TALISON LITHIUM

Talison Lithium Australia Pty Ltd

Greenbushes Lithium Mine Expansion

Environmental Referral Additional Information

December 2018

GHD

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

Limitations

This report has been prepared by GHD Pty Ltd (GHD) for Talison Lithium Australia Pty Ltd (Talison) and may only be used and relied on by Talison for the purpose agreed between GHD and the Talison as set out in the contract, or as otherwise agreed between GHD and Talison.

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

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Talison and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Acronyms

AHD	Australian Height Datum
AH Act	*Aboriginal Heritage Act 1972*
Air NEPM	*National Environment Protection (Ambient Air Quality) Measure*
AMA	Active Mining Area
BAM Act	*Biosecurity and Agricultural Management Act 2007*
BBG	Blackwood Basin Group
BoM	Bureau of Meteorology
Cwth	Commonwealth
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter Breast Height
dB(A)	A-weighted decibels
DER	Department of Environment Regulation (former)
DotEE	Department of the Environment and Energy
DMIRS	Department of Mines, Industry Regulation and Safety
DPLH	Department of Planning, Lands and Heritage
DRF	Declared Rare Flora
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
GAMG	Global Advanced Metals Greenbushes Pty Ltd
Ha	hectare
IBRA	Interim Biogeographic Regionalisation of Australia
ILUA	Indigenous Land Use Agreement
IUCN	International Union for Conservation of Nature
Mbcm	Million bank cubic metres
MDE	Mine Development Envelope (Proposal area)
Mining Act	*Mining Act 1978*
MNES	Matters of National Environmental Significance
Mtpa	Million tonne per annum

PEC	Priority Ecological Community
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns in diameter
PM_{10}	Particulate matter less than or equal to 10 microns in diameter
ROM	Run of Mine
SWALSC	South West Aboriginal Land and Sea Council
TEC	Threatened Ecological Community
Talison	Talison Lithium Australia Pty Ltd
TSP	Total Suspended Particulates
TSF	Tailings Storage Facility
tpa	tonnes per annum
WA	Western Australia
WC Act	*Wildlife Conservation Act 1950*
WoNS	Weeds of National Significance
WRL	Waste Rock Landform
WRP	Western Ringtail Possum

Executive summary

Talison Lithium Australia Pty Ltd (**Talison**) is proposing to expand the existing Greenbushes Lithium Mine (**the Mine**), to increase the production of spodumene ore and lithium mineral concentrate from the operation (**the Proposal**). The mine is located immediately south of the town of Greenbushes, approximately 250 km south east of Perth, Western Australia (**WA**).

The Greenbushes region is recognised as the longest continuously operated mining area in WA, with mining of tin having commenced in 1888. Tin, tantalum and lithium mining have all occurred throughout the history of mining activity in the area. Modern day hard rock, open cut mining of the Greenbushes deposit commenced in 1983 for tantalum and lithium. From the 1980's to the early 2000's tantalum mining and processing has been the primary activity, however changing market conditions have led to tantalum production being limited, and lithium mining and production being the key activities at the Mine since the early 2000's (Talison 2016).

The existing mining operation is located predominately within the Greenbushes State Forest (**State Forest 20**) with the surrounding region comprising the State Forest, agricultural properties, tree plantations, water storage and urban environment (Greenbushes townsite). The proposed expansion will involve the merging of the existing open pits to develop an expanded open pit, extension of the Floyds Waste Rock Landform (**WRL**) footprint, establishment of a new tailings storage facility (**TSF**) adjacent to existing facilities, and construction and operation of new infrastructure including a new Mine Services Area (**MSA**), explosive facilities, a new crushing circuit, linear infrastructure including an access road, two new spodumene processing plants and a tailings retreatment plant.

The mining rate will increase to an annual average of approximately 16 million bank cubic metres (**Mbcm**) as a result of the expansion and may reach up to 25 Mbcm. Processing of the is expected to produce an anticipated 2.8 million tonnes of lithium mineral concentrate per annum. Lithium mineral concentrates from the operation will continue to be transported to the Ports of Bunbury and Fremantle (limited volumes) for export as per current arrangements, and will also supply the Tianqi Lithium Process Plant under construction in Kwinana, and the Albemarle Lithium Process Plant proposed for construction in the Kemerton Strategic Industrial Area north of Bunbury.

The current Active Mine Area boundary (authorised under *Mining Act 1978* approvals) will expand from the 1,591 hectare (**ha**) approved area to a 1,989 ha Mine Development Envelope (**MDE**) (398 ha or 25% increase). Approximately 66% of the MDE has already been disturbed as a result of the extensive history of mining within the area, as well as forestry, water storage and supply, surrounding agriculture activities and edge effects from the town of Greenbushes. The expansion activities require native vegetation clearing of up to 350 ha within the surrounding State Forest 20 on mining tenure. The native vegetation is predominantly Jarrah/Marri forest and Jarrah/Marri forest with banksia understorey and is well represented within the conservation estate at a local and regional level. No threatened flora or vegetation communities occur within the MDE. Some areas of the MDE and surrounding State Forest 20 are affected by dieback and weeds due to the extensive history of disturbance in the region.

Native vegetation clearing will impact on the habitat of Matters of National Environmental Significance (**MNES**) including Baudin's, Carnaby's and Forest Red-tailed Black Cockatoos, Chuditch, and possibly the Western Ringtail Possum (**WRP**). Other conservation significant fauna known to occur within the native vegetation habitat within the MDE include Wambenger Brush-tailed Phascogale, Quenda and the Western Brush Wallaby.

The nearest sensitive receptors to the Mine are within the town of Greenbushes approximately 100 m from the MDE northern boundary. The proposed expansion will increase the scale and impact of the mining operation. This will potentially result in increased impacts of noise, dust and

visual amenity being experienced by surrounding landholders to the south and east, who have not previously experienced these impacts, as well to the town of Greenbushes.

This document is provided as additional information to support the assessment of the impacts of the Mine expansion by the WA Environmental Protection Authority (**EPA**) under Part IV of the *Environmental Protection Act 1986* and by the Federal Department of the Environment and Energy as a Controlled Action under the *Environment Protection and Biodiversity Conservation Act 1999.* Further details relating to the expansion can be found in the initial referral information submitted to the EPA, Talison Greenbushes Lithium Mine Expansion Environmental Referral Supporting Report (GHD 2018) available on the EPA website www.epa.wa.gov.au.

Table of Contents

Table index

Figure index

Appendices

Appendix A - Flora and Vegetation Studies (Onshore Environmental Consultants, 2018 and 2012)

Appendix B – Fauna Studies (Biologic Environmental Survey Pty Ltd, 2018 and 2011)

Appendix C – 2018 Black Cockatoo Studies (Tony Kirkby, Greg Harewood, Onshore Environmental Consultants, Blackwood Basin Group, Per Christensen)

Appendix D – Western Ringtail Possum Studies 2018 (Greg Harewood and Onshore Environmental Consultants)

Appendix E – Conservation Significant Flora and Native Vegetation, Conservation Significant Fauna, and Weed and Hygiene Management Plans (Talison Lithium Pty Ltd)

Appendix F – Dust Impact Assessment Peer Review (ERM 2018) and Revised Dust Impact Assessment (GHD 2018)

Appendix G – Greenhouse Gas Estimate for Greenbushes Expansion Project (Greenbase 2018)

Appendix H – Aboriginal Heritage Survey (Brad Goode and Associates 2018)

Appendix I – Visual Impact Assessment (Onshore Environmental Consultants 2018)

Appendix J – Talison Proposed Expansion Greenbushes Acoustic Assessment (Herring Storer Acoustics 2018) and Noise Management Plan (Draft) (Talison Lithium Pty Ltd 2018)

Appendix K – Greenbushes Mine Expansion Prediction of Vibration and Air Overpressure (George Boucher Consulting 2018)

Appendix L – Talison Greenbushes Mine Expansion Offset Proposal (Talison Lithium Pty Ltd)

1. Introduction

1.1 Background

The Greenbushes Lithium Mine (**the Mine**) is an existing mining operation owned and operated by Talison Lithium Australia Pty Ltd (**Talison**, or **the Proponent**). Talison currently undertakes mining and processing of spodumene ore at the Mine to produce a lithium mineral concentrate of approximately 6% Lithium Oxide (**Li_2O**). Talison proposes to undertake an expansion of the existing Mine to increase the production of spodumene ore and lithium mineral concentrate from the Greenbushes deposit (**the Proposal**). The expansion will occur at the existing operation, which is located immediately south of the Greenbushes townsite, approximately 250 km south of Perth, and 80 km south east of Bunbury in Western Australia (**WA**) (Figure 1).

Talison proposes to undertake the expansion to meet the increasing global demand for lithium products. The expansion will increase the mining rate to an anticipated annual average of 16 million bank cubic metres (**Mbcm**) (and maximum rate of up to 25 Mbcm) to produce approximately 2.8 Mtpa of lithium mineral concentrate.

The expansion will require the current approved (authorised under the *Mining Act 1978*) operational boundary (Active Mining Area) to be extended to the south, with a small extension also to the north, increasing the current (approved) area of 1,591 hectare (**ha**) to a 1,989 ha Mine Development Envelope (**MDE**). This represents a 398 ha (25%) increase to the current approved extent of the Mine. The MDE will include additional areas of State Forest 20 and agricultural land. Up to 350 ha of native vegetation clearing (outside existing approved areas) is required within the MDE for the expansion. Talison hold Mining and General Purpose Lease tenure over the extent of the MDE for this Proposal. The tenure within the MDE is summarised below and illustrated in Figure 2.

- M01/3
- M01/6
- M01/7
- M01/8
- M01/9
- M01/16
- G01/1
- G01/2

The Proposal is planned to commence in 2019 subject to the receipt of required approvals with production from the mine progressively increasing over an approximate five year period to reach peak production. Based on the current resource estimate and predicted production rate, it is estimated that the mine will continue production until at least 2038. The mine life is likely to increase as further resource is defined.

The Proposal was formally referred to the Environmental Protection Authority (**EPA**) under Section 38 of the *Environmental Protection Act 1986* (**EP Act**) on 29 June 2018. The referral included an Environmental Referral Supporting Document (GHD 2018) which describes the Greenbushes Lithium Mine Expansion Proposal in detail along with receiving environments, potential impacts and mitigation strategies to address the identified impacts. The Proposal was advertised for a seven day public comment period on 24 July 2018. The EPA determined that the Project would be 'Assessed on Referral Information' (with Additional Information required under section 40(2)(a) of the EP Act) on 1 August 2018. The additional information is required to be published for a three week public review period.

The Proposal was also formally referred to the Commonwealth Department of the Environment and Energy (**DotEE**) on 9 May 2018 (EPBC reference: 2018/8206) for consideration as to whether it is a Controlled Action under the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**). On 17 June 2018 the DotEE determined the Proposal is a Controlled Action and requires assessment and a decision on approval under the EPBC Act due

to potential impact on listed threatened species and communities which are Matters of National Environmental Significance (**MNES**). The DotEE advised on 19 August 2018 that under section 87 of the EPBC Act the Proposal would be assessed by an accredited assessment with the WA Government. The EP Act Part IV Environmental Impact Assessment Process is the accredited process which applies to this Proposal.

1.2 Purpose of this report

In deciding to assess the Proposal, the EPA determined that the preliminary key environmental factors for the Mine expansion are Flora and Vegetation, Terrestrial Environmental Quality, Terrestrial Fauna, Inland Waters, Air Quality and Social Surrounds. The referral generally provided adequate information regarding the proposal, potential impacts and proposed management measures to enable the EPA to undertake its assessment. However further information is required for the assessment of some of the preliminary key environmental factors. The purpose of this document is to provide this additional information for the EPA's assessment of the Proposal (as required under section 40(2)(a) of the EP Act). The additional information provided is in relation the following preliminary key environmental factors:

- Flora and Vegetation
- Terrestrial Fauna
- Air Quality
- Social Surroundings

For information pertaining to other preliminary key environmental factors identified by the EPA including Terrestrial Environmental Quality and Inland Waters, readers are referred to the Talison Greenbushes Lithium Mine Expansion Environmental Referral Supporting Report (GHD 2018) available on the EPA website www.epa.wa.gov.au.

In addition to the above, this document provides additional information requested by the DotEE to support the accredited assessment of the Proposal under section 87 of the EPBC Act. This primarily relates to:

- The potential impacts of the Proposal, and mitigation of these impacts, on MNES including listed threatened Black Cockatoos, Western Ringtail Possum, Chuditch and the Pink Spider Orchid;
- The Proposal's consideration of Recovery and Threat Abatement Plans and Conservation Advice relating to the MNES;
- Proposed offsets; and
- Social and economic costs and benefits of the Proposal.

1.3 The Proponent

The Proponent for this Proposal is Talison Lithium Australia Pty Ltd, ABN 39 139 401 308, a wholly owned subsidiary of Windfield Holdings Pty. Windfield Holdings Pty Ltd is ultimately owned by Tianqi Lithium Industries Inc (China, 51%) and Albemarle Corporation (USA, 49%).

The contact for Talison in relation to this Proposal is:

Stephen Green

Manager – Workplace Health, Safety, Training and Environment

Telephone: +61 8 9782 5700

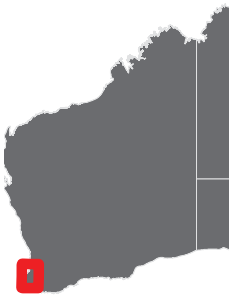
Email:steve.green@talisonlithium.com

Greenbushes Lithium Mine

Regional Location Plan

Legend

- Project Area
- Primary Roads
- Railways
- Rivers



GEOGRAPHE BAY

BUNBURY

BUSSELTON

GREENBUSHES

PROJECT AREA

BRIDGETOWN

OLD COAST ROAD

SOUTH WESTERN HIGHWAY

MURRAY RIVER

BRUNSWICK RIVER

COLLIE RIVER

COALFIELDS ROAD

FERGUSON RIVER

PRESTON RIVER

BUSSELL HIGHWAY

DONNYBROOK BOYUP BROOK ROAD

SUES ROAD

BROCKMAN HIGHWAY

BLACKWOOD RIVER

DONNELLY RIVER

VASSE HIGHWAY

STEWART HIGHWAY

MUIRS HIGHWAY

WARREN RIVER

N

0 5 10 15 20

Kilometers

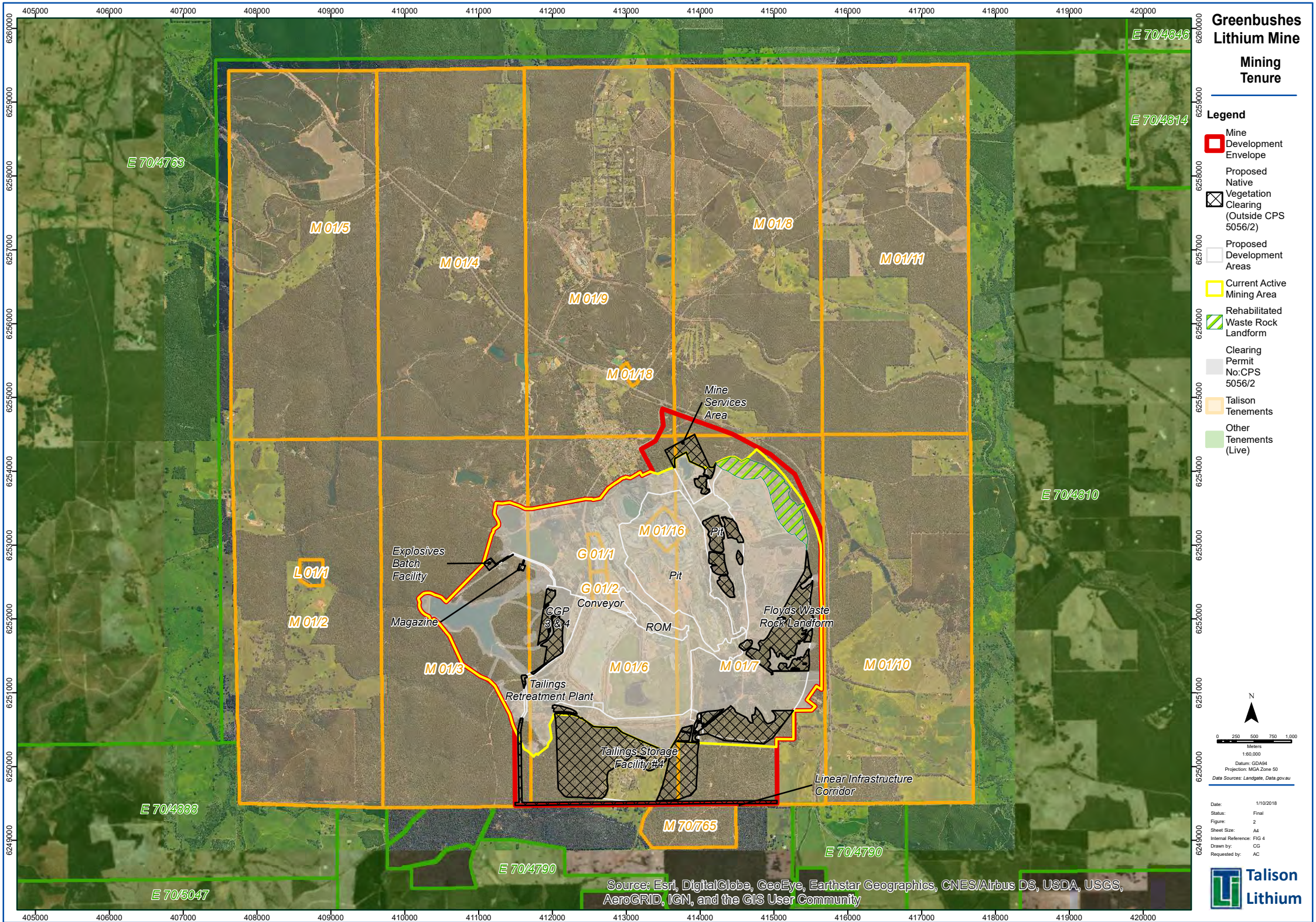
1:750,000

Datum: GDA94

Projection: MGA Zone 50

Date:	12/07/2018
Status:	Final
Figure:	1
Sheet Size:	A2
Internal Reference:	FIG1
Drawn by:	CG
Requested by:	AC

Talison Lithium


Greenbushes Lithium Mine
Mining Tenure
Legend
Mine Development Envelope
Proposed Native Vegetation Clearing (Outside CPS 5056/2)
Proposed Development Areas
Current Active Mining Area
Rehabilitated Waste Rock Landform
Clearing Permit No:CPS 5056/2
Talison Tenements
Other Tenements (Live)
E 70/4846
E 70/4814
E 70/4763
M 01/5
M 01/4
M 01/8
M 01/11
M 01/9
M 01/18
Mine Services Area
E 70/4810
M 01/16
Pit
G 01/1
Explosives Batch Facility
L 01/1
M 01/2
G 01/2 Conveyor
CGP 3 & 4
Magazine
ROM
Floyds Waste Rock Landform
M 01/3
M 01/6
M 01/7
M 01/10
Tailings Retreatment Plant
Tailings Storage Facility #4
Linear Infrastructure Corridor
E 70/4888
M 70/765
E 70/4790
E 70/4790
E 70/5047
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
N
0 250 500 750 1,000
Meters
1:60,000
Datum: GDA94
Projection: MGA Zone 50
Data Sources: Landgate, Data.gov.au
Date: 1/10/2018
Status: Final
Figure: 2
Sheet Size: A4
Internal Reference: FIG 4
Drawn by: CG
Requested by: AC
Talison Lithium

2. Proposal Overview

2.1 Overview of the Existing Mine

The Greenbushes region is recognised as the longest continuously operated mining area in WA, with the discovery of tin occurring in 1886, and subsequent mining commencing in 1888 (Talison 2011). Mining of casseterite (tin), tantalite (tantalum) and spodumene (lithium bearing mineral) have all occurred throughout the history of mining activity in the area. During the first century of mining activities in the Greenbushes region, a large number of companies and individuals operated at different times. Initially this focused on alluvial resources and the weathered soft rock above the host pegmatite. Casseterite was the initial target of the mining activity with tantalite and spodumene gradually became more important.

A range of techniques have been used throughout the history of mining in the area, including dredging for a period in the 1960's. Open cut hard rock mining of tantalite and spodumene commenced at the Mine in 1983. From the 1980's to the early 2000's, tantalum mining and processing were the primary activities at the Mine.

Between 1999 and 2003, there was a major change in the markets for both tantalum and lithium products. The tantalum market was depressed, resulting in tantalum mining and primary processing operations at the Mine being placed on care and maintenance in 2006. Limited secondary processing of tantalum concentrates sourced from external sources, secondary process tailings, and as a by-product of lithium production continued. From 2006, the lithium market experienced substantial growth, resulting in the progressive expansion of the lithium operations. In 2010, the ownership of the lithium assets and the tantalum and other minerals assets was separated (the Mine was previously owned and operated by a single entity).

The tantalum and other minerals assets (primary and secondary tantalum processing plants and crusher) and mining rights are currently owned and operated by Global Advanced Metals Greenbushes Pty Ltd (**GAMG**). The lithium assets (remainder of the operational infrastructure and waste landforms) and mining rights are owned and operated by Talison. GAMG's tantalum operations (with the exception of the secondary process plant) are currently under care and maintenance. GAMG's secondary processing inputs are anticipated to increase based on supply from Talison's primary processing and potential third party supply from other tantalum operations in WA. The scale of the tantalum operation is not expected to reach current approved levels. Contractual arrangements are in place between the two companies for Talison to provide essential services and access to GAMG including environmental services, tailings storage and water management.

The existing Mine is concentrated to the east of the Maranup Ford Road, west of South West Highway, and south of the town of Greenbushes. Water storage and supply for the Mine is located to the west of the Maranup Ford Road. The Mine is predominantly within the Greenbushes State Forest (**State Forest 20**), and located on top of part of the southern section of the Darling Scarp. The main ore body is orientated north-northwest to south-southeast and lies along a ridgeline that rises to approximately 320 m Australian Height Datum (**AHD**). The method of extraction is open-pit using drill and blast, and load and haul to remove the hard rock which is then subsequently crushed and processed. Extracted ore is processed through either a technical grade (**TG**) or chemical grade (**CG**) plant to produce a lithium mineral concentrate of approximately 6% Li_2O via predominantly gravity processing methods. Tailings from mineral processing are discharged into an above ground TSF.

