest, which is likely to involve one (1) or two (2) control burns over the life of this plan. Appropriate fire regimes will contribute to avoiding the catastrophic outcomes associated with large scale bushfire events.

3.2.2 Weed Control

A total of eleven (11) introduced species (weeds) were recorded from the Carlotta Offset Area during the reconnaissance flora and vegetation survey (Onshore Environmental 2019a) (Table 4). One (1) of these species represents a risk to native vegetation; **Rubus anglocandicans* (Blackberry).

Blackberry was recorded from the drainage line in the northwest corner of the Carlotta Offset Area and has the potential to locally outcompete native species and establish dense thickets along the immediate drainage line. A weed control program aimed at reducing the prominence of Blackberry from the immediate area will be implemented by Talison. Ongoing management will subsequently be undertaken by DBCA through the integration with priority setting for weed management currently being implemented within the adjoining Beaton Forest Block of the North Donnelly State Forest.

Table 4: Weed species recorded from the Carlotta Offset Area.

Genus	Species	Common Name
<i>*Asparagus</i>	<i>asparagoides</i>	Bridal Creeper
<i>*Carduus</i>	sp. indet	Thistle
<i>*Centaureium</i>	<i>erythraea</i>	Common Centaury
<i>*Disa</i>	<i>bracteata</i>	South African weed orchid
<i>*Hypochaeris</i>	<i>glabra</i>	Smooth Cats-ear
<i>*Lolium</i>	<i>rigidum</i>	Annual Ryegrass
<i>*Mentha</i>	<i>pulegium</i>	Pennyroyal
<i>*Rubus</i>	<i>anglocandicans</i>	Black Berry
<i>*Solanum</i>	<i>nigrum</i>	Black nightshade
<i>*Sonchus</i>	<i>oleraceus</i>	Common Sowthistle
<i>*Trifolium</i>	sp. indet	Clover



3.2.3 Dieback Management

There key objective for the Carlotta Offset Area is to reduce the risk for introduction or spread of *Phytophthora* Dieback to the site. When undertaking the proposed management and monitoring activities, Talison and DBCA will have regard to:

- Policy Statement 3: Management of *Phytophthora* and disease caused by it (Department of Parks and Wildlife [DPaW] (2015); and
- *Phytophthora* Dieback Management Manual (DBCA 2017).

Dieback management at the Carlotta Offset Area by DBCA will be integrated with wider management currently being implemented within the adjoining Beaton Forest Block of the North Donnelly State Forest and undertaken as required in the DAS or PFP approval documents.



4.0 RISK ASSESSMENT

A risk assessment was undertaken for the Carlotta Offset Area to consider the risks associated with achieving the objectives of the Plan (Table 5). The risks are identified and characterised as low, medium, high or severe, as derived from the likelihood (highly likely, likely, possible, unlikely, rare) and consequence (minor, moderate, high, major and critical) risk matrix based on the Department of Environment Guidelines for Developing Environmental Management Plans (DoE 2014).

The risk analysis assesses the risk of not achieving the management objectives. It may be necessary to re-evaluate and modify the risk analysis and contingency measures throughout the period of the Plan, particularly if any unforeseen risks or issues emerge during the implementation of the Plan.

Table 5: Risk management for the Carlotta Offset Area.

Risk	Likelihood	Consequence	Inherent Risk	Trigger	Contingency Measures
Objectives: <ul style="list-style-type: none"> protect and improve the quality of existing habitat and trees at the Carlotta Offset Area that will provide nesting sites for Black Cockatoos in the future; and protect existing suitable hollows within the Carlotta Offset Area. 					
Uncontrolled fires occur within the Carlotta Offset Area	Possible	High	Medium	Unplanned fire occurring within Carlotta Offset Area.	DBCA undertake fire management practices within the Carlotta Offset Area and incorporate with the surrounding Beaton Forest Block of the North Donnelly State Forest.
Damage to vegetation from vandalism e.g. 4wd vehicles, off-road motorbikes etc.	Possible	Minor	Low	Evidence of damage to vegetation from unauthorised entry.	DBCA will identify access points and introduce signage, or other site management as required.
Increase in population(s) of Declared Pests	Possible	Minor	Low	Monitoring undertaken by Talison indicates additional populations or increased coverage of Declared weed or pest species in the Carlotta Offset Area.	Talison /DBCA review requirement for additional weed/pest control measures.



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Risk	Likelihood	Consequence	Inherent Risk	Trigger	Contingency Measures
Human induced Dieback spread and/or disease is significantly affecting vegetation within the Carlotta Offset Area	Possible	Moderate	Medium	Unexplained senescence of dieback susceptible species.	DBCA to determine requirement for additional dieback control measures.



5.0 MONITORING PROGRAM

Talison will be responsible for implementing a qualitative monitoring program at the Carlotta Offset Area to document evidence that required management actions are being implemented as required by the management plan, aimed at protecting and maintaining habitat for Protected Matters in particular the Black Cockatoo.

Monitoring of the management actions will be undertaken by a suitably qualified professional in Spring 2022, and then at six (6) year intervals for the lifetime of the plan (20 years), i.e. Spring 2028, Spring 2034 and Spring 2040.

The results of the annual monitoring will be included in Talison's Annual Environmental Offset Report as described in Section 6.0.

5.1 Qualitative Monitoring

The Carlotta Offset Area will be evaluated against the management actions and performance indicators with respect to:

- Fire management;
- Weed control; and
- *Phytophthora* Dieback management.

Monitoring results will be reported in the Annual Environmental Offset Report as described in Section 6.



6.0 REPORTING AND REVIEW

6.1 Reporting

Compliance reporting frequency and timing for the Carlotta Offset Area will be submitted annually from 2021 in accordance with Condition 14 EPBC 2018/8206 compliance reporting requirements. Talison will submit a compliance report annually by the 14 December to DAWE.

The annual compliance reports prepared by Talison and submitted to DAWE will include:

- a review of management actions and performance indicators for activities undertaken in the previous 12 months under the Plan; and
- a summary of compliance against the Plan.

Talison will notify the DAWE of any incident at the site, non-compliance with the conditions, or non-compliance with the commitments or performance indicators made in the Plan. The notification will be given in writing as soon as practicable, and no later than two (2) business days after the incident or non-compliance. The notification will include the following information:

- any condition which is or may be in breach;
- the location (including coordinates), date and time of the incident and/or non-compliance; and
- a short description of the incident and/or non-compliance.

6.2 Adaptive Management

The management approach for the Carlotta Offset Area will be adaptive through ongoing review and reporting measures, to ensure that it achieves the identified purpose, environmental objectives of the Plan and ultimately meets requirements of the EPBC condition.

The Plan will be formally reviewed five (5) yearly by a suitably qualified and experienced person. In addition to the scheduled review, the Plan will be reviewed if:

- new information is learned from monitoring, or monitoring indicates that performance indicators are not being achieved;
- new information becomes available about Protected Matters (e.g. a change in conservation status of a species); or
- new requirements need to be included as a consequence of approvals being issued or modified.

Where an adaptive management response is required to respond to any issues identified in the implementation of management measures and monitoring, Talison will in consultation with DBCA, identify and implement the management response in order to more effectively meet the environmental objectives of the Plan.

The following potential adaptive management actions have been developed to respond in the event that performance indicators show that the condition of the Offset Area is declining, or if there is an incident involving Protected Matters at the site:

- investigate cause;



- Talison and DBCA in consultation will review and revise the Plan and management measures as required; and
- Talison and DBCA in consultation will implement additional contingency measures identified as part of the risk assessment.



7.0 ROLES AND RESPONSIBILITIES

Talison is responsible for:

- purchasing and transferring ownership of the Carlotta Offset Area to the State of WA for management and future reservation as State Forest, classified as a forest conservation area under the CALM Act;
- undertaking or providing agreed funds to the DBCA towards the management of the Carlotta Offset Area to achieve the required standards and approval conditions;
- engaging a suitably qualified professional to undertake monitoring where required after DBCA take ownership and management responsibility for the Carlotta Offset Area; and
- report compliance against the Plan.

The DBCA is responsible for:

- integrating the management of the Carlotta Offset Area with the surrounding State Forest and manage in accordance with requirements of the CALM Act and Forest Management Plan 2014-2023;
- facilitate future reservation as State Forest and classification as forest conservation areas under section 62 of the CALM Act; and
- Facilitate access by Talison, or their agents, to the Carlotta Offset Area to undertake necessary actions detailed in this Plan, or other relevant activities.



8.0 GLOSSARY

Black Cockatoo habitat includes foraging, breeding, potential breeding and roosting habitat for Black Cockatoos, as defined in the *EPBC Act Referral Guidelines for three species of Western Australian black cockatoos: Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), (Endangered) Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) (Vulnerable) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (Vulnerable)* (October 2012).

Black Cockatoo/s means the EPBC Act listed Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Business day means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.

Clearing means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of vegetation (but not including weeds)

Commencement of the action means the first instance of any specified activity associated with the action including clearance of vegetation and construction of any infrastructure. Commencement does not include minor physical disturbance necessary to:

- undertake pre-clearance surveys or monitoring programs;
- install signage and or temporary fencing to prevent unapproved use of the project area;
- protect environmental and property assets from fire, weeds and feral animals, including
 - construction of fencing, and maintenance of existing surface access tracks;
- install temporary site facilities for persons undertaking pre-commencement activities so long as these are located where they have no impact on the Protected Matters.

DBCA is the Western Australian Department of Biodiversity, Conservation and Attractions or any future entity that retains that agency's roles and responsibilities.

Department means the Australian Government agency responsible for administering the EPBC Act. Previously the Department of Environment and Energy and now (since February 2020) the Department of Agriculture, Water and the Environment.

EPBC Act means the Environment Protection and Biodiversity Conservation Act 1999.

Habitat quality means the capacity of the land to provide ecosystem services for Protected Matters.

Incident means any event which has the potential to, or does, impact on one or more protected matter(s).

Known nesting hollow means any tree bearing a hollow in use or showing historical evidence of use by Black Cockatoos for breeding, as verified by a suitably qualified field ecologist, including any hollow identified during the investigation required by Condition 2.



Ministerial Statement 1111 means the Statement that a proposal may be implemented for Greenbushes Lithium Mine Expansion Statement No. 1111 as signed by the WA Minister for Environment on 19 August 2019 or as subsequently amended/replaced.

Offset Area is the area as defined in the table in Condition 4 and in Condition 5. These areas are also identified in the Maps at Attachment B as follows:

- the areas within the yellow outline in Map 1
- the areas within the yellow outline that are hatched in orange and green in Map 2
- the area within the yellow outline that is hatched in green in Map 3
- the area within the yellow outline that is not shaded in green in Map 4.

Plan(s) means any of the documents required to be prepared, approved by the Minister, and/or implemented by the approval holder and published on the website in accordance with these conditions (includes action management plans and/or strategies).

Project Area is the area Greenbushes Mine Expansion area also referred to as the Mine Development Area (MDE).

Protected Matter/s means a matter protected under a controlling provision in Part 3 of the EPBC Act for which this approval has effect including, but not limited to, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*), Chuditch (*Dasyurus geoffroii*) and Western Ringtail Possum (*Pseudocheirus occidentalis*).

Suitable nesting hollow means any tree bearing a hollow capable of being used by the Black Cockatoos for breeding, as identified by a suitably qualified person.

Suitably qualified field person means a person who has professional qualifications, training, skills and/or experience related to the nominated subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods and/or literature.

Suitably qualified field ecologist means a person who has professional qualifications and at least 3 years of work experience designing and implementing surveys for Black Cockatoo Habitat, and can give an authoritative assessment and advice on the presence of suitable nesting hollows using relevant protocols, standards, methods and/or literature.

Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.



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APPENDIX 1

GREENBUSHES OFFSET SITE FLORA AND VEGETATION SURVEY



Proposed Talison Offset Lots Vegetation Survey

Prepared for Talison Lithium
22 September 2018



Document Status						
Rev No.	Authors	Reviewer/s	Date	Approved for Issue		
				Name	Distributed To	Date
1	D.Brearley	B.Menezies	19/09/18	D.Brearley	C.Griffin	22/09/18



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1.0 INTRODUCTION

1.1 Background

Talison Lithium Pty Ltd (Talison) owns and operates an operational lithium mine near the town of Greenbushes in the south west of Western Australia. The Greenbushes operation represents the world's largest known lithium reserve and has been producing lithium for 25 years, contributing to Australia's position as one of the two top global producers of lithium.

Talison is proposing to undertake an expansion at the Greenbushes Mine, aimed at increasing supply of lithium to the market. The proposed expansion will require 350 hectares of native vegetation to be cleared outside existing approval areas.

In 2018, Talison referred its proposal to expand operations to the Department of Energy and Environment (DoEE) for assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The referral was made on the basis that the expansion would require the clearing of 350 ha of native vegetation known to contain habitat for listed threatened species, namely:

- Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable; confirmed as present);
- Baudin's Cockatoo *Calyptorhynchus baudinii* (Vulnerable; secondary evidence recorded); and
- Carnaby's Cockatoo *Calyptorhynchus latirostris* (Endangered; secondary evidence recorded).

1.2 EPBC Environmental Offsets Policy

DoEE has advised Talison that the *EPBC Environmental Offsets Policy* (DSEWPAC 2012a) would apply to the proposed clearing of native vegetation, to compensate for residual impacts to the three threatened black cockatoo species (collectively referred to by DoEE as forest black cockatoos - FBC). In response, Talison has been working to identify measures that, in combination, would constitute an acceptable and cost-effective package of environmental offsets that would satisfy the requirements of the EPBC Policy, as per the policy's acceptance criteria.

The *EPBC Offsets Assessment Guide* (DSEWPAC 2012b) has been used to characterise and quantify the residual impacts that require offsetting under the EPBC Policy. The Policy requires that a minimum of 90% of the offset package go towards directly offsetting residual impacts to the attribute of the protected matter that will be affected ('direct offsets'), with the remainder having the option of including offsets that are less directed towards the specific nature of the impact ('indirect offsets').

Efforts by Talison to identify suitable environmental offsets has included regular liaison with the WA Department of Biodiversity Conservation and Attractions (DBCA). DBCA has a land acquisition program for adding to its conservation estate suitable areas of environmental value that meet its selection criteria. The criteria includes the area being contiguous with existing estate or sufficiently large in its own right relative to the environmental values that the site contains.

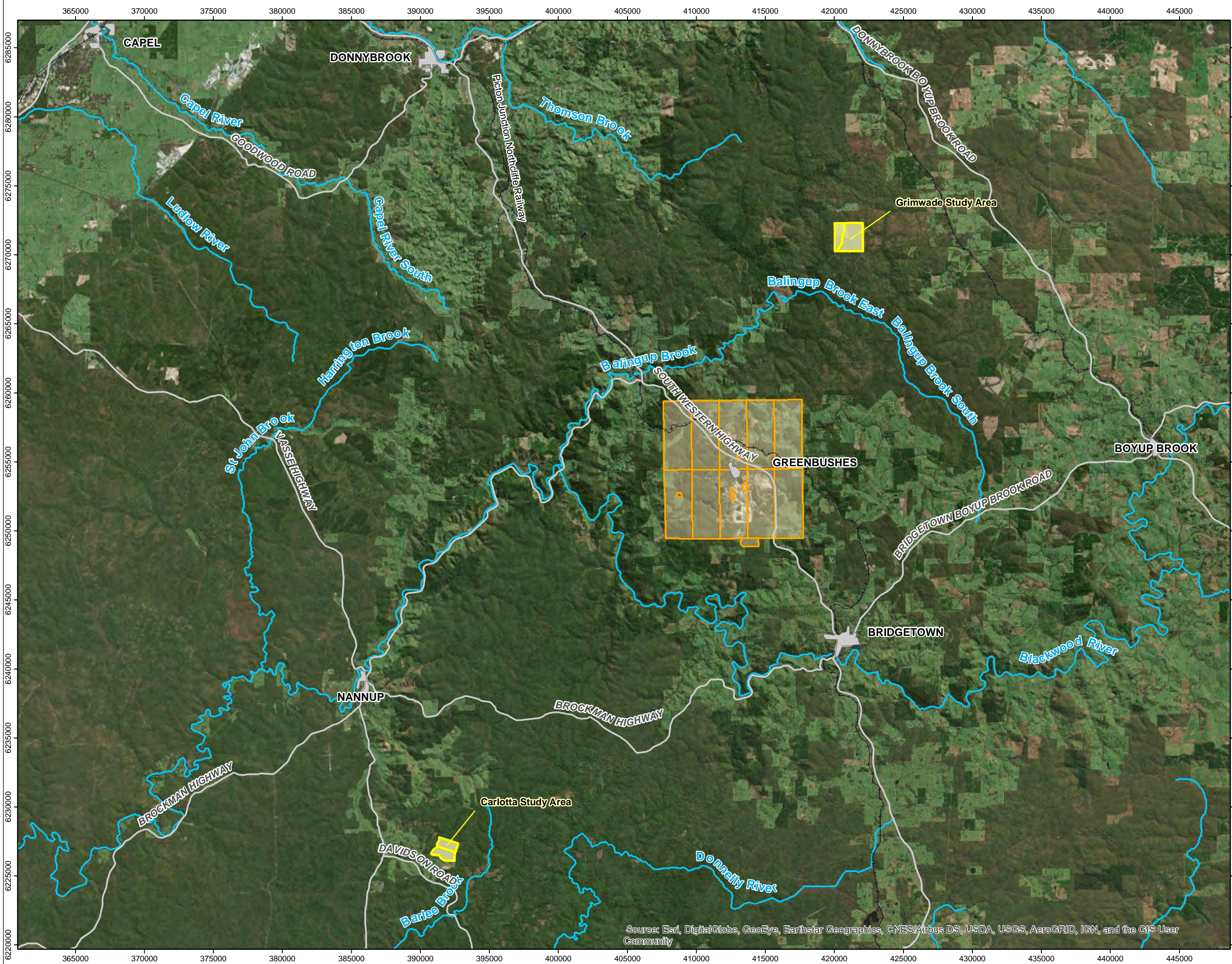
Potential synergies may arise in circumstances where DBCA's acquisition program and EPBC offset requirements coincide. Talison and DBCA have identified two

securable sites that potentially satisfy both DBCA's criteria and those of the *EPBC Environmental Offsets Policy* (Figure 1):

- 1) Grimwade/Wilga - Lot 1731 on Plan 123504 (Wilga West), 409 hectares; and
- 2) Nelson locations 11189 and 11215 - Carlotta (Wishart), 204 hectares.

1.3 Scope of Works

To support environmental approvals for the proposed expansion, Onshore Environmental Consultants Pty Ltd (Onshore) was commissioned by Talison to undertake a reconnaissance vegetation survey of the two proposed offset lots, herein referred to as 'the study area'. The objectives of the survey was to describe and map vegetation associations present within the study area, and assess and map vegetation condition within the study area.

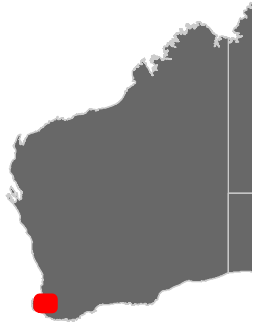


TALISON
Carlotta and Grimwade

Study Area Location

Legend

- Study Area
- Talison Tenure
- BHP Rail



0 2.5 5 7.5
 Kilometers
 1:250,000
 Datum: GDA94
 Projection: MGA Zone 51

Date: 21/09/2018
 Status: Draft
 Figure: 1
 Sheet Size: A3
 Internal Reference: TL_Loc_Map
 Drawn by: GSM
 Requested by: DB



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

1.4 Biogeographic Regions

The Interim Biogeographic Regionalisation for Australia (IBRA) describes a system of 89 'biogeographic regions' (bioregions) and 419 subregions covering the entire Australian continent (IBRA7, Department of Environment 2015a). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna. The study area is situated in the Jarrah Forest bioregion (Thackway and Cresswell 1995). The Jarrah Forest bioregion is divided into two subregions; the Northern Jarrah Forest (JF1) and the Southern Jarrah Forest (JF2). The study area is located within the Southern Jarrah Forest subregion.