The mine has been subject to various regulatory requirements since modern hard rock mining commenced in 1983. The potential environmental impacts of the existing Mine are currently regulated primarily through authorisations under the *Mining Act 1978* (Mining Act) (Mining

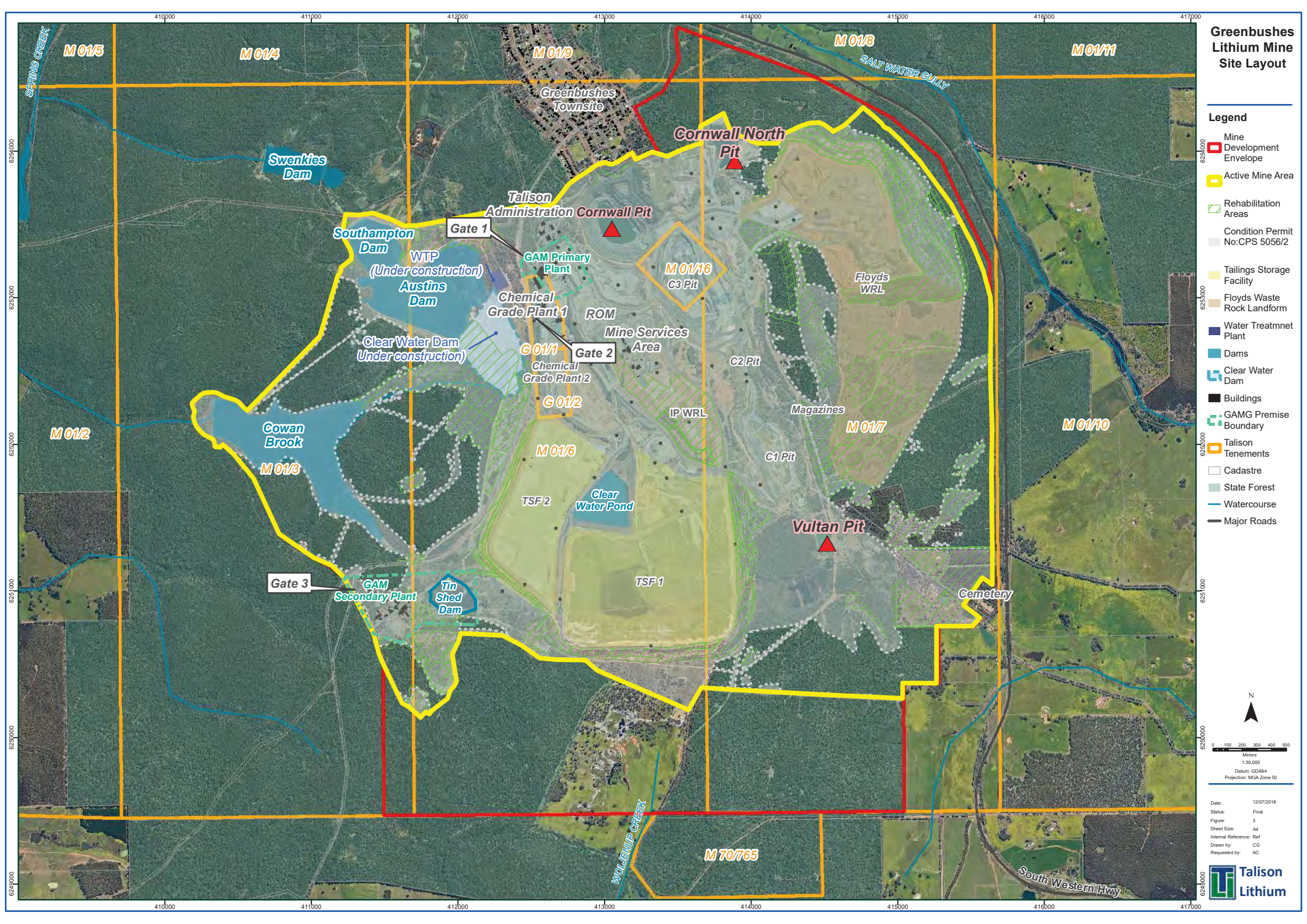
Proposals and tenement conditions) and the EP Act (Part V Operating Licence L4247/1991/13, and associated Amendment Notices). Clearing within the current Active Mining Area is authorised under a Permit to Clear Native Vegetation purpose permit (CPS 5056/2) issued under section 51M of the EP Act. The permit authorises clearing of no more than 120 ha across M01/3, M01/6, M01/7, M01/16, G01/1 and G01/2. Additionally, clearing for the current approved extent of the Floyds Waste Rock Landform (**WRL**) was referred to and deemed by the DotEE to be a Controlled Action due to the potential impact of the clearing on MNES (Black Cockatoos). Clearing of this area was subsequently authorised under the EPBC 2013/6904

A summary of infrastructure comprising the existing Mine and GAMG tantalum operation is listed in Table 1. The existing, approved mine layout is illustrated in Figure 3.

Table 1 Summary of existing approved infrastructure and landforms at the Greenbushes Lithium Mine

Mining Infrastructure/Landform	Processing Infrastructure/Landform	Supporting Infrastructure
Greenbushes Lithium Operation (Talison)		
C1-C3 Open pits (approved to be combined into a single open pit)	Talison TGP1 (0.4 Mtpa)	Austin's / Southampton Water Circuit (dams)
Cornwall Open Pit and underground (care and maintenance used for water storage)	Talison CGP1 (1.9 Mtpa)	Cowan Brook Water Supply Dam
Cornwall North Open Pit (inactive used for water storage)	Talison CGP2 (2.4 Mtpa) (under construction, being established on top of an inactive historic TSF)	Administration Area
Floyds WRL	Talison Crushers (CR1 – currently a mobile plant and CR2 - under construction)	Warehouse
IP WRL	CGP2 ROM (under construction)	Mine Services Area (includes servicing and refuelling facilities)
Explosives magazine	TSF 1 (currently inactive)	Miscellaneous linear infrastructure including pipelines, powerlines and access roads
Miscellaneous haul roads and tracks	TSF 2 (active)	Clear Water Dam (under construction)
Rehabilitated historic disturbance areas (alluvial working, shafts, dredge channels etc)	Clear Water Pond	Water Treatment Plant (under construction)
	TSF 3 (rehabilitated)	Sound Wall
Greenbushes Tantalum Operation (GAMG)		
	GAMG Primary Process Plant and Crusher (Care and Maintenance)	Tin Shed Dam
	GAMG Secondary Process Plant (operational)	

Note 2 – TSF – Tailings storage facility, WRL – Waste rock landform, TGP – Technical Grade Plant, CGP – Chemical Grade Plant.


Greenbushes Lithium Mine Site Layout
Legend
Mine Development Envelope
Active Mine Area
Rehabilitation Areas
Condition Permit No:CPS 5056/2
Tailings Storage Facility
Floyds Waste Rock Landform
Water Treatmnet Plant
Dams
Clear Water Dam
Buildings
GAMG Premise Boundary
Talison Tenements
Cadastre
State Forest
Watercourse
Major Roads
M 01/5
M 01/4
M 01/9
M 01/8
M 01/11
SPRING CREEK
SALT WATER GULLY
Greenbushes Townsite
Cornwall North Pit
Swenkies Dam
Talison Administration
Cornwall Pit
Southampton Dam
Gate 1
WTP (Under construction)
GAM Primary Plant
Austins Dam
M 01/16
C3 Pit
Floyds WRL
Chemical Grade Plant 1
ROM
Mine Services Area
Clear Water Dam (Under construction)
G 01/1
Gate 2
Chemical Grade Plant 2
C2 Pit
G 01/2
IP WRL
Magazines
M 01/7
M 01/10
M 01/2
Cowan Brook
M 01/3
M 01/6
C1 Pit
TSF 2
Clear Water Pond
Vultan Pit
Gate 3
GAM Secondary Plant
Tin Shed Dam
TSF 1
Cemetery
WOLLENUP CREEK
M 70/765
South Western Hwy
410000
411000
412000
413000
414000
415000
416000
417000
6254000
6253000
6252000
6251000
6250000
6249000
N
0 100 200 300 400 500
Meters
1:30,000
Datum: GDA94
Projection: MGA Zone 50
Date: 12/07/2018
Status: Final
Figure: 3
Sheet Size: A4
Internal Reference: Ref
Drawn by: CG
Requested by: AC
Talison Lithium

2.2 Key Characteristics for the Proposal

Talison proposes to undertake an expansion of the Mine to increase the production of lithium mineral concentrate from the Greenbushes deposit to meet the increasing global demand for lithium products. The expansion will increase the mining rate to an anticipated annual average of 16 Mbcm (and maximum rate of up to 25 Mbcm) to produce approximately 2.8 Mtpa of lithium mineral concentrate at 6% Li_2O.

The Key Characteristics of the Proposal are summarised in Table 2 and discussed in further detail in the following sections. The anticipated layout of the expanded Mine is illustrated in Figure 4.

Table 2 Greenbushes Lithium Mine Expansion Key Characteristics

Proposal title	Greenbushes Lithium Mine Expansion		
Proponent name	Talison Lithium Australia Pty Ltd		
Proposal Activities	The Proposal is to undertake Stage 3 and Stage 4 expansion of the existing Greenbushes Lithium Mine in the Shire of Bridgetown - Greenbushes, WA. The Proposal includes the following: • Developing an expanded open pit; • Establishment of two additional chemical grade processing plants, a plant for retreatment of tailings, an additional crusher and expansion of a centralised ROM; • Establishment of a new Mine Services Area and explosives storage and handling infrastructure; • Expansion of the existing Floyds WRL; • Construction of an additional TSF4; and • Establishment of additional linear infrastructure corridors (Bypass Road, powerline, pipeline and road corridors).		
Element	**Location**	**Previous Approved Extent (Mining Proposal &/or EP Act Part V Operating Licence)**	**Proposed Extent**
Physical			
Mine Development Envelope (MDE)	Figure 4 M01/3, M01/6, M01/7, M01/8, M01/9, M01/16, G01/1, G01/2	The approved Active Mining Area for the Greenbushes Lithium Mine is 1,591 ha. A Clearing Permit (CPS 5056/2) has been previously approved authorising up to 120 ha of native vegetation clearing within the Permit boundary which occurs within the Active Mining Area	The MDE for the Greenbushes Lithium Mine Expansion is 1,989 ha. The total area of native vegetation clearing required (outside current CPS 5056/2 approved areas) within the MDE is 350 ha.
Expanded Open Pit	Figure 4 M01/6, M01/7, M01/16	Existing approval authorises three existing open pits C1, C2 and C3 to be combined and extended to a single pit approximately 2.8 km long by 750 m wide and 310 m deep.	An expanded open pit will be developed which is approximately 2.8 km long, 1.0 km wide and up to 450 m deep (footprint of approximately 180 ha). The expanded open pit is predominately within already disturbed areas. The mining rate will increase to an annual average of 16 Mbcm (and peak rate of up to 25 Mbcm.
Expanded ROM	Figure 4 M01/6,	Existing approved ROM	Expand the existing Talison CGP2 ROM to approximately

Proposal title	Greenbushes Lithium Mine Expansion		
			21 ha within the existing disturbance footprint.
Processing Infrastructure	Figure 4 M01/6	TGP (0.4 Mt) CGP1 (1.9 Mt) CGP2 (2.4 Mt) Talison Crusher 2 2.4 Mt Talison Crusher 1 2.4 Mt Total processing capacity 4.7 Mtpa All existing processing infrastructure is to the east of the Maranup Ford Road.	Establish two new Chemical Grade Processing Plants (CGP3 and CGP4) to the west of Maranup Ford Road as well as a tailings retreatment plant (**TRP**) adjacent to TSF1. A two stage crusher (Talison Crusher 3) will be established to the east of Maranup Ford Road at the expanded ROM with a conveyor established linking the crusher to CGP3 and CGP4. All three plants will have a design throughput capacity of 2.4 Mtpa and are expected to each produce approximately 0.5 Mtpa lithium mineral concentrate. CGP3 and CGP4 will be established partially within a disturbed area and therefore will require some native vegetation clearing outside the existing CPS 5056/2 boundary. The footprint of CGP3 and CGP4 will be approximately 45 ha. The TRP will be established within the proposed footprint for TSF4 and therefore does not require additional clearing.
Mine Services Area (MSA)	Figure 4 M01/6 M01/7	Mine Services area located on the IP WRL.	Establishment of a MSA of approximately 32 ha. The facility will require native vegetation clearing outside the existing CPS 5056/2 boundary. The existing facility location will be consumed by the expanded pit.
Explosives magazine and batching facility	Figure 4 M01/3,	Explosives Magazine between C3 open pit and Floyds WRL	Establishment of a new site explosives magazine and batching facility to the west of Maranup Ford Road. The facilities will require native vegetation clearing outside the existing CPS 5056/2 boundary. The existing facility location will be consumed by the expanded pit.
Waste Rock Landform (WRL)	Figure 4 M01/7	Floyds WRL approved footprint is 210 ha and the approved height limit is a final height of 330 mAHD	Expand Floyd's WRL beyond the existing approved extent to a final footprint of approximately 400 ha and a final height of 330 mAHD. Clearing of rehabilitation and native vegetation outside the existing CPS 5056/2 boundary is required for the expansion of the WRL.
Tailings Storage Facility	Figure 4 M01/3, M01/6, M01/7	TSF 1 (approved to height 282 mRL) and TSF 2 (approved raises to height 280 mRL)	New TSF4 to be constructed immediately south of the existing TSFs having a footprint of approximately 240 ha. The existing TSFs 1 and 2 will

Proposal title	Greenbushes Lithium Mine Expansion		
		TSF 3 –decommissioned and under rehabilitation	continue to be raised above their current approved height limit subject to DMIRS approval (increased height has been indicated in past Mining Proposals).
Linear supporting infrastructure	M01/3, M01/6, M01/7	Not specified, miscellaneous roads, tracks, pipelines, drainage and powerlines have been developed within the approved Active Mining Area.	Linear supporting infrastructure including access tracks, pipelines, power supply and a mine access road is proposed. The infrastructure will preferentially be located within disturbed areas, where possible. However some native vegetation clearing outside the boundary of CPS 5056/2 will be required. The location of the mine access road will be determined through consultation with Main Roads WA and the Shire of Bridgetown-Greenbushes.
Operational			
Tailings Production	Figure 4 M01/3, M01/6, M01/7	5 Mtpa deposited to TSF 2	Increased production of tailings to approximately 9 million tpa and disposal to a new TSF4 to be constructed immediately south of the existing TSFs.
Ore Processing	Figure 4 M01/6	Approved processing capacity 4.7 Mtpa	Establishment of three additional process plants, CGP3, CGP4 and TRP will increase processing capacity to approximately 9.5 Mtpa ore and 2.1 Mtpa recovered tailings to produce an anticipated 2.8 Mtpa of lithium mineral concentrate.
Transport routes	NA	Not specified	• Transport of lithium mineral concentrate from Greenbushes to: – Port of Bunbury – Kemerton Strategic Industrial Area – Kwinana Industrial Area – Fremantle Port (limited amounts of technical grade product) The transport route between Greenbushes and Bunbury/Port of Fremantle is already in use for the existing operation but the number of truck movements will increase. Inclusive of supply trucks and product transport to and from the operation, there will be approximately 200 movements in total per day (100 movements each way) when the expanded mine reaches peak production.

Greenbushes Lithium Mine

Proposed Layout and Disturbance

409000 410000 411000 412000 413000 414000 415000 416000 417000

6255000 6254000 6253000 6252000 6251000 6250000 6249000

M 01/5
M 01/4
M 01/9
M 01/18
M 01/8
M 01/11
Mine Services Area
Explosives Batch Facility
Magazine
L 01/1
G 01/1
G 01/2
M 01/16
Pit
Satellite Pit
Floyds Waste Rock Landform
South Western Hwy
Chemical Grade Plant 3 & 4
ROM
M 01/7
M 01/2
M 01/3
M 01/10
Tailings Retreatment Plant
M 01/6
Tailings Retreatment Plant
Linear Infrastructure Corridor
Floyds Waste Rock Landform
Tailing Storage Facility 4
M 70/765

Legend

- Mine Development Envelope
- Proposed Development Footprints
- Rehabilitated Waste Rock Landform
- Current Active Mining Area
- Condition Permit No:CPS 5056/2
- Talison Tenements
- Cadastre

Proposed Native Vegetation Clearing (Outside CPS 5056/2)

- Chemical Grade Plant 3 & 4
- Explosives Batch Facility
- Floyds Waste Rock Landform
- Linear Infrastructure Corridor
- Magazine
- Mine Services Area
- Satellite Pit
- Tailing Storage Facility 4

N

0 100 200 300 400 500
Meters

1:25,000

Datum: GDA94
Projection: MGA Zone 50

Date:	1/10/2018
Status:	Final
Figure:	4
Sheet Size:	A3
Internal Reference:	FIG 4
Drawn by:	CG
Requested by:	SG

Talison Lithium

2.2.1 Mining

The Greenbushes ore body will continue to be mined via conventional hard rock open cut methods of drill, and blast, load and haul (via truck and excavator). The existing lithium pits C1-C3 will be combined into a single pit as per the current approved plans for the Mine. The pit design has increased in depth and width from the current approved pit parameters (2013 Mining Proposal REG ID 45382) and will be up to 2.8 km long by 1 km wide and extend to up to 450 m in depth. The mining rate will increase to an annual average of approximately 16 Mbcm as a result of the expansion and may reach up to 25 Mbcm at its peak. The mining rate will be progressively increased in line with increasing processing capacity. The required mining fleet is anticipated to increase from three excavators (110 tonne) and 12 trucks (90 tonne) to four excavators (260 tonne) and 28 trucks (140 tonne). Blasting is expected to occur daily.

Spodumene ore will be hauled via truck to one of three crushers for processing, and waste rock will be hauled to the existing Floyds WRL located between the open pit and the South Western Highway. Floyds WRL is currently approved for construction to a design height of 330 m AHD. It has been progressively built up from its lowest level of 230 m AHD in 10 m lifts. A lateral expansion of Floyds WRL is proposed to increase the footprint of the dump from the approved 210 ha (2013 Mining Proposal REG ID 45382) to approximately 400 ha, to accommodate the additional waste rock produced from the mining operation. Sterilisation drilling of the WRL footprint will occur prior to use for waste rock storage.

Additional water control infrastructure and catchment dams are also proposed to be established at the foot of Floyds WRL to capture surface water and control sediment runoff and seepage from the landform.

2.2.2 Processing

Two new CG processing plants (CGP3 and CGP4) will be established to the west of the Maranup Ford Road. A two stage crushing circuit, Talison Crusher 3, will also be established to the east of the road (adjacent to the CGP2 ROM) to supply the plants. Each plant will have a design capacity of approximately 2.4 Mtpa and produce an anticipated combined total of up to 1.0 Mtpa of lithium mineral concentrate at approximately 6% Li_2O. The plants will be a near identical replication of CGP2 which is currently under construction (approved through 2016 Mining Proposal REG ID 63657). A conveyor will be established between the Talison Crusher 3 and the two process plants across the Maranup Ford Road. The existing CGP2 ROM will be expanded to accommodate additional ore for CGP3 and CGP4.

In addition to processing spodumene ore, Talison proposes to undertake recovery and reprocessing of tantalum tailings currently stored in TSF1. Elevated lithium grades were deposited into the facility as the processing focussed on tantalum and tin extraction. An additional simplified chemical grade TRP will be established within the proposed footprint for TSF4. The TRP is only expected to be operational for a period of approximately five years and will be removed before the TSF4 footprint expands into this area.

When all plants are operational the Mine will produce approximately 2.8 Mtpa of lithium mineral concentrate.

2.2.3 Tailings Storage

The volume of tailings produced from the Mine will increase from the current rate of 3.1 Mtpa to approximately 9 Mtpa. An additional TSF is required to accommodate the predicted 133 Mt of tailings which will be produced over the life of the project. TSF4 will be constructed to the south of the existing tailings storages (TSF 1-2) to accommodate the additional tailings. Additional linear infrastructure (tracks and pipelines) will be established for transport of tailings to the new facility. The TSF4 has been designed as a two cell centreline tailings storage facility in

accordance with the *Code of Practice for Tailings Storage Facilities in Western Australia (DMP 2013)* and the *ANCOLD Guidelines on Tailings Dam Planning, Design, Construction, Operation and Closure (ANCOLD 2012)*. The TSF has been designed to accommodate approximately 68.2 Mtpa of tailings at an average density of 1.4 t/m^3. The TSF design incorporates a starter embankment and 10 subsequent raises. Due to its centreline construction method, the footprint of the TSF will progressively expand as embankment raises are completed.

2.2.4 Supporting Infrastructure

Mine Services Area

The existing MSA is not sufficiently sized for the increased mining fleet and is currently located within the proposed open pit expansion footprint. A new MSA is required as part of this Proposal. Talison proposes to construct the new facility to the north of the expanded Floyd's WRL. The facility will cover approximately 32 ha and comprise the following infrastructure:

- Heavy haulage workshop;
- Stores building;
- Heavy vehicle refuelling and hydrocarbon storage area. The hydrocarbon storage area will include diesel storage tanks with a capacity of 2 million litres and lubricant storage;
- Haulage contractors building;
- Drill and blast contractors building;
- Drill and blast workshop;
- Light vehicle workshop;
- Core shed;
- Exploration contractor building;
- Technical services building;
- Mining technical services shed; and
- Laydown areas.

Explosive batching facility and magazine

The existing explosive magazine and batching facility is within the footprint of the proposed pit expansion. Therefore, the Proposal includes new facilities that need to be established prior to the existing facilities being mined out. The magazine will be established approximately 400 m west of CGP3/4 and the batching facility established approximately 750 m west of CGP3/4. The facilities have been located in order to meet separation requirements and will be security fenced to prevent unauthorised access.

Access roads will be established to each facility from the CGP3/4. The magazine and batching facility will be established and licensed in a manner that complies with the *Dangerous Goods Safety Act 2004*, *Dangerous Goods (Explosives) Regulations 2007* and relevant guidelines.

Sewage collection and treatment infrastructure

Additional sewage treatment is required for new buildings being established at the MSA, CGP3, CGP4 and the Explosive Batching Facility. An approved sewage system will be established within each area. The sewage treatment infrastructure will be established within the disturbance footprint for each area.

Linear infrastructure corridors

The Mine expansion will require additional linear infrastructure including roads, power supply and pipelines. Corridors will be developed for the establishment of the required linear infrastructure. These will be established within existing disturbed areas, where possible.

Road train movements carting lithium mineral concentrate and supplies will increase with the increased production from the Mine. Trucks travelling to and from the mine are currently required to travel through the town of Greenbushes to access the Mine. To reduce the number of truck movements through the town of Greenbushes, this Proposal includes development of a mine access road. Consultation is in progress with Main Roads WA and the Shire of Bridgetown-Greenbushes in regards to a suitable route for the access road between the Mine access points and the South Western Highway.

2.2.5 Transport

The lithium mineral concentrate produced by the process plant will be transported via truck to one of two lithium hydroxide production plants currently planned (Kemerton) or under construction (Kwinana), or to the Bunbury or Fremantle port for export as per current arrangements. The existing transport route to Bunbury will be maintained and from Bunbury trucks will be diverted to one of the four destinations listed. Inclusive of supplies and lithium mineral concentrate transport, it is anticipated that truck movements from the Mine will increase from 60 movements per day (30 trucks to and from site) to approximately 200 per day total (100 trucks each way to and from the Mine) when the expansion reaches peak production.

2.2.6 Project timing

An approximate timeframe for the described activities is included in Table 3.

Table 3 Greenbushes Lithium Mine Expansion Timeline

Expansion activity	Anticipated timing
TRP/CGP3/Talison Crusher 3/Conveyor construction	Planned commencement by mid 2019
Construction of new TSF4	Planned commencement early 2019
Mining fleet increase	Planned increases from mid 2019
Establish new batching facility and magazine	Planned for completion by mid 2019
Establish new MSA	Planned for completion by mid 2020
Floyds WRL expansion	Planned to commence in late 2020
CGP4 construction	Planned to commence in late 2020

2.3 Social and Economic Justification

Talison is a global leader in the production of lithium mineral concentrate and produces two categories at the Mine. Technical-grade lithium mineral concentrate with low iron content, primarily for feedstock for glass and ceramic industries, and high yielding chemical grade concentrate used to produce lithium chemicals for lithium-ion batteries and lithium based greases. Talison is well placed to realise the economic benefits of the growing demand for lithium products through the proposed expansion of the existing Mine

The following social and economic justification for the Mine expansion is provided in this document in order to address the DotEE's request for details of the social and economic costs and benefits associated with the Proposal. Talison considers the Mine expansion will deliver significant social and economic benefits to the South West Region, wider State of Western Australia, and Australia.

2.3.1 Economic Benefits

The key economic benefits associated with the Proposal:

- The estimated capital investment required for the Mine expansion is predicted to exceed $800 Million Australian Dollars (**AUD**), more than 90% of which is planned to be spent within Australia with local companies supporting the local economy.
- The Proposal will have a sustained investment in the Australian economy. More than 85% of Talison's ongoing operational expenditure is expected to be spent within the Australian economy.
- Talison will continue to support the local economy through locally sourced goods, utilities and services creating economic value and supporting job growth within WA and the broader Australian economy. Goods and services in the order of at least AUD$70 million per annum are expected to be sourced locally.
- Talison will continue to contribute to the Australian economy over the life of the project through payment of Local , State and Federal taxes
- Talison will continue contribute to the WA economy through payment of spodumene royalties (estimated to be AUD$80 million per annum) over the life of the project
- A significant volume of the final product (lithium mineral concentrate) from the Mine will be delivered to downstream processing facilities located in WA (Tianqi plant at Kwinana and Albemarle Plant at Kemerton) to produce Lithium Hydroxide, adding significant value to what is currently a lower value Australian export.
- The Proposal will increase direct and indirect employment opportunities for the local, regional and State population during both the construction and operational phases.
- The construction workforce will peak at 250 direct jobs which will be sourced locally and from the wider region. Those drawn from outside the region will be housed in purpose built accommodation close to the Mine.
- Additional direct payroll staff levels for the Project are expected to exceed 200 personnel plus an additional 200 permanent contractors (mainly mining, drilling and blasting) will be required. Additional jobs will be created for the ongoing maintenance and services area of 100 personnel.
- Talison will continue to provide apprenticeship and traineeship opportunities which may be increased in line with the expanded workforce.
- A number of casual or part time roles will also be created such as cleaners and relief staff positions.
- All permanent operational personnel, both payroll and contractors, will be residential in line with Talison's Fatigue Management Policy for shift workers allowing for a 13 hour door to door working day.
- The majority of Talison's permanent workforce lives in Bridgetown and surrounds (38%), Greenbushes and surrounds (23%) and in Donnybrook and surrounds (15%). Other towns offering residential options include Manjimup, Boyup Brook and Nannup.
- There will be ongoing indirect job opportunities in areas such as transport, storage, shipping, supply of parts and reagents, itinerant equipment suppliers, fabrication, training providers and other professional services.
- Indirect employment related to the provision of services for the workers and their families locally and regionally is expected to be positively impacted.

- In accordance with the requirements of the *Australian Jobs Act 2013,* Talison is in the process of applying for an Australian Industry Participation (AIP) Plan.

2.3.2 Social Benefits

The key social benefits associated with the Proposal are:

- Provision of local jobs. The Mine is classified as a residential mine with employees and their families able to reside within half an hour of the Site. These families add value to the towns in which they live, and attract additional services and support for the wider community.
- Talison is one of the largest employers in the region and as a consequence, many of its staff are involved in community run organisations. For example, senior management personnel live in Greenbushes and nearby towns providing professional support to many local government and community initiatives as well sporting and cultural groups.
- Small towns often struggle to sustain services such as medical, Community Resource Centres, retail shops, police, fire and emergency services due to a dwindling population. An increase in employees at Talison will boost the local population with an expected beneficial flow on effect to the variety and number of services on offer as well as providing more volunteers to assist in local community organisations. Talison has received gold category recognition through DFES Volunteer employer recognition awards.
- Talison supports many community groups and community projects with cash and in-kind contributions and a number of large community projects have been underpinned by significant financial backing by Talison. Recent examples include funding support for the redevelopment of the Bridgetown-Greenbushes Swimming Pool and funding assistance for the purchase of a new Community Bus for Bridgetown-Greenbushes Shire. Talison also supports regional initiatives such as the Youth Driver Development Programme and Foodbank.
- The mine expansion is expected to increase the number of families residing in Greenbushes which will support the viability of the Greenbushes Primary School which currently has a low number of enrolments.
- Talison and its major contractors will continue to provide financial support to the school to enable the employment of an Arts teacher. Talison staff also provide support for environmental and Science, Technology, Engineering and Mathematics programs at the school.
- Talison supports initiatives to increase participation of country students in tertiary education by sponsoring scholarships for rural students to attend St George's College in Perth when undertaking science degrees.
- A large number of families live in the Region however many partners are employed in the mining and offshore Fly-in Fly-out (**FIFO**) operations. These FIFO workers will, as a result of the Proposal, have more opportunities to obtain local employment and therefore be able to enjoy the benefits of a more family centric lifestyle, and involvement in the local community.

3. Stakeholder Consultation

3.1 Key Stakeholders

The key stakeholders for the Talison Greenbushes Operation include:

- Shire of Bridgetown-Greenbushes
- Greenbushes and North Greenbushes Communities
- Grow Greenbushes (Rate Payers and Residents Association)
- Neighbouring rural landholders
- Bridgetown Community
- Balingup Community
- South west towns along the key transport route
- South West Boojarah and Wagyl Kaip Native Title Groups via the South West Aboriginal Land and Sea Council
- Department of Biodiversity Conservation and Attractions (**DBCA**)
- Department of Mines, Industry Regulation and Safety (**DMIRS**)
- Department of Water and Environmental Regulation (EPA Services, Regulatory Services) (**DWER**)
- Main Roads Western Australia (**MRWA**)
- Department of the Environment and Energy (Federal) (**DotEE**)
- Blackwood Basin Group (**BBG**)

3.2 Stakeholder Engagement Strategy

The Mine is an existing project and has an established stakeholder engagement program. Relevant stakeholders are consulted in relation to plans and changes at the operation as required. The surrounding communities are kept informed of activities at the operation through regular presentations at monthly 'Grow Greenbushes' meetings (formerly known as the Greenbushes Rate Payers and Residents Association) and contributions to local publications. Grow Greenbushes meetings are also used to advise the community of the proposed changes at the Mine and obtain feedback on any issues or concerns that the community may have.

Talison maintains an open communication channel with key government stakeholders. Annual reports inform and update agencies on activities and compliance at the operation. Talison also organise a joint regulatory agency site visit with representatives from DWER, DMIRS and DBCA invited to attend where the company's environmental performance and plans for the coming year are presented. Typically this event is organised annually although may be held less frequently if Talison has been in regular contact with the involved government Departments over the preceding year.

Talison maintains an active community presence through support of, and attendance at local events, an annual open day, and employee participation in community organisations such as the Volunteer Fire Brigade, St John's Ambulance, the Tidy Towns Committee and the BBG. Talison recognise that an ongoing program of stakeholder engagement relating to the proposed expansion activities will be required to ensure key stakeholders are kept informed of the proposed expansion plans for the Mine and any concerns which arise are addressed.

Talison has appointed a Stakeholder Engagement Officer to plan and manage the stakeholder consultation for the expansion. A formal Stakeholder Engagement Plan has been developed which outlines the engagement activities proposed to be undertaken with identified stakeholders, and assigns responsibility and timing for the key engagement activities. The key engagement methods which have been identified within the Stakeholder Engagement Plan are listed below:

- One on one meetings, phone calls and written correspondence with neighbouring landholders, government agencies, NGO's, members of parliament, and local government;
- Regular articles in the local newspaper and community newsletters (available in hard copy or online);
  - Greenbushes-Balingup Newsletter;
  - Manjimup-Bridgetown Times;
  - The Blackwood Times;
  - Donnybrook-Bridgetown Mail; and
  - Preston Press.
- Monthly presentations at Grow Greenbushes meetings (includes presenting details of proposed changes and seeking feedback);
- Email distribution list to provide updates, site bulletins and seek feedback (generated from community meetings, site tours, public submissions);
- Questionnaires or surveys to seek community feedback on community concerns and expectations regarding the Mine;
- Talison website (publish frequently asked questions relating to the expansion, site bulletins and approval documentation);
- Community Information Sessions (open to the public);
- Annual mine open day (includes mine tour, information briefing and discussions with Talison employees);
- Annual reports and site visit for government regulators (DWER, DMIRS, DBCA, DotEE);
- Exhibitions and displays manned by Talison employees at key community events such as the Balingup Small Farm Field Day and the Bridgetown Show;
- Site tours via arrangement;
- Manned community information booth at the Greenbushes Community Resource Centre; and
- Dedicated telephone and email address for the community to register concerns, comments or queries.

3.3 Stakeholder consultation

A summary of consultation undertaken in relation to the expansion of the Mine is provided in Table 4. To date, consultation has been focussed on key regulatory agencies, surrounding land holders and immediate community. Consultation will be maintained as the expansion project progresses. Talison has established a community liaison office at the Community Resource Centre in Greenbushes. The office is manned once a week with community members having the opportunity to attend and discuss the expansion with the Talison staff members manning the office at this time.

A Mine Open Day held on 8th July 2018 was an avenue to demonstrate Talison's expansion plans to interested stakeholders. Over 400 people attended the event which included a bus tour of the Mine and current CGP2 construction project area, a video and plans of the proposed mine expansion. Staff were in attendance to answer questions from the public in regards to the expansion and the associated impacts. Other activities undertaken on the day included:

- A presentation from Per Christiansen from the Blackwood Basin Group about the group's four year waterbird project at Schwenke's Dam, north of the Mine;
- A "Welcome to Country" conducted by Josh Whiteland from Koomal Dreaming who also provided guided walks through the forest around the Schwenke's Dam to highlight bush tucker and medicines;
- Recruitment officers from contractors associated with current projects at Talison were on hand to discuss employment opportunities;
- Geologists were available to discuss the mine geology and provide rock samples; and
- A showcase of drill and blast equipment and explanation of blasting procedures.

Table 4 Greenbushes Lithium Mine stakeholder consultation summary

Stakeholder	Date/Time	Consultation type	Purpose of consultation	Outcomes
DBCA	7/07/2017	Meeting	Site Closure & Final Land Use - Options for final land use and closure discussed	Continue discussions regarding closure and final land use.
DBCA	3/08/2017	Meeting	Meeting to progress historic rehabilitation handback and agreement on closure criteria	Progress closure criteria for the historic areas of the Talison site
Grow Greenbushes	5/10/2017	Meeting	General Site Update	Minutes of Grow Greenbushes Incorporated General Meeting 5 October 2017.
Grow Greenbushes	2/11/2017	Meeting	General Site Update	Minutes of Grow Greenbushes Incorporated General Meeting 2 November 2017
Multiple state government agencies	7/11/2017	Presentation	Discussion on change of tenure in the Active Mining Area with multiple government agencies	Continue to progress with discussions with relevant agencies.
DWER - EPA Services	7/11/2017	Meeting	Expansion plans to include Chemical Grade Plant 3 (CGP3)	Options for CGP3 approvals pathway.
Greenbushes Community	4/12/2017	Community Meeting / Presentation	Community meeting to discuss CGP2 construction and operation and changes at the mine	No specific issues raised

Stakeholder	Date/Time	Consultation type	Purpose of consultation	Outcomes
DBCA	12/12/2017	Site Visit / Meeting	DBCA Site visit.	Exploration drilling inspected & discussed the Working Arrangements document
Landholder 1	22/12/2017 - Current	Meeting / Phone Call / Email	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Discussion to reduce clearing footprint by way utilising previously disturbed land. Consultation led to finalised purchase of land for project.
Landholder 2	24/1/18 - Current	Meeting / Phone Call / Email	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Discussion to reduce clearing footprint by way utilising previously disturbed land. Consultation led to finalised purchase of land for project.
DMIRS	15/01/2018	Meeting	Discussed approval requirements for the planned expansion under the Mining Act 1978 - Mining Proposal & Mine Closure Plan	Mining Proposal required for whole of expanded mine in accordance with 2016 guidance. Updated Mine Closure Plan required for submission with the Mining Proposal.
BBG	17/01/2018	Meeting	Meeting to discuss TLA/BBG direction for 2018	Option for 2018 partnership and Working arrangement
Landholder 3	31/1/18 - Current	Phone Call/ Meeting	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Grow Greenbushes	1/02/2018	Meeting	General Site Update	Minutes of Grow Greenbushes Incorporated General Meeting 1 February 2018.
DBCA	7/02/2018	Meeting	Meeting with DBCA to discuss change of land tenure	Progressed discussion relating to the proposed land tenure changes

Stakeholder	Date/Time	Consultation type	Purpose of consultation	Outcomes
Main Roads WA	19/02/2018	Meeting	Talison Lithium Expansion (including Bypass proposal)	Consultation continuing
Landholder 4	21/2/2018 - Current	Meeting / Phone Call/ Letter / Email	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 5	05/2/2018 - Current	Meeting / Phone Call/ Letter / Email	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Grow Greenbushes	1/03/2018	Meeting	General Site Update	Minutes of Grow Greenbushes Incorporated General Meeting 1 March 2018.
DWER - EPA Services	14/03/2018	Meeting	Overview of full expansion plans and required clearing footprint	Approvals pathway defined.
Community Meeting / Bridgetown-Greenbushes Tourism Association	21/03/2018	Community Meeting / Presentation	Community meeting at Shamrock hotel regarding the Talison Lithium Expansion Project	No specific outcomes. General support for the Project.
Landholder 6	05/2/2018 - Current	Meeting / Phone Call/ Letter / Email	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 7	15/3/2018 - Current	Meeting / Phone Call/ Letter / Email	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 8	30/1/2018	Meeting / Phone Call/ Letter / Email	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Balingup Small Farm Field Day	21/04/2018	Presentation	Talison Lithium Expansion Presentation To BSFF Patrons - Presentation to Community and Wider Public	No specific issues raised. General support for the Project and high level of interest in associated job opportunities.
DotEE	10/05/2018	Presentation	Overview of the mine expansion and the impact assessment undertaken for potentially impacted MNES	No specific outcomes.

Stakeholder	Date/Time	Consultation type	Purpose of consultation	Outcomes
DMIRS	11/05/2018	Meeting	Update DMIRS on the status of approvals for the proposed mine expansion. Confirm information requirements/design details for the Mining Proposal and Mine Closure Plan	Risk assessment requires more detail for the Mining Proposal. Meet again when risk assessment and outcomes are complete (will be after completion of studies)
DWER (Regulatory Services and EPA Services	11/05/2018	Meeting	Overview of the planned mine expansion and the approvals pathway for the expansion	Recommended joint meeting with DMIRS and DWER (Regulatory services) when approval applications for TSF are near completion
DWER (Regulatory Services and EPA Services)	31/05/2018	Site Visit	Overview of the planned mine expansion, tour of existing mine and proposed expansion area and the approvals pathway for the expansion	Recommendation to complete impact studies underway and include them with the referral
Landholder 9	20/6/2018	Meeting / Phone Call	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 10	15/6/2018	Meeting / Phone Call	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 11	2/5/2018	Meeting / Phone Call	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 12	14/6/2018	Meeting / Phone Call	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 13	15/6/2018	Meeting / Phone Call	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
Landholder 14	21/6/2018	Meeting / Phone Call	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing

Stakeholder	Date/Time	Consultation type	Purpose of consultation	Outcomes
Landholder 15	21/6/2018	Meeting / Phone Call	General site update and overview of the Greenbushes Lithium Mine Expansion plans	Consultation continuing
DotEE and DMIRS	4/07/2018	Site Visit	Overview of the planned mine expansion, tour of existing mine and proposed expansion area and the approvals pathway for the expansion	Discussed potential offsets options and additional supporting information for the Project
DBCA	25/07/2018 - Current	Meeting/Email/Phone Calls	Proposed offset opportunities.	Consultation with DBCA in regards to potential offset locations is continuing.
Local community	8/07/2018	Mine Open Day	Conduct tours of the mine and present details of the proposed expansion to the local community	General support for the Project with questions regarding the impacts to the local community and employment.
DWER (EPA Services) and DotEE	14/08/2018	Meeting	Discussion of the referral, additional information requirements and timing for submission of additional information for the public review period.	Broad scope for additional information and timeframe for submission agreed.
Main Roads WA	24//8/2018	Meeting	Talison Lithium Expansion (including Bypass proposal)	Consultation continuing
Shire of Bridgetown - Greenbushes	24//8/2018	Meeting	Talison Lithium Expansion (including Bypass proposal)	Consultation continuing
Regional Shires / SWDC / Arc Infrastructure	3/09/2018	Local Government Forum	Talison Lithium Expansion (including Rail Study)	Talison Rail Study, Potential for Jobs, Growth of the Region, Impacts on the South West
Port of Albany Rotary Club	12/09/2018	Presentation	General Site overview and Talison Lithium Expansion	Overview of Talison Greenbushes Mine, and the planned expansions
EPA	13/09/2018	Meeting	Confirmation of the scope of additional information requirements.	Pathways and submission request and structure of submission

Stakeholder	Date/Time	Consultation type	Purpose of consultation	Outcomes
Community Liaison Office	Weekly occurrence from 8/8/18 - Current	Face to face liaison opportunity	Answer queries from general public in relation to the Talison Lithium Mine expansion	Provide information to interested parties and answer questions. Record details for stakeholder register.
Bridgetown-Show	24/11/2018	Presentation	Talison Lithium Expansion Presentation To Bridgetown Show patrons - Presentation to Community and Wider Public	No specific issues raised. General support for the Project and high level of interest in associated job opportunities.
Greenbushes Community	5/12/2018	Community Meeting / Presentation	Community meeting to discuss Talison Mine Expansion plans. Attended by 127 people.	Discussion focussed on the proposed mine access road and offsets.

Note – Talison has also undertaken informal consultation with the Kirup and Boyanup Progress Associations and Shire of Donnybrook in response to requests for information on the expansion plans.

4. Flora and Vegetation

4.1 EPA Objective

The EPA applies the following objective in its assessment of proposals that may have a significant effect on flora and vegetation:

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

For the purposes of Environmental Impact Assessment (**EIA**), the EPA defines flora as native vascular plants, and vegetation as groupings of different flora patterned across the landscape in response to environmental conditions (EPA 2016a).

4.2 Policy and guidance

- Environmental Factor Guideline Flora and Vegetation (EPA 2016a).
- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b).
- Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004)
- *Environmental Protection Act 1986* (**EP Act**).
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (**Clearing Regulations**).
- *Wildlife Conservation Act 1950* (WC Act).
- *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**).
- *Biosecurity and Agricultural Management Act 2007* (**BAM Act**).
- *Conservation and Land Management Act 1984* (**CALM Act**).

4.3 Receiving environment

Five flora and vegetation surveys have been undertaken within the Greenbushes Mine leases:

- Trudgen and Morgan (1991) A Flora and Vegetation Survey of part of the Greenbushes Leases;
- Onshore Environmental Consultants (2006) Flora and Vegetation Survey Greenbushes Lithium Mine Site: Vegetation surrounding south east corner of the TSF;
- AECOM Australia Pty Ltd (2010) Bridgetown RWSS Pipelines Millstream Dam to Greenbushes Link Biological Survey;
- Onshore Environmental Consultants (2012) Flora and Vegetation Survey Greenbushes Mining Leases. (Appendix A); and
- Onshore Environmental Consultants (2018a) Greenbushes Mining Operations Detailed Flora and Vegetation Survey (Appendix A).

The Onshore Environmental Consultants 2012 study was a Level 2 flora and vegetation study (now referred to as a detailed flora and vegetation survey) undertaken in Spring 2011 across all of the Greenbushes Mine leases covering a total area of 10,059.82 ha (referred to as the **Greenbushes Study Area**). This vegetation study was the first broad scale assessment of all the Greenbushes Mine leases and has been referred to by Talison as a baseline for

environmental approvals, impact assessment and closure planning. The study included a review of previous survey work completed within, and immediately adjacent to the Greenbushes Study Area, along with a comprehensive detailed flora and vegetation survey including description and mapping of vegetation communities and condition, targeted searches for significant flora, and identification of introduced (weed) species present within the area (Onshore Environmental 2012).

The survey was undertaken by three botanists between the 13th and 21st October 2011. It included assessment of a total of 26 quadrats and a number of relevé plots providing good coverage over the Greenbushes Study Area. It is acknowledged that the Greenbushes Study Area is large, however good coverage of the vegetation associations was made and the dominant associations were consistently represented across the larger Greenbushes Study Area. The field survey involved systematic sampling using quadrats and transects which generally linked the quadrats. The study sites were generally 10 m by 10 m, or an equivalent area (100 m^2) along narrow associations such as minor drainage lines (Onshore Environmental 2012).

A review of the survey was undertaken in February 2018 (Onshore Environmental 2018b, Appendix A) to assess its adherence to the most recent technical guidelines for flora and vegetation surveys (EPA 2016h), and address any updates required in relation to nomenclature, conservation significance and disturbance mapping. The review identified that the proposed areas of disturbance for the Proposal had not been surveyed as intensively as other areas during the 2011 survey. As a result, Onshore Environmental Consultants was engaged to undertake a two season detailed flora and vegetation survey of the MDE. The survey area included areas outside the existing approved clearing permit boundary (CPS 5056/2) (referred to as the **Proposal Study Area**). Assessment was not undertaken within the CPS 5056/2 boundary as clearing within the boundary has already been subject to assessment and is approved to occur in accordance with the clearing permit.

The survey was undertaken in autumn and spring 2018 by three botanists working over nine days (four autumn and five spring days. The survey involved systematic sampling using quadrats. Relevé vegetation descriptions were made to increase the accuracy of vegetation mapping and targeted searches were completed in habitats where it was anticipated significant flora might occur (Onshore Environmental 2018a).

The study sites were 10 m by 10 m in dimension, or an equivalent area (100 m^2) along narrow associations such as minor drainage lines fringing lake units. The area sampled for each study site is standard for the Jarrah Forest bioregion. The number of study sites sampled was determined by the size and heterogeneity of the study area, with 41 quadrats formally assessed. Additionally, 72 relevé sites were assessed to confirm vegetation mapping boundaries and provide site descriptions for points of interest. The high sampling intensity ensured good coverage and resulted in a high proportion of total flora present across the two seasons being recorded (Onshore Environmental 2018a).

4.3.1 Regional biogeography

The Mine is located in the Southern Jarrah Forrest subregion (JF2) within the Jarrah Forrest Bioregion as described by the Interim Biogeographic Regionalisation for Australia (**IBRA**) (Thackway & Cresswell 1995). 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 Southern Jarrah Forest sub-region is described as, “Extensive areas of swamp vegetation in the south-east, dominated by Paperbarks and Swamp Yate. The understorey 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).

The MDE supports State Forest, plantation, cleared/disturbed areas for farmland and mining, water catchments and rehabilitated mining areas. A summary of land uses within the MDE is included in Table 5.

Table 5 Land Uses within the Greenbushes Lithium Mine Expansion MDE

Land Use	Area (ha)
Native Vegetation (State Forest)	671.3 (33.8%)
Plantation	8.9 (0.4%)
Rehabilitation	129.4 (6.5%)
Mining	1,052.7 (52.9%)
Water Catchment/Storage	74.8 (3.8%)
Agriculture	52.1 (2.6%)
Total	1,989

Note – areas are based on results of the Onshore Environmental 2018b review of the previous (Onshore Environmental 2012) flora and vegetation survey results and updated to account for disturbance since the survey

4.3.2 Regional Vegetation Description

The MDE occurs in the Menzies Subdistrict of the Darling Botanical District, in the South-West Botanical Province (Beard 1981). The Menzies Subdistrict (southern jarrah forest) covers a total area of 26,103 km^2, of which 18,060 km^2 (67.86%) originally supported jarrah and jarrah-marri forest (GoWA 2018). The MDE is mapped as Beard Vegetation Association 3 – Medium Forest; Jarrah-Marri. At this broad level of mapping (sub-district) almost 60% of the pre-European extent remains intact (GoWA 2018) (Table 6).