The Southern Jarrah Forest is described as; "Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and in the eastern part, by Wandoo - Marri woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands (Hearn *et al.* 2002)."

1.5 Land Use

The major land uses within the study area and surroundings are State Forest, residential, mining and agriculture. The study area predominantly encompasses State Forest with a smaller block of privately-owned farmland to the south. Nearby towns include Bridgetown (approximately 15 km to the south-east) and Balingup (approximately 10 km to the north-west).

1.5.1 *Agriculture and Associated Industry*

Bridgetown is the oldest town in the south-west of Western Australia. It was first settled by sheep farmers E. Hester and John Blechyden in 1857. The Bridgetown Agricultural Society was formed in 1885 and by this time the area had a well-established agricultural industry, including sheep, cattle, dairy products, timber, fruit and nuts. In 1889 the railway line was extended to Bridgetown allowing the expansion of the fruit and timber markets. Many of these agricultural industries are still operational with wineries and olive farms also established in the area. Currently one of the largest employers in the area is Auswest Timbers, a local timber milling company.

1.5.2 *Mining*

The Greenbushes Mine is situated on the oldest mining tenement in Western Australia and has a long history of mining activities dating back to 1888. Tin was first reported in 1886 in a Government geological survey, and mining commenced in 1888. Since it was first discovered, tin has been mined almost continuously in the Greenbushes area, although in recent years the lower tin prices and emergence of tantalum as the major revenue earner have relegated tin to the position of a by-product. The presence of tantalite was noted as far back as 1893 but at that time the mineral had no value in its own right and was seen as a nuisance because it downgraded the value of tin. Although open cut mining began to be practiced on a small scale in the 1900s much of the tin mined in the early years by small operators came from underground workings to access weathered pegmatite below the caprock. Shafts were blasted in the surface rock and tunnels dug out into the tin bearing alluvium. The dirt was hauled to the surface and stockpiled during the summer months then puddled and sluiced in winter when there was an abundance of water. Tin mining continued more or less as a cottage industry under the control of many small mining companies up to the early 1960s when, for the first time, a major mining company became involved in the tinfields.

For several years a dredge was used to recover surface deposits of tin and tantalum. By 1970 alluvial resources were dwindling and it was necessary to increase exploration activity. As a direct result of this work development of the weathered pegmatite commenced in 1974. This tin/tantalum source sustained the operation until 1992. Small parcels of tantalite were sold occasionally, but it was not until 1944, when war had stimulated interest in the element tantalite, that the mineral began to be produced steadily for use in telecommunications, electronics and radar equipment.

Spodumene, the major lithium mineral, was first identified by the Western Australian Government Survey in 1949 from a specimen collected in 1928 which was initially thought to be feldspar. During the extensive diamond drilling programme for tantalum that took place between 1977 and 1980, substantial spodumene rich zones were identified. Later drilling confirmed the existence of the richest spodumene ore body ever discovered, with resources sufficient to maintain production well into the 21st Century. However, being a new product, markets had to be developed, so it was not until 1983 that the initial development of the lithium ore body at Greenbushes commenced, and the first lithium processing plant was commissioned in 1985. Since that time, the lithium processing plant has been expanded several times to produce a range of lithium concentrates, with the most recent expansion of the Greenbushes operations occurring in 2012.

1.5.3 Tourism

Tourism is the other major industry in the area with the scenery, historical sites, wineries, and galleries serving as the major attractions. Events such as the annual Blues at Bridgetown Festival also draw large numbers of people to the area.

1.6 Landforms, Soils

Tille (1996) has mapped soils of the Wellington-Blackwood District, which includes the town sites of Greenbushes and Bridgetown on its southern boundary. The study area occurs within the Hester Sub-system of the Darling Plateau System, and consists of undulating ridges and hill crests formed on laterite and gneiss which typically slope downwards off the main plateau into the surrounding Lowden Valleys System. The soils are mostly loamy gravels, sandy gravels and loamy earths.

In 2010 AECOM reviewed the Environmental Geology Series maps prepared by the Geological Survey of Western Australia (1980) for a nearby project area (described in more detail in Section 3.1.1). The geology of this project area was described as Archean granite of the Yilgarn Block and the soils of this area are listed below:

- Bt - Shallow red and yellow earths and rock outcrops on slopes and narrow alluvial terraces;
- Ba - Red and yellow earths, duplex soils on slopes, narrow alluvial terraces, swampy floors;
- G - Grey sands and some swamps;
- Hr - Duricrust and gravels flanked by gravelly duplex soils; and
- Cc - Yellow and duplex soils and red earths on slopes, and narrow alluvial terraces.

1.7 Flora and Vegetation

The study area occurs in the Menzies Sub-district of the Darling Botanical District, in the South-West Botanical Province (Beard 1981). The Menzies Sub-district (southern jarrah forest) covers a total area of 26,572 km², of which 18,715 km² (70%) originally

supported jarrah and jarrah-marri forest (Beard 1990). It is estimated that approximately 61% of the total area has been cleared since European settlement, mainly in the valleys which are free of laterite, leaving the forest intact on laterised higher plateau levels.

The Menzies Sub-district is characterised by Jarrah stands on laterite within some Marri and Wandoo woodlands. Valley soils are often richer and Blackbutt (*Eucalyptus patens*) is more dominant in these areas. Flooded Gum (*Eucalyptus rudis*) is common along stream banks and Bullich (*Eucalyptus megacarpa*) is also present in some areas. Within the study area vegetation is dominated by Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) forest over the tall shrubs bull banksia (*Banksia grandis*) and snotty gobble (*Persoonia longifolia*). The lower understorey strata contains a range of plant genera including *Hakea*, *Acacia*, *Xanthorrhoea*, *Adenanthos*, *Hovea*, *Leucopogon*, *Macrozamia*, *Leucopogon*, *Bossiaea*, *Daviesia*, *Grevillea*, *Patersonia*, *Styphelia* and *Kennedia*.

A variety of published studies that relate to flora and vegetation of the southern jarrah forest are listed below:

- Distribution & prehistory of karri, jarrah & marri - Churchill (1968);
- Structure & composition of the karri forest around Pemberton - McArthur and Clifton (1975);
- Vegetation mapping of the Manjimup-Pemberton area - (Smith 1972);
- Vegetation mapping of the Swan area - Beard (1981);
- Vegetation mapping of the Darling System - Heddle *et al.* (1980); and
- Vegetation mapping as part of the Regional Forest Agreement - Mattiske and Havel (1998).

Vegetation complexes of the southern jarrah forest have most recently been defined by Heddle *et al.* (1980) and updated by Mattiske and Havel (1998). Mattiske and Havel (1998) describe vegetation of the survey area as 'mixture of open forest of *Eucalyptus marginata* - *Corymbia calophylla* with some *Eucalyptus patens* on slopes'.

2.0 METHODOLOGY

2.1 Legislation and Guidance Statements

The reconnaissance vegetation survey was carried out in a manner that was compliant with Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of flora and vegetation in Western Australia:

- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a); and
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016b).

2.2 Field Survey Methodology

2.2.1 *Timing and Personnel*

The flora and vegetation survey was completed by Principal Botanist Dr Darren Brearley and Senior Botanist Ms Jessica Waters, working over a four day field trip from the 4th to the 7th September 2018.

2.2.2 *Sampling of Study Sites*

The field survey involved systematic sampling to record relevé vegetation descriptions and note changes in vegetation structure and composition. The following environmental parameters were recorded at relevé sampling points:

- Landform;
- Aspect;
- Soil colour and soil type;
- Rock type;
- Slope (angle);
- Vegetation condition;
- Disturbance (caused by fire, clearing, grazing etc);
- Age since fire;
- Broad floristic formation;
- Vegetation association description; and
- Height and percentage ground cover provided by individual plant taxa.

Other parameters recorded for each study site were:

- Study site number and date of assessment;
- Names of the botanists undertaking the assessment;
- Location description and waypoint - GPS coordinate (GDA94) using a handheld GPS; and
- Photograph number.

2.2.3 *Vegetation Association and Condition Mapping*

The vegetation mapping utilised high-resolution aerial photography of the study area at a scale of 1:3,500, with definition of vegetation polygons based on shading patterns. Ground-truthing of the study area was completed during the survey with vegetation descriptions made within selected vegetation polygons to confirm dominant structural layers and associated plant taxa.

The location of relevé sites assessed during the survey was overlaid on the aerial photography, and associated flora and vegetation data used to provide vegetation association descriptions for individual polygons defined. Description of vegetation

structure follows the height, life form and density classes of Muir (1977) (see Appendix 1). This is largely a structural classification suitable for broader scale mapping, but taking all ecologically significant strata into account. Vegetation condition for each of the study sites was determined using a recognised rating scale (based on Keighery 1994, see Appendix 2).

3.0 RESULTS

3.1 Grimwade/Wilga - Lot 1731 on Plan 123504 (Wilga West)

A total of eight vegetation types from four broad landforms were described and mapped from the study area (Figure 2). The vegetation types were classified into three broad floristic formations according to dominant vegetation strata (Table 1). Native vegetation was broadly described as Jarrah-Marri forest on uplands, and Yarri-Flooded Gum forest along gullies and drainage lines.

Native remnant vegetation was consolidated and covered 297.4 hectares. One square block of cleared annual pasture occurred over 111.6 hectares (27% of the study area) in the north east corner of the study area; vegetation condition was rated as *completely degraded* (Figure 3).

Remnant native vegetation within the study area was predominantly rated as *good* (221.3 hectares or 74%) in response to recent logging and associated impact to vegetation structure. It is noted that heavy logging has occurred, and continues to occur, in surrounding state forest, and vegetation condition is similar across the regional area. Vegetation condition within portions of the study area that has not been recently logged was rated as *very good* (63.5 hectares or 21%). Disturbance within these areas was restricted to historical logging and a few non-aggressive weed species. A smaller proportion of remnant vegetation within the study area was rated *degraded* (12 hectares or 4%). These small and localised areas are laydown and loading areas linked to logging operations and have been intensively disturbed.

3.2 Nelson locations 11189 and 11215 - Carlotta (Wishart)

A total of six vegetation types from four broad landforms were described and mapped from the study area (Figure 4). The vegetation types were classified into three broad floristic formations according to dominant vegetation strata (Table 2). Native vegetation was broadly described as Jarrah-Marri forest on uplands, and Yarri-Bullich-Flooded Gum forest along gullies and drainage lines.

Native remnant vegetation was consolidated in the southern and eastern sectors of the study area, where it bordered state forest. The northwest corner of the study area supported Blue Gum plantation stands amongst retained remnant vegetation, resulting in fragmentation amongst localised poorer quality remnant. The condition of this fragmented vegetation was rated as *good* and occurred over 4.3 hectares (2% of the study area, see Figure 5).

Blue Gum plantation covered a total of 59.1 hectares (29% of the study area) with vegetation condition rated as *completely degraded*. It is noted that dense regrowth of native coloniser species occurred at some of the plantation blocks. Remaining native vegetation within the study area was predominantly rated as *excellent* (130.8 hectares or 64%), with a smaller portion rated as *very good* (9.8 hectares or 5%); disturbance within these areas was restricted to historical logging and a few non-aggressive weed species.

Table 1 Vegetation types mapped within the Wilga-Grimwade study area.

Code	Broad Florstic Formation and Vegetation Type	Area (ha)
	<i>Eucalyptus</i> Forest	
WE Er MI JILr	Forest of <i>Eucalyptus rudis</i> over Low Scrub A of <i>Melaleuca lateritia</i> , (<i>Astartea scoparia</i> and <i>Taxandria linearifolia</i>) over Open Low Woodland A of <i>Banksia littoralis</i> and <i>Melaleuca preissiana</i> over Open Low Scrub B of <i>Juncus pallidus</i> and <i>Leptocarpus roycei</i> on brown clay loam in wetland	5.0
HS EmCc HhPc	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Low Heath D of <i>Hibbertia hypericoides</i> and <i>Phyllanthus calycinus</i> with Open Dwarf Scrub C of <i>Pteridium esculentum</i> , (<i>Macrozamia riedlei</i> and <i>Hakea lissocarpha</i>) on brown sandy loam on lateritic hill slopes	170.4
HS EmCc Xp HhPc	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Low Heath D of <i>Hibbertia hypericoides</i> and <i>Phyllanthus calycinus</i> with Open Low Scrub A of <i>Xanthorrhoea preissii</i> over Open Dwarf Scrub C of <i>Pteridium esculentum</i> , <i>Macrozamia riedlei</i> and <i>Xanthorrhoea preissii</i> on brown sandy loam on lateritic hill slopes	63.4
DL EpMp XpHp	Forest of <i>Eucalyptus patens</i> and <i>Melaleuca preissiana</i> over Open Scrub of <i>Kunzea glabrescens</i> , <i>Hakea varia</i> and <i>Xanthorrhoea preissii</i> over Open Low Scrub A of <i>Xanthorrhoea preissii</i> and <i>Hakea prostrata</i> over Open Dwarf Scrub D of <i>Hibbertia commutata</i> on brown clay loam on minor drainage lines	15.7
HS EmCc Bg Xp	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> (<i>Eucalyptus patens</i>) over Dwarf Scrub C of <i>Xanthorrhoea preissii</i> , <i>Macrozamia riedlei</i> and <i>Pteridium esculentum</i> over Open Dwarf Scrub D of <i>Hibbertia hypericoides</i> with Open Scrub of <i>Banksia grandis</i> and <i>Xanthorrhoea preissii</i> on orange sandy loam on lateritic hill slopes	3.3
DL EpEr Xp	Forest of <i>Eucalyptus patens</i> and <i>Eucalyptus rudis</i> over Low Scrub A (to Open Low Scrub A) of <i>Xanthorrhoea preissii</i> over Open Dwarf Scrub C of <i>Pteridium esculentum</i> over *Poaceae spp. Open Low Grass on brown clay loam on drainage lines	24.3
	<i>Melaleuca</i> Low Forest B	
WE MvMp Er Lr	Low Forest B of <i>Melaleuca viminea</i> and <i>Melaleuca preissiana</i> over Open Low Grass of *Poaceae spp. with Open Woodland of <i>Eucalyptus rudis</i> (<i>Eucalyptus patens</i>) over Open Low Scrub B of <i>Leptocarpus roycei</i> on brown sandy clay loam in wetland	14.3
	<i>Hypocalymma</i> Low Heath D	
GR HaBc Ep HpAp	Low Heath D of <i>Hypocalymma angustifolium</i> and <i>Babingtonia camphorosmae</i> with Open Low Woodland B of <i>Eucalyptus patens</i> over Open Low Scrub A of <i>Hakea prostrata</i> and <i>Acacia pulchella</i> on brown clay loam on granite outcrop	1.0
	Cleared Pasture	111.6

Table 2 Vegetation types mapped within the Carlotta study area.

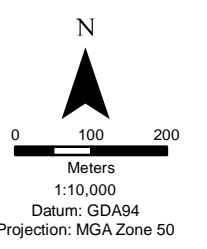
Code	Broad Florstic Formation and Vegetation Type	Area (ha)
	<i>Eucalyptus</i> Forest	
HC EmCc PdMr	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Low Scrub B of <i>Podocarpus drouynianus</i> and <i>Macrozamia riedlei</i> (<i>Xanthorrhoea preissii</i> and <i>Hovea elliptica</i>) with Open Low Woodland B of <i>Banksia grandis</i> , Open Dwarf Scrub D of <i>Leucopogon capitellatus</i> , <i>Tremandra stelligera</i> and <i>Patersonia occidentalis</i> on brown sandy loam on lateritic hill crests	4.9
HS EmCc Bg Ba	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Thicket of <i>Bossiaea aquifolium</i> and <i>Acacia browniana</i> over Low Scrub B of <i>Taxandria parviceps</i> , <i>Bossiaea aquifolium</i> , <i>Podocarpus drouynianus</i> and <i>Macrozamia riedlei</i> with Open Low Woodland A of <i>Banksia grandis</i> and <i>Persoonia longifolia</i> on black sandy clay loam on lateritic hill slopes	90.7
DL EpEmCc BaAd LtGd	Forest of <i>Eucalyptus patens</i> , <i>Eucalyptus megacarpa</i> and <i>Corymbia calophylla</i> over Thicket of <i>Bossiaea aquifolium</i> and <i>Acacia divergens</i> (<i>Callistachys lanceolata</i> and <i>Trymalium odoratissimum</i>) over Tall Sedges of <i>Lepidosperma tetraquetrum</i> and <i>Gahnia decomposita</i> over Low Scrub B of <i>Pteridium esculentum</i> , <i>Bossiaea aquifolium</i> , <i>Hypocalymma cordifolium</i> and <i>Thomasia paniculata</i> on orange loam in broadly unincised gullies	19.2
WE Ep Mm GdLt	Forest of <i>Eucalyptus patens</i> over Low Forest A of <i>Melaleuca microphylla</i> over Tall Sedges of <i>Gahnia decomposita</i> and <i>Lepidosperma tetraquetrum</i> with Open Scrub of <i>Acacia divergens</i> and <i>Taxandria linearifolia</i> over Open Dwarf Scrub D of <i>Hypocalymma cordifolium</i> on white medium clay in wetland	1.5
	<i>Bossiaea</i> Dense Thicket	
HS Ba EmCc PePd	Dense Thicket of <i>Bossiaea aquifolium</i> (<i>Trymalium odoratissimum</i> and <i>Xanthorrhoea preissii</i>) with Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> and Open Low Scrub A of <i>Pteridium esculentum</i> and <i>Podocarpus drouynianus</i> on brown sandy loam on lateritic hill slopes	27.0
	<i>Taxandria</i> Heath A	
HS Tp EmCc	Heath A of <i>Taxandria parviceps</i> with Woodland of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Dwarf Scrub C of <i>Bossiaea pulchella</i> and <i>Taxandria parviceps</i> on grey sand on lateritic hill slopes	2.3
	Blue Gum Plantation	58.3
	Cleared / Disturbed	0.1



TALISON LITHIUM Wilga-Grimwade Vegetation Types

Legend


Study Area






Date: 03/09/2018
Status: Draft
Figure: 2
Sheet Size: A3
Internal Reference: TL_Grimwade_VT
Drawn by: GSM
Requested by: DB




TALISON LITHIUM**Grimwade****Vegetation Types
Legend****Legend**

 Study Area



Vegetation Types**Hill Slope**

-  HS EmCc Bg Xp Forest of *Eucalyptus marginata* and *Corymbia calophylla* (*Eucalyptus patens*) over Dwarf Scrub C of *Xanthorrhoea preissii*, *Macrozamia riedlei* and *Pteridium esculentum* over Open Dwarf Scrub D of *Hibbertia hypericoides* with Open Scrub of *Banksia grandis* and *Xanthorrhoea preissii* on orange sandy loam on lateritic hill slopes
-  HS EmCc HhPc Forest of *Eucalyptus marginata* and *Corymbia calophylla* over Low Heath D of *Hibbertia hypericoides* and *Phyllanthus calycinus* with Open Dwarf Scrub C of *Pteridium esculentum*, (*Macrozamia riedlei* and *Hakea lissocarpha*) on brown sandy loam on lateritic hill slopes
-  HS EmCc Xp HhPc Forest of *Eucalyptus marginata* and *Corymbia calophylla* over Low Heath D of *Hibbertia hypericoides* and *Phyllanthus calycinus* with Open Low Scrub A of *Xanthorrhoea preissii* over Open Dwarf Scrub C of *Pteridium esculentum*, *Macrozamia riedlei* and *Xanthorrhoea preissii* on brown sandy loam on lateritic hill slopes



Granite Outcrop

-  GR HaBc Ep HpAp Low Heath D of *Hypocalymma angustifolium* and *Babingtonia camphorosmae* with Open Low Woodland B of *Eucalyptus patens* over Open Low Scrub A of *Hakea prostrata* and *Acacia pulchella* on brown clay loam on granite outcrop


Drainage Line

-  DL EpEr Xp Forest of *Eucalyptus patens* and *Eucalyptus rudis* over Low Scrub A (to Open Low Scrub A) of *Xanthorrhoea preissii* over Open Dwarf Scrub C of *Pteridium esculentum* over *Poaceae spp. Open Low Grass on brown clay loam on drainage lines
-  DL EpMp XpHp Forest of *Eucalyptus patens* and *Melaleuca preissiana* over Open Scrub of *Kunzea glabrescens*, *Hakea varia* and *Xanthorrhoea preissii* over Open Low Scrub A of *Xanthorrhoea preissii* and *Hakea prostrata* over Open Dwarf Scrub D of *Hibbertia commutata* on brown clay loam on minor drainage lines

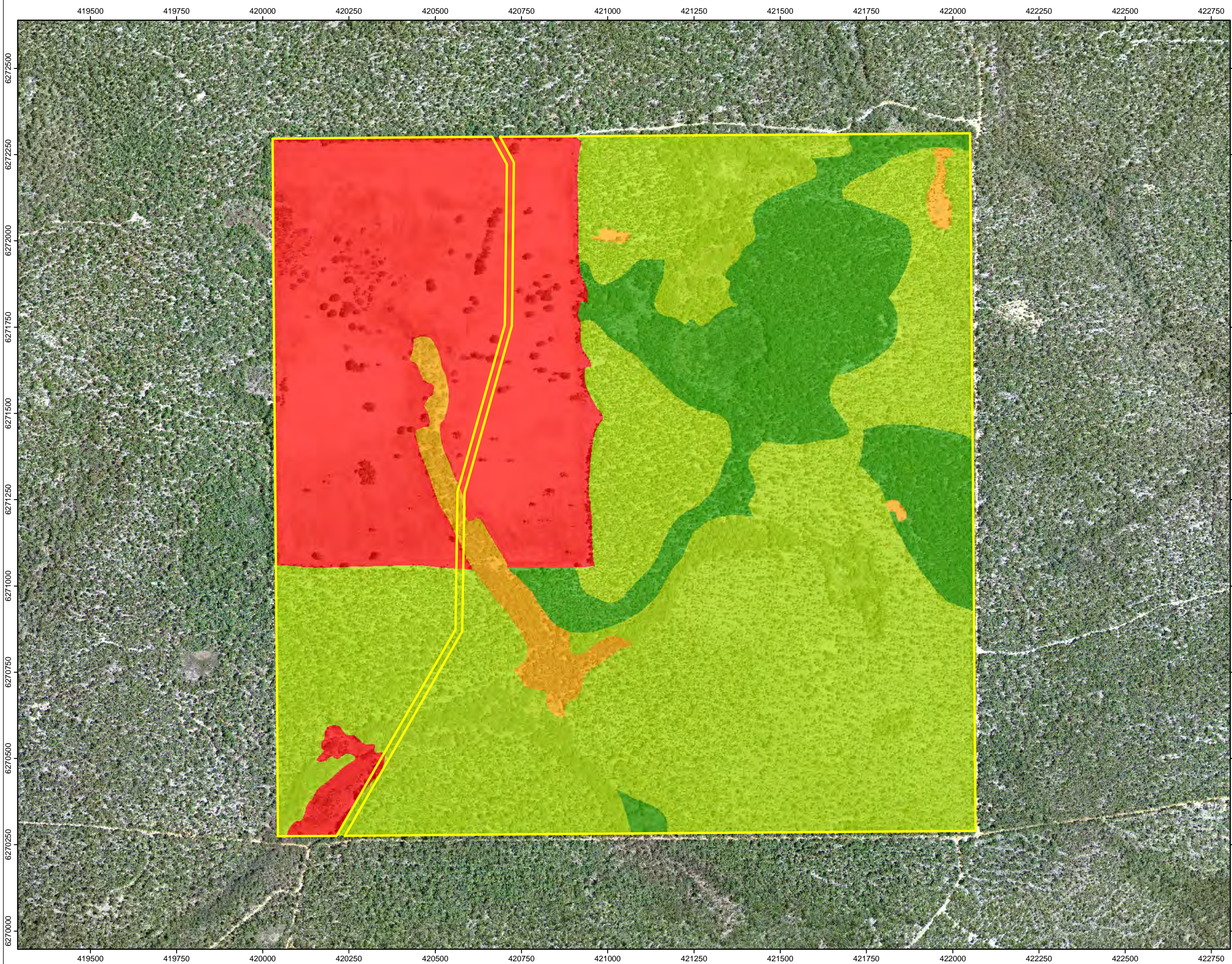
Wetlands

-  WE MvMp Er Lr Low Forest B of *Melaleuca viminea* and *Melaleuca preissiana* over Open Low Grass of *Poaceae spp. with Open Woodland of *Eucalyptus rudis* (*Eucalyptus patens*) over Open Low Scrub B of *Leptocarpus roycei* on brown sandy clay loam in wetland
-  WE Er MI JILr Forest of *Eucalyptus rudis* over Low Scrub A of *Melaleuca lateritia*, (*Astartea scoparia* and *Taxandria linearifolia*) with Open Low Woodland A of *Banksia littoralis* and *Melaleuca preissiana* over Open Low Scrub B of *Juncus pallidus* and *Leptocarpus roycei* on brown clay loam in wetland

Cleared

-  Cleared Pasture

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 Status: Draft
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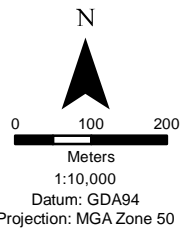
TALISON LITHIUM

Wilga-Grimwade

Vegetation Condition

Legend

- Study
- Vegetation Condition**
- Completely Degraded
- Degraded
- Good
- Very Good



Date: 03/09/2018
 Status: Draft
 Figure: 3
 Sheet Size: A3
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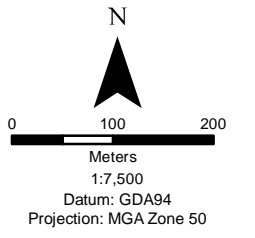
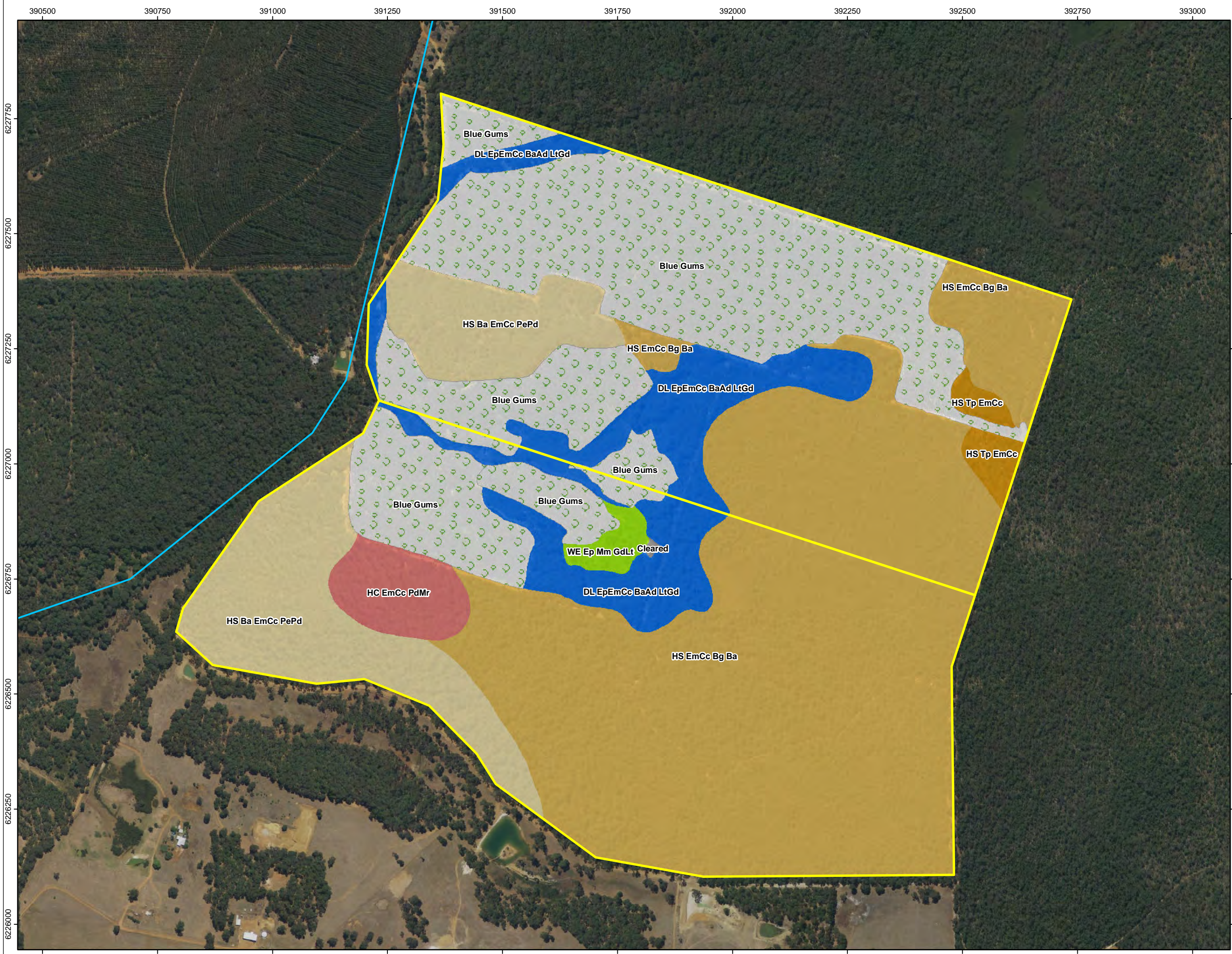


TALISON LITHIUM Carlotta

Vegetation Types

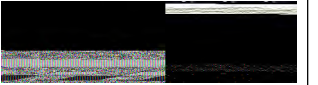
Legend

Study Area



Date: 03/09/2018
 Status: Draft
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 Sheet Size: A3
 Internal Reference: TL_Carlotta_VC
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TALISON LITHIUM

Carlotta


Vegetation Types Legend

Legend


 Study Area


Vegetation Types


Hill Crest

 HC EmCc PdMr Forest of *Eucalyptus marginata* and *Corymbia calophylla* over Low Scrub B of *Podocarpus drouynianus* and *Macrozamia riedlei* (*Xanthorrhoea preissii* and *Hovea elliptica*) with Open Low Woodland B of *Banksia grandis*, Open Dwarf Scrub D of *Leucopogon capitellatus*, *Tremandra stelligera* and *Patersonia occidentalis* on brown sandy loam on lateritic hill crests


Hill Slope

 HS Ba EmCc PePd Dense Thicket of *Bossiaea aquifolium* (*Trymalium odoratissimum* and *Xanthorrhoea preissii*) with Forest of *Eucalyptus marginata* and *Corymbia calophylla* and Open Low Scrub A of *Pteridium esculentum* and *Podocarpus drouynianus* on brown sandy loam on lateritic hill slopes


 HS EmCc Bg Ba Forest of *Eucalyptus marginata* and *Corymbia calophylla* over Thicket of *Bossiaea aquifolium* and *Acacia browniana* over Low Scrub B of *Taxandria parviceps*, *Bossiaea aquifolium*, *Podocarpus drouynianus* and *Macrozamia riedlei* with Open Low Woodland A of *Banksia grandis* and *Persoonia longifolia* on black sandy clay loam on lateritic hill slopes

 HS Tp EmCc Heath A of *Taxandria parviceps* with Woodland of *Eucalyptus marginata* and *Corymbia calophylla* over Dwarf Scrub C of *Bossiaea pulchella* and *Taxandria parviceps* on grey sand on lateritic hill slopes

Drainage Line


 DL EpEmCc BaAd LtGd Forest of *Eucalyptus patens*, *Eucalyptus megacarpa* and *Corymbia calophylla* over Thicket of *Bossiaea aquifolium* and *Acacia divergens* (*Callistachys lanceolata* and *Trymalium odoratissimum*) over Tall Sedges of *Lepidosperma tetraquetrum* and *Gahnia decomposita* over Low Scrub B of *Pteridium esculentum*, *Bossiaea aquifolium*, *Hypocalymma cordifolium* and *Thomasia paniculata* on orange loam in broadly unincised gullies

Wetlands

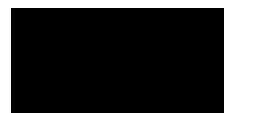
 WE Ep Mm GdLt Forest of *Eucalyptus patens* over Low Forest A of *Melaleuca microphylla* over Tall Sedges of *Gahnia decomposita* and *Lepidosperma tetraquetrum* with Open Scrub of *Acacia divergens* and *Taxandria linearifolia* over Open Dwarf Scrub D of *Hypocalymma cordifolium* on white medium clay in wetland

Others

 Blue Gums

 Cleared

Date: 03/09/2018
 Status: Draft
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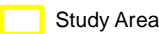



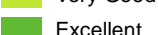


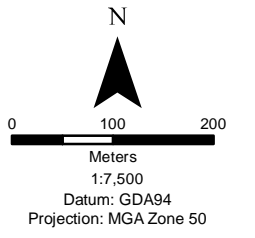
TALISON LITHIUM

Carlotta

Vegetation Condition

Legend

-  Study Area
- Vegetation Condition**
-  Completley Degraded
-  Good
-  Very Good
-  Excellent



Date: 03/09/2018
 Status: Draft
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3.3 Vegetation Significance

3.3.1 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information, and includes 419 sub-regions (Department of Environment 2013). The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The study area is located within the Southern Jarrah Forest (JF2) sub-region within the Jarrah Forest bioregion, which shows that 56 percent of the pre-European extent of the bioregion remains intact (Table 3).

3.3.2 Regional Forest Agreement

The representation of vegetation complexes within the reserve system has been published as part of the Regional Forest Agreement process (The Commonwealth of Australia and the State of Western Australia 1999), and updated as part of the next Forest Management Plan.

The survey areas occur across six vegetation complexes; Catterick CC1, Dwellingup D1 and Wilga WG (Wilga-Grimwade study area, see Figure 6), and Bevan BE1, Wheatley WH and Yanmah YN1 (Carlotta study area, see Figure 7). All six vegetation complexes are considered well represented, with greater than 30 percent of the pre-European extent remaining (Table 3). Furthermore, a review of vegetation complexes occurring in the central Blackwood sub-region (Nannup to Bridgetown) and eastern Blackwood sub-region (Boyup Brook to Towering) by Havel and Mattiske (2002) found none of the six vegetation complexes occurring within the study areas were determined to be poorly reserved.

3.3.3 Beard Mapping

The study areas occur in the Menzies Sub-district of the Darling Botanical District, in the South-West Botanical Province (Beard 1981). The Menzies Sub-district (southern jarrah forest) covers a total area of 26,572 km², of which 18,715 km² (70 percent) originally supported jarrah and jarrah-marri forest (Beard 1981). The study area is mapped as Beard Vegetation Association 3 - Medium Forest; Jarrah-Marri. At this broad level of mapping 67 percent of the pre-European extent remains intact.

Table 3 Pre-European extent of vegetation represented on the basis of identified datasets.

Vegetation Association / Complex	Pre-European Extent (ha)	Extent Remaining (ha)	% Extant of Pre-European
IBRA Bioregions			
Jarrah Forest*	4,671,007	2,801,026	56
Shire			
Bridgetown Greenbushes*	133,759	73,835	55
Mattiske Vegetation Complex**			
Bevan 1 (BW1)	76,778	62,864	82
Catterick (CC1)	27,424	16,503	60
Dwellingup (D1)	208,334	183,334	88

Vegetation Association / Complex	Pre-European Extent (ha)	Extent Remaining (ha)	% Extant of Pre-European
Wheatley (WH1)	20,322	16,501	81
Wilga (WG)	38,204	24,718	65
Yanmah (YN1)	23,510	19,394	82
Beard Vegetation Association			
3 - Medium Forest; Jarrah-Marri	2,661,404	1,806,035	67
Beard Vegetation Association within Bioregion			
3 - Medium Forest; Jarrah-Marri	2,390,591	1,606,736	67



TALISON LITHIUM

Wilga-Grimwade

Vegetation Complexes

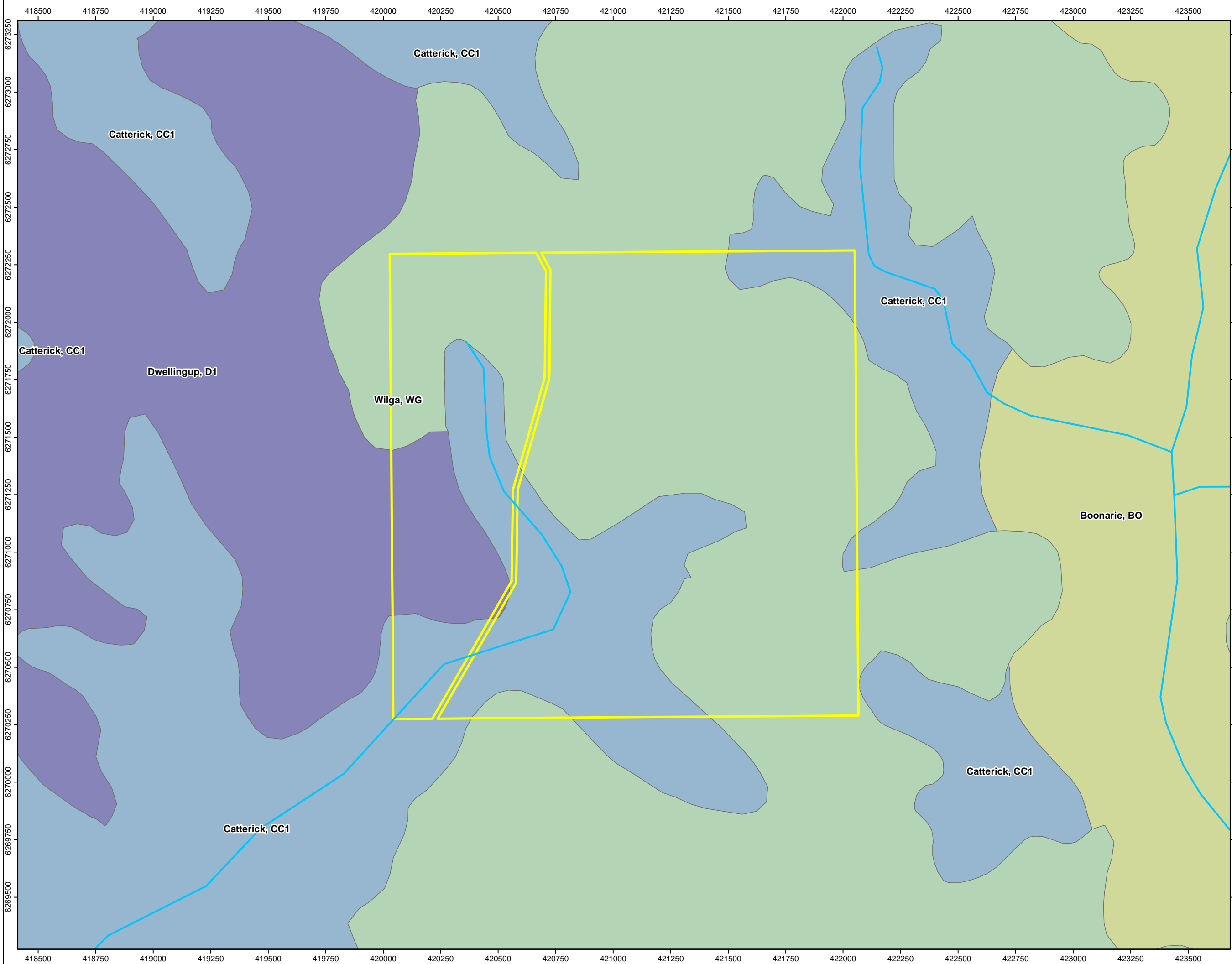
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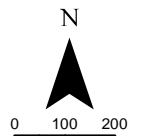
Vegetation Complexes