Table 6 Extent of Beard Vegetation Association 3 - Medium Forest, Jarrah-Marri (GoWA 2018)

Scale	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	Remaining within DBCA Managed Lands (%)
State: WA	2,661,404.6	1,806,035.9	67.86	81.36
Bioregion: Jarrah Forest	2,390,591.5	1,606,736.8	67.21	80.85
Sub-region: Southern (JAF02)	1,482,491.9	883,557.8	59.6	78.25
LGA: Shire of Bridgetown - Greenbushes	121,152.7	68,440.4	56.49	86.65

Vegetation complexes of the southern jarrah forest have most recently been defined by Mattiske and Havel (1998) and updated by Webb *et al* (2016). Vegetation complexes mapped within the MDE are listed in Table 7. The current extent of all vegetation complexes occurring within the MDE is more than 50% of the calculated pre-European extent within the South West Forest Region. All but the Grimwade complex have more than 50% of their current extent within DBCA managed lands (GoWA 2018) (Section 4.5.1, Table 12 and Table 13).

Table 7 Vegetation complexes within the Greenbushes Lithium Mine Expansion MDE

Vegetation Complex
Uplands
Dwellingup 1 (D1) Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.
Hester (HR) Tall open forest to open forest of *Eucalyptus marginata subsp. marginata-Corymbia calophylla* on lateritic uplands in perhumid and humid zones.
Depressions and Swamps on Uplands
Goonaping Complex (G) Mosaic of open forest of *Eucalyptus marginata subsp. marginata* (humid zones) and *Eucalyptus marginata subsp. thalassica* (semiarid to perarid zones) on the sandy-gravels, low woodland of *Banksia attenuata* on the drier sandier sites (humid to perarid zones) with some *Banksia menziesii* (northern arid and perarid zones) and low open woodland of *Melaleuca preissiana-Banksia littoralis* on the moister sandy soils (humid to perarid zones).
Valleys
Catterick (CC1) Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* mixed with *Eucalyptus patens* on slopes, *Eucalyptus rudis* and *Banksia littoralis* on valley floors in the humid zone.
Grimwade (GR) Tall open forest to open forest of *Corymbia calophylla-Eucalyptus marginata* subsp. *marginata* with *Eucalyptus patens* on slopes and *Eucalyptus rudis* over some *Agonis flexuosa* on lower slopes in the humid zone.

4.3.3 Site Vegetation Description

Onshore Environmental (2012) mapped and described the vegetation types of the Greenbushes Study Area. Seven natural vegetation types were described and mapped within the Study Area, of which three were mapped within the MDE. The vegetation types and their extent are described in Table 8 and illustrated in Figure 5.

Onshore Environmental (2018a) mapped and described nine natural vegetation types within the Proposal Study Area. The vegetation types have been classified into seven broad floristic formations according to dominant vegetation strata. The vegetation types and their extent are described in Table 9 and illustrated in Figure 6.

4.3.4 Conservation significant vegetation

Searches of the EPBC Act Protected Matters database and the DBCA NatureMap confirmed that there are no Commonwealth (**Cwth**) or State listed Threatened Ecological Communities (**TEC**) and no State listed Priority Ecological Communities (**PEC**) within a 20 km radius of the MDE. The Onshore Environmental (2012 and 2018a) field surveys did not identify any TEC or PEC within the MDE or the Greenbushes Study Area.

4.3.5 Other significant vegetation

Onshore Environmental (2012) identified a winter-wet dampland supporting a population of Threatened (Cwth) /Declared Rare Flora (**DRF**, WA) *Caladenia harringtoniae* within mining lease M01/3. The area is classified as an Environmentally Sensitive Area (**ESA**).This is approximately 560 m west of the south-west boundary of the MDE (outside of the MDE).

Table 8 Vegetation types within the MDE (Onshore Environmental 2012, 2018b)

Broad Floristic Formation	Code	Description	Extent within the Greenbushes Study Area[1]	Extent within the MDE (ha, (Biologic 2018b)	Vegetation Condition	Representative Photograph
Eucalyptus Dense Forest	1a	*Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Dense Forest over *Banksia grandis, Bossiaea linophylla* and *Persoonia longifolia* Open Scrub over *Pteridium esculentum, Macrozamia riedlei* and *Leucopogon verticillatus* Open Low Scrub B (with *Leucopogon capitellatus* and *Bossiaea ornata* Open Dwarf Scrub D) in brown sandy loam on upper hill slopes and plateaux	1021.29	71.9	Very Good to Good	
	1b	*Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* Dense Forest over *Bossiaea ornata, Hibbertia hypericoides* and *Leucopogon capitellatus* Dwarf Scrub D in brown sandy loam over undulating hill slopes and plateaux	3985.18	403.9	Very Good	

Broad Floristic Formation	Code	Description	Extent within the Greenbushes Study Area[1]	Extent within the MDE (ha, (Biologic 2018b)	Vegetation Condition	Representative Photograph
Eucalyptus Forest	2a	*Eucalyptus marginata* subsp. *marginata, Corymbia calophylla* Forest (to Dense Forest) over *Banksia grandis, E. marginata* subsp. *marginata, C. calophylla* Low Forest A over *Pteridium esculentum, Leucopogon capitellatus* and *Bossiaea ornata* Dwarf Scrub C in brown loamy sand on upper hill slopes and plateaux	364.11	195.4	Very Good to Good	

Note 1: Extent within the Greenbushes Study Area has been updated from the results reported in Onshore Environmental 2012 based on updated disturbance footprint from Onshore Environmental 2018b.

Table 9 Vegetation types within the MDE (Onshore Environmental 2018a)

Broad Floristic Formation	Code	Description	Vegetation Condition	Extent within the Proposal Study Area (ha)	Representative Photograph
Eucalyptus Forest	Hs Bo	Forest of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Low Heath D of *Bossiaea ornata* and *Leucopogon capitellatus* on grey/brown loamy sand on hillslopes.	Very Good	499.52	

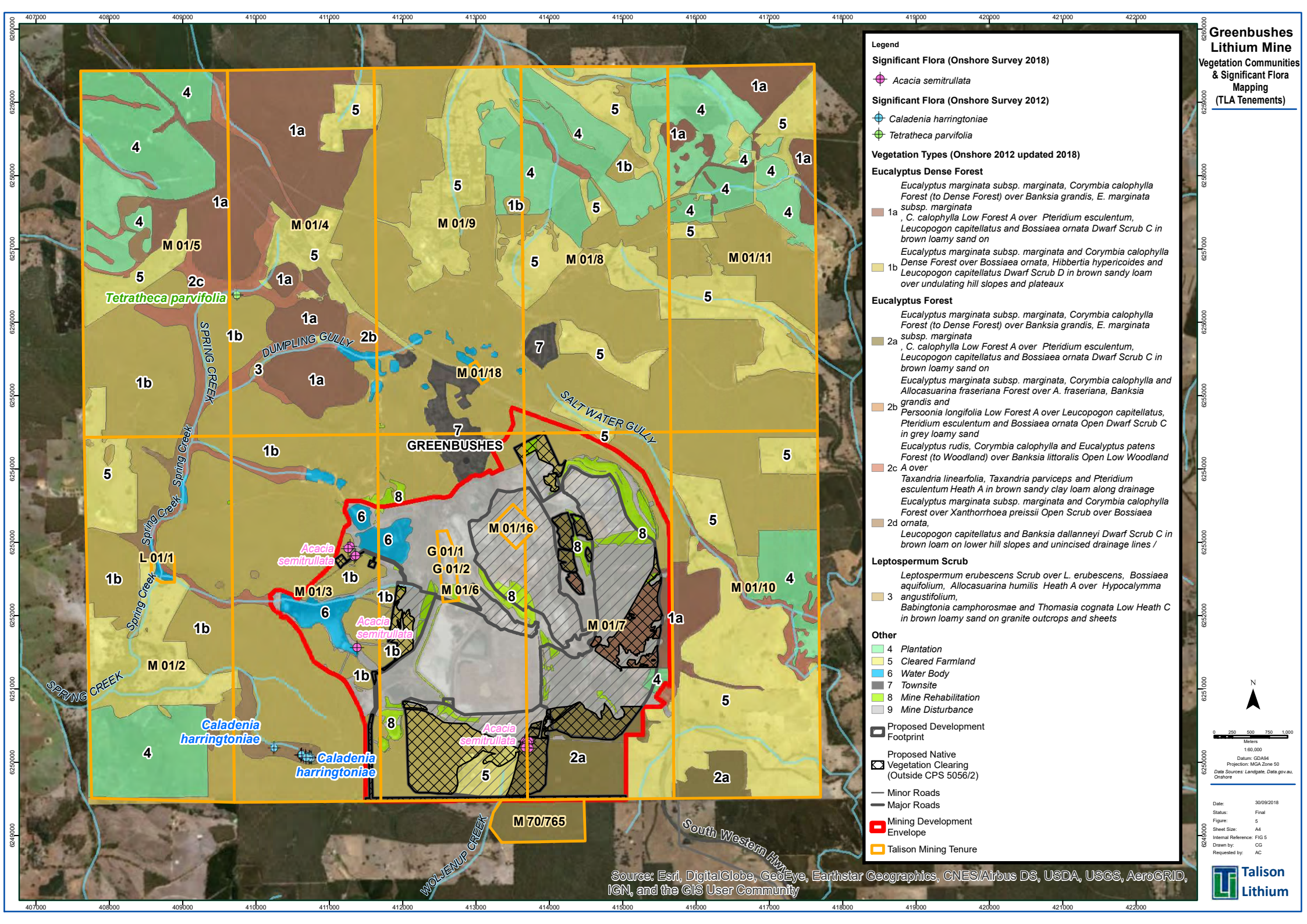
Broad Floristic Formation	Code	Description	Vegetation Condition	Extent within the Proposal Study Area (ha)	Representative Photograph
	DL Er	Forest of *Eucalyptus rudis* subsp. *rudis* (sometimes mixed species) over Scrub of *Trymalium odoratissimum* subsp. *odoratissimum*, *Taxandria linearifolia* and/or *Hakea prostrata* over Open Tall Sedges of *Lepidosperma tetraquetrum* or *Chorizandra enodis* on brown sandy clay loam on minor drainage lines	Good to Degraded	1.21	
Eucalyptus Woodland	DL EpCc Tp	Woodland (to Forest) of *Eucalyptus patens* and *Corymbia calophylla* (sometimes with *Banksia seminuda* or *Banksia littoralis*) over Thicket of *Taxandria parviceps* (sometimes with *Bossiaea linophylla*, *Acacia extensa* and *Pteridium esculentum*) over Open Dwarf Scrub D of *Dasypogon bromeliifolius* and *Conospermum capitatum* on grey sand on drainage lines	Very Good	17.89	

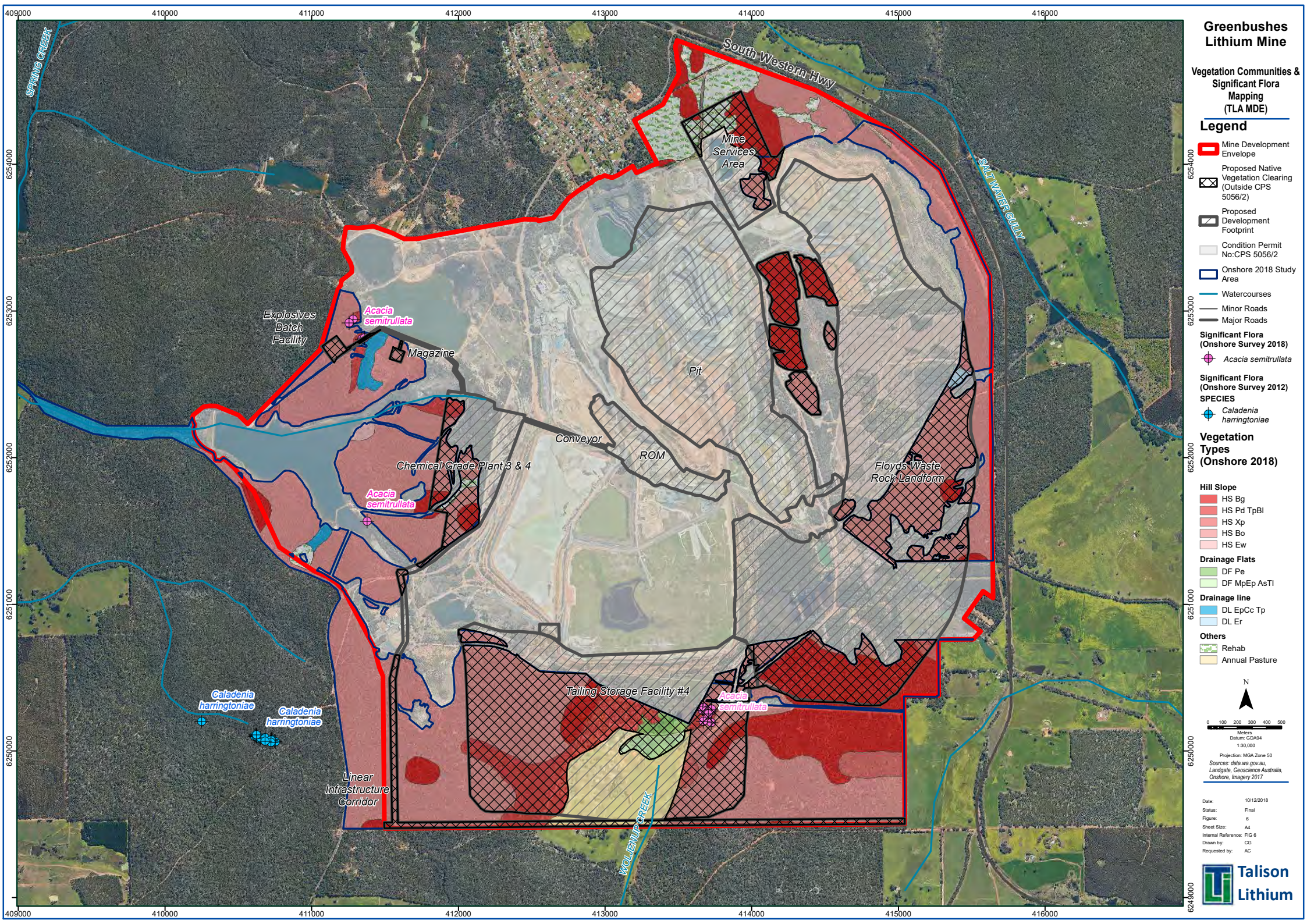
Broad Floristic Formation	Code	Description	Vegetation Condition	Extent within the Proposal Study Area (ha)	Representative Photograph
Corymbia Forest	HS Bg	Forest of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Low Woodland A of *Banksia grandis*, *Persoonia longifolia*, *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Open Low Scrub A of *Pteridium esculentum* and *Macrozamia riedlei* over Low Heath D of *Bossiaea ornata* and/or *Leucopogon capitellatus* on brown sandy loam on upper hillslopes	Very Good	139.19	
	HS Xp	Forest of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* over Scrub of *Xanthorrhoea preissii* (*Bossiaea linophylla*) over Dwarf Scrub C of *Xanthorrhoea gracilis* and *Phyllanthus calycinus* on brown sandy loam on hillslopes	Good	12.3	

Broad Floristic Formation	Code	Description	Vegetation Condition	Extent within the Proposal Study Area (ha)	Representative Photograph
Podocarpus Heath A	HS Pd TpBl	Heath A of *Podocarpus drouynianus* (*Pultenaea ocheata*) with Woodland (to Forest) of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Scrub of *Taxandria parviceps* (*Bossiaea linophylla*) over Dwarf Scrub C/D of *Dasypogon bromeliifolius*, *Adenanthos obovatus* and *Leucopogon oxycedrus* on grey sand on lower hillslopes	Very Good	42.95	
Hypocalymma Low Heath C	HS Ew	Low Heath C of *Hypocalymma angustifolium*, *Babingtonia camphorosmae* and *Banksia dallanneyi* (*Xanthorrhoea gracilis* and *Bossiaea ornata*) with Low Woodland A of *Eucalyptus wandoo* (*Corymbia calophylla*) over Open Low Scrub B of *Xanthorrhoea preissii*, *Acacia celastrifolia* and *Corymbia calophylla* on grey clay loam soil on lower hillslopes	Very Good	1.34	

Broad Floristic Formation	Code	Description	Vegetation Condition	Extent within the Proposal Study Area (ha)	Representative Photograph
Melaleuca Forest	DF MpEp AsTl	Forest of *Melaleuca preissiana* and *Eucalyptus patens* over Scrub of *Astartea scoparia* and *Taxandria linearifolia* over Low Scrub B of *Aotus gracillima* and *Pteridium esculentum* over Open Low Grass of **Anthoxanthum odoratum* and **Vulpia* sp. indet over Very Open Tall Sedges of *Isolepis cyperoides* and *Juncus pallidus* on black sandy clay loam on seasonally wet drainage flats	Good	4.89	
Pteridium Dense Heath A	DF Pe	Dense Heath B of *Pteridium esculentum* on grey sand on seasonally wet drainage flats	Degraded	3.57	

Note: The Proposal Study Area included areas outside of the MDE. Refer to Figure 6.


Greenbushes Lithium Mine
Vegetation Communities & Significant Flora Mapping (TLA Tenements)
Legend
Significant Flora (Onshore Survey 2018)
Acacia semitrullata
Significant Flora (Onshore Survey 2012)
Caladenia harringtoniae
Tetratheca parvifolia
Vegetation Types (Onshore 2012 updated 2018)
Eucalyptus Dense Forest
1a Eucalyptus marginata subsp. marginata, Corymbia calophylla Forest (to Dense Forest) over Banksia grandis, E. marginata subsp. marginata, C. calophylla Low Forest A over Pteridium esculentum, Leucopogon capitellatus and Bossiaea ornata Dwarf Scrub C in brown loamy sand on
1b Eucalyptus marginata subsp. marginata and Corymbia calophylla Dense Forest over Bossiaea ornata, Hibbertia hypericoides and Leucopogon capitellatus Dwarf Scrub D in brown sandy loam over undulating hill slopes and plateaux
Eucalyptus Forest
2a Eucalyptus marginata subsp. marginata, Corymbia calophylla Forest (to Dense Forest) over Banksia grandis, E. marginata subsp. marginata, C. calophylla Low Forest A over Pteridium esculentum, Leucopogon capitellatus and Bossiaea ornata Dwarf Scrub C in brown loamy sand on
2b Eucalyptus marginata subsp. marginata, Corymbia calophylla and Allocasuarina fraseriana Forest over A. fraseriana, Banksia grandis and Persoonia longifolia Low Forest A over Leucopogon capitellatus, Pteridium esculentum and Bossiaea ornata Open Dwarf Scrub C in grey loamy sand
2c Eucalyptus rudis, Corymbia calophylla and Eucalyptus patens Forest (to Woodland) over Banksia littoralis Open Low Woodland A over Taxandria linearfolia, Taxandria parviceps and Pteridium esculentum Heath A in brown sandy clay loam along drainage
2d Eucalyptus marginata subsp. marginata and Corymbia calophylla Forest over Xanthorrhoea preissii Open Scrub over Bossiaea ornata, Leucopogon capitellatus and Banksia dallanneyi Dwarf Scrub C in brown loam on lower hill slopes and unincised drainage lines /
Leptospermum Scrub
3 Leptospermum erubescens Scrub over L. erubescens, Bossiaea aquifolium, Allocasuarina humilis Heath A over Hypocalymma angustifolium, Babingtonia camphorosmae and Thomasia cognata Low Heath C in brown loamy sand on granite outcrops and sheets
Other
4 Plantation
5 Cleared Farmland
6 Water Body
7 Townsite
8 Mine Rehabilitation
9 Mine Disturbance
Proposed Development Footprint
Proposed Native Vegetation Clearing (Outside CPS 5056/2)
Minor Roads
Major Roads
Mining Development Envelope
Talison Mining Tenure
N
0 250 500 750 1,000
Meters
1:60,000
Datum: GDA94
Projection: MGA Zone 50
Data Sources: Landgate, Data.gov.au, Onshore
Date: 30/09/2018
Status: Final
Figure: 5
Sheet Size: A4
Internal Reference: FIG 5
Drawn by: CG
Requested by: AC
Talison Lithium
GREENBUSHES
M 01/1
M 01/2
M 01/3
M 01/4
M 01/5
M 01/6
M 01/7
M 01/8
M 01/9
M 01/10
M 01/11
M 01/16
M 01/18
G 01/1
G 01/2
L 01/1
M 70/765
Tetratheca parvifolia
Caladenia harringtoniae
Caladenia harringtoniae
Acacia semitrullata
Acacia semitrullata
Acacia semitrullata
SPRING CREEK
Spring Creek
Spring Creek
Spring Creek
DUMPLING GULLY
SALT WATER GULLY
WOLJENUP CREEK
South Western Hwy
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Greenbushes Lithium Mine

Vegetation Communities & Significant Flora Mapping (TLA MDE)

Legend

- Mine Development Envelope
- Proposed Native Vegetation Clearing (Outside CPS 5056/2)
- Proposed Development Footprint
- Condition Permit No:CPS 5056/2
- Onshore 2018 Study Area
- Watercourses
- Minor Roads
- Major Roads

Significant Flora (Onshore Survey 2018)

- *Acacia semitrullata*

Significant Flora (Onshore Survey 2012)

SPECIES

- *Caladenia harringtoniae*

Vegetation Types (Onshore 2018)

Hill Slope

- HS Bg
- HS Pd TpBl
- HS Xp
- HS Bo
- HS Ew

Drainage Flats

- DF Pe
- DF MpEp AsTl

Drainage line

- DL EpCc Tp
- DL Er

Others

- Rehab
- Annual Pasture

N

0 100 200 300 400 500
Meters
Datum: GDA94
1:30,000

Projection: MGA Zone 50

Sources: data.wa.gov.au, Landgate, Geoscience Australia, Onshore, Imagery 2017

Date:	10/12/2018
Status:	Final
Figure:	6
Sheet Size:	A4
Internal Reference:	FIG 6
Drawn by:	CG
Requested by:	AC

Talison Lithium

4.3.6 Vegetation condition

Vegetation condition within the Greenbushes region has been impacted by activities that include logging, uncontrolled and controlled access tracks, historical mine activities including excavation of costeans, shafts and dredging, construction of powerline and rail corridors, clearing for farmland and plantation timber, edge effects around the Greenbushes townsite and illegal dumping of domestic rubbish in addition to more recent mining and exploration activity in the area (Onshore Environmental 2012). Dieback and macropod grazing also impact on vegetation condition within the Greenbushes region.

Assessment of vegetation condition was undertaken within the Proposal Study Area (Onshore Environmental 2018a) using a recognised rating scale based on the method detailed in Keighery 1994. The majority of the Proposal Study Area (more than 90%) was rated as Very Good or Good condition (Onshore Environmental 2018a).

A summary of vegetation condition within the Proposal Study Area is included in Table 10.