Darling Plateau

- Boonarie, BO
- Catterick, CC1
- Dwellingup, D1
- Wilga, WG



6273250
6273000
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6272500
6272250
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Meters

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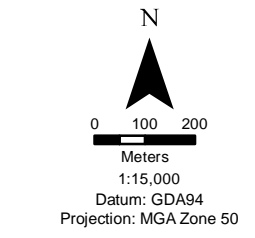
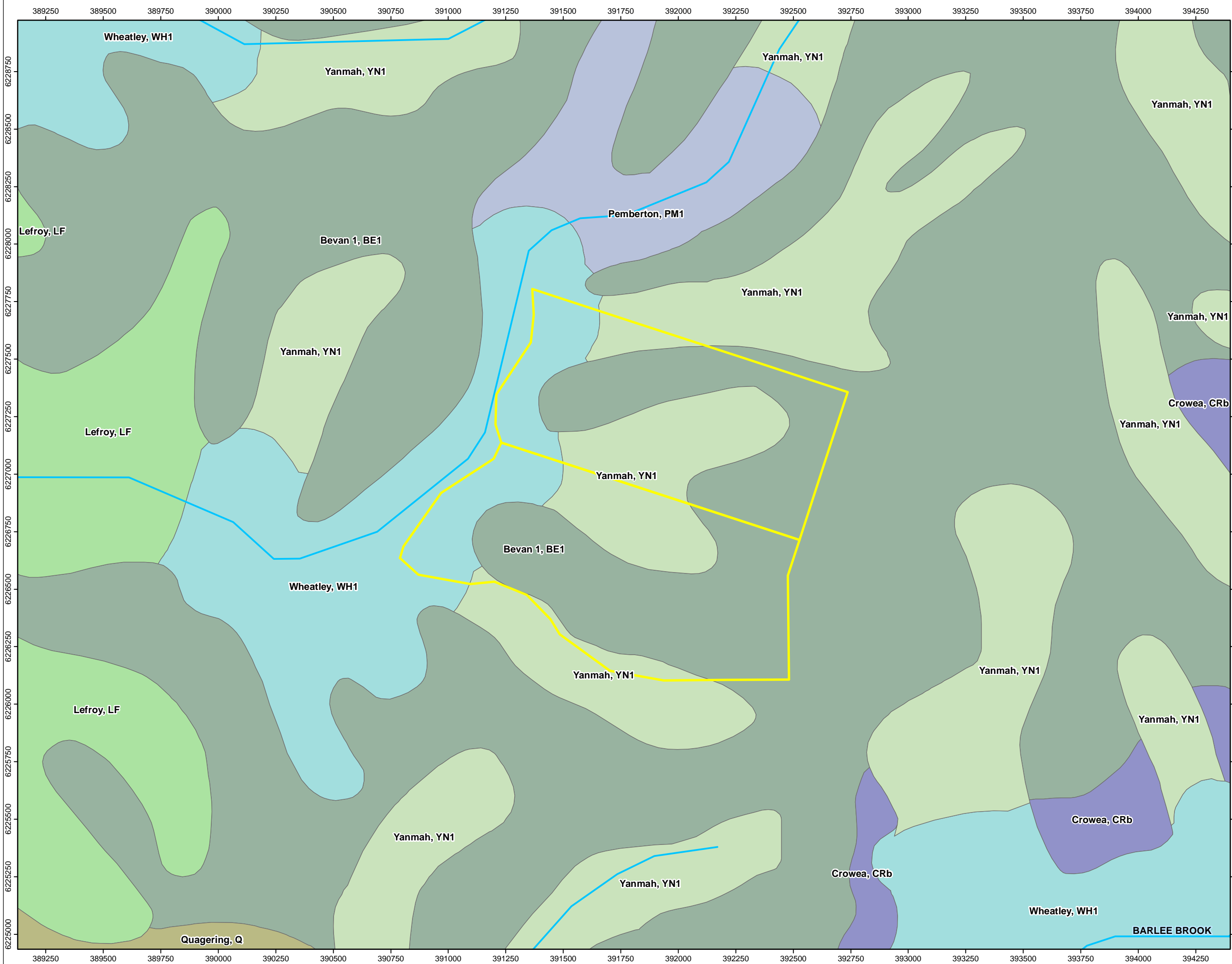
TALISON LITHIUM

Carlotta

Vegetation Complexes

Legend

- Study Area
- Vegetation Complexes**
- Darling Plateau**
 - Bevan 1, BE1
 - Crowea, CRb
 - Lefroy, LF
 - Pemberton, PM1
 - Wheatley, WH1
 - Yanmah, YN1
- Southern Plain**
 - Quagering, Q



Date: 03/09/2018
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4.0 SUMMARY

Talison propose to increase the current (approved) area of the Greenbushes Lithium Operations from 1,591 hectares to 1,989 hectares, representing a 398 hectare (or 25%) increase to the current approved extent of the mine. The proposed expansion will require 350 hectares of native vegetation to be cleared outside existing approval areas. This vegetation is known to contain habitat for three listed threatened species of forest black cockatoos.

As part of a larger package to compensate for residual impacts to the three forest black cockatoos, Talison identified two parcels of land within a 30 km radius that abut state forest; Grimwade/Wilga (409 hectares) and Carlotta (204 hectares). In September 2018, Onshore Environmental completed a vegetation survey of both sites to determine the vegetation types and vegetation condition present.

The Grimwade/Wilga site supported eight vegetation types across four broad landforms. Native remnant vegetation was consolidated over 297.4 hectares, with a 111.6 hectare square paddock in the northwest corner of the lot historically cleared for annual pasture. Remnant native vegetation was predominantly rated as *good* (221.3 hectares or 74%) with the major disturbance related to recent logging. The remaining remnant vegetation condition was rated as *very good* (63.5 hectares or 21%) and *degraded* (12 hectares or 4%). Degraded patches were small and localised laydown areas intensively disturbed during logging operations.

Remnant native vegetation at the Grimwade/Wilga site supports Jarrah-Marri forest on uplands, and Yarri-Flooded Gum forest along gullies and drainage lines. It abuts state forest that supports the same vegetation types and is part of recent and ongoing timber harvest operations by Forest Products Commission (FPC). The vegetation also has a high similarity to forest within the proposed extension at Greenbushes.

The Carlotta site supported six vegetation types across four broad landforms. Native remnant vegetation was consolidated over 145.6 hectares (71%), with 59.1 hectares (29%) of Blue Gum plantation in the northwest corner of the lot. Vegetation condition within the Blue Gum plantation was rated as *completely degraded*. Remaining native vegetation within the study area was predominantly rated as *excellent* (130.8 hectares or 64%) with a smaller portion rated as *very good* (9.8 hectares or 5%); disturbance within these areas was restricted to historical logging and a few non-aggressive weed species.

Defining characteristics of native vegetation at the Carlotta site included long period since logging, old fire age, and few non-invasive introduced (weed) species. The very good and excellent vegetation condition classes representing 140.6 hectares, were commensurate with the adjacent state forest.

5.0 STUDY TEAM

The reconnaissance vegetation survey was planned, coordinated and executed by the following personnel:

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Licences

The field survey was conducted under the authorisation of the following licences issued by DBCA:

- Darren Brearley, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL012077;
- Jessica Waters, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL012078.

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APPENDIX 1

Vegetation Classifications following Muir (1997)

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE	MID DENSE	SPARSE	VERY SPARSE
	70 % - 100%	30% - 70%	10% - 30%	2% - 10%
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

APPENDIX 2

**Vegetation condition scale
(as developed by Keighery 1994)**

Condition	Scale	Description
Pristine	1	Pristine or nearly so, no obvious signs of disturbance.
Excellent	2	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	3	Vegetation structure altered; obvious signs of disturbance.
Good	4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
Degraded	5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching Very Good condition without intensive management.
Completely Degraded	6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.



Talison Lithium Pty Ltd
GREENBUSHES LITHIUM OPERATION

ENV-MP-0009

Carlotta Offset Area Management Plan

APPENDIX 2

GREENBUSHES OFFSET SITE FAUNA SURVEY



Level 1 Vertebrate Fauna Survey Greenbushes Offset Areas

Prepared for Talison Lithium
27 January 2019



Document Status						
Rev No.	Authors	Reviewer/s	Date	Approved for Issue		
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EXECUTIVE SUMMARY

Talison Lithium (Talison) currently operates a lithium mine at Greenbushes, situated approximately 250 km south of Perth in south-west Western Australia. Onshore Environmental Consultants Pty Ltd (Onshore Environmental) was commissioned to undertake a Level 1 vertebrate fauna survey of three proposed offset areas located in the vicinity of the mine site (herein referred to as the 'study areas'):

1. Tone Bridge;
2. Carlotta; and
3. Grimwade.

These areas were assessed as proposed offsets to the clearing of native vegetation as part of the current expansion of mining operations at the Greenbushes Mine.

The field survey was completed over six days by a Senior Zoologist and Senior Botanist from Onshore Environmental. Field work was undertaken between the 19th and 21st of November and the 3rd and 5th of December 2018.

Four conservation significant fauna species were recorded from the study areas during the survey:

- Red-tailed Black Cockatoos (Grimwade and Tone Bridge);
- Western Brush Wallaby (Grimwade and Tone Bridge);
- South-western Brush-tailed Phascogale (Grimwade and Tone Bridge); and
- Chuditch (Tone Bridge).

Carnaby's Black Cockatoos were photographed foraging within the Gwimwade study area after the survey by the owner of the property.

Two introduced fauna species (feral animals) were recorded during the survey:

- Fox (*Vulpes vulpes*) (all study areas); and
- Feral Pigs (Grimwade) (*Sus scrofa*).

A total of eight fauna habitat types were described and mapped from the three study areas, with the most common habitats being hillslopes, minor drainage lines and wetlands. The fauna habitats mapped within the study areas are well represented locally as well as regionally.

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1.0 INTRODUCTION

1.1 Background

Talison Lithium Pty Ltd (Talison) owns and operates an operational lithium mine near the town of Greenbushes in the south west of Western Australia. The Greenbushes operation represents the world's largest known lithium reserve and has been producing lithium for 25 years, contributing to Australia's position as one of the two top global producers.

Talison is proposing to undertake an expansion at the Greenbushes Mine, aimed at increasing supply of lithium to the market. The proposed expansion will require 350 ha of native vegetation to be cleared outside existing approved areas.

In 2018, Talison referred its' proposal to expand operations to the Department of Energy and Environment (DoEE) for assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The referral was made on the basis that the expansion would require the clearing of 350 ha of native vegetation known to contain habitat for listed threatened species, namely:

- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - listed as Vulnerable under the EPBC Act and Schedule 3 under the *Wildlife Conservation Act 1950* (WC Act);
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) - listed as Vulnerable under the EPBC Act and Schedule 2 under the WC Act;
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - listed as Endangered under the EPBC Act and Schedule 2 under the WC Act;
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – listed as Critically Endangered and Schedule 1 under the WC Act;
- Chuditch (*Dasyurus geoffroii*) – listed as Vulnerable under the EPBC Act and Schedule 3 under the WC Act;

1.2 Environmental Offsets

Talison has identified a significant residual impact to five threatened species; three Black Cockatoo species, Western Ringtail Possums and Chuditch, associated with the proposed clearing of native vegetation for the mine expansion. Talison proposes to counteract these impacts through the implementation of an environmental offset in accordance with the Principles of the WA Government's Environmental Offset Policy (GoWA, 2011) and the Australian Government's EPBC Act Environmental Offsets Policy (DSEWPAC, 2012a).

Talison has been working to identify measures that, in combination, would constitute an acceptable and cost effective package of environmental offsets that would satisfy the requirements of the Policy, as per the acceptance criteria.

The *Offsets Assessment Guide* (DSEWPAC 2012b) has been used to characterise and quantify the residual impacts that require offsetting under the policy. The policy requires that a minimum of 90 percent of the offset package go towards directly offsetting residual impacts to the attribute of the protected matter that will be affected ('direct offsets'), with the remainder having the option of including offsets that are less

directed towards the specific nature of the impact ('indirect offsets').

Efforts by Talison to identify suitable environmental offsets has included regular liaison with the Department of Biodiversity Conservation and Attractions (DBCA). DBCA has a land acquisition program for adding suitable areas of environmental value that meet its selection criteria, to its conservation estate. The criteria includes the suitable area being contiguous with existing estate or sufficiently large in its own right relative to the environmental values that the site contains. Potential synergies may arise in circumstances where DBCA's acquisition program and requirements under the Policy coincide. Talison and DBCA have identified three area of land that potentially satisfy both DBCA's criteria and those of the policy (Figure 1):

1. *Tone Bridge*:
 - Lot 12374 on Plan 206984 Terrace Road, Tone Bridge; and
 - Lot 31 on Plan 99257 Terrace Road, Tone Bridge.
2. *Carlotta*:
 - Nelson locations 11189 and 11215, Carlotta (Wishart).
3. *Grimwade*:
 - Lot 1731 on Plan 123504, Wilga West.

1.3 Purpose of the Survey

To support environmental approvals for the proposed expansion, Onshore Environmental was commissioned by Talison to undertake a Level 1 vertebrate fauna survey of the three proposed offset areas.

The objectives of the survey were to:

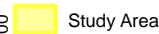

- describe and map fauna habitats present within the study areas, and assess their likelihood to support fauna species of conservation significance; and
- undertake targeted searches for fauna species of conservation significance within the study areas.

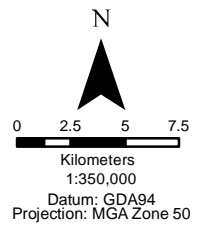
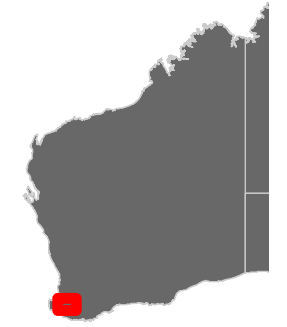


TALISON Offset Areas

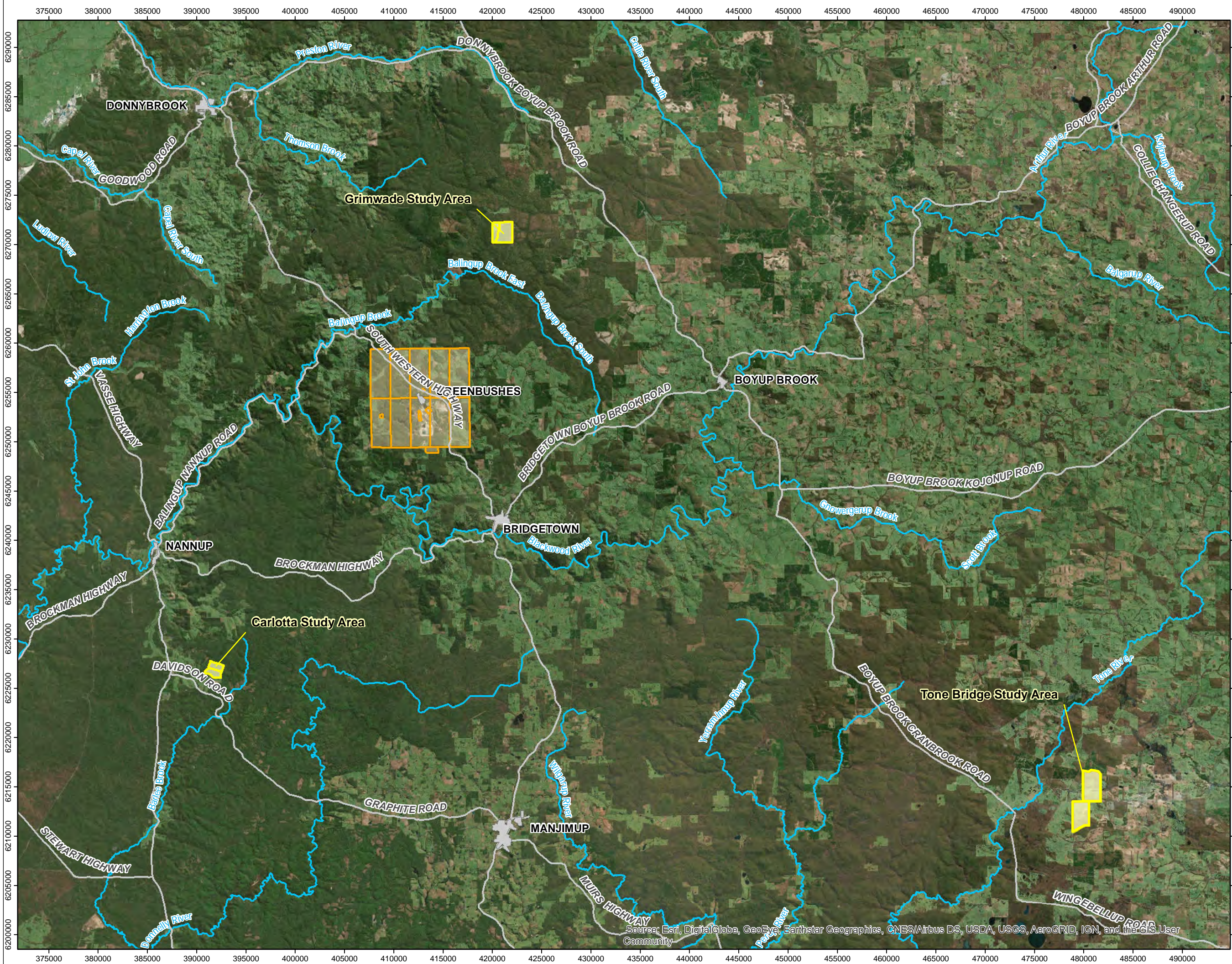
Study Area Locations

Legend

-  Study Area
-  Talison Tenure



Date:	21/01/2019
Status:	Final
Figure:	1
Sheet Size:	A3
Internal Reference:	Offset_Loc_Map
Drawn by:	GSM
Requested by:	DB



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

1.4 Climate

The study areas occurs on a boundary between the dry Mediterranean region to the north which experiences six dry months per year, and the moderate Mediterranean region to the south which experiences four dry months per year (Beard 1981). The Greenbushes region has cool wet winters and hot dry summers. Average annual rainfall for the town of Greenbushes is 928.7 mm (Bureau of Meteorology [BOM] 2018), with the majority of falls occurring during the winter months of June and July, associated with cold fronts moving across the south-west of Western Australia.

The annual rainfall for the twelve-month period prior to the December 2018 field survey was 786 mm, which is below the long-term average of 924 mm (Figure 2). Temperatures experienced during the survey period were typical for the time of year and aligned with the monthly long-term averages (Figure 2).

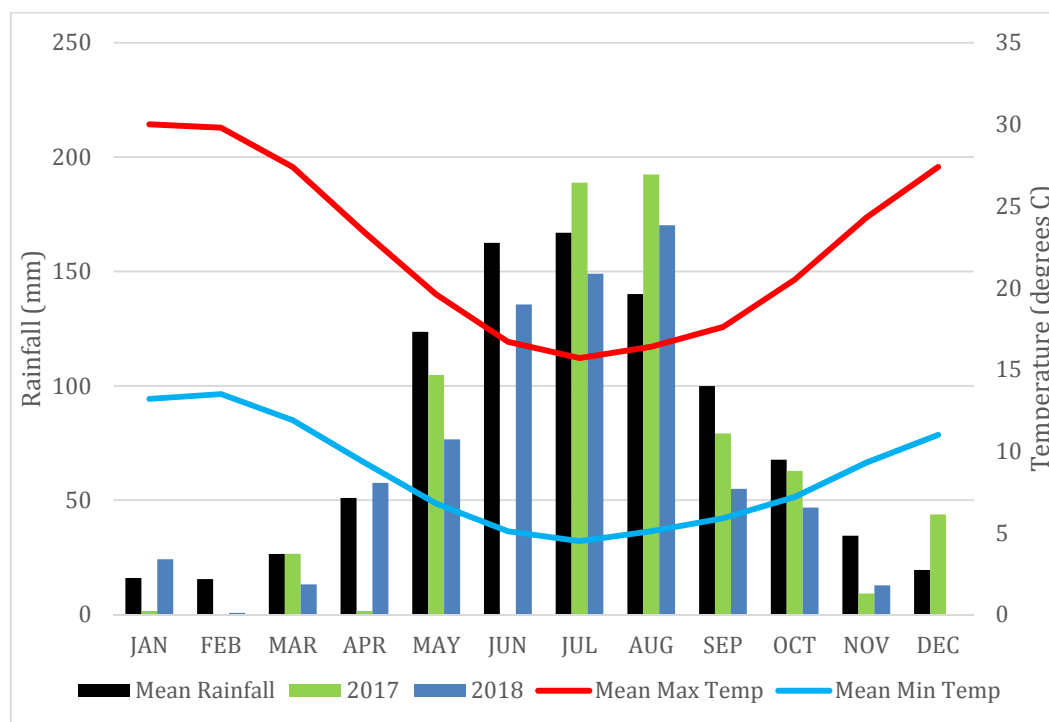


Figure 2 Climatic data – rainfall data is from the Greenbushes Weather Station and temperature data from the Bridgetown Weather Station (BOM 2018).

1.5 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA 7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information, and includes 419 sub-regions (DoEE 2018a). The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The study areas are located within the Southern Jarrah Forest (JF2) sub-region within the Jarrah Forest bioregion. The Southern Jarrah Forest sub-region is described as, “*Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. Eluvial and alluvial deposits support Agonis shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands. The climate*

is *Warm Mediterranean*" (Hearn *et al.* 2002).

The vegetation of the sub-region is described as "*Jarrah-Marri forest in the west grading to Marri and Wandoo woodlands in the east. There are extensive areas of swamp vegetation in the south-east, dominated by Paperbarks and Swamp Yate. The understory component of the forest and woodland reflects the more mesic nature of this area. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions*" (Hearn *et al.* 2002).

1.6 Land Use

The major land uses within the study areas and surroundings are State Forest, residential, mining and agriculture. The study areas predominantly traverse sections of State Forest and privately-owned farmland to the south-east. Nearby towns include Nannup (approximately 25 km to the north of the Carlotta study area), Balingup (approximately 22 km to the south-west of the Grimwade study area) and Rocky Gully (approximately 45 km to the south-east of the Tone Bridge study area).

1.6.1 Agriculture and Associated Industry

Bridgetown is the oldest town in the south-west of Western Australia and lies between the three study areas. It was first settled by sheep farmers E. Hester and John Blechyden in 1857. The Bridgetown Agricultural Society was formed in 1885 and by this time the area had a well-established agricultural industry, including sheep, cattle, dairy products, timber, fruit and nuts. In 1889 the railway line was extended to Bridgetown allowing the expansion of the fruit and timber markets. Many of these agricultural industries are still operational with wineries and olive farms also established in the area. Currently one of the largest employers in the area is Auswest Timbers, a local timber milling company.

The central portion of the Tone Bridge offsets area was historically cleared for dryland agriculture, with annual winter growing pastures supporting sheep and wool production. The remnants of a farm homestead and shearing shed remain on the property. More recently, farmland has been converted to timber plantation (*Eucalyptus globulus*), with these trees now harvested and exported as wood chips.

Large consolidated blocks of remnant native vegetation remain across the northern and southern sectors of the Tone Bridge study area. Historical grazing by domestic stock has occurred along the intersection with cleared farmland areas, but impacts are generally restricted to relatively narrow edge effects. Smaller isolated remnants occurring within the larger cleared farmland block have been intensively grazed for extended periods, resulting in the removal of understorey vegetation strata (parkland cleared).

Hardwood and softwood timber plantations are common on private land in the region. State Forest is also managed for selective logging of mainly Jarrah (*Eucalyptus marginata*).

Nature conservation is a significant land use in the Perup Forest and the Lake Muir/Unicup complex of Nature Reserves. The Tone Perup Nature Reserve occurs less than 8 km west of the Tone Bridge study area.

1.6.2 Mining

The Greenbushes Mine is situated on the oldest mining tenement in Western Australia and has a long history of mining activities dating back to 1888. Tin was first reported in 1886 in a Government geological survey, and mining commenced in 1888. Since it was first discovered, tin has been mined almost continuously in the Greenbushes area, although in recent years the lower tin prices and emergence of tantalum as the major revenue earner have relegated tin to the position of a by-product. The presence of tantalite was noted as far back as 1893 but at that time the mineral had no value and was seen as a nuisance because it downgraded the value of tin. Although open cut mining began to be practiced on a small scale in the 1900s much of the tin mined in the early years by small operators came from underground workings to access weathered pegmatite below the caprock. Shafts were blasted in the surface rock and tunnels dug out into the tin bearing alluvium. The dirt was hauled to the surface and stockpiled during the summer months then puddled and sluiced in winter when there was an abundance of water. Tin mining continued more or less as a cottage industry under the control of many small mining companies up to the early 1960s when, for the first time, a major mining company became involved in the tinfields.

For several years a dredge was used to recover surface deposits of tin and tantalum. By 1970 alluvial resources were dwindling and it was necessary to increase exploration activity. As a direct result of this work development of the weathered pegmatite commenced in 1974. This tin/tantalum source sustained the operation until 1992. Small parcels of tantalite were sold occasionally, but it was not until 1944, when war had stimulated interest in the element tantalite, that the mineral began to be produced steadily for use in telecommunications, electronics and radar equipment.

Spodumene, the major lithium mineral, was first identified by the Western Australian Government Survey in 1949 from a specimen collected in 1928 which was initially thought to be feldspar. During the extensive diamond drilling programme for tantalum that took place between 1977 and 1980, substantial spodumene rich zones were identified. Later drilling confirmed the existence of the richest spodumene ore body ever discovered, with resources sufficient to maintain production well into the 21st Century. However, being a new product, markets had to be developed, so it was not until 1983 that the initial development of the lithium ore body at Greenbushes commenced, and the first lithium processing plant was commissioned in 1985. Since that time, the lithium processing plant has been expanded several times to produce a range of lithium concentrates. The current expansion plans aim to increase production by 520,000 tonnes per year and includes a new concentrate plant, crushing plant and related infrastructure.

1.6.3 Tourism

Tourism is the other major industry in the area with the scenery, historical sites, wineries, and galleries serving as the major attractions. Events such as the annual Blues at Bridgetown Festival also draw large numbers of people to the area.

1.7 Landforms and Soils

Tille (1996) has mapped soils of the Wellington-Blackwood District, which includes the town sites of Greenbushes and Bridgetown on its southern boundary. The study areas occurs within the Hester sub-system of the Darling Plateau System, and consists of undulating ridges and hill crests formed on laterite and gneiss which typically slope downwards off the main plateau into the surrounding Lowden Valleys System. The soils are mostly loamy gravels, sandy gravels and loamy earths.

In 2010 AECOM reviewed the Environmental Geology Series maps prepared by the Geological Survey of Western Australia (1980) for a nearby area (AECOM 2010). The soils and landforms described for the area are expected to be similar to those within the study areas. The geology of the nearby area was described as Archean granite of the Yilgarn Block and the soils of this area are listed below:

- Bt - Shallow red and yellow earths and rock outcrops on slopes and narrow alluvial terraces;
- Ba - Red and yellow earths, duplex soils on slopes, narrow alluvial terraces, swampy floors;
- G - Grey sands and some swamps;
- Hr - Duricrust and gravels flanked by gravelly duplex soils; and
- Cc - Yellow and duplex soils and red earths on slopes, and narrow alluvial terraces.

The regional geology has been described by Wilde and Walker (1984), Muhling and Brakel (1985), Myers (1990a, 1990b) and De Silva (2000). The Archaean Yilgarn Craton (in which the study areas occurs) is characterised by crystalline rocks, predominantly granite and gneiss, which are often deeply weathered. Sediments typically overlie these basement rocks, and extensive laterisation is evident. The laterite varies from massive and cemented structure with either a pisolitic or vesicular texture, to loose uncemented pisolites.

1.8 Flora and Vegetation

Vegetation of the area has been broadly mapped by Smith (1972) and Beard (1979), with a combined vegetation systems map (1:1,000,000 scale) produced by Beard (1981).

The study areas occur in the Menzies sub-district of the Darling Botanical District, in the South-West Botanical Province (Beard 1981). The Menzies sub-district (Southern Jarrah Forest) covers a total area of 26,572 km², of which 18,715 km² (70%) originally supported jarrah and jarrah-marri forest (Beard 1990). It is estimated that approximately 61% of the total area has been cleared since European settlement, mainly in the valleys which are free of laterite, leaving the forest intact on laterised higher plateau levels. The Menzies sub-district is characterised by Jarrah stands on laterite within some Marri and Wandoo woodlands. Valley soils are often richer and Blackbutt (*Eucalyptus patens*) is more dominant in these areas. Flooded Gum (*Eucalyptus rudis*) is common along stream banks and Bullich (*Eucalyptus megacarpa*) is also present in some areas. Within the study areas vegetation is dominated by Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) forest over the tall shrubs bull banksia (*Banksia grandis*) and snotty gobble (*Persoonia longifolia*). The lower understory strata contains a range of plant genera including *Hakea*, *Acacia*, *Xanthorrhoea*, *Adenanthos*, *Hovea*, *Leucopogon*, *Macrozamia*, *Leucopogon*, *Bossiaea*, *Daviesia*, *Grevillea*, *Patersonia*, *Styphelia* and *Kennedia*.

Vegetation complexes of the southern jarrah forest have most recently been defined by Heddle *et al.* (1980) and updated by Mattiske and Havel (1998). Mattiske and Havel (1998) describe vegetation of the survey area as 'mixture of open forest of *Eucalyptus marginata* - *Corymbia calophylla* with some *Eucalyptus patens* on slopes'.

2.0 METHODOLOGY

2.1 Guidance Statements

The single-season Level 1 vertebrate fauna survey was carried out in a manner that was compliant with Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of vertebrate fauna in Western Australia:

- Statement of Environmental Principles, Factors and Objectives (EPA 2018);
- Environmental Factor Guideline Terrestrial Fauna (EPA 2016a);
- Technical Guidance Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016b);
- Technical Guidance Terrestrial Fauna Surveys (EPA 2016c);
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a) Survey Guidelines for Australia's Threatened Bats;
- DEWHA (2010b) Survey Guidelines for Australia's Threatened Birds;
- DSEWPaC (2011a) Survey Guidelines for Australia's Threatened Mammals;
- DSEWPaC (2011b) Survey Guidelines for Australia's Threatened Reptiles;
- DEWHA (2010c) Survey Guidelines for Australia's Threatened Frogs;
- DSEWPaC (2012c) EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species; and
- Department of Parks and Wildlife (DPaW) (2017) Western Ringtail Possum Recovery Plan.

2.2 Desktop Assessment

2.2.1 Literature Review

Regional scale reports relevant to the study areas locality were reviewed, including:

- a summary of bioregional data (Hearn *et al.* 2002); and
- vegetation description and mapping by Beard (1981), and more recently by Hedde *et al.* (1980) and by Mattiske and Havel (1998).

In addition, there was a review of all publicly available literature and internal reports commissioned and held by Talison. A single survey has previously been completed of the Carlotta study area. Additionally, there are seven vertebrate surveys that have been completed between 2011 and 2018 within the Greenbushes Mine expansions area, in the vicinity of the study areas. The previous survey work is summarised in more detail in Section 3.1.1.

2.2.2 Database Searches

The desktop assessment included databases relating to significant fauna, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) previously collected or described within, or in close proximity to, the study areas. For this report the search was extended beyond the study areas to place vertebrate fauna values into a local and regional context. The following databases were searched:

- NatureMap: This database represents the most comprehensive source of information on the distribution of Western Australia's fauna (20 km radial search around the central point 1: GDA94 Zone 50 - 414500E 6252000N, accessed October 2018; and central point 2: GDA94 Zone 50 - 480000E 6212500N, accessed December 2018) (DPaW 2018);

- DBCA's Threatened Fauna Database was searched to confirm the NatureMap results (50 km radial search around the central point GDA94 Zone 50 - 414500E 6252000N, accessed October 2018) (DBCA 2018a);
- DBCA's TEC, PEC and Environmentally Sensitive Areas (ESAs) database was searched to identify significant communities (20 km radial search around the central point GDA94 Zone 50 - 413000E 6252000N, accessed March 2018) (DBCA 2018b);
- EPBC Act Protected Matters database (20 km radial search around the central point 1: GDA94 Zone 50 - 414500E 6252000N, accessed October 2018; and central point 2: GDA94 Zone 50 - 480000E 6212500N, accessed December 2018) (DoEE 2018b); and
- International Union for Conservation of Nature (IUCN) database (accessed October 2018) (IUCN 2018).

2.2.3 Assessment of Conservation Significance

The conservation significance of fauna and ecological communities are classified at a Commonwealth, State and Local level on the basis of various Acts and Agreements, including:

International Level:

- IUCN: The IUCN 'Red List' lists species at risk under nine categories (status codes) (Appendix 1); and
- International Conventions: Migratory taxa listed under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Commonwealth Level:

- EPBC Act: The DoEE lists Threatened fauna and ecological communities, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists flora that are considered to be of conservation significance under one of six categories (Appendix 2).

State Level:

- WC Act: At a State level, native fauna species are protected under the WC Act – Wildlife Conservation Notice. A number of species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations (Appendix 3); and
- DBCA Priority list: DBCA produces a list of Priority species and ecological communities that have not been assigned statutory protection under the WC Act. Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added under Priorities 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been removed from the threatened species list for other taxonomic reasons, are placed in Priority 4. These species require regular monitoring (see Appendix 4). The list of PECs identifies those that need further investigation before nomination for TEC status at a State level.

Local Level:

- Species may be considered of local conservation significance because of their patterns of distribution and abundance. Although not formally protected by legislation, such species are acknowledged to be in decline as a result of threatening processes, primarily habitat loss through land clearing.

2.2.4 Assessment of Likelihood of Occurrence in the Study areas

A list of conservation significant fauna species occurring within a 50 km radius of the study areas was compiled during the literature review and database searches. The likelihood of each taxon occurring within the study areas was assessed using a set of rankings and criteria (Table 1) based on presence of suitable landform (inferred from aerial imagery with contours overlaid, and from knowledge of the adjacent areas), and distance to known records.

Table 1 Ranking system used to assign the likelihood that a species would occur in the study areas.

Rank	Criteria
Recorded	The species has been recorded in the study areas.
Likely to occur	The species has previously been recorded from a landform/habitat which is present within the study areas, and there are previous records within immediate surrounds of the study areas.
Possible to occur	The species has previously been recorded from a landform/habitat which is present within the study areas, and there are previous records within a 20 km radius of the study areas.
Unlikely to occur	The landform/habitat from which the species has previously been recorded is absent within the study areas, and/or there are no previous records within a 20 km radius of the study areas.

2.3 Field Survey Methodology

2.3.1 Timing and Personnel

The vertebrate fauna survey was completed by Senior Zoologist Mr Michael Brown and Senior Botanist Ms Jessica Waters over six field days between the 19th and 21st of November 2018, and the 3rd to 5th of December 2018.

2.3.2 Surveying of Study areas

The study areas were walked and assessed to document habitat characteristics including evaluation of the presence of habitats suitable to support conservation significant fauna. The survey recorded any observations of fauna species via primary or secondary evidence. In addition, low intensity sampling was undertaken throughout the study areas, involving bird census, active foraging and the use of motion cameras. Targeted searches (as detailed below) were also undertaken for conservation significant fauna species identified during the database review.

The following parameters were recorded for all conservation significant fauna:

- Co-ordinate locations;
- Description of habitat in which the species was located; and
- Photograph of the species, evidence of species and/or habitat.

Active Foraging

Active foraging, involving raking litter and turning over rocks, was completed throughout the study areas. Records were made for any conservation significant species sighted during foraging.

Motion Cameras

Motion camera were set up throughout the study areas within habitats deemed most likely to be utilised by conservation significant fauna species. Motion cameras were baited with universal bait. A total of 20 cameras were deployed across the three study sites (Table 2). Cameras were deployed for a total of 12 nights at the Carlotta study area, and 14 nights at each of the Tone Bridge and Grimwade study areas.

Table 2 Camera traps deployed across the three study areas.

Site	Number of Cameras	Deployed	Retrieved
Carlotta	6	21 st Nov	3 rd Dec
Grimwade	7	20 th Nov	4 th Dec
Tone Bridge	7	21 st Nov	5 th Dec

2.3.3 Targeted Surveys for Conservation Significant Species

Tree Hollow Searches and Tree Density Assessments

Tree hollows were actively searched and recorded during transect walks within the three study areas. Each tree hollow encountered was assessed for its suitability to provide habitat for conservation significant species (namely, Western Ringtail Possums and Black Cockatoos), and other species. Those hollows deemed appropriate (i.e. sufficient size) were assessed further (as per below). To determine approximate densities of potential future habitat trees (trees >50 cm diameter) tree counts were conducted within specific vegetation types. Tree numbers within these areas were then extrapolated to provide a per hectare density for different habitats within each of the study areas.

Black Cockatoo Searches

Habitats used by black cockatoos have been placed into three categories by DSEWPac (2012c), these being:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

Breeding habitat for black cockatoos was assessed by the identification of all suitable breeding trees that had a diameter at breast height (DBH) of equal to or greater than 50 cm. Target tree species included marri and jarrah and any other *Corymbia* or *Eucalyptus* species of a suitable size that was present. The location of each tree identified (with appropriate DBH) was recorded along with details on the number and size of hollows present (if any).

Trees were examined to identify hollows using binoculars and evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Any evidence of foraging (e.g. chewed fruits around the base of trees) was recorded, and the type of foraging was also detailed. Potential foraging habitat was documented notwithstanding of the presence of foraging evidence. Any evidence of roosting (e.g. branch clippings, droppings or moulted feathers) within trees was recorded.

Drey Searches

Dreys were actively searched to provide evidence of the presence of Western Ringtail Possums. Each drey encountered was photographed (where possible) and a GPS point recorded.

Nocturnal Searches

Two hours of nocturnal searches were undertaken within suitable habitat in each study area. The nocturnal searches involved spotlighting trees and undertaking foot transects using a head torch, with any fauna of conservation significance recorded along with a GPS coordinate.

2.3.4 Fauna Habitat Mapping

Assessment of the fauna habitat was undertaken throughout each of the three study areas to document habitat characteristics and map the fauna habitat types. The fauna habitat mapping utilised high-resolution aerial photography of the study areas at a scale of 1:15,000. Ground-truthing of the study areas was completed during the survey with habitat characteristics recorded at each habitat assessment site, and the habitat type selected for each polygon. Vegetation association mapping was utilised to further aid in characterising the habitat map accuracy across the full extent of the study areas.

2.3.5 Species Identification and Nomenclature

Vertebrate fauna species were identified at the time of capture/observation in the field by the Senior Zoologist. All species were able to be fully identified with no specimens needed to be taken for further examination. Nomenclature and conservation significance rankings used in this report are in accordance with the current listing of WA fauna recognised by the DBCA, as listed on NatureMap.

2.4 Field Survey Constraints

The EPA Technical Guidance (EPA 2016c) list potential limitations that field surveys may encounter. Limitations associated with the Level 1 vertebrate fauna survey, are addressed in Table 3. There were no survey-specific limitations for this survey.

Table 3 Relevance of limitations, as identified by EPA (2016c), to the Greenbushes vertebrate survey.

Constraint	Relevance
Competency/experience of the consultant carrying out the survey	The Senior Zoologist and Senior Botanist working on the survey have in excess of 12 years and 8 years' experience in the south-west, respectively. Both team members have completed other fauna, and flora/vegetation, surveys for Talison in the area.
Scope (faunal groups sampled and were some sampling methods not able to be employed because of constraints)	The study areas were assessed and all allocated tasks detailed in the scope of works were achieved during the survey, with foraging, bird census, motion cameras and targeted searches undertaken. Two nights of nocturnal searches were also undertaken as part of this survey.
Proportion of fauna identified, recorded and/or collected	All fauna species were identified and recorded in the field when observed or via camera footage.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	There has been no previous fauna survey work completed within the study areas. However, there have been seven previous vertebrate fauna surveys undertaken in the vicinity to the study areas, providing a comprehensive local database.