Table 10 Vegetation Condition mapped within the Proposal Study Area

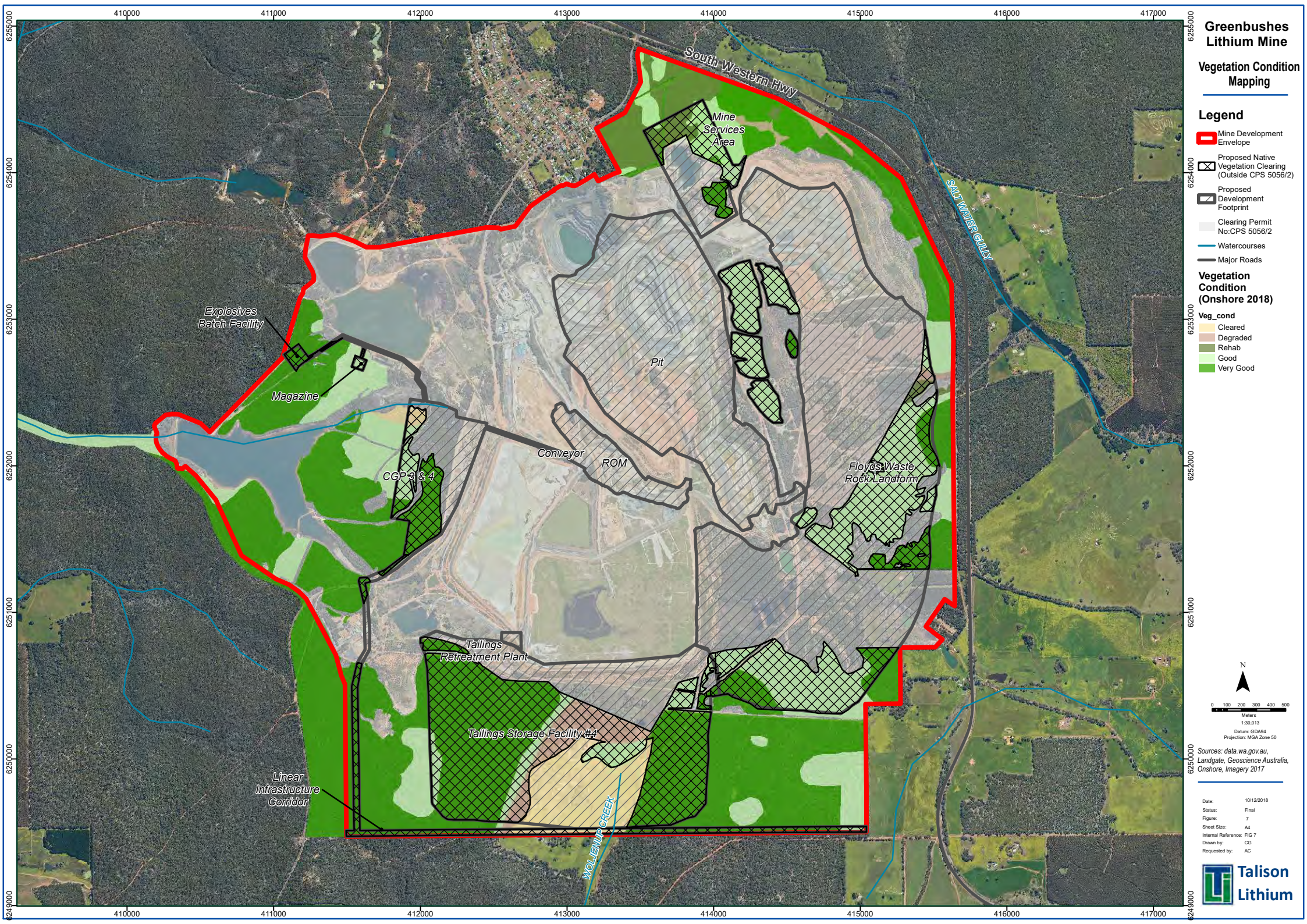
Vegetation condition	Area within the Proposal Study Area (ha)	% of the Proposal Study Area
Very Good	472.54	59.2
Good	222.75	27.9
Degraded / Rehabilitation	54.92	6.9
Cleared / Completely Degraded	47.67	6.0
Total	797.88	100%

Note: The Proposal Study Area included areas outside of the MDE. Refer to Figure 6.

4.3.7 Flora diversity

The 2011 Spring survey recorded 368 plant taxa from 73 families and 208 genera within the Greenbushes Study Area. Species representation was greatest among the Fabaceae, Poaceae, Myrtaceae, Malvaceae, Asteraceae, Orchidaceae, Cyperaceae, Proteaceae and Stylidiaceae families. The most speciose genus was Acacia (18 taxa), followed by Stylidium (10 taxa), Caladenia (7 taxa), Lepidosperma (6 taxa), Lomandra (6 taxa) and Hakea (6 taxa) (Onshore Environmental 2012).

The 2018 survey recorded 363 plant taxa (including varieties and subspecies) from 62 families and 197 genera within the Proposal Study Area. Species representation was greatest among the Fabaceae, Asteraceae, Orchidaceae, Cyperaceae, Poaceae, Asparagaceae, Myrtaceae and Proteaceae families. The most speciose genus was *Acacia* (18 taxa), followed by *Stylidium* (12 taxa), *Lomandra* (8 taxa), *Caladenia, Drosera* and *Leucopogon* (7 taxa each) (Onshore Environmental 2018a). .



Greenbushes Lithium Mine

Vegetation Condition Mapping

Legend

- Mine Development Envelope
- Proposed Native Vegetation Clearing (Outside CPS 5056/2)
- Proposed Development Footprint
- Clearing Permit No:CPS 5056/2
- Watercourses
- Major Roads

Vegetation Condition (Onshore 2018)

Veg_cond

- Cleared
- Degraded
- Rehab
- Good
- Very Good

N

0 100 200 300 400 500
Meters
1:30,013

Datum: GDA94
Projection: MGA Zone 50

Sources: data.wa.gov.au, Landgate, Geoscience Australia, Onshore, Imagery 2017

Date:	10/12/2018
Status:	Final
Figure:	7
Sheet Size:	A4
Internal Reference:	FIG 7
Drawn by:	CG
Requested by:	AC

Talison Lithium

4.3.8 Conservation significant flora

Searches of the following were undertaken to identify the potential presence of conservation significant flora within the MDE (Onshore Environmental 2012, 2018a):

- DBCA NatureMap Database;
- DBCA Threatened and Priority Flora Database;
- DotEE Protected Matters Database; and
- International Union for Conservation of Nature (**IUCN**) Database.

Conservation significant species occurring within a 20 km or 50 km radius of the relevant Study area were identified and a likelihood of occurrence assessment was undertaken (Onshore Environmental 2012, 2018a). A summary of conservation significant flora species considered likely to occur within the MDE based on this assessment is included in Table 11. The Table also identifies those species listed that have been identified within the Greenbushes Study Area, or the Proposal Study Area.

No threatened flora listed under the EPBC Act or DRF listed under the *Wildlife Conservation Act 1950* (**WC Act**) have been recorded within the MDE. One priority species recognised by the DBCA (*Acacia semitrullata,* Priority 4) was recorded within the MDE.

Table 11 Conservation significant flora summary

Species	Likelihood or location recorded	EPBC Act (Cwth) /WC Act (WA) listing	DBCA (WA) listing	Occurrence	Distance from the MDE
Acacia semitrullata	Recorded M01/3, M01/06, M1/07	NA	P4	231 plants from 29 point locations, representing two populations	Within the north west and central-southern sector
Caladenia harringtoniae	Recorded M01/3	Vulnerable	NA	26 plants located in an unincised drainage line/dampland	560 m west of the south-west boundary
Tetratheca parvifolia	Recorded M01/5	NA	P3	Two locations, one of scattered plants at an estimated density of 5 plants/ 10 m^2 and the other a single plant.	~3 km north west
Dampiera heteroptera	Species or habitat considered likely to occur within the MDE	NA	P3	Not identified during surveys	
Grevillea ripicola		NA	P4		
Melaleuca viminalis		NA	P2		

Caladenia harringtoniae (Pink Spider Orchid)

One occurrence (26 individual plants) of the EPBC Act and the WC Act listed, *Caladenia harringtoniae* (Vulnerable, Cwth and WA) was recorded within the Greenbushes Study Area approximately 560 m from the south-west boundary of the MDE. This known population and the associated winter-wet dampland habitat in which it occurs is a designated Environmentally Sensitive Area (Onshore Environmental, 2012). *Caladenia harringtoniae* (Pink Spider Orchid) is

a tuberous perennial herb visible above ground between August-November/December. The distinctive pink flowers are present from October to November (Brown *et al.,* 2006). Not all plants in a population will flower annually, with flowering influenced by environmental conditions including the presence or absence of summer fire and the amount of rainfall received during winter and spring (DotE 2013a). As such, it is possible that the species may be present in an area but not be found during single-year field surveys.

C. harringtoniae grows in sandy loam soils on winter wet flats, granite outcrops and along the margins of streams and lakes. It usually occurs in swampy areas that are inundated for parts of the year with Paperbark (*Melaleuca*) species and Flooded Gum (*Eucalyptus rudis*). It has also been located along creek lines in Jarrah (*Eucalyptus marginata*) and Karri (*Eucalyptus diversicolor*) forests (Hoffman and Brown 1992). It is restricted to 37 populations in the south-west of Western Australia occurring between Nannup and Albany within the Southern Jarrah Forest and Warren bioregions (DotEE 2008). Potential habitat for this species within the MDE would correspond to creek lines in Jarrah/Marri forest types that are present.

It appears to be relatively well conserved but is in need of ongoing monitoring in relation to habitat change (Hearn *et al*.,2006). Plants are killed by fire during their active growing period (May-November). However, flowering is known to be stimulated by summer fire (December-April), with most populations having only been seen in any numbers in the spring following a summer fire.

Despite targeted searches of the MDE no other occurrences of this species have been recorded.

4.3.9 Introduced and invasive species

A total of 86 introduced flora species were recorded within the Greenbushes Study Area during the Onshore Environmental 2011 survey. Three of those recorded are Declared Plants under the *Biosecurity and Agricultural Management Act 2007* (**BAM Act**).

- *Asparagus asparagoides* (Bridal Creeper);
- *Galium aparine* (Goosegrass); and
- *Rubus ulmifolius* (Blackberry).

A total of 62 introduced flora species were recorded within the Proposal Study Area during the Onshore Environmental 2018 survey, of which three taxa are Declared Plants under the BAM Act:

- *Asparagus asparagoides* (Bridal Creeper);
- *Rubus anglocandicans* (Blackberry); and
- *Rumex acetosella* (Sorrell).

The relatively high diversity of weeds within the MDE and surrounding mining leases reflects the long mining history of the Greenbushes area and close proximity to surrounding agricultural land (Onshore Environmental 2018a). Many of the weed species recorded are likely to have been introduced during early exploration and mining, becoming established on disturbed ground and extending into adjacent areas. High moisture habitats are particularly vulnerable to colonisation by weeds, however infestations recorded during the 2018 survey were generally localised (Onshore Environmental 2018a).

Farmland in the southern sector of the MDE is another source of introduced species, with ‘edge effects’ typically evident around the boundary of cleared annual pasture areas. The annual pasture and verge species are represented within intact native vegetation as a minor component of the understorey. Disturbed areas such as tracks and historical rehabilitation are

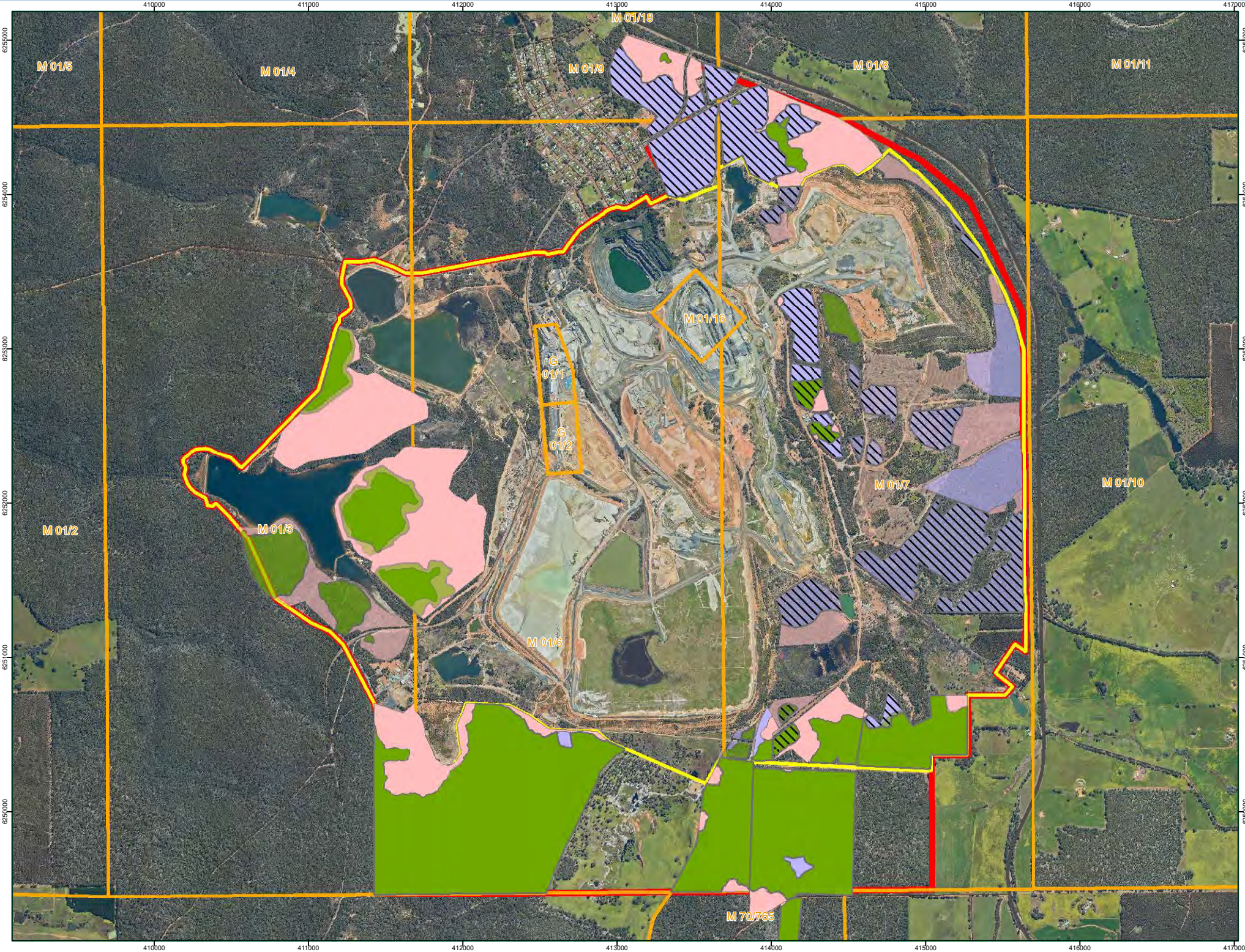
more susceptible to invasion by these taxa, which are generally not vigorous and do not impact on native vegetation structure (Onshore Environmental 2018a).

4.3.10 Dieback

Phytophthora cinnamomi is a soil fungus which kills susceptible plants by attacking their root systems preventing the plant from absorbing water and nutrients. Dieback is the term commonly used when referring to this fungus due to its effect on vegetation. The fungus is found throughout the southern extent of Western Australia in areas with susceptible plant species that receive rainfall in excess of 400 mm/year (Dieback Working Group 2008). Project Dieback (2017) data shows that the Greenbushes area is within an area at risk of *Phytophthora cinnamomi*.

Vegetation within the area is highly susceptible to the fungus and has been identified within the MDE. Dieback mapping has been undertaken by the DBCA within part of the MDE. The mapping outcomes show that dieback occurs in some areas of the MDE. Some areas have been mapped as unprotectable due to surrounding land use and nearby presence of dieback infested areas. There are also areas which remain dieback free where controls are necessary to prevent infestation occurring. A map showing the current knowledge of dieback presence within the MDE is included in Figure 8.

Some of the proposed areas of disturbance for the Mine expansion have not yet been mapped. Due to natural and assisted disease spread, the dieback status of an area can change over time. Talison therefore intends to map any unmapped areas prior to the commencement of activity in these areas to ensure appropriate hygiene measures are in place and infected areas are identified. This will also assist to identify topsoils requiring burial rather than collection for rehabilitation. Re-survey of proposed clearing areas will also be undertaken where it has been more than two years since the last survey.



Greenbushes Operations

Phytophthora cinnamoni (dieback) Mapping MDE

Legend

- Mine Development Envelope
- Active Mining Area
- Talison Tenements

Dieback Status (2018)

Status

- Infested
- Uninfested
- Uninterpretable
- Unprotectable
- Minor Road
- Major Road

N

0 100 200 300 400
Meters

1:30,000

Datum: GDA94
Projection: MGA Zone 50

Date:	30/09/2018
Status:	Draft
Figure:	8
Sheet Size:	A4
Internal Reference:	014_01_2018
Drawn by:	CG
Requested by:	AC

Talison Lithium

4.4 Potential impacts to flora and vegetation

The Proposal will result in the direct loss of up to 350 ha of native vegetation (State Forest 20) in predominantly good or very good condition outside of the existing approved disturbance area (CPS 5056/2).

Additionally the proposal could result in the direct loss of up to 231 Priority 4 *Acacia semitrullata* plants as a result of native vegetation clearing to establish landforms and infrastructure.

The Proposal could also result in the following indirect impacts to vegetation and flora:

- Fragmentation of native vegetation (discussed in section 5.5.1);
- Possible introduction and/or spread of invasive pathogens causing vegetation deterioration or death;
- Possible introduction, spread or increase in abundance of invasive plant species (weeds) causing increased competition with native vegetation in undisturbed and rehabilitated areas;
- Changes to vegetation health, structure and floristic composition in surrounding areas due to hydrological changes;
- Reduced vegetation health as a result of smothering by dust generated from the operational activities; and
- Damage to surrounding vegetation through accidental generation of a bushfire.

4.5 Assessment of impacts

4.5.1 Vegetation clearing

Talison proposes to clear up to 350 ha of native vegetation within the MDE for the purpose of lithium mining and processing. The MDE is within State Forest 20 and clearing for the mine expansion will remove 350 ha of vegetation from an area of state forest, freehold land and unallocated crown land. The State Forest is managed in accordance with the 2014-2023 Forest Management Plan under the Regional Forest Agreement for the South-West Forest Region of WA.

Vegetation clearing will reduce the local and regional extent of the vegetation communities represented within the MDE. The clearing footprint will result in the loss of one population of Priority 4 species *Acacia semitrullata* which occurs within the proposed footprint of TSF4 and some individuals from the second population within the MDE may be removed dependant on the final footprint of infrastructure. It is likely that the majority of the *A.semitrullata* individuals in the second population can be avoided however the population is located in close proximity to an existing track which will be expanded to provide an access road to the explosive batching facility. Some individuals in close proximity to the existing track may not be able to be avoided.

The impact of vegetation clearing has been considered in terms of vegetation complexes and site-vegetation types. Vegetation complexes have been used to assess the impact of clearing at both regional and local scales and site-vegetation types have been used to assess the impact of clearing at the local scale.

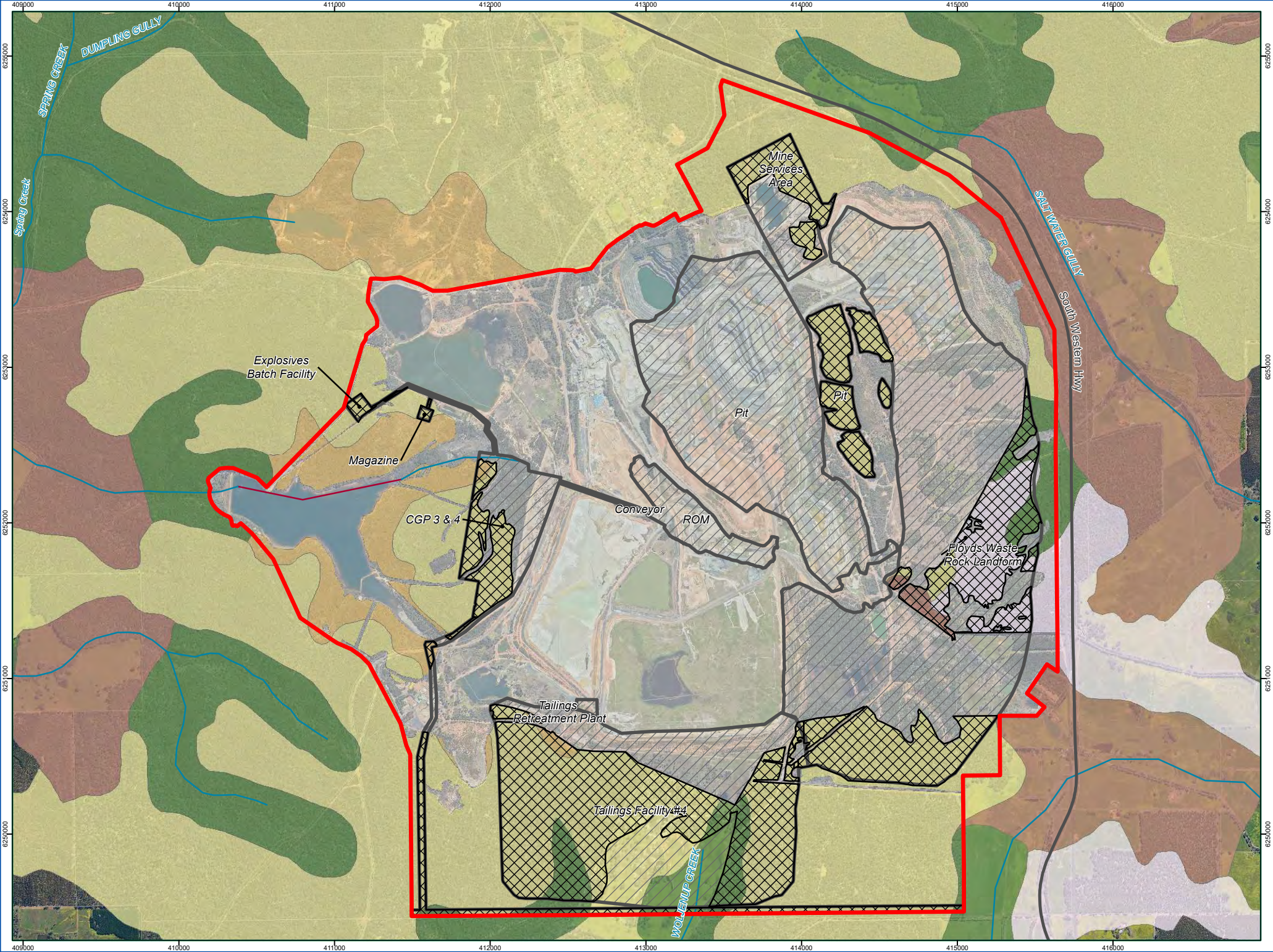
Vegetation complexes

Proposed clearing within the MDE will primarily occur within the Dwellingup complex (Figure 9). Over 85% of the pre-European extent of this complex is remaining, of which over 80% is within DBCA managed lands within the South West Forest Region. Table 12 and Table 13 show the current extents of all vegetation complexes mapped within the MDE, and the extent of proposed

clearing within each complex at the South West Forest Region of Western Australia (regional), and the Shire of Bridgetown - Greenbushes (local) scales.

There is less than 0.3% of the current extents of all vegetation complexes within the proposed clearing footprint at a regional scale (South West Forest Region) (Table 12), and less than 3.5 % of the current extents of all vegetation complexes within the proposed clearing footprint at a local scale (Shire of Bridgetown-Greenbushes) (Table 13).