Constraint	Relevance
Proportion of the task achieved and further work which might be needed	The Level 1 vertebrate fauna survey was aimed at mapping fauna habitats within the study areas and assessing their suitability to support fauna species of conservation significance, as well as targeting fauna species of conservation significance. All allocated tasks detailed in the scope of works were achieved during the survey.
Timing/weather/season/cycle	The survey was completed in November and December 2018 under <i>good</i> seasonal conditions with average rainfall and temperatures experienced, providing favourable conditions for the surveying of fauna species.
Disturbances which affected results of survey	There were no disturbances recorded within the study areas that influenced survey outcomes.
Intensity	A Senior Zoologist and Senior Botanist working over a 6-day period traversed and sampled suitable habitat within the three offset areas, and assessed habitats during the field survey, representing an adequate survey intensity for a Level 1 survey.
Completeness	All allocated tasks detailed in the scope of works were adequately completed during the Level 1 survey.
Resources	All resources required to complete the Level 1 survey were available, with information available from numerous surveys completed from neighbouring areas.
Remoteness and/or access problems	There were no access restrictions experienced during the survey with the study areas accessible by vehicle and on foot; noting that fauna habitat mapping was facilitated by high-resolution aerial photography.
Availability of contextual information on the region	There has been no previous survey work completed within the study areas with the exception of one survey completed at Carlotta (Kirkby 2015). There have been at least seven previous vertebrate fauna surveys undertaken in the vicinity to the study areas, providing a comprehensive local database.

3.0 RESULTS

3.1 Desktop Assessment

3.1.1 Literature Review

The results from previous vertebrate fauna surveys completed within the vicinity of the study areas are summarised below and presented In Table 4.

Black Cockatoo Habitat Survey, Proposed Offset Block, Mount Leeuwin Loop Road, Nannup (Kirkby 2015)

In 2015, Kirkby undertook a survey of the Carlotta lots to determine the presence of Black Cockatoos and to locate and document suitable breeding, feeding and roosting habitat used by Black Cockatoos. All habitat types within the study area were considered to contain trees suitable for breeding (diameter >500mm). A total of 101 Marri, 12 Jarrah, 14 Blackbutt and 6 Bullich trees were recorded as breeding trees. Three active hollows were observed within the study area however it is unknown which species were utilising these trees. Feeding was observed from Jarrah, Marri, *Banksia grandis* and *Pinus* spp at 44 locations. Of these records 28 were from Forest Red-tailed Black Cockatoo, 14 from Baudin's Cockatoo, one from Carnaby's Cockatoo and one from a white-tailed spp. probably Baudin's Cockatoo. No roosting sites were recorded from the study area. Two Forest Red-tailed Black Cockatoos were heard calling within the area and two Baudin's Cockatoos were observed.

Greenbushes Level 1 Fauna Survey (Biologic Environmental Survey 2011)

Biologic Environmental Survey was commissioned by Talison to undertake a Level 1 vertebrate fauna survey and comprehensive literature and database review of the active mining area and all leases held by Talison.

Desktop assessments identified 196 vertebrate fauna species to have the potential to occur within the survey areas. Of these, the survey recorded a total of 82 species of vertebrates. Four current conservation significance fauna species were recorded from the survey areas:

- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) - WC Act Schedule 6, IUCN Near Threatened;
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - EPBC Act Vulnerable, WC Act Schedule 3;
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) - EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered; and
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered.

Six broad fauna habitats were identified within the survey area:

- Jarrah (*Eucalyptus marginata*)/Marri (*Corymbia calophylla*) forest;
- Jarrah/Marri forest over *Banksia* dominated mid-storey;
- Marri/Blackbutt (*Eucalyptus patens*) / Flooded Gum (*Eucalyptus rudis*) Woodland over *Banksia* dominated mid-storey;
- *Typha* dense tall sedges;
- *Leptospermum* scrub; and
- Disturbed/rehabilitated areas.

Black Cockatoo Survey, Talison Mining, Greenbushes (Kirkby 2018)

Kirkby (2018) was commissioned to locate and document feeding, breeding and roosting habitat used by black cockatoos (*Calyptorhynchus species*) at the proposed mining extension areas at the Greenbushes Mine. Breeding habitat within the survey area was identified as Jarrah / Marri forest with a small amount of Flooded Gum. In the Jarrah/Marri Forest, Marri provided the vast majority (over 90 percent) of breeding trees.

A total of 50 trees (49 Marri, 1 Jarrah) with a hollow entrance of suitable size, shape and position in the tree to be considered suitable for use as a black cockatoo breeding hollow were located within the survey area. Twenty four of these trees had entrances which showed evidence of use. The remaining 26 trees had hollows with a suitable entrance and were 'possibly' or 'potentially' black cockatoo breeding hollows, but show no evidence of past use. No roost sites were located during the survey.

Forest Red-tailed Black Cockatoo feeding residues was observed during the survey and ranged from fresh to old indicating presence throughout the year and breeding seasons. The feeding residues noted from Baudin's Cockatoo and Carnaby's Cockatoo were all classed as not recent.

Small numbers of Forest Red-tailed Black Cockatoo were seen and/or heard at most locations during the survey. Carnaby's Cockatoo were heard to the east of the survey area on one occasion. Baudin's Cockatoo were not present during the survey.

Black Cockatoo Habitat Quality Assessment (Ennovate 2018)

Ennovate was commissioned to undertake an assessment of Black Cockatoo habitat quality and assign a habitat condition score to each of the separate blocks of native vegetation. Parameters used to determine habitat condition score included location of habitat trees, bird sightings, feeding residues, and use of historical and detailed current aerial photography to ascertain vegetation disturbance history and class structure.

Overall, the condition of the Black Cockatoo habitat within the expanded Greenbushes Mine development area was assigned a median score (ranging from 5 to 7 out of 10) for the remnant vegetation blocks assessed.

Talison Lithium Offset Proposal (Griffin 2018)

The proposal to expand the existing Greenbushes Mine has been referred to the WA Environmental Protection Authority (EPA) under Section 38 of the Environmental Protection Act 1986 (EP Act) and the Federal Department of the Environment and Energy (DotEE) for assessment under the Commonwealth EPBC Act. The expansion will require clearing of 350 ha outside the current approved area and includes habitat for specially protected fauna species.

As part of the offset proposal an assessment of habitat quality for each of the protected species was undertaken. The overall habitat quality score for Black Cockatoos was 9 out of 10 due to the presence of breeding hollows (known and suitable), foraging habitat with evidence of use and close proximity to known roosting habitat. The habitat quality score of the Chuditch is 6 out of 10 based on the usability of habitat but considering there are likely to be few individuals within the area due to large home ranges and low stocking rates. Western Ringtail Possum habitat quality was assessed as 5 out of 10 due to the lack of suitable structure within most habitats in the MDE and low stocking rates. The habitat quality for Wambenger Brush-tailed Phascogales was 9 out of 10, reflecting usable habitat and numerous records of this species in the area.

Greenbushes Black Cockatoo Hollow Review (Harewood 2018a)

A number of potential breeding hollows have been identified within and near the Mine Development Envelope area at Greenbushes. Previous surveys involved the assessment of tree hollows from ground level. As this method has limitations, Talison requested Harewood (2018a) to undertake an assessment of all identified tree hollows using a drone, with the aim of photographing specific hollows so that additional characteristics relating to their potential to represent actual or possible black cockatoo breeding hollows could be determined.

Of the 70 trees re-inspected 14 were positively identified as showing evidence of previous use by black cockatoos in the form of chew marks to varying degrees. An additional 16 trees were assessed as being 'possibly' suitable for use by black cockatoos, but showed no conclusive evidence of actual use for nesting purposes. The remaining trees inspected (40) did not appear to have suitable hollows for black cockatoos.

Greenbushes Preliminary Western Ringtail Possum Surveys – June 2018 (Harewood 2018b)

Harewood was commissioned to undertake a preliminary Western Ringtail Possum (*Pseudocheirus occidentalis*) survey within and near the Greenbushes Mine. Day and nocturnal surveys were completed with no conclusive evidence of Western Ringtail Possums found during the course of the survey in and around the mine development area.

Generally speaking, much of the vegetation observed seemed to represent poor or marginal habitat for Western Ringtail Possums. This conclusion was based on the fact that much of the area had been historically logged and lacked a coherent mid-storey vegetation component, a structural component most often favoured by Western Ringtail Possums.

Greenbushes Vertebrate Fauna, SRE and Subterranean Fauna Desktop Assessment (Biologic Environmental Survey 2018a)

Biologic Environmental Survey was commissioned by Talison to undertake a desktop assessment for terrestrial vertebrate fauna, short-range endemic (SRE) invertebrate fauna, and subterranean fauna occurring within and surrounding the Greenbushes Mine. The survey area comprised 1,989 hectares that included the current mining area and an indicative expansion area.

The vertebrate fauna desktop assessment reviewed a total of seven literature sources and four databases. A total of eight fauna habitats have previously been recorded and mapped across the survey area, comprising four naturally occurring habitat types (Jarrah / Marri Forest, Jarrah / Marri Forest over Banksia, Marri / Blackbutt / Flooded Gum Woodland over Banksia, and Waterbodies).

The desktop assessment identified a total of 44 conservation significant fauna species which have previously been recorded and/or have the potential to occur within the survey area, of which seven have been recorded within the survey area:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered;
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) - EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered;
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - EPBC Act Vulnerable, WC Act Schedule 3;
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) - WC Act Schedule 6, IUCN Near Threatened;

- Chuditch (*Dasyurus geoffroi*) - EPBC Act Vulnerable, WC Act Schedule 3, IUCN Near Threatened;
- Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) - DBCA Priority 4; and
- Western Brush Wallaby (*Notamacropus irma*) - DBCA Priority 4.

One additional species, Western Ringtail Possum (*Pseudocheirus occidentalis*) (Vulnerable EPBC Act, Critically Endangered, WC Act), was considered highly likely to occur in the survey area.

Five databases were searched for SRE invertebrate fauna records within and surrounding the survey area. Broad fauna habitats were also reviewed for their ability to support SRE species. Of the four naturally occurring habitats present in the survey area, three were assessed as having a moderate potential for SRE fauna: Jarrah/ Marri Forest, Jarrah/Marri Forest over Banksia, Marri/Blackbutt/Flooded Gum Woodland over Banksia. Only one terrestrial invertebrate (a widespread species) has previously been recorded within the survey area to date.

Five databases were searched for subterranean fauna records. Geology and hydrogeology of the survey area was also reviewed. Three broad surface geology types have been mapped, with the dominant geological groups being the undivided sediments and ferruginous duricrust, both of which are sedimentary in nature. The survey area is situated in the Blackwood River catchment within the Karri groundwater sub-area. Based on the available information, it was concluded that a number of prospective habitats for troglofauna and stygofauna may potentially occur within the survey area.

Greenbushes Targeted Vertebrate and SRE Invertebrate Fauna Survey (Biologic Environmental Survey 2018b)

Biologic Environmental Survey was commissioned by Talison to undertake a targeted survey for vertebrate fauna of conservation significance and short-range endemic (SRE) invertebrate fauna within and surrounding the Greenbushes Mine. The survey area comprised 1,989 hectares, comprising the current mining area and an indicative expansion area.

The survey was undertaken between the 12th and 21st of February 2018. Twelve motion camera sites were established in the survey area, each consisting of five baited cameras. Twelve additional motion cameras were deployed opportunistically throughout the survey area. Targeted searches for vertebrate fauna were conducted at 27 locations within the survey area. Spotlighting searches were undertaken at ten locations over four nights.

A total of 43 species were recorded during the survey directly and/or via secondary evidence, including five species of conservation significance:

- Chuditch (*Dasyurus geoffroi*) - EPBC Act Vulnerable, WC Act Schedule 3, IUCN Near Threatened;
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) - WC Act Schedule 6, IUCN Near Threatened;
- Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) - DBCA Priority 4;
- Western Brush Wallaby (*Notamacropus irma*) - DBCA Priority 4; and
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - EPBC Act Vulnerable, WC Act Schedule 3.

Scats possibly belonging to the Western Ringtail Possum (*Pseudocheirus occidentalis*) (listed as EPBC Act Critically Endangered, WC Act Schedule 1, and IUCN Critically Endangered) were also recorded but could not be confirmed as belonging to the species.

SRE sampling comprised sampling at 12 sites for a total of 18 person hours. Each site was subject to active foraging, leaf and soil sieving and burrow excavations (if found). Three invertebrate taxa recorded during the survey were identified as 'Potential SRE'. In all three cases, a precautionary level of Potential SRE was allocated as a precise taxonomic identification could not be made. This comprised two specimens identified as Nemesiidae sp. indet, two specimens of Paradoxosomatidae sp. indet., and one specimen belonging to the family Siphonotidae.

Table 4 Results from vertebrate fauna surveys previously completed within the vicinity of the study areas.

Survey	Consultant	Field Survey Date	Survey Level	Conservation Significant Fauna Species
Black Cockatoo Habitat Survey, Proposed Offset Block, Mount Leeuwin Loop Road, Nannup (Kirkby 2015)	Kirkby	May 2015	Targeted	Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) – EPBC Act Vulnerable, WC Act Schedule 3 Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>) – EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) – EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered
Greenbushes Level 1 Fauna Survey	Biologic Environmental Survey	13 – 17 Oct 2011	Level 1	South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) – WC Act Schedule 6, IUCN Near Threatened Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) – EPBC Act Vulnerable, WC Act Schedule 3 Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>) – EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) – EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered
Black Cockatoo Survey	Kirkby	22 Jan – 12 Feb 2018	Targeted	Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) – EPBC Act Vulnerable, WC Act Schedule 3 Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>) – EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) – EPBC Act Endangered, WC Act Schedule 2, IUCN Endangered
Black Cockatoo Habitat Quality Assessment	Ennovate Consulting	Not relevant	Desktop	Not recorded
Greenbushes Black Cockatoo Tree Hollow Review	Harewood	11 – 19 Jun 2018	Targeted	None

Survey	Consultant	Field Survey Date	Survey Level	Conservation Significant Fauna Species
Greenbushes Preliminary Western Ringtail Possum Surveys	Harewood	11, 13 & 15 Jun 2018	Targeted	South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) – WC Act Schedule 6, IUCN Near Threatened
Greenbushes Vertebrate Fauna, SRE and Subterranean Fauna Desktop Assessment	Biologic Environmental Survey	Not relevant	Desktop	Not recorded
Greenbushes Targeted Vertebrate and SRE Invertebrate Fauna Survey	Biologic Environmental Survey	12 – 21 Feb 2018	Targeted	Chuditch (<i>Dasyurus geoffroii</i>) – EPBC Act Vulnerable, WC Act Schedule 3, IUCN Near Threatened Western Ringtail Possum (<i>Pseudocheirus occidentalis</i>) – EPBC Act Critically Endangered, WC Act Schedule 1, IUCN Critically Endangered ¹ South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) – WC Act Schedule 6, IUCN Near Threatened Southern Brown Bandicoot (<i>Isoodon obesulus fusciventer</i>) – DBCA Priority 4 Western Brush Wallaby (<i>Notamacropus irma</i>) – DBCA Priority 4 Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) – EPBC Act Vulnerable, WC Act Schedule 3

¹ This record is of scats possibly belonging to the species, and therefore the record is unconfirmed.

3.1.2 Database Searches

Threatened Fauna listed under the EPBC Act

A search of the EPBC Act Protected Matters database was undertaken for a 20 km buffer around the study areas (DoEE 2018b). The database search listed 12 Threatened fauna species, or species habitat, that may occur in the study areas:

Mammals:

- Chuditch (*Dasyurus geoffroi*) – listed as Vulnerable;
- Red-tailed Phascogale (*Phascogale calura*) - listed as Vulnerable;
- Numbat (*Myrmecobius fasciatus*) – listed as Endangered;
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – listed as Critically Endangered;
- Woylie (*Bettongia penicillata*) – listed as Endangered; and
- Quokka (*Setonix brachyurus*) – listed as Vulnerable.

Birds:

- Australasian Bittern (*Botaurus poiciloptilus*) – listed as Endangered;
- Curlew Sandpiper (*Calidris ferruginea*) – listed as Critically Endangered;
- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable;
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) – listed as Endangered;
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – listed as Endangered; and
- Eastern Curlew (*Numenius madagascariensis*) – listed as Critically Endangered.

The database search also identified nine Migratory bird species, or species habitat, that may occur in the study areas:

- Osprey (*Pandion haliaetus*);
- Eastern Curlew (*Numenius madagascariensis*);
- Common Greenshank (*Tringa nebularia*);
- Common Sandpiper (*Actitis hypoleucos*);
- Pectoral Sandpiper (*Calidris melanotos*);
- Sharp-tailed Sandpiper (*Calidris acuminata*);
- Curlew Sandpiper (*Calidris ferruginea*);
- Fork-tailed Swift (*Apus pacificus*); and
- Grey Wagtail (*Motacilla cinerea*).

Threatened Fauna listed under the WC Act

The DBCA Threatened Fauna database search (DBCA 2018b) and NatureMap search (DPaW 2018) identified 19 species listed as Scheduled species under the WC Act from around the study areas:

Mammals:

- Chuditch (*Dasyurus geoffroi*) – listed as Schedule 3;
- Red-tailed Phascogale (*Phascogale calura*) – listed as Schedule 6;
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) – listed as Schedule 6;
- Numbat (*Myrmecobius fasciatus*) – listed as Schedule 2;
- Bilby (*Macrotis lagotis*) – listed as Schedule 3;
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – listed as Schedule 1;
- Woylie (*Bettongia penicillata ogilbyi*) – listed as Schedule 1; and
- Quokka (*Setonix brachyurus*) – listed as Schedule 3.

Birds:

- Australasian Bittern (*Botaurus poiciloptilus*) – listed as Schedule 2;
- Osprey (*Pandion haliaetus*) – listed as Schedule 5;
- Common Greenshank (*Tringa nebularia*) – listed as Schedule 5;
- Wood Sandpiper (*Tringa glareola*) – listed as Schedule 5;
- Red-necked Stint (*Calidris ruficollis*) – listed as Schedule 5;
- Sharp-tailed Sandpiper (*Calidris acuminata*) – listed as Schedule 5;
- Peregrine Falcon (*Falco peregrinus*) – listed as Schedule 7;
- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – listed as Schedule 3;
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – listed as Schedule 2;
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) – listed as Schedule 2; and
- Muir's Corella (*Cacatua pastinator pastinator*) – listed as Schedule 6.

Priority Fauna recognised by the DBCA

The DBCA Threatened Fauna database search (DBCA 2018b) and NatureMap search (DPaW 2018) identified 10 Priority fauna species as potentially occurring around the study areas:

Mammals:

- Southern Brown Bandicoot (*Isodon obesulus fusciventer*) – listed as Priority 4;
- Tammar Wallaby (*Notamacropus eugenii derbianus*) – listed as Priority 4;
- Western Brush Wallaby (*Notamacropus irma*) – listed as Priority 4;
- Water-rat (*Hydromys chrysogaster*) – listed as Priority 4; and
- Western False Pipistrelle (*Falsistrellus mackenziei*) – listed as Priority 4.

Reptiles:

- Dell's skink (*Ctenotus delli*) – listed as Priority 4.

Birds:

- Blue-billed Duck (*Oxyura australis*) – listed as Priority 4;
- Australian Little Bittern (*Ixobrychus dubius*) – listed as Priority 4;
- Hooded Plover (*Thinornis rubricollis*) – listed as Priority 4; and
- Masked Owl (southwest) (*Tyto novaehollandiae novaehollandiae*) – listed as Priority 3.

A total of 35 conservation significant species were identified during the desktop assessment, comprising 13 mammals, one reptile and 21 bird species.