The proposal is therefore not expected to significantly reduce the extent of any vegetation complexes at the regional or local scale.



Greenbushes Lithium Mine

Vegetation Complexes

Legend

- Mine Development Envelope
- Proposed Native Vegetation Clearing (Outside CPS 5056/2)
- Proposed Development Footprint
- Clearing Permit No:CPS 5056/2
- Cadastre

Vegetation Complexes – South West Forest Region (Mattiske and Havel (1998) and updated by Webb et al (2016))

- Catterick, CC1
- Dwellingup, D1
- Goonaping, G
- Grimwade, GR
- Hester, HR
- Watercourses
- Primary Roads
- Railways

N

0 100 200 300 400
Meters
1:30,000

Datum: GDA94
Projection: MGA Zone 50

Sources: data.wa.gov.au, Landgate, Geoscience Australia, Ennovate, Biologic Imagery 2017

Date:	30/09/2018
Status:	Final
Figure:	9
Sheet Size:	A4
Internal Reference:	FIG 8
Drawn by:	CG
Requested by:	AC

Talison Lithium

Table 12 Extent of vegetation complexes mapped within the MDE for South West Forest Region of WA (GoWA 2018)

Vegetation complex	Pre-European extent (ha)	Current extent (ha)	% pre-European extent remaining	Current extent remaining within all DBCA managed land (%)	Estimated extent to be cleared within the MDE (ha)	% of current extent within SWFR to be cleared (ha)
Dwellingup Complex D1	208,490.90	180,683.44	86.66	82.11	269	0.15
Goonaping Complex G	27,467.04	21,836.72	79.50	70.45	4	0.02
Catterick Complex CC1	27,385.55	16,745.40	61.15	55.54	37	0.22
Grimwade Complex GR	22,046.59	11,092.40	50.31	43.35	5	0.05
Hester Complex HR	32,249.57	23,763.74	73.69	67.12	35	0.15

Table 13 Extent of vegetation complexes mapped within the MDE for Shire of Bridgetown - Greenbushes (GoWA 2018)

Vegetation complex	Pre-European extent (ha)	Current extent (ha)	% pre-European extent remaining	Proportion of the vegetation complex within the LGA (%)	Estimated extent to be cleared within the MDE (ha)	% of current extent to be cleared (ha)
Dwellingup Complex	13,704.69	8,482.20	61.89	6.57	269	3.17
Goonaping Complex	523.27	212.20	40.56	1.91	4	1.89
Catterick Complex	11,732.17	4,533.08	38.64	42.84	37	0.82
Grimwade Complex	5,272.19	1,662.71	31.54	23.91	5	0.3
Hester Complex	4,212.47	1,621.18	38.49	13.06	35	2.16

Table 14 Extent of clearing impact on Onshore Environmental 2012 vegetation associations within the MDE

Vegetation Association	Vegetation Condition	Extent mapped within Greenbushes Study area (ha)	Extent mapped within MDE (ha)	Proposed clearing area (ha)*	% Mapped extent proposed to be cleared	% mapped within MDE proposed to be cleared
1a	Very Good to Good	1021.29	71.9	55	5.39	76.5
1b	Very Good	3985.18	403.9	180	4.52	44.6
2a	Very Good to Good	364.11	195.4	115	31.58	58.9

*Note: The estimated clearing area within each community given above is approximate given the location of some infrastructure is yet to be finalised.

Table 15 Extent of clearing impact on Onshore Environmental 2018 vegetation types within the MDE

Vegetation type	Vegetation Condition	Extent mapped within the Proposal Study area (ha)	Extent mapped within MDE (ha)	Extent of Proposed clearing (ha)*	% Mapped Extent Proposed to be cleared	% mapped within MDE proposed to be cleared
Hs Bo	Very Good	499.52	451.33	214.7	43	47.6
DL Er	Good to Degraded	1.21	1.21	1.21	100	100
DL EpCc Tp	Very Good	17.89	5.86	0.5	2.8	8.5
HS Bg	Very Good	139.19	135.83	83.13	59.7	61.2
HS Xp	Good	12.3	12.3	4	32.5	32.5
HS Pd TpBl	Very Good	42.95	42.95	38	88.5	88.5
HS Ew	Very Good	1.34	1.34	0	0.0	0.0
DF MpEp AsTl	Good	4.89	4.89	4.89	100	100
DF Pe	Degraded	3.57	3.57	3.57	100	100

*Note: The estimated clearing area within each community given above is approximate given the location of some infrastructure is yet to be finalised.

Vegetation types

Native vegetation covers approximately 671 ha (33.8%) of the MDE with Jarrah-Marri forest being the dominant vegetation association (Onshore Environmental 2018b). Proposed clearing will impact on three of the vegetation types mapped by Onshore Environmental (2012), and eight of the vegetation types mapped by Onshore Environmental (2018a). The estimated impact of clearing on the mapped extent of Onshore Environmental 2012 vegetation types within the Greenbushes Study Area is detailed in Table 14, and on the mapped extent of Onshore Environmental 2018 vegetation types within the Proposal Study area is detailed in Table 15. The vegetation proposed to be cleared is predominantly in Good or Very Good condition. None of the vegetation types within the MDE are considered to be locally or regionally significant.

Clearing of some rehabilitated mining areas and plantation vegetation (*Pinus sp*.) will also occur within the MDE.

The proposed clearing of native vegetation is not considered to represent a significant impact to flora and vegetation on the basis that:

- Vegetation types to be cleared are well represented at a regional and local scale and are not considered to be regionally or locally significant; and
- No Threatened or Priority ecological communities occur within the MDE or surrounding mining leases.

Conservation significant flora

No Threatened or Declared Rare Flora occurs within the MDE with the closest record (*Caladenia harringtoniae*) restricted to a single location (26 individual plants) in State Forest 20 approximately 560 m from the MDE south-west boundary. The MDE has been subject to targeted survey for further locations of this species but it has not been found. The Proposal is unlikely to result in direct or indirect impacts the known location of *C. harringtoniae* given its distance from the MDE.

Clearing for development of the TSF4 will result in the loss one of the two populations of Priority 4 species *Acacia semitrullata* present within the MDE. There have been 231 individuals recorded within the two populations (Onshore Environmental 2018a). It is likely that the majority of the *A.semitrullata* plants identified in the north-west corner of the MDE can be avoided however the population is located in close proximity to an existing track which will be expanded to provide an access road to the explosive batching facility. Some individuals in close proximity to the existing track may not be able to be avoided.

A.semitrullata has been recorded from Pinjarra in the north, to Cape Leeuwin in the south, and Collie and Nannup in the east, with one outlying record from Walpole on the south coast (Atlas of Living Australia 2018). Available data shows 140 records across three IBRA Bioregions (Jarrah Forest, Swan Coastal Plain and Warren) (GoWA 2018), however the number of individuals is unknown as records often provide the count (frequency) in descriptors such as common, frequent, scattered without providing an actual number of plants. As such population estimates are likely underrepresented with the actual number of plants expected to be much higher. The species has been recorded from sand or clay soils on sandplains, swampy or disturbed areas. Within the MDE, the species has been recorded on grey sand within vegetation in Very Good and Degraded condition. Given the wide distribution of the species and ability to grow within disturbed areas, the loss of one population of the species from the MDE is not considered significant.

4.5.2 Introduction and/or spread of invasive pathogens and weeds

The Proposal has the potential to introduce and/or spread invasive pathogens (*Phytophthora cinnamomi* or dieback), and invasive flora species (weeds) as a result of vehicle or heavy equipment movement throughout the MDE, land clearing, or movement of soil and plant materials. Dieback and weeds can also potentially be carried to downstream areas through the surface hydrological systems. The Mine has a surface water circuit designed to capture and recover as much surface water as possible for Mine use. There is therefore limited surface water flows from the Mine to the surrounding area limiting the opportunity for transfer of dieback or weeds through the hydrological systems. Water discharges are managed under the current EP Act Part V licence for the mine.

Phytophthora cinnamomi can potentially result in widespread vegetation death in infested areas, and weeds can affect the health and survival of vegetation in rehabilitation areas and adjacent forested areas, potentially causing a reduction in species diversity and overall ecosystem health both within, and in the area surrounding, the MDE. Given that weeds are widespread throughout the MDE, and known infestations of *Phytophthora cinnamomi* are also present, spread of these invasive species and pathogen could potentially occur as a result of the Mine expansion. Vegetation within the MDE is also known to be susceptible to dieback.

Spread of weeds and dieback is mostly likely to occur as a result of poor hygiene practices when vehicles and mine equipment enter or depart the MDE or when they move around the MDE, particularly from areas known to be infested to areas which aren't. Collection and use of topsoil for rehabilitation is also a potential factor in the spread of weeds and pathogens if infested soils are stored or used in areas which have not been impacted. Although topsoil is a valuable rehabilitation material, soil which is known to be heavily infested with weeds or *Phytophthora cinnamomi* is currently disposed of through burial and an alternative growth medium (oxidised clay) is used for rehabilitation to prevent weed and dieback abundance in rehabilitation areas. This practice will continue throughout implementation of the Proposal to minimise the risk of dieback or heavily weed infested soils impacting upon the success of rehabilitation.

Talison has established vehicle hygiene and ground disturbance procedures as well as working arrangements with the DBCA to prevent the spread and introduction of invasive pathogens. All areas of vegetation proposed to be disturbed are required to have had a dieback assessment (typically undertaken by DBCA or if unavailable a DBCA approved dieback interpreter) within the two years prior to the disturbance occurring. An annual program of weed control is also undertaken by a dedicated Weed Control Officer to prevent increases in weed abundance and diversity within the MDE. Based on visual observations within the Mine, and the outcomes of rehabilitation monitoring assessments, the implementation of the annual weed control program has resulted in some weed species being reduced in abundance to a level where they are now able to be treated through targeted hand pulling rather than broadscale application of herbicides (pers. comm S Green 2018).

4.5.3 Changes to vegetation health, structure and floristic composition in surrounding areas due to hydrological changes

A number of elements of the Mine expansion will potentially impact on the hydrology at a local scale which could lead to associated changes in vegetation health, structure and floristic composition within the MDE. These are discussed below.

Land clearing

Land clearing can potentially result in groundwater level rise in shallow/perched aquifers as a result of reduced evapotranspiration and increased rainfall infiltration and recharge. It is

however considered unlikely that a rise in the groundwater level will result from vegetation clearing for a number of reasons:

- The MDE has been subject to extensive clearing over the history of mining in the area without evidence of local groundwater level rise.
- The local area is likely to already experience reduced evapotranspiration and increased infiltration rates as a result of historic clearing for the Mine and surrounding agricultural properties east and south of the Mine.
- The MDE is also surrounded by an expansive area (6,088 ha) of state forest which will buffer the effect of reduced local evapotranspiration rates and increased infiltration.

Groundwater mounding

Establishment and operation of a TSF can potentially cause groundwater mounding to occur. Tailings storage facilities impound large volumes of wet slurry (ground ore, residual reagents and water) within a specially designed storage facility. Groundwater mounding can occur in the vicinity of a TSF when retained water percolates through the foundations of the structure to the unsaturated zone beneath the infrastructure. Saturation of this zone causes groundwater to mound beneath the infrastructure. Mounding of groundwater can potentially lead to localised flooding and water logging of vegetation in the area of impact causing decline in health or change to the structure and floristic composition of vegetation.

Due to the nature of groundwater resources within the MDE it is considered unlikely that mounding will occur as the underlying geology tends to have low permeability and porosity which is unlikely to support mounding. Additionally the design of the new TSF4 will be such that the likelihood of percolation through the foundations is minimised.

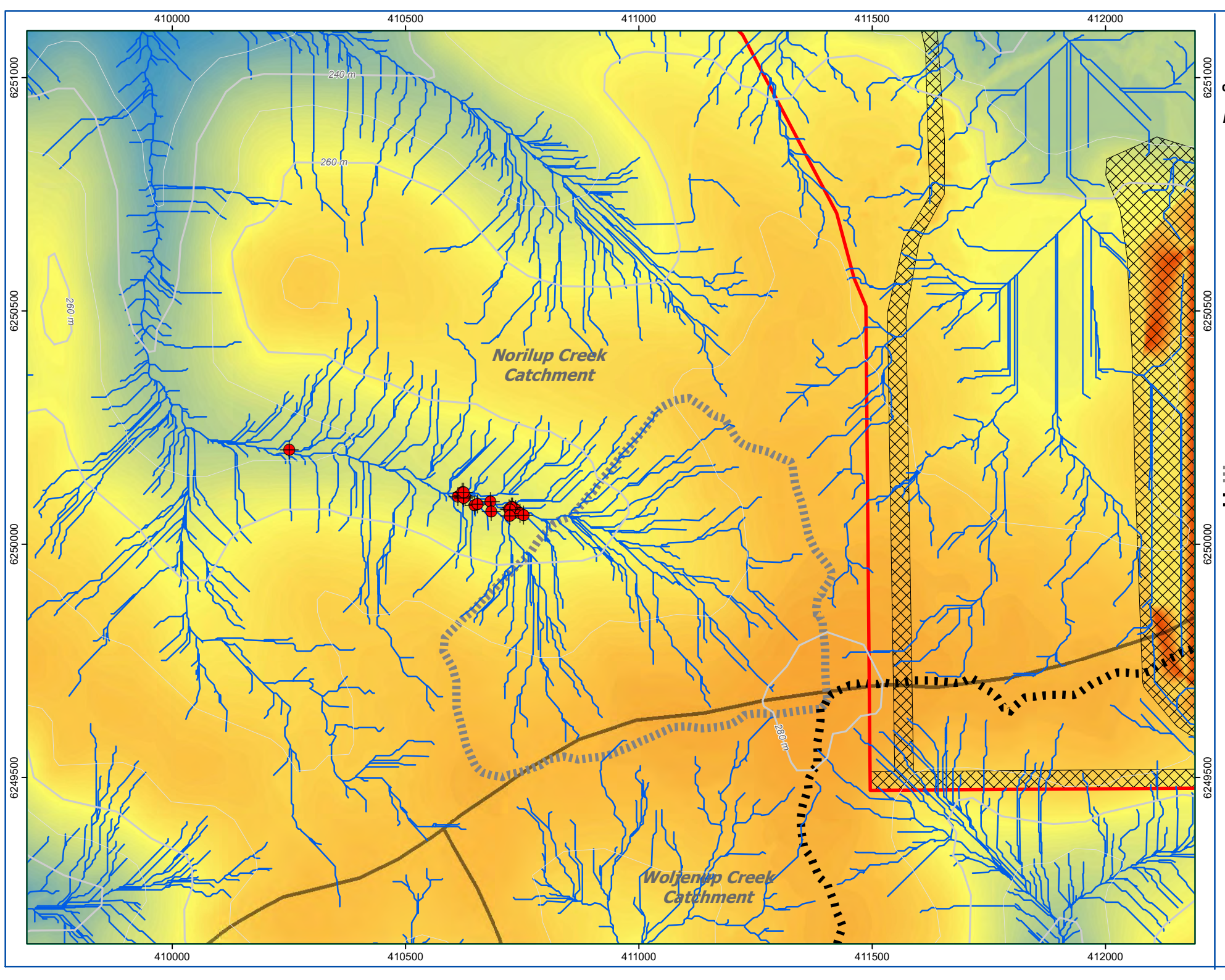
Alteration of natural topography

Establishment of new or expanded landforms and infrastructure can potentially impact on surface water flows through removal of vegetation and associated groundwater drainage patterns on a local scale through alteration of the natural topography. Drainage patterns within the Greenbushes area have been subject to a long history of alteration as a consequence of continued mining activity in the area, by various mining techniques including dredging, since the late 19th century. The expanded open cut will increase the capture of rainfall and runoff, roads and new infrastructure may intercept surface water flows within the surface water catchments of the MDE, expanded and new landforms (Floyds WRL, TSF4) may intercept surface water flows and contribute additional flows from the constructed slopes.

Site drainage has been engineered to collect surface water flows and seepage from landforms as part of the Mine's water management strategy. The Mine relies largely of surface water to provide the majority of supply therefore all potentially contaminated waters from processing, landforms or seepage are directed into the mine water circuit for use. Talison will continue to manage surface water flows within the expanded MDE to collect potentially impacted flows for water supply. This is not expected to have a significant impact on surrounding vegetation as this approach to surface water management is already implemented at the mine.

The drainage system which supports the known population of *Caladenia harringtoniae* could potentially be impacted by alterations to hydrological flows which may affect the health of the population. Mapping and assessment of the surface water catchments within the area surrounding the recorded population indicates that run-off from the activities and landforms within the MDE drains internally in the MDE and will not impact on the sub-catchment within which the *Caladenia harringtoniae* occurs.

The Mine does not interact with any of the watercourses in which the sub-catchment the C. *harringtoniae* population has been identified. It is therefore not expected that the habitat of the recorded population of this species will be directly or indirectly affected by the Mine expansion. An illustration of predicted surface water flow and catchments in relation to the identified *Caladenia harringtoniae* location is included in Figure 10.



Greenbushes Lithium Mine

Surface water catchments in relation to *Caladenia harringtoniae* location

Legend

Caladenia harringtoniae

Elevation (m AHD)

Contours

5m

Index (20m)

2031 Indicative Surface Flow

Proposed Development Areas

Subcatchments

South West Catchments (GHD Hydrology study)

Name

West

WoljenupCreek SubCatchment

Predictive 2031 Surface Model

Value

High : 300 AHD

Low : 202 AHD

N

0 50 100 150 200

Meters

1:10,000

Datum: GDA94

Projection: MGA Zone 50

Date:	30/09/2018
Status:	Final
Figure:	10
Sheet Size:	A4
Internal Reference:	Pred2031
Drawn by:	CG
Requested by:	CG

Talison Lithium

4.5.4 Dust causing reduced vegetation health

Dust can potentially impact the health and condition of vegetation. If dust particles settle and accumulate on the surface of the leaves of vegetation it can block stomata causing reduced transpiration and photosynthesis and an associated decline in plant health. Mining activities (blasting and ore/waste handling), ore processing, land clearing and open areas such as stockpiles, WRL and TSF are likely to generate dust. Opportunities for dust emissions are expected to increase as a result of the Mine expansion due to increased mining activity, open areas, land clearing and vehicle movements however Talison has established practices to control emissions.

Dust can potentially travel long distances depending on particle characteristics, weather conditions and topography (Turner 2013). There is therefore potential for dust impacts to vegetation outside of the MDE, however this is considered unlikely to occur with implementation of effective dust mitigation practices which limit the generation of dust. Talison currently implements a range of effective dust mitigation measures (further discussed in section 6.6) and vegetation within the surrounds of the Mine does not currently show signs of decline as a result of dust impacts indicating the effectiveness of these measures.

4.5.5 Vegetation loss due to bushfire

There is a low risk of accidental fires being ignited as a result of mining activities within the MDE. More than half of the MDE is currently comprised of cleared area for mining activity and water storage, and is unlikely to support a fire. The cleared area will increase as the Mine is expanded further reducing fuel levels. As mining activities are predominantly undertaken within cleared areas it is unlikely that a fire will become established in the operational area and spread to the surrounding vegetation. In the unlikely event a fire occurs that spreads beyond the active mining area, widespread, but temporary, damage to vegetation within the surrounding State Forest 20 areas could occur. Robust emergency planning and management measures will reduce the likelihood of fire spread beyond the MDE.

Native vegetation clearing is the activity most likely to potentially cause a bushfire as it is undertaken in vegetated areas where there are fuel loads which could potentially support a bushfire. Effective management of clearing activities will minimise the risk of bushfire as a result of clearing activity and robust emergency management procedures will ensure a quick response to prevent fire spread if an accidental ignition occurs. There is no record of bushfires resulting from the Mine throughout the past 30 years of open pit mining activity and the risk of one being generated as a consequence of the Mine expansion is considered to be very low.

4.6 Mitigation

4.6.1 Avoid

The Proposal is an expansion of an existing mining operation that has been operated for over 30 years. Mineral resource developments are limited in the extent they can be moved from the location where the resource has been identified. Therefore, due to the nature of the Proposal being an expansion of an existing mineral resource development, the location of infrastructure and landforms is restricted by existing infrastructure and landforms, as well as the location of the ore body. Key constraints when planning the location of infrastructure and landforms for the expansion include:

- South West Highway to the immediate east of the proposed Floyd's WRL footprint;
- Greenbushes townsite immediate north of the existing open pits;
- Water storage dams to the west of the mining and processing area; and

- The location of the ore body which could potentially be sterilised through placement of infrastructure and landforms.

The proposed clearing required for the Proposal cannot be avoided as it is necessary to enable the Mine expansion to occur. Talison will wherever practicable use existing cleared or disturbed and rehabilitated areas for the development in preference to clearing remnant vegetation.

4.6.2 Minimise

The key measures to minimise potential impacts to flora and vegetation associated with the Proposal are summarised in Table 16. The management plans and procedures listed are currently implemented at the Mine as part of Talison's ISO 14001 certified EMS and therefore undergo review in accordance with the EMS requirements.

Table 16 Mitigation measures to minimise flora and vegetation impacts

Potential impact	Mitigation Measures to Minimise Impact

Vegetation clearing	• Talison will implement a Conservation Significant Flora and Native Vegetation Management Plan (Appendix E)
	• Talison has preferentially located landforms and infrastructure in existing cleared areas (or areas which have previously been disturbed and rehabilitated) where possible to avoid unnecessary vegetation clearing.
	• Roads and infrastructure corridors in particular will maximise use of existing cleared, or disturbed and rehabilitated areas, to avoid remnant native vegetation clearing where practical.
	• Talison will consider the location of identified *Acacia semitrullata* populations when planning the explosive storage, batching facility and access roads position to avoid removal where practical to do so.
	• Implementation of the Talison Clearing Disturbance Criteria and Permit Procedure. Key requirements of the procedure include:
	  • Internal permits must be granted before clearing can occur;
	  • All clearing areas must be demarcated prior to clearing; and
	  • All clearing areas must be surveyed after clearing to confirm the area cleared is within the approved area and for entry into the GIS clearing database.
	  • An appropriately timed targeted survey for *Caladenia harringtoniae* will be conducted prior to clearing

Potential impact	Mitigation Measures to Minimise Impact

Introduction, spread or abundance increase of weeds or plant pathogens	• Implementation of the Talison Weed and Hygiene Management Plan (Appendix E). Key requirements of the Plan include:
	  • Adhere to the Talison Vehicle Hygiene Form which requires vehicles/equipment to be clean on entry to the Mine, subject to inspection and cleaned down if required. Vehicles leaving the mine site that have been working in the field are required to be cleared prior to leaving.
	  • Adhere to the Talison Dieback Work Procedure.
	  • Signage and traffic controls at entry points into uninfected areas.
	  • Treatment of uninterpretable areas to be uninfected for the purposes of hygiene management.
	  • Requirements for clean down points and cleaning of vehicles prior to entering uninfected areas or if travelling from an infected area to an uninfected or uninterpretable area.
	  • Inclusion of information on weeds, dieback and vehicle hygiene requirements in the Site Induction.
	  • Greencard training for relevant employees.
	  • GIS records of weed and dieback infestation
	  • Inspection of proposed clearing areas for weed infestations.
	  • Lists key known weeds within the MDE and recommended controls.
	• Proposed clearing areas will have been assessed for dieback presence within two years prior to clearing occurring.
	• In accordance with Talison's Working Arrangements with DBCA, prior to any new disturbance within state forest areas a DBCA Dieback Management Plan is submitted for approval.
	• Employment of a full time Weed Control Officer who assesses weed presence and develops the annual weed control plan. Additional control resources are employed where necessary to implement weed control.