An assessment of the likelihood of each species occurring within the study area was determined based on the known distributions and habitat preferences of the species and comparison with the habitats identified and mapped within the study areas. Seven species were determined as being “likely” to occur within at least one of the study areas (Table 5). Five species were determined as “possible” to occur within at least one of the study areas (Table 5). The remaining species were identified as “unlikely” to occur (Table 5).

Table 5 Conservation significant fauna species identified during the desktop assessment.

Common Name	Scientific Name	Cons. Code				Habitat Preference	Suitable Habitat Present	Likelihood in the Study Area
		EPBC Act	WC Act	IUCN	DBCA			
Mammals								
Chuditch	<i>Dasyurus geoffroii</i>	VU	S3	NT		Jarrah forest, in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in riparian vegetation (Orell & Morris 1994).	Yes – habitat present at all study areas	All study areas: Likely
Red-tailed Phascogale	<i>Phascogale calura</i>	VU	S6	NT		Wandoo-rock sheoak uplands, and lowland habitat with riverine fringing vegetation of swamp sheoak, York Gum and Wandoo (Short <i>et al.</i> 2011).	Yes – only limited areas in Tone Bridge	Tone Bridge: Possible – due to small size of suitable habitat Grimwade and Carlotta Unlikely – due to absence of suitable habitat
South-western Brush-tailed Phascogale	<i>Phascogale tapoatafa wambenger</i>		S6	NT		Dry sclerophyll forests and open woodlands that contain hollow-bearing trees with a sparse ground cover (Woinarski <i>et al.</i> 2014).	Yes - habitat present at all study areas	All study areas: Likely
Numbat	<i>Myrmecobius fasciatus</i>	EN	S2	EN		Eucalypts forests and woodland, notably wandoo and jarrah woodland (Van Dyck & Strahan 2008).	Yes - habitat present at all study areas	All study areas: Unlikely – while habitat is suitable there are no known recent recordings of this species from the local area.

Common Name	Scientific Name	Cons. Code				Habitat Preference	Suitable Habitat Present	Likelihood in the Study Area
		EPBC Act	WC Act	IUCN	DBCA			
Bilby	<i>Macrotis lagotis</i>	VU	S3	VU		Mixture of woodland including Jarrah, Marri and Wandoo in the south-west (Abbott 2001).	Yes - habitat present at all study areas	All study areas: Unlikely - while habitat is suitable there are no known recent recordings of this species from the local area
Western Ringtail Possum	<i>Pseudocheirus occidentalis</i>	CE	S1	CE		Coastal <i>Agonis flexuosa</i> forest or eucalypt woodland or forest with a mid-story of <i>Agonis flexuosa</i> (DPaW 2017, Jones <i>et al.</i> 1994). Additionally, inland forest areas that have been unlogged and unburnt for long periods (Wayne <i>et al.</i> 2006).	Yes – Carlotta (Jarrah/Marri forest with relatively high mid-story connectivity)	Carlotta: Possible – habitat is suitable but not high quality Grimwade and Tone Bridge: Unlikely – due to absence of suitable habitat
Woylie	<i>Bettongia penicillata ogilbyi</i>	EN	S1	CE		Woodlands and adjacent heaths with a dense understory of shrubs (Woinarski <i>et al.</i> 2014).	Yes - habitat present at all study areas	All study areas: Unlikely - while habitat is suitable there are no known recent recordings of this species from the local area
Quokka	<i>Setonix brachyurus</i>	VU	S3	VU		Habitat varies, but prefer <i>Acacia</i> and <i>Melaleuca</i> thickets. Associated with <i>Taxandria linearifolia</i> in Jarrah Forest (de Tores 2008).	No – all study areas	All study areas: Unlikely – due to absence of suitable habitat
Southern Brown Bandicoot	<i>Isoodon obesulus fusciventer</i>				P4	Jarrah forest and swamp habitats, preferring dense vegetation around wetland fringes and heathland (Cooper 1998, Woinarski <i>et al.</i> 2014).	Yes - only limited areas at all study areas	All study areas: Possible – due to small amount of suitable habitat

Common Name	Scientific Name	Cons. Code				Habitat Preference	Suitable Habitat Present	Likelihood in the Study Area
		EPBC Act	WC Act	IUCN	DBCA			
Tammar Wallaby	<i>Notamacropus eugenii derbianus</i>				P4	Inhabits dense low coastal scrub, heath and dry sclerophyll forest (Woinarski <i>et al.</i> 2014).	No – all study areas	All study areas: Unlikely – due to absence of suitable habitat
Western Brush Wallaby	<i>Notamacropus irma</i>				P4	Wide-range of habitats including low <i>Banksia</i> woodlands, Jarrah/Marri woodlands and moist <i>Melaleuca</i> lowlands, favours open, grassy areas (Wann & Bell 1997, Woinarski <i>et al.</i> 2014).	Yes – suitable habitat at all study areas	All study areas: Likely
Water-rat	<i>Hydromys chrysogaster</i>				P4	Permanent bodies of fresh or brackish water, subalpine streams to lakes and farm dams (Van Dyck & Strahan 2008).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Western False Pipistrelle	<i>Falsistrellus mackenziei</i>			NT	P4	Tall forests and woodlands in higher rainfall parts of the south-west, particularly Karri forests but also Tuart and Jarrah forests (Woinarski <i>et al.</i> 2014).	Yes - limited areas in all three study areas	All study areas: Possible – due to small size of suitable habitat
Reptiles								
Dell's skink	<i>Ctenotus delli</i>				P4	Dry sclerophyll forest on stony hills and ranges (Cogger 2014).	Yes - limited areas in all three study areas	All study areas: Possible – due to small size of suitable habitat
Birds								
Blue-billed Duck	<i>Oxyura australis</i>			NT	P4	Mainly deep freshwater swamps and lakes, occasionally salt lakes and estuaries freshened by flood waters (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat

Common Name	Scientific Name	Cons. Code				Habitat Preference	Suitable Habitat Present	Likelihood in the Study Area
		EPBC Act	WC Act	IUCN	DBCA			
Australasian Bittern	<i>Botaurus poiciloptilus</i>	EN	S2	EN		Tall dense Typha and sedges in freshwater swamps (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Australian Little Bittern	<i>Ixobrychus dubius</i>				P4	Freshwater wetlands with vegetation of reeds and sedges, and inundated shrub thickets (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Osprey	<i>Pandion haliaetus</i>	MG	S5			Sheltered seas around islands, tidal creeks, estuaries and saltwork ponds, and large river pools (Johnstone <i>et al.</i> 2013).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Hooded Plover	<i>Thinornis rubricollis</i>				P4	Subcoastal lagoons (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Eastern Curlew	<i>Numenius madagascariensis</i>	CE, MG	S3	EN		Tidal mudflats, also reef flats, sandy beaches (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Common Greenshank	<i>Tringa nebularia</i>	MG	S5			Freshwater wetlands (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Wood Sandpiper	<i>Tringa glareola</i>		S5			Freshwater wetlands and occasional brackish intertidal mudflats (Geering <i>et al.</i> 2007).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat

Common Name	Scientific Name	Cons. Code				Habitat Preference	Suitable Habitat Present	Likelihood in the Study Area
		EPBC Act	WC Act	IUCN	DBCA			
Common Sandpiper	<i>Actitis hypoleucos</i>	MG	S5			Edge of sheltered waters, salt or fresh, estuaries, river pools, claypans, drying swamps (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Red-necked Stint	<i>Calidris ruficollis</i>	MG	S5	NT		Coastal and inland areas saline and fresh or brackish wetlands (Geering <i>et al.</i> 2007).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Pectoral Sandpiper	<i>Calidris melanotos</i>	MG	S5			Fresh waterbodies including swamps, lagoons and river pools (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	MG	S5			Coastal and inland areas saline and fresh or brackish wetlands (Geering <i>et al.</i> 2007).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Curlew Sandpiper	<i>Calidris ferruginea</i>	CE, MG	S3	NT		Intertidal mudflats in sheltered coastal areas (Geering <i>et al.</i> 2007).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat
Masked Owl	<i>Tyto novaehollandiae</i>				P3	Forested areas and occasionally dry woodland areas (Johnstone & Storr 1998).	Yes – suitable habitat at all study areas	All study areas: Likely
Fork-tailed Swift	<i>Apus pacificus</i>	MG	S5			Entirely aerial species (Johnstone & Storr 1998).	N/A	Possible – may fly over
Peregrine Falcon	<i>Falco peregrinus</i>		S7			Coastal cliffs, rivers and ranges, wooded watercourses and lakes (Johnstone & Storr 1998).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat

Common Name	Scientific Name	Cons. Code				Habitat Preference	Suitable Habitat Present	Likelihood in the Study Area
		EPBC Act	WC Act	IUCN	DBCA			
Forest Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii naso</i>	VU	S3			Eucalypt forests, areas of seeding Marri, Jarrah, Blackbutt, Karri and Sheoak (Johnstone & Storr 1998).	Yes – suitable habitat at all study areas	All study areas: Likely
Carnaby's Cockatoo	<i>Calyptorhynchus latirostris</i>	EN	S2	EN		Eucalypt woodlands and forests and adjacent area of Proteaceous scrubs and heaths (Johnstone & Storr 1998).	Yes – suitable habitat at all study areas	All study areas: Likely
Baudin's Cockatoo	<i>Calyptorhynchus baudinii</i>	EN	S2	EN		Eucalypt forest, areas of Marri, Karri and Wandoo (Johnstone & Storr, 1998, Johnstone & Kirkby 2008).	Yes – suitable habitat at all study areas	All study areas: Likely
Muir's Corella	<i>Cacatua pastinator</i>		S6			Restricted distribution around the Tone Bridge and Lake Muir region, occurring in woodlands (DPaW 2015).	Yes – suitable habitat at Tone Bridge	Tone Bridge: Likely Grimwade and Carlotta: Unlikely – due to restricted distribution
Grey Wagtail	<i>Motacilla cinerea</i>	MG	S5			Various habitats with open waterbodies (Johnstone & Storr 2004).	No - all study areas	All study areas: Unlikely – due to absence of suitable habitat

3.1.3 Ecological Communities

TECs listed under State and Federal Legislation

A search of the EPBC Act Protected Matters database (DoEE 2018b) and the DBCA ecological communities database (DBCA 2018b) identified no fauna related Federal listed TECs previously recorded within, or adjacent to, the study areas.

PECs recognised by DBCA

A search of the State database (DBCA 2018b) identified no fauna related PECs previously recorded within, or adjacent to, the study areas.

Environmentally Sensitive Areas

There were no Environmentally Sensitive Area (ESA) identified within or adjacent to the study areas.

3.2 Level 1 Fauna Survey

3.2.1 Vertebrate Fauna Species

Threatened Fauna listed under the WC Act and EPBC Act

Two vertebrate fauna species listed as Scheduled species under the WC Act or listed as Threatened fauna under the EPBC Act were recorded from the study areas:

4. Chuditch (*Dasyurus geoffroii*) - EPBC Act Vulnerable, WC Act Schedule 3, IUCN Near Threatened, and
5. Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - EPBC Act Vulnerable, WC Act Schedule 3.

Priority Fauna recognised by the DBCA

Two Priority fauna species, as recognised by the DBCA, were recorded from the study areas:

6. Western Brush Wallaby (*Notamacropus irma*) - listed as Priority 4; and
7. South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) - WC Act Schedule 6, IUCN Near Threatened.

A full list of species recorded is provided in Appendix 5

Introduced Fauna Species

Two introduced fauna species (feral animals) were observed within the study areas during the survey:

- Fox (*Vulpes vulpes*); and
- Feral Pigs (*Sus scrofa*).

Foxes were recorded from the motion sensitive cameras at all three of the study areas. Foxes were recorded from four of the cameras at the Carlotta study area and from a single camera at the Tone Bridge and Grimwade study areas.

Areas disturbed by pigs and the pig tracks were observed along the drainage lines within the Grimwade study area. Tracks and ground disturbance were recent however, animals were not directly observed.

3.2.2 Fauna Habitat

Habitat Types

Eight fauna habitats types were identified and mapped within the three study areas during the field survey (Figures 3-5, Table 6).

The Carlotta study area supported four fauna habitats; hillslopes/hillcrests, drainage lines/wetlands, plantation and cleared areas (Table 6, Figure 3). The majority of the study area was hillslopes and hillcrests with Jarrah/Marri Forest and dense shrub mid-storey. This habitat provided good connectivity due to the dense understorey and dense tree cover.

The wetland/drainage line habitat occurred in the central part of the Carlotta study area and supported large trees of Yarri (*Eucalyptus patens*), Bullich (*Eucalyptus megacarpa*) and Marri (*Corymbia calophylla*), with a dense understorey of shrubs and sedges. Remaining parts of the study area supported Blue Gum plantation and small areas of cleared land which have little value as fauna habitat.

The Grimwade study area supported five fauna habitat types; hillslopes, granite outcrops, drainage lines, wetlands and cleared areas (Figure 4). The majority of the study area was mapped as hillslope habitat supporting Jarrah and Marri Forest. Much of this habitat was heavily logged, and there was little connectivity and a sparse understorey cover.

The Tone Bridge study area supported five fauna habitats; hillslopes/hillcrest, Wandoo hillslopes, heath hillslopes and minor drainage lines (Figure 5). The study area was dominated by the hillslope habitat with areas of heath and Wandoo in the northern half of the study area. The central study area was dominated by plantation and cleared areas while the southern section was predominantly hillcrest habitat.

Table 6 Fauna habitat mapped within the study areas.

Habitat Type	Description
Carlotta	
Hillcrest/Hillslopes	Jarrah/Marri with open scrubs on loamy sands with laterite
Drainage Lines/Wetland	Yarri (and some Marri) forest over sedges on orange/white loams and clay
Pasture/Cleared	Areas of cleared annual pasture on farmland or cleared areas
Plantation	Areas of Blue Gum (<i>Eucalyptus globulus</i>) or Pine plantation
Grimwade	
Hillcrest/Hillslopes	Jarrah/Marri with open scrubs on loamy sands with laterite
Granite outcrops	Heath and Yarri on brown clay loam
Drainage lines	Yarri and Flooded Gum on brown clay loam
Wetlands	Flooded Gum and <i>Melaleuca's</i> on brown sandy clay loam
Cleared	Cleared Pasture
Tone Bridge	
Hillcrest/Hillslopes	Jarrah/Marri with open scrub on loamy sands with laterite
Heath Hillslopes	Thickets and Heaths on brown sandy loam
Wandoo Hillslopes	Wandoo Forest on brown loam
Minor Drainage Line	Low heath and scrub on brown clayey sand
Plantation	Areas of Blue Gum (<i>Eucalyptus globulus</i>) or Pine plantation



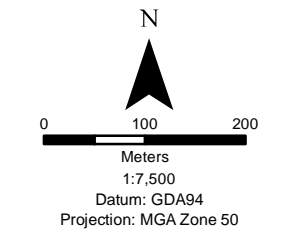
TALISON LITHIUM

Carlotta

Habitat Types

Legend

- Study
- Habitat Type**
- Drainage Lines/Wetland
- Hillcrest/Hillslopes
- Pasture/Cleared
- Plantation



Date: 14/01/2019
 Status: Final
 Figure: 3
 Sheet Size: A3
 Internal Reference: TL_Carlotta_HT
 Drawn by: GSM
 Requested by: DB





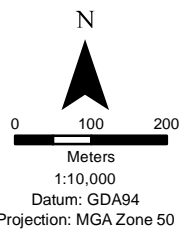
TALISON LITHIUM

Grimwade

Habitat Types

Legend

- Study
- Habitat Types**
- Cleared Pasture
- Drainage lines
- Granite outcrops
- Hillcrest/Hillslopes
- Wetlands



Date: 14/01/2019
 Status: Final
 Figure: 4
 Sheet Size: A3
 Internal Reference: TL_Grimwade_HT
 Drawn by: GSM
 Requested by: DB











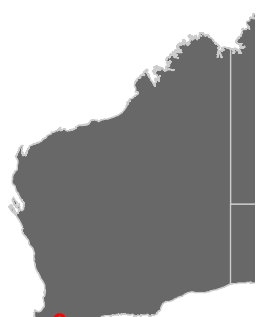
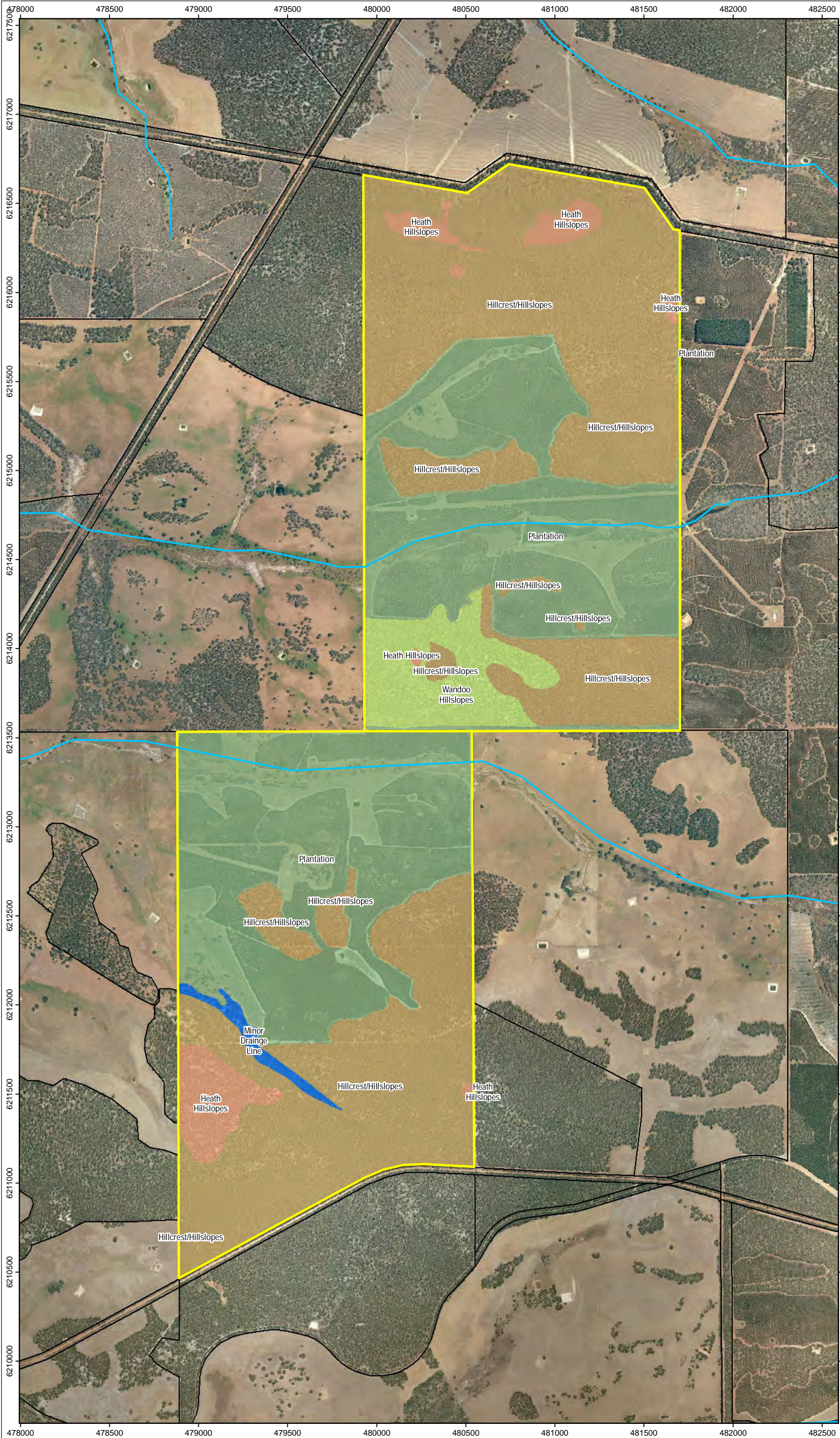
TALISON LITHIUM

Tone Bridge Habiat Types

Lot 12374

Legend

-  Study Area
- Habitat Types**
-  Heath Hillslopes
-  Hillcrest/Hillslopes
-  Minor Drainage Line
-  Plantation
-  Wandoo Hillslopes



0 100 200 300 400 500
Meters
1:20,000
Datum: GDA94
Projection: MGA Zone 50

Date: 14/01/2019
Status: Final
Figure: 5
Sheet Size: A3
Internal Reference: Tone Bridge HT
Drawn by: GSM
Requested by: DB



3.2.3 Fauna Habitats and Species of Significance

Assessment of Habitat Trees

To assess the potential for habitat trees within the study areas, suitable tree species (i.e. *Corymbia/Eucalyptus* species) that had a DBH of equal to or greater than 50 cm were counted within defined areas at several habitat types. Trees with a diameter at breast height of over 50 cm were relatively common at the Carlotta study area with an estimated density of 83 trees per hectare on hillslopes, and 438 trees per hectare within the wetland. The Grimwade study area averaged 93 trees per hectare within the drainage line habitat and 78 trees per hectare on hillslopes. At Tone Bridge the Wandoo habitat had an inferred density of 19 trees per hectare, and the Jarrah/Marri hillslope habitat had an inferred density of 175 trees per hectare. Within the proposed Mine Development Envelope at Greenbushes habitat tree density ranged from 2.9 to 10.7 trees per hectare (average 6.0 trees per hectare) (Kirkby 2018).