Changes to vegetation health associated with hydrological changes	• Progressive clearing of new infrastructure and landform areas only when required to limit the potential for groundwater level rise. • Diversion structures will be used where necessary to direct surface flows around constructed landforms and infrastructure to join natural drainage lines. • Road design and location will be cognisant of maintaining surface water flows and drainage. • The TSF4 design incorporates underdrainage to minimise the potential for seepage to occur. • Progressive rehabilitation of WRL and TSF embankments to minimise flows from the embankments. • Surface drainage features will be designed and installed to manage runoff from landforms.

Potential impact	Mitigation Measures to Minimise Impact
Reduced vegetation health due to dust	• Implementation of the Talison Dust Management Plan. Details of the key requirements of the Plan are included in section 6.6.1. • Establishment of up to four dust deposition gauges to monitor cumulative dust emissions around the MDE boundary.
Vegetation loss due to bushfire	• Implementation of the Talison Greenbushes Operations Hot Work Permit System. • Implementation of the Talison Emergency Management Plan in the event of a fire. • Clearing activities will not be undertaken when the Fire Danger Rating is severe or higher. • Equipment and vehicles undertaking native vegetation clearing activities will be fitted with a fire extinguisher.

4.6.3 Rehabilitate

Talison implements a DMIRS approved Mine Closure Plan (2016 REG ID 60857) which undergoes review of a three yearly basis. The Mine Closure Plan details the rehabilitation and closure requirements for the Mine. A revised plan incorporating the Mine expansion is currently in development and will be submitted to DMIRS with the Mining Proposal for the expansion. The key measures to rehabilitate potential impacts to flora and vegetation associated with the Proposal are summarised in Table 17.

Table 17 Mitigation measures to rehabilitate flora and vegetation impacts

Potential impact	Measures to Rehabilitate Impact
Vegetation clearing	• Update the DMIRS approved 2016 Mine Closure Plan to include the Mine expansion (in progress) and submit with the Mining Proposal. The plan includes closure objectives and completion criteria related to rehabilitation. • Progressive rehabilitation of disturbed areas where possible, as per the DMIRS approved Mine Closure Plan. This includes the WRL and outer batters of the existing TSFs that are in their final form. Areas active for the duration of mining activity (such as TSF4 and the surface of existing TSFs) will be rehabilitated at the end of life. • The objective of rehabilitation is to establish a self-sustaining heath community with selected attributes compatible with surrounding Jarrah/Marri forest, and landforms that blend with the Mine's undulating scarp location. • Growth medium is applied to rehabilitation areas to improve the likelihood of suitable vegetation establishing. Growth medium can comprise topsoil and/or weathered regolith material that has proven suitable for rehabilitation of current mining landforms. • Rehabilitation areas are planted with seedlings, including *Corymbia calophylla* (Marri), *Eucalyptus marginata* (Jarrah), *Eucalyptus patens* (Blackbutt) and *Eucalyptus rudis* (Flooded Gum). The rehabilitation areas are direct sown with provenance seed by hand which is typically sourced from within 50 km of Greenbushes. • Seed mixes are reviewed and modified dependant on the type of landform being rehabilitated, recommendations of annual rehabilitation monitoring, and availability of seed.
Weed spread	• Ongoing weed management is undertaken, in rehabilitation areas with treatment during the first three growing seasons to minimise weeds and promote native vegetation growth. Weed spraying is undertaken in late winter or early spring. • Annual monitoring of rehabilitation includes assessment of weeds with recommendations for management requirements included in the assessment. • Seeding with native species at the earliest opportunity is a key undertaking to prevent weed colonisation of disturbed areas, even if those areas may require disturbance again in the future. • Ongoing weed control is undertaken on growth medium stockpiles where required to minimise weed infestation.

4.7 Predicted outcome

The Greenbushes area has been extensively disturbed over a long history of mining within the region, farming and logging activity. The Mine is located within State Forest 20 and therefore impacts to flora and vegetation associated with the Mine expansion will reduce the area of protected vegetation within the South West Region, albeit at a small scale relative to the area of protected vegetation in the region. Talison has maximised the use of existing cleared and disturbed and rehabilitated areas for the Mine expansion to minimise the amount of remnant vegetation clearing required. Talison considers that the impacts on flora and vegetation associated with the proposed Mine expansion do not significantly impact on the biological diversity and ecological integrity on a local or regional level.

Therefore, it is expected that the Proposal can meet the EPA objective for this factor.

5. Terrestrial Fauna

5.1 EPA Objective

The EPA applies the following objective in its assessment of proposals that may have a significant effect on terrestrial fauna:

To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

For the purposes of EIA, terrestrial fauna are defined as animals living on land or using land (including aquatic systems) for all or part of their lives. Terrestrial fauna includes vertebrate (birds, mammals including bats, reptiles, amphibians, and freshwater fish) and invertebrate (arachnids, crustaceans, insects, molluscs and worms) groups (EPA 2016c).

5.2 Policy and guidance

- Environmental Factor Guideline Terrestrial Fauna (EPA 2016c).
- Technical Guidance Sampling methods for terrestrial vertebrate fauna (EPA 2016d).
- Technical Guidance Terrestrial Fauna Surveys (EPA 2016e).
- Technical Guidance: Sampling of Short-range Endemic Invertebrate Fauna (EPA 2016f).
- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011).
- *Wildlife Conservation Act 1950.*
- *Biodiversity Conservation Act 2016.*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Conservation and Land Management Act 1984* (CALM Act).

5.3 Receiving environment

The following fauna studies have been undertaken within Talison's Greenbushes mining leases which have informed this assessment:

- Biologic (2011) Greenbushes Level 1 Fauna Survey (Appendix B);
- Biologic (2018a) Greenbushes Targeted Vertebrate and SRE Invertebrate Fauna Survey (Appendix B);
- Biologic (2018b) Greenbushes Vertebrate, SRE and Subterranean Fauna Desktop Assessment (Appendix B);
- Kirkby (2018a) Black Cockatoo Survey, Talison Mining, Greenbushes (Appendix C);
- Kirkby (2018b) Additional Black Cockatoo Survey at the Mine Services Area, Proposed Mining Expansion, Greenbushes (Appendix C)
- Harewood (2018a) Greenbushes Black Cockatoo Tree Hollow Review, Talison Lithium Pty Ltd (Appendix C);
- Harewood (2018b) Greenbushes - Preliminary Western Ringtail Possum Surveys – June 2018 (Appendix D);
- Onshore Environmental Consultants (2018c) Western Ringtail Possum - Desktop Regional Habitat Mapping (Appendix D); and
- Onshore Environmental Consultants (2018d) Targeted Western Ringtail Possum Survey Greenbushes Mine (Appendix D);

- Onshore Environmental Consultants (2018e) Significant Tree Survey Talison Lithium (Appendix C).

The Biologic 2011 study was a Level 1 Fauna survey (as defined by EPA Technical Guidance Terrestrial Fauna Surveys (EPA, 2016j) undertaken in Spring 2011 across all of the Talison Greenbushes mining leases covering a total area of 10,059.82 ha (referred to as the **Greenbushes Study Area**). This fauna study was the first broad scale assessment of all Talison's Greenbushes mining leases and is regarded as a baseline survey for environmental approvals, impact assessment and closure planning. The study included a desktop assessment of previous fauna surveys and records within the Greenbushes Study Area, a field survey to map and describe fauna habitats and species present, and targeted surveys for fauna of conservation significance including habitat tree assessments for the three threated black cockatoo species (Biologic 2011). The assessment included nocturnal surveys, bat recording, motion camera recording and opportunistic surveys of tracks, scats, other traces of fauna, and incidental recordings.

A review of the Biologic 2011 survey was undertaken in early 2018 with the primary objective being to update information from the assessment and assess the likelihood of occurrence of conservation significant fauna, Short Range Endemic (**SRE**) and subterranean fauna within the MDE. A targeted survey for vertebrate fauna of conservation significance and SRE invertebrates was also undertaken within the MDE which included all areas outside the existing approved disturbance boundary of the mine (CPS 5056/2) (referred to as the **Proposal Study Area**). The survey was undertaken in February 2018 (Biologic 2018a) and included motion camera recording, targeted searches, opportunistic records and nocturnal surveys, as well as active foraging and leaf litter and soil sifting for SRE's. The Biologic 2018 targeted vertebrate fauna survey was unable to confirm or otherwise the presence, or use of habitat within the MDE, by the Critically Endangered Western Ringtail Possum (*Pseudocheirus occidentalis*). Therefore, a further targeted survey for the species was conducted by Greg Harewood in June 2018 (Harewood 2018a). Additional desktop and in field assessments of suitable habitat for WRP based on fire and logging history and vegetation was undertaken by Onshore Environmental (2018c and 2018d) to support Harewood's survey.

A ground based targeted black cockatoo survey was undertaken by recognised black cockatoo Researcher Tony Kirkby in January/February 2018. The survey was undertaken within blocks of vegetation within the MDE to assess the suitability for foraging and breeding by the three black cockatoo species known from the Greenbushes area. The survey report was peer reviewed by Mike Bamford and updated based on feedback received. Following this survey, Talison recognised that due to the age of the Biologic (2011) black cockatoo habitat tree assessments, the status of the trees identified during the survey was unconfirmed. Additionally there are limitations to the assessment of suitable tree hollows from ground level.

To address these issues in June 2018 Greg Harewood was engaged to undertake an aerial (drone) survey of recorded trees with hollows suitable for black cockatoo breeding (within and in proximity to the MDE). The purpose of the survey was to confirm the presence of trees with suitable breeding hollows from the earlier 2011 survey, and assess the characteristics of confirmed hollows from the Biologic 2011 and Kirkby 2018a surveys for their potential to represent known or suitable black cockatoo breeding hollows (Harewood 2018a). The survey outcomes and report were peer reviewed by Tony Kirkby.

One area of the MDE (the north east corner where the MSA will be developed) was not included in Kirkby's survey therefore a survey of this area was undertaken later in the year to assess potential breeding hollows in the area (Kirkby 2018b). A field survey of potential black cockatoo breeding habitat within areas of state forest surrounding the MDE was also undertaken by

Onshore Environmental (2018e) to compare the density of potential breeding habitat within the MDE, which has been impacted by logging, fire and mining activity, to the surrounding area.

5.3.1 Fauna habitats

Fauna habitat types were initially mapped by Biologic (2011) within the Greenbushes Study Area. Four natural and seven anthropogenic habitat types were mapped. The habitat types identified are directly correlated to the vegetation communities mapped within the area by Onshore Environmental 2012. Of the habitat types mapped, two natural and five anthropogenic habitats are present within the MDE (Biologic 2018b). A description of fauna habitat types, correlated vegetation communities, and their extent within the MDE is provided in Table 18. The extent of the habitat types within the Greenbushes Study Area and the MDE are illustrated in Figure 11 and Figure 12 respectively. The fauna habitats defined by Biologic are well represented in the immediate vicinity of the MDE (Biologic 2011) and the broader Blackwood district (particularly in State Forest) and are therefore not considered to be restricted or unique to the MDE. .

5.3.2 Ecological linkages

Ecological linkages can be described as ‘a series of (contiguous and non-contiguous) patches of vegetation which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape’ (Molloy *et al* 2009). Axis lines defined in Molloy *et al* 2009 identify patches of remnant vegetation within the South West Region with high connectivity or linkage value.

The MDE is linked to extensive areas of un-fragmented forest to the south west (State Forest 20) and north east (Wilga State Forest). The MDE is located to the east of a north-south aligned South West Regional Ecological Linkage (**SWREL**) Axis Line and south of an east-west aligned SWREL Axis Line (Map 4: Bunbury Wellington Region, Molloy *et al* 2009). Remnant vegetation within the MDE is classified as 1a (vegetation is touching or <100m from a SWREL) and 1b (vegetation is touching or <100m from an area classified as 1a) in association with the SWREL axis lines meaning the area forms part of the ecological linkage. The Proposal is not expected to significantly impact on ecological linkages as fauna will still be able to move around the MDE through vegetation cover.

5.3.3 Fauna diversity

Desktop assessments of vertebrate fauna potentially occurring within the MDE were undertaken by Biologic (2011, 2018b). The assessments were based on review of available literature and searches within a 25 km radius of the following:

- DBCA Naturemap Database;
- DBCA Threatened and Priority Fauna Database;
- Birdlife Australia Birdata Bird Atlas; and
- DotEE Protected Matters Database.

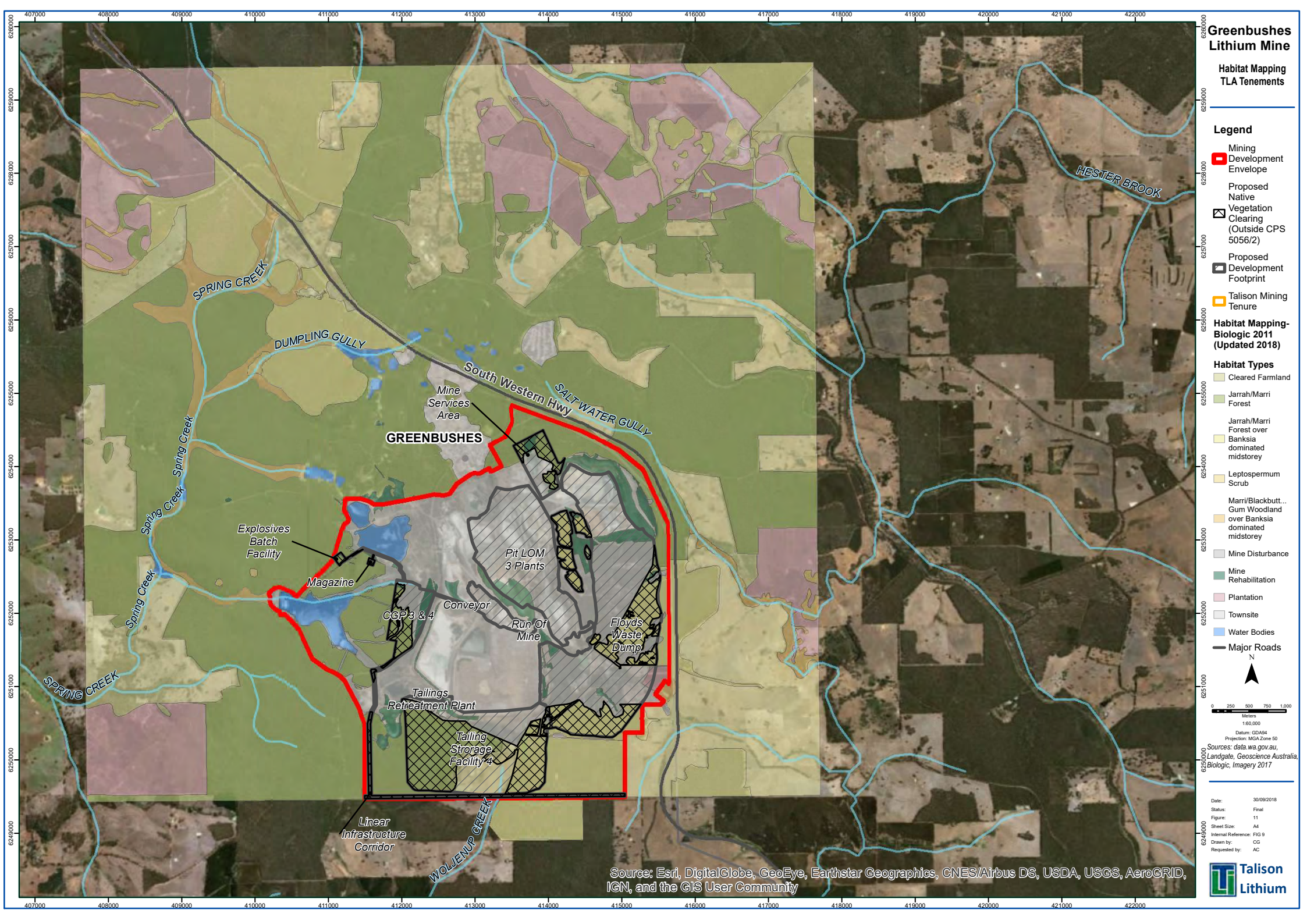
The 2011 desktop assessment identified 196 vertebrate fauna species with the potential to occur within the Greenbushes Study Area. Eighty two of these species were recorded as occurring within the Greenbushes Study Area during the field assessment. The fauna assemblage recorded comprised eight native mammal species, six introduced mammal species, 59 bird species, four reptile species and five amphibian species. The number of reptile species was low due to the cool conditions during the time of the survey (Biologic 2011)

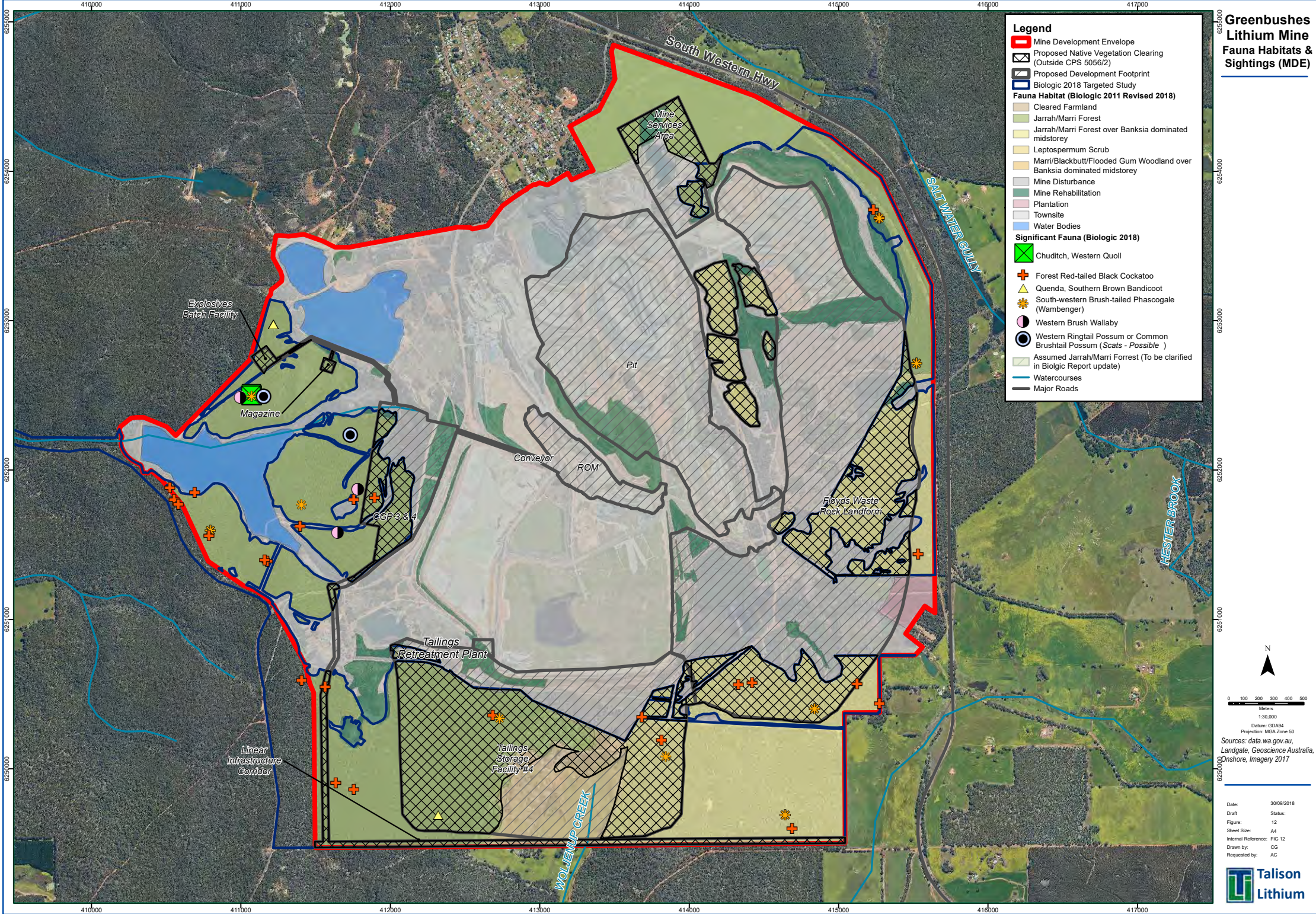
The 2018 desktop assessment identified a total of 291 species of vertebrate fauna which have previously been recorded and/or have the potential to occur within the MDE. This comprised 31 native mammals, 10 non-native mammals, 169 native birds, six non-native birds, 45 reptiles, 19 amphibians and 11 fish species. Fifty three vertebrate fauna species were also recorded directly and/or via secondary evidence, comprising 14 mammals (including six introduced species), 30 birds, seven reptiles and two amphibians Biologic (2018a).

Table 18 Fauna habitats within the Greenbushes Lithium Mine Expansion MDE (Biologic 2011, 2018a, 2018b)

Habitat	Extent within the Greenbushes Study Area (ha)	Extent within the MDE (ha)	Description	Significant vegetation species associated with habitat	Vegetation type (Onshore 2012)
Jarrah (*E. marginata*)/Marri (*C. calophylla*) forest over Banksia dominated midstorey	1,240.9	267.4	*E. marginata/C. calophylla* forest over *Banksia grandis/Persoonia longifolia* dominated scrub on upper hill slopes and plateaux	*C. calophylla* *E. Marginata* *B. grandis* *P. longifolia*	1a, 2a, 2b
Jarrah/Marri forest	3,946	403.9	*E. marginata/C. calophylla* forest over scrub on undulating hill slopes and drainage lines.		1b, 2d
Water bodies	117	74.8	Comprises large open water bodies of the study area, appear to be man-made structures	NA	6
Plantation	1,211.4	8.9	Artificial pine plantations with the MDE	*Pinus* spp	4
Rehabilitation	140.8	129.4	Areas which have been rehabilitated within the MDE	NA	8
Cleared Farmland	1931.3	52.1	Open paddocks, sometimes containing remnant trees	NA	5
Mine Disturbance	1054.7	1052.7	Areas impacted by mining activity	*Pinus* spp.	9

Note – Habitats identified in the Greenbushes Study Area (Biologic 2011) not occurring within the MDE are not included in the table.