A total of 114 trees were observed with hollows within the representative plots sampled at each of the three study areas (six trees at Carlotta, 72 trees at Grimwade, and 36 trees at Tone Bridge). Tree hollows were further classified according to their suitability to provide habitat for species of conservation significance and other species, according to the size and depth of the hollows (Table 7). Details of each tree hollow and example photographs are presented in Appendix 5.

Table 7 Classification of tree hollows recorded within the study areas.

Classification	Description of Usage
Used	Hollows with scratch marks or other evidence of recent use
Usable Hollow	Hollows which can be used by a variety of animals i.e. parrots, and possums as well as Black Cockatoos
Potential Hollows	Tree potentially has hollows but difficult to see and of unknown depth and size
Unsuitable	Hollow is shallow and/or small

Black Cockatoos

Habitats within the study areas were assessed for the use by, and suitability for, Black Cockatoos. While there was no evidence of foraging by black cockatoos observed from within the study areas during the survey, the majority of habitats were deemed to be suitable for foraging by Black Cockatoos, with the exception being areas of cleared annual pasture (Figure 5). Photos taken by the owner at Grimwade show foraging on Bull Banksia (*Banksia grandis*) trees by Carnaby's Black Cockatoo. The study areas are considered suitable habitat for foraging as they contain documented species including Marri, Banksia's, Wandoo and Blackbutt.

Although it is not a native habitat, Black Cockatoos are considered likely to use the areas of plantation. They may forage within the plantation areas (known to feed on *Pinus* species), and may use large introduced *Eucalyptus* species (i.e. the Blue Gum) for night roosting, but not for nesting or foraging (Figure 5).

Birds and feathers of Red-tail Black Cockatoos were observed at the Grimwade and Tone Bridge study areas. No evidence of roosting from black cockatoos was observed during the field survey.

Western Ringtail Possum

Dreys were actively searched for within the study areas to provide evidence of the presence of Western Ringtail Possums. No evidence of Western Ringtail Possums

were recorded during the survey. No scats or dreys were observed during the active searches undertaken within the study areas, and no individuals were observed from the camera traps.

The majority of habitats within the study areas are considered to be unsuitable for Western Ringtail Possums (WRP). Areas supporting cleared annual pasture (farmland) and plantation do not provide suitable habitat for this species (Figure 5). Areas with open scrubs that are lacking a well-connected mid-storey and upper-storey (i.e. the Hill Crest and Upper Hill Slope habitat types) are also considered unsuitable habitat for the Western Ringtail Possum. These habitats are prevalent within the Grimwade and Tone Bridge study areas, hence both study areas are considered unlikely to support WRP. The Carlotta study area has higher mid-storey connectivity on hillslopes but is still considered unlikely to support WRP as the connectivity is not particularly strong. The remaining wetland and drainage line habitat types within the study areas (Figure 5) provide poor or marginal habitat for the Western Ringtail Possum as they provide a denser tree canopy and moderate midstorey connectivity.

South-western Brush-tailed Phascogale

The South-western Brush-tailed Phascogale was assessed during the desktop assessment as likely to occur within all the study areas based on the presence of suitable habitat and previous records in the area (Table 5). Two individuals of this species were recorded from the camera traps during the survey of the Tone Bridge and Grimwade study areas within the hillslope habitats. Possible prints from this species were also observed within the main drainage line at the Grimwade study area.

This species is known to inhabit dry sclerophyll forests and open woodlands that contain hollow-bearing trees with a sparse ground cover (Woinarski *et al.* 2014). South-western Brush-tailed Phascogales rely on tree hollows for nesting. The Hill Slope/Hill Crest and Drainage/Wetland habitat types of the study areas at Grimwade and Tone Bridge contain trees with appropriate hollows for this species and are considered high quality habitat for this species (Figure 5).

Western Brush Wallaby

The Western Brush Wallaby was assessed during the desktop assessment as likely to occur within the study areas based on the presence of suitable habitat and previous records in the area (Table 5). A single individual of this species was observed during the daytime searches of the Tone Bridge study area within the Jarrah/Marri hillslope habitat. Additionally, a single individual was recorded from a camera trap at the Grimwade study area.

This species is known to inhabit a wide-range of habitats including low Banksia woodlands, Jarrah/Marri woodlands and moist Melaleuca lowlands, and it favours open, grassy areas (Wann and Bell 1997, Woinarski *et al.* 2014). The Western Brush Wallaby is likely to utilise hillslopes and wetland/drainage line habitats within the study areas.

Chuditch

The Chuditch was assessed during the desktop assessment as likely to occur within the study area based on the presence of suitable habitat and previous records in the area (Table 5). This species was recorded from a camera trap within the Tone Bridge study area.

The Chuditch inhabits Jarrah forest, in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in riparian vegetation (Orell and Morris

1994). Within the Tone Bridge study area the single individual was recorded from a rocky hillslope in the northern sector. Chuditch may utilise the Drainage/Wetland habitat types at the Carlotta and Grimwade sites which provide denser undergrowth and litter suitable for dens and refuge sites. They may also forage and disperse through the Hillslope habitat types within these study areas.

4.0 SUMMARY

Talison currently operates a lithium mine at Greenbushes, situated approximately 250 km south of Perth in south-west Western Australia. As part of the current expansion of mining operations at the Greenbushes Mine, Onshore Environmental was commissioned to undertake a vertebrate fauna survey of three proposed offset areas located in the vicinity of the mine site:

1. Tone Bridge;
2. Carlotta; and
3. Grimwade.

The field survey was completed by a Senior Zoologist and Senior Botanist from Onshore Environmental working over a six day period between the 19th and 21st November and the 3rd and 5th of December 2018.

Four conservation significant fauna species were recorded from the study areas during the survey:

- Red-tailed Black Cockatoos (Grimwade and Tone Bridge);
- Western Brush Wallaby (Grimwade and Tone Bridge);
- South-western Brush-tailed Phascogale (Grimwade and Tone Bridge); and
- Chuditch (Tone Bridge).

Carnaby's Black Cockatoos were photographed foraging within the Grimwade study area after the survey by the owner of the property.

Two introduced fauna species (feral animals) were observed during the survey:

- Fox (*Vulpes vulpes*) (all study areas); and
- Feral Pigs (Grimwade) (*Sus scrofa*).

A total of eight fauna habitat types were described and mapped from the study areas, with the most common being the hillslope habitat type, followed by areas of drainage lines and wetlands. The fauna habitats mapped within the study areas are well represented in adjacent local areas, as well as regionally.

Habitats within the study areas were assessed for the use by, and suitability for, Black Cockatoos. There was no evidence of foraging, roosting or breeding by Black Cockatoos observed from within the study areas. Within the study areas 114 trees with hollows were assessed, of which 99 trees were deemed to have usable hollows for Black Cockatoos or other species.

Dreys were actively searched for within the study areas to determine the presence of Western Ringtail Possums. No evidence of Western Ringtail Possums was recorded during the survey (i.e. no scats, dreys or individuals were observed during the active searches). The majority of habitats within the study areas are considered to be unsuitable for Western Ringtail Possums.

The South-western Brush-tailed Phascogale, Western Brush Wallaby and Chuditch were assessed during the desktop assessment as being likely to occur, and were recorded at the Grimwade and Tone Bridge study areas. These species are likely to utilise the Hill Slope and Drainage habitat types within the study areas for foraging. The Chuditch was only observed at Tone Bridge and is considered unlikely to utilise habitats within the Carlotta and Grimwade study areas.

5.0 STUDY TEAM

The Level 1 vertebrate fauna survey was planned, co-ordinated and executed by the following personnel:

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Mr Todd Griffin	BSc	GIS and Mapping Specialist

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APPENDIX 1

Status codes for species listed on the IUCN 'Red List'

Category	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

APPENDIX 2

Conservation categories for species listed under the EPBC Act

Category	Description
Extinct	A species is extinct if there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A species is categorised as extinct in the wild if it is only known to survive in cultivations, in captivity, or as a naturalised population well outside its past range; or if it has not been recorded in its known/expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	The species is facing an extremely high risk of extinction in the wild and in the immediate future.
Endangered	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival, or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Conservation Dependent	The species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

APPENDIX 3

Conservation categories for species listed under the WC Act

Fauna Species - Wildlife Conservation (Specially Protected Fauna) Notice 2017

Category	Description
Schedule 1	Fauna that is rare or is likely to become extinct as critically endangered fauna.
Schedule 2	Fauna that is rare or is likely to become extinct as endangered fauna.
Schedule 3	Fauna that is rare or is likely to become extinct as vulnerable fauna.
Schedule 4	Fauna presumed to be extinct.
Schedule 5	Migratory birds protected under an international agreement.
Schedule 6	Fauna that is of special conservation need as conservation dependent fauna.
Schedule 7	Other specially protected fauna.

APPENDIX 4

Conservation codes for Western Australian species

Threatened Species

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna* and *Wildlife Conservation (Rare Flora) Notice for Threatened Flora* (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the *Wildlife Conservation Act*.

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the *Wildlife Conservation Act*.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria.

Priority One: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

Priority Two: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

Priority Three: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Priority Four: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX 5

List of all fauna species recorded within the study areas

Common Name	Scientific Name	EPBC Act	WC Act	IUCN	DBCA	Record Type	Tone Bridge	Sites	
								Grimwade	Carlotta
Mammals									
Chuditch, Western Quoll	<i>Dasyurus geoffroii</i>	VU	S3	NT		C	Y		
Western Grey Kangaroo	<i>Macropus fuliginosus</i>					C, O	Y	Y	Y
South-western Brush-tailed Phascogale	<i>Phascogale tapoatafa wambenger</i>		S6	NT		C	Y	Y	
Western Brush Wallaby	<i>Notamacropus irma</i>				P4	C, O	Y (O)	Y (C)	
Common Brush tailed Possum	<i>Trichosurus vulpecula</i>					C	Y	Y	
Mouse/Mardo/Pygmy Possum	<i>Unsure</i>					C	Y		
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>					P		Y	
Fox	* <i>Vulpes vulpes</i>					C	Y	Y	Y
Pig	* <i>Sus scrofa</i>					P			
Birds									
Western Yellow Robin	<i>Eopsaltria griseogularis</i>					C		Y	
Scarlet Robin	<i>Petrocica boodang</i>					C	Y	Y	
Emu	<i>Dromaius novaehollandiae</i>					O	Y	Y	
Pigeon -Common Bronzewing	<i>Phaps chalcoptera</i>					C		Y	
Forest Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii naso</i>	VU	S3			O		Y	
Carnaby's Black Cockatoo	<i>Calyptorhynchus latirostris</i>	EN	S2	EN		O ²		Y	
Australian Magpie	<i>Cracticus tibicen</i>					O	Y		
Kookaburra	<i>Dacelo novaeguineae</i>					O	Y		
Grey Currawong	<i>Strepera versicolor</i>					C			Y
Twenty-eight Parrot/Australian Ringneck	<i>Barnardius zonarius</i>					O	Y	Y	
Tawny Frogmouth	<i>Podargus strigoides</i>					C	Y		
Elegant Parrot	<i>Neophema elegans</i>					O (feathers)			Y
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>					O		Y	
Reptiles									
Heath Monitor	<i>Varanus rosenbergi</i>					C		Y	
South-western Crevice Skink	<i>Egernia napoleonis</i>					C			Y
Shingle-back, Blue Tounge	<i>Tiliqua rugosa</i>					C	Y		
Skink	<i>Morethia obscura</i>					C	Y		

O= Observed
C=Camera trap
P=Prints

² Not observed during the survey. Photos of foraging behaviour obtained from property owner.

APPENDIX 6

Tree hollows recorded within the study areas

Site	Waypoint	Easting	Northing	Suitability	
Carlotta	116	391851	6226810	Usable	
Carlotta	117	391250	6226750	Usable	
Carlotta	1114	391353	6226785	Usable	
Carlotta	1214	391353	6226785	Usable	
Carlotta	70212	391875	6226811	Usable	
Carlotta	70312	391944	6226759	Usable	
Tone Bridge	204	480281	6213593	Unsuitable	
Tone Bridge	205	480270	6213576	Usable	
Tone Bridge	208	480262	6213598	Potential	Ph 4676
Tone Bridge	209	480269	6213621	Usable	
Tone Bridge	210	480252	6213640	Unsuitable	
Tone Bridge	211	480247	6213646	Potential	
Tone Bridge	212	480259	6213657	Usable	
Tone Bridge	215	480204	6213657	Usable	
Tone Bridge	216	480201	6213629	Usable	
Tone Bridge	218	480216	6213602	Unsuitable	
Tone Bridge	221	480233	6213698	Unsuitable	
Tone Bridge	228	480192	6214163	Usable	
Tone Bridge	229	480587	6214343	Usable	
Tone Bridge	230	480621	6214344	Usable	
Tone Bridge	231	480637	6214191	Usable	
Tone Bridge	232	480647	6214167	Usable	
Tone Bridge	233	480640	6214168	Usable	
Tone Bridge	235	481106	6215981	Usable	
Tone Bridge	237	481106	6215716	Usable	
Tone Bridge	241	481494	6216218	Potential	
Tone Bridge	244	481478	6216220	Potential	
Tone Bridge	246	480482	6216614	Usable	
Tone Bridge	247	479646	6211681	Usable	
Tone Bridge	248	479631	6211675	Usable	
Tone Bridge	249	479702	6211499	Usable	
Tone Bridge	250	479922	6211095	Used	
Tone Bridge	251	479912	6211093	Potential	Ph 4690
Tone Bridge	Habitat trees 1	481006	6215998	Usable	
Tone Bridge	Habitat trees 2	480130	6211459	Usable	
Tone Bridge	Habitat trees 3	479721	6211676	Usable	
Tone Bridge	Habitat trees 4	479713	6211681	Usable	
Tone Bridge	Habitat trees 5	479691	6211647	Usable	
Tone Bridge	Potential Hollows	479693	6211623	Potential	
Tone Bridge	Stag 14	480074	6211471	Usable	
Tone Bridge	Stag 15	479961	6211514	Usable	
Tone Bridge	Tree 58	480122	6211457	Usable	
Wilga	36	421601	6271334	Usable	
Wilga	37	421643	6271316	Usable	Ph 4585
Wilga	38	421704	6271343	Usable	
Wilga	75	421967	6271580	Usable	
Wilga	76	421957	6271593	Usable	
Wilga	77	421500	6272250	Usable	
Wilga	78	421923	6271728	Usable	
Wilga	123	421439	6271157	Usable	

Site	Waypoint	Easting	Northing	Suitability	
Wilga	150	421355	6272040	Usable	
Wilga	157	421149	6271890	Potential	
Wilga	195	420714	6270953	Usable	
Wilga	200	420680	6271026	Potential	
Wilga	201	421060	6270331	Usable	Ph 4657
Wilga	202	421054	6270379	Unsuitable	Ph 4660-4661
Wilga	Stag 011	420963	6270775	Usable	Ph 4663
Wilga	Stag 021	420892	6270769	Usable	
Wilga	Stag 03	420874	6270794	Usable	
Wilga	Stag 04	420873	6270793	Usable	
Wilga	Stag 05	420874	6270795	Usable	
Wilga	Stag 06	420879	6270851	Usable	
Wilga	Stag 07	420854	6270871	Usable	
Wilga	Stag 08	421147	6271041	Usable	
Wilga	Stag 09	421401	6271388	Usable	
Wilga	Stag 10	421610	6271468	Usable	
Wilga	Stag 11	421627	6271445	Usable	
Wilga	Stag 111	421624	6271521	Usable	
Wilga	Stag 12	421488	6270543	Usable	
Wilga	Stag 13	420916	6270670	Usable	
Wilga	Tree 01	421175	6270360	Usable	
Wilga	Tree 02	421137	6270382	Usable	
Wilga	Tree 03	421118	6270363	Usable	
Wilga	Tree 04	421123	6270349	Usable	
Wilga	Tree 05	421138	6270392	Usable	
Wilga	Tree 06	421115	6270403	Usable	
Wilga	Tree 07	421115	6270434	Usable	
Wilga	Tree 08	421051	6270475	Usable	
Wilga	Tree 09	421044	6270479	Usable	
Wilga	Tree 10	421055	6270490	Usable	
Wilga	Tree 11	421040	6270495	Usable	
Wilga	Tree 12	421028	6270506	Usable	
Wilga	Tree 13	421030	6270514	Usable	
Wilga	Tree 14	420944	6270638	Usable	
Wilga	Tree 15	420935	6270660	Usable	
Wilga	Tree 16	420936	6270683	Usable	
Wilga	Tree 17	421002	6270681	Usable	
Wilga	Tree 18	420941	6270701	Usable	
Wilga	Tree 19	420910	6270734	Usable	
Wilga	Tree 27	420757	6270989	Usable	
Wilga	Tree 28	421003	6271079	Usable	
Wilga	Tree 29	421022	6271085	Usable	
Wilga	Tree 31	421162	6271165	Usable	
Wilga	Tree 32	421160	6271174	Usable	
Wilga	Tree 33	421190	6271277	Usable	
Wilga	Tree 34	421401	6271362	Usable	
Wilga	Tree 38	421633	6271475	Usable	
Wilga	Tree 40	421828	6271391	Usable	
Wilga	Tree 41	421831	6271398	Usable	
Wilga	Tree 42	421833	6271399	Usable	

Site	Waypoint	Easting	Northing	Suitability	
Wilga	Tree 43	422068	6271227	Usable	
Wilga	Tree 44	422058	6271224	Usable	
Wilga	Tree 45	422072	6271207	Usable	
Wilga	Tree 46	422079	6271170	Usable	
Wilga	Tree 47	422081	6271040	Usable	
Wilga	Tree 48	422038	6270874	Usable	
Wilga	Tree 49	422024	6270868	Usable	
Wilga	Tree 50	421967	6270853	Usable	
Wilga	Tree 51	421882	6270807	Usable	
Wilga	Tree 52	421811	6270798	Usable	
Wilga	Tree 54	421483	6270621	Usable	
Wilga	Tree 55	421394	6270567	Usable	
Wilga	Tree 56	421441	6271452	Usable	
Wilga	Tree 57	421081	6270397	Usable	

Tone Bridge 208



Tone Bridge 251



Wilga 37



Wilga 201



Wilga 202



Wilga Stag 011




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Carbon Copy Events	Status	Timestamp
Witness Events	Signature	Timestamp
Notary Events	Signature	Timestamp
Envelope Summary Events	Status	Timestamps
Envelope Sent	Hashed/Encrypted	9/11/2023 09:54
Certified Delivered	Security Checked	9/11/2023 10:14
Signing Complete	Security Checked	9/11/2023 10:14
Completed	Security Checked	9/11/2023 10:14
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Electronic Record and Signature Disclosure		

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Screen Resolution:	800 x 600 minimum

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