Greenbushes Lithium Mine
Habitat Mapping TLA Tenements
Legend
Mining Development Envelope
Proposed Native Vegetation Clearing (Outside CPS 5056/2)
Proposed Development Footprint
Talison Mining Tenure
Habitat Mapping-Biologic 2011 (Updated 2018)
Habitat Types
Cleared Farmland
Jarrah/Marri Forest
Jarrah/Marri Forest over Banksia dominated midstorey
Leptospermum Scrub
Marri/Blackbutt... Gum Woodland over Banksia dominated midstorey
Mine Disturbance
Mine Rehabilitation
Plantation
Townsite
Water Bodies
Major Roads
N
0 250 500 750 1,000
Meters
1:60,000
Datum: GDA94
Projection: MGA Zone 50
Sources: data.wa.gov.au, Landgate, Geoscience Australia, Biologic, Imagery 2017
Date: 30/09/2018
Status: Final
Figure: 11
Sheet Size: A4
Internal Reference: FIG 9
Drawn by: CG
Requested by: AC
Talison Lithium
SPRING CREEK
DUMPLING GULLY
South Western Hwy
SALT WATER GULLY
HESTER BROOK
Spring Creek
Mine Services Area
GREENBUSHES
Explosives Batch Facility
Magazine
Pit LOM 3 Plants
Conveyor
CGP 3 & 4
Run Of Mine
Floyds Waste Dump
Tailings Reticulation Plant
Tailing Storage Facility 4
Linear Infrastructure Corridor
WOLJENUP CREEK
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Greenbushes Lithium Mine
Fauna Habitats & Sightings (MDE)
Legend
Mine Development Envelope
Proposed Native Vegetation Clearing (Outside CPS 5056/2)
Proposed Development Footprint
Biologic 2018 Targeted Study
Fauna Habitat (Biologic 2011 Revised 2018)
Cleared Farmland
Jarrah/Marri Forest
Jarrah/Marri Forest over Banksia dominated midstorey
Leptospermum Scrub
Marri/Blackbutt/Flooded Gum Woodland over Banksia dominated midstorey
Mine Disturbance
Mine Rehabilitation
Plantation
Townsite
Water Bodies
Significant Fauna (Biologic 2018)
Chuditch, Western Quoll
Forest Red-tailed Black Cockatoo
Quenda, Southern Brown Bandicoot
South-western Brush-tailed Phascogale (Wambenger)
Western Brush Wallaby
Western Ringtail Possum or Common Brushtail Possum (Scats - Possible)
Assumed Jarrah/Marri Forrest (To be clarified in Biolgic Report update)
Watercourses
Major Roads
South Western Hwy
Mine Services Area
SALT WATER GULLY
Explosives Batch Facility
Magazine
Pit
Conveyor
ROM
CGP 3 &4
Floyds Waste Rock Landform
HESTER BROOK
Tailings Retreatment Plant
Tailings Storage Facility #4
Linear Infrastructure Corridor
WOLLENUP CREEK
410000
411000
412000
413000
414000
415000
416000
417000
6255000
6254000
6253000
6252000
6251000
6250000
N
0 100 200 300 400 500
Meters
1:30,000
Datum: GDA94
Projection: MGA Zone 50
Sources: data.wa.gov.au, Landgate, Geoscience Australia, Onshore, Imagery 2017
Date: 30/09/2018
Draft
Status:
Figure: 12
Sheet Size: A4
Internal Reference: FIG 12
Drawn by: CG
Requested by: AC
Talison Lithium

5.3.4 Conservation significant fauna

Biologic (2018b) undertook database searches and literature reviews to identify conservation significant fauna species potentially occurring within the MDE. Based on the results of the database searches and literature review, 44 conservation significant fauna species were identified as having the potential to occur within the MDE. Fauna surveys confirmed the presence of seven conservation significant species (Biologic 2018b) and possible evidence of another (Western Ringtail Possum) was recorded. The sighting locations are illustrated in Figure 12. Of the remaining 36 species identified as having the potential to occur one species is deemed highly likely, two likely, six possible, and 27 rarely, unlikely or highly unlikely to occur. This determination was based on species distribution, previous records and the habitats known to occur. The 17 conservation significant fauna identified within the MDE or considered highly likely, likely or possible to occur are detailed in Table 19.

Records of conservation significant fauna within the MDE are from the Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats. The greatest density of conservation significant fauna records are from the northwest sector of the MDE. This area adjoins water bodies as well as a large area of relatively undisturbed state forest to the west which is likely to be preferred habitat. This area also has more mid-storey tall shrubs and sedges providing greater protection for native fauna and it is linked to the Schwenke's wetland area to the immediate north of the MDE, which is also likely to be a preferred habitat. This is due to the abundance of prey likely to occur in the area, riparian habitat and areas of the surrounding vegetation having experienced a long period of time since logging has occurred (Onshore Environmental 2018c). The Schwenke's area is a historic mining void which has been converted into an artificial wetland area by the Blackwood Basin Group and Talison with the aim of attracting wetland species, primarily birds, to the area (Christensen 2016).

Table 19 Conservation significant fauna species summary for the MDE

Species	EPBC Act listing (Cwth)	WC Act or DBCA Listing (WA)	Likelihood of Occurrence within the MDE (Biologic 2018b)
Mammals			
Western Quoll/Chuditch (*Dasyurus geoffroii*)	Vulnerable	Vulnerable	Confirmed present. Recorded within a single transect in the Jarrah/Marri forest habitat in the northwest of the MDE (Biologic 2018a).
Wambenger Brush-tailed Phascogale (*Phascogale tapoatafa wambenger)*	NA	Conservation Dependant	Confirmed present. Recorded from one location in the southeast of the MDE during the Biologic 2011 survey and 15 locations in the northwest, southeast and northeast of the MDE during the Biologic 2018a survey. The recordings were within Jarrah/Marri forest, Jarrah/Marri forest over Banksia and to a lesser extent rehabilitated areas habitats. The rehabilitated areas are not considered core habitat as they lack suitable hollow-bearing trees for nesting.

Species	EPBC Act listing (Cwth)	WC Act or DBCA Listing (WA)	Likelihood of Occurrence within the MDE (Biologic 2018b)
Southern Brown Bandicoot (*Isoodon fusciventer*)	NA	P4	Confirmed present. Recorded from two locations in the northwest and south of the MDE during the Biologic 2018a survey within Jarrah/Marri forest habitat.
Western Brush Wallaby (*Notamacropus irma*)	NA	P4	Confirmed present. Recorded from six motion cameras in the northwest of the MDE during the Biologic 2018a survey within Jarrah/Marri forest habitat.
Western Ringtail Possum (*Pseudocheirus occidentalis*)	Critically Endangered	Critically Endangered	Possibly recorded - Secondary evidence, scats, potentially belonging to the WRP were recorded in the Jarrah/Marri forest habitat within the northwest of the MDE during Biologic 2018a survey and there are two confirmed records from approximately 320 m north of the MDE. The scats cannot be confirmed as from the WRP due to the similarity with scats of the Common Brushtail Possum which also occurs within the MDE. Further survey effort by Harewood (2018b) and Onshore Environmental (2018d) did not find any further evidence of WRP within the MDE.
Quokka (*Setonix brachyurus*)	Vulnerable	Vulnerable	Possible - recent surveys have identified a population in the Nannup State Forest which is connected to the Greenbushes State Forest in which the MDE is located.
Numbat (*Myrmecobius fasciatus*)	Endangered	Endangered	Possible – species have been recently (2006) recorded within approximately 5 km of the MDE, suitable habitat is present and the MDE is within the species known distribution.
Western Falsistrelle (*Falsistrellus mackenziei*)	NA	P4	Likely – species has a large nightly range and has been recorded within the vicinity of the MDE within similar habitats to what occurs
Water Rat (*Hydromys chrysogaster*)	NA	P4	Possible – the broader Greenbushes area has been assessed as containing suitable habitat (Biologic 2011). Habitats contained within the MDE are less suitable for the species
Birds			

Species	EPBC Act listing (Cwth)	WC Act or DBCA Listing (WA)	Likelihood of Occurrence within the MDE (Biologic 2018b)
Baudin's Cockatoo (*Calyptorhynchus baudinii*)	Endangered	Endangered	Confirmed present. Feeding signs observed within Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats during Biologic 2011 and Kirkby 2018a surveys.
Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	Endangered	Endangered	Confirmed present. Feeding signs observed within Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats during Biologic 2011 and Kirkby 2018a surveys.
Forest Red-tailed Black Cockatoo (**FRTBC**) (*Calyptorhynchus banksii naso*)	Vulnerable	Vulnerable	Confirmed present. Recorded throughout Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats during Biologic 2011, 2018a, and Kirkby 2018a surveys.
Black Bittern (*Ixobrychus flavicollis australis*)	NA	P2	Possible - no recent records of this species in the surrounding area but it possibly occurs as it is within the known distribution and the broader Greenbushes area has been assessed as containing suitable habitat (Biologic 2011).
Barking Owl (southwest population) (*Ninox connivens connivens*)	NA	P3	Possible - no recent records of this species in the surrounding area but it possibly occurs as it is within the known distribution and the broader Greenbushes area has been assessed as containing suitable habitat (Biologic 2011).
Masked Owl (southwest population) (*Tyto novaehollandiae novaehollandiae*)	NA	P3	Highly Likely – new database search has revealed the locality of several recent records including two within 1 km of the MDE. The MDE contains suitable habitat.
Blue billed duck (*Oxyura australis*)	NA	P4	Likely - suitable habitat (deep freshwater lakes) is present within the MDE and it is within the known distribution for the species.
Reptiles			
Dell's Skink (*Ctenotus delli*)	NA	P4	Possible – previously recorded within 8 km of the MDE which contains suitable habitat for the species.

5.3.5 Black Cockatoos

The MDE is within the modelled distribution for three species of threatened black cockatoo (Carnaby's, Forest Red-tailed and Baudin's) and evidence of all three species using the area (and surrounding State Forest 20) has been recorded (Biologic 2011 and 2018a, Kirkby 2018a and 2018b and Harewood 2018a). Black cockatoos are long-lived, slow-breeding birds that nest

in tree hollows, with trees likely to take up to 200 years to develop suitable nest hollows (DotEE 2017). Currently, the overall population trend for all three black cockatoo species is declining due to the loss and fragmentation of foraging and breeding habitat resulting from vegetation clearing (DotEE 2017).

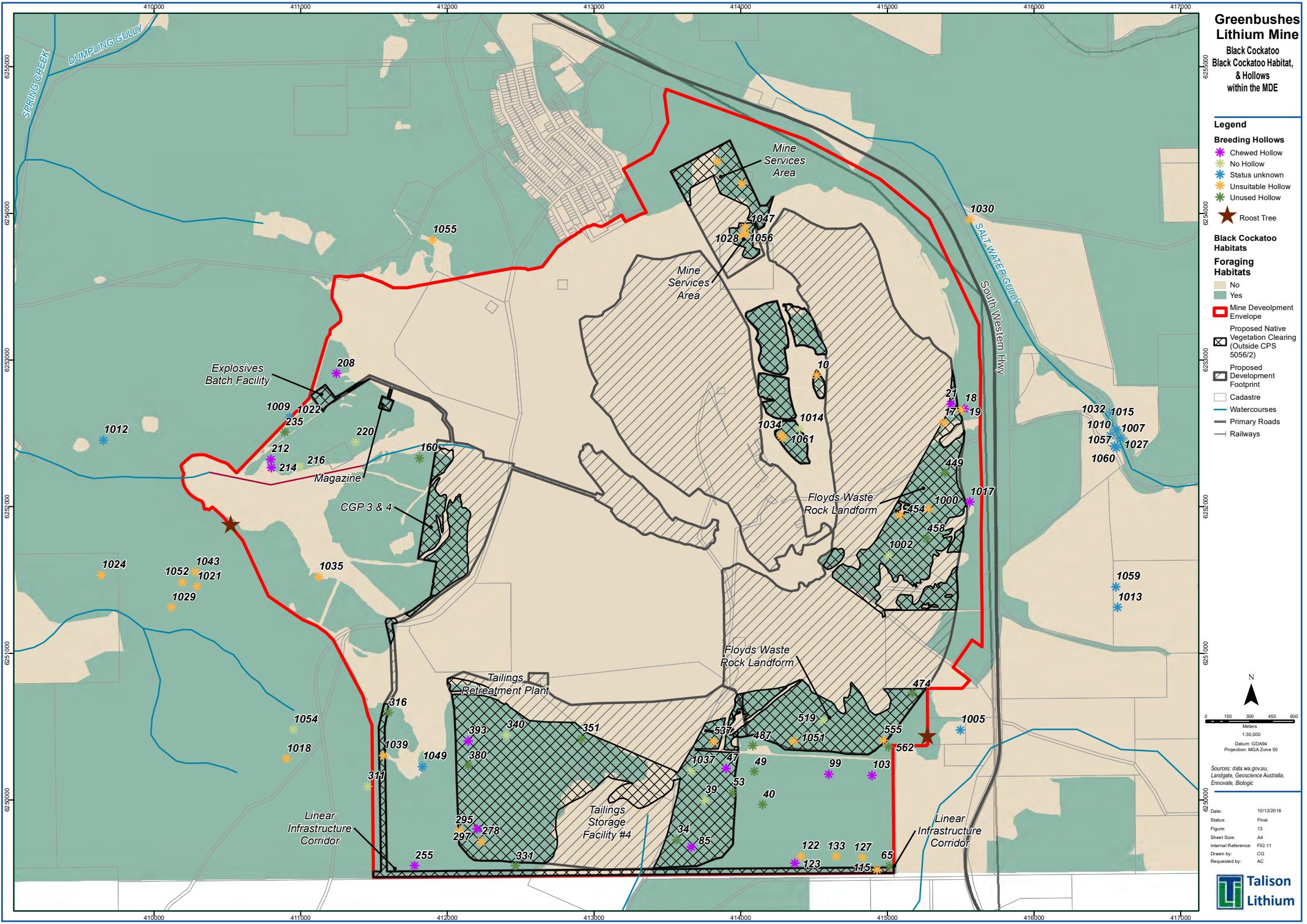
Black cockatoos forage over a large area, feeding on a variety of native and introduced vegetation species. They vary their foraging strategy dependant on the availability of suitable foraging resources which can vary from year to year (DotEE 2017). The protection and management of foraging habitat is as important to the survival of black cockatoos as for breeding habitat, as sufficient foraging resources in proximity to breeding hollows is critical to successful breeding for all three species (DotEE 2017).

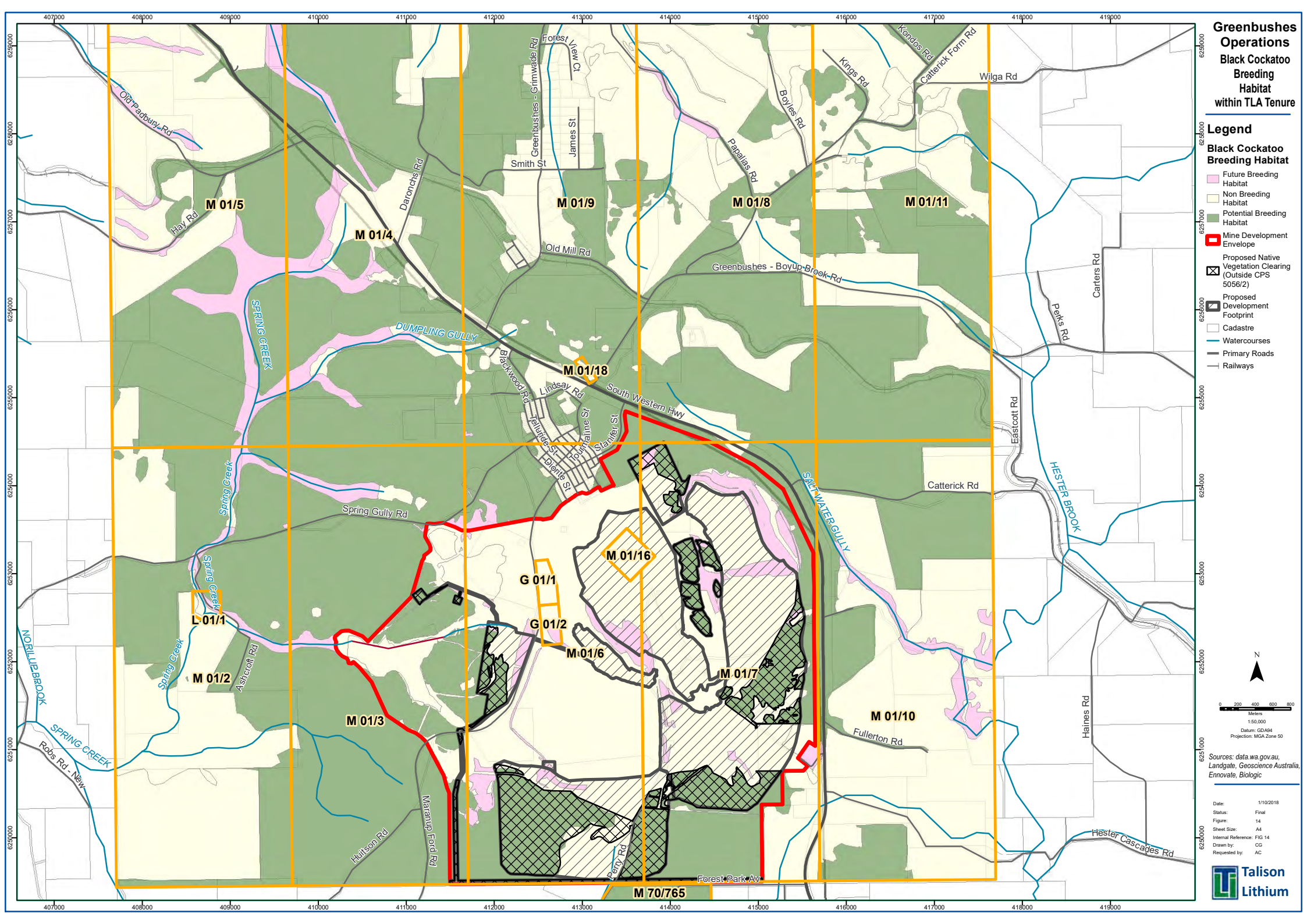
Baudin's and FRTBC mainly occur in dense eucalypt forests in south west WA, especially Jarrah, Marri and Karri forest (DEC 2008). Mature Marri, Jarrah and Karri trees are the preferred breeding habitat of both species. Baudin's breeds in the densely forested areas of the Southern Jarrah Forest bioregion, and after breeding amalgamates to form large flocks which migrate in a north easterly direction searching for food. The FRTBC is a relatively sedentary typically remaining in its breeding areas year round (DotEE 2018) and usually forages within 4 km of roost sights (DEC 2008). FRTBC may preferentially use hollows that are in close proximity to each other, rather than hollows throughout the landscape (DotEE 2018). Both species feed mainly on seeds of Marri but switch to Jarrah and other foraging species (*Banksia* spp., *Hakea* spp., *Dryandra* spp.) when Marri fruits are less abundant. Baudin's also feeds on invertebrate larvae (DEC 2008).

Carnaby's Black Cockatoo is highly mobile and displays a seasonal migratory pattern linked to breeding. Breeding takes place between July to December and mainly occurring in the Wheatbelt but has also been recorded on the Swan Coastal Plain (DPAW 2013). Breeding is primarily within smooth barked eucalypts such as Salmon Gum and Wandoo but has been reported in tree species such as Jarrah and Tuart. During the non-breeding season the majority of birds move to higher rainfall coastal regions. There are some resident populations of the species that do not show breeding migration however none of these are known from the Greenbushes region (DPAW 2013).

Night roosting generally occurs in or near riparian environments or other permanent water sources (DotEE 2017). While breeding, black cockatoos will generally forage within a 6–12 km radius of their nesting site. Following breeding, birds assemble into flocks and move through the landscape searching for food, usually foraging within 20 km of a communal night roost, though in some cases, foraging distances can be greater (DotEE 2017) (exclusive of the FRTBC which typically remains at breeding sites). The nearest documented breeding sites of both Carnaby's and FRTBC are 35 km to the north-west of the MDE at the Whicher Range. The nearest documented breeding site of Baudin's Black Cockatoo is 35 km to the south-west near Nannup. Given the suitable Jarrah/Marri habitat in the general Greenbushes area, the lack of known closer breeding sites, is almost certainly due to lack of survey effort (Kirkby 2018a).

An assessment of foraging and breeding habitat within the Greenbushes Study Area was undertaken by Biologic as part of the 2011 fauna survey (the mapped habitats within the MDE and the broader Study Area are illustrated Figure 13 and Figure 14). A field survey of foraging and breeding habitat, including a targeted ground search for potential black cockatoo breeding trees, within the MDE, expansion areas was undertaken by recognised black cockatoo researcher Tony Kirkby in January/February 2018a and November 2018b (MSA only). An aerial survey to confirm the presence of, and assess the suitability of identified hollows for breeding was undertaken by Harewood (2018a) (excluding the MSA as Harewood's survey was undertaken before Kirkby 2018b).


Greenbushes Lithium Mine
Black Cockatoo Black Cockatoo Habitat, & Hollows within the MDE
Legend
Breeding Hollows
Chewed Hollow
No Hollow
Status unknown
Unsuitable Hollow
Unused Hollow
Roost Tree
Black Cockatoo Habitats
Foraging Habitats
No
Yes
Mine Deveolpment Envelope
Proposed Native Vegetation Clearing (Outside CPS 5056/2)
Proposed Development Footprint
Cadastre
Watercourses
Primary Roads
Railways
Mine Services Area
Explosives Batch Facility
Magazine
CGP 3 & 4
Floyds Waste Rock Landform
Tailings Retreatment Plant
Tailings Storage Facility #4
Linear Infrastructure Corridor
SPRING CREEK
DUMPLING GULLY
SALT WATER GULLY
South Western Hwy
N
0 150 300 450 600
Meters
1:30,000
Datum: GDA94
Projection: MGA Zone 50
Sources: data.wa.gov.au, Landgate, Geoscience Australia, Ennovate, Biologic
Date: 10/12/2018
Status: Final
Figure: 13
Sheet Size: A4
Internal Reference: FIG 11
Drawn by: CG
Requested by: AC
Talison Lithium


Greenbushes Operations
Black Cockatoo Breeding Habitat within TLA Tenure
Legend
Black Cockatoo Breeding Habitat
Future Breeding Habitat
Non Breeding Habitat
Potential Breeding Habitat
Mine Development Envelope
Proposed Native Vegetation Clearing (Outside CPS 5056/2)
Proposed Development Footprint
Cadastre
Watercourses
Primary Roads
Railways
M 01/5
M 01/4
M 01/9
M 01/8
M 01/11
M 01/18
M 01/16
G 01/1
G 01/2
M 01/6
M 01/7
M 01/10
L 01/1
M 01/2
M 01/3
M 70/765
Old Padbury Rd
Hay Rd
Daronchs Rd
Greenbushes - Grimwade Rd
Forest View Ct
James St
Smith St
Boyles Rd
Papalias Rd
Kings Rd
Kondos Rd
Catterick Form Rd
Wilga Rd
Old Mill Rd
Greenbushes - Boyup Brook Rd
Carters Rd
Petks Rd
SPRING CREEK
DUMPLING GULLY
Blackwood Rd
Lindsay Rd
South Western Hwy
Telluride St
Diorite St
Tourmaline St
Stanifer St
Eastcott Rd
HESTER BROOK
SALTWATER GULLY
Catterick Rd
Spring Creek
Spring Gully Rd
Ashcroft Rd
NORILUP BROOK
Robs Rd - New
Hutton Rd
Maranup Ford Rd
Perry Rd
Forest Park Av
Fullerton Rd
Haines Rd
Hester Cascades Rd
N
0 200 400 600 800
Meters
1:50,000
Datum: GDA94
Projection: MGA Zone 50
Sources: data.wa.gov.au, Landgate, Geoscience Australia, Ennovate, Biologic
Date: 1/10/2018
Status: Final
Figure: 14
Sheet Size: A4
Internal Reference: FIG 14
Drawn by: CG
Requested by: AC
Talison Lithium

The assessments found that the MDE contains suitable habitat for breeding, foraging and roosting by black cockatoos. The habitat value within the MDE has been reduced as a result of past mining and timber harvesting activities. These activities have resulted in many of the larger trees suitable for breeding (Diameter at Breast Height (DBH) >500 mm) being removed from the MDE (Biologic 2011).

Biologic (2011) defined most areas of remnant native Jarrah-Marri forest within the Greenbushes Study Area (and within the MDE) as suitable foraging and breeding habitat for black cockatoos based on tree density assessments. The canopy layer in the native vegetation is entirely comprised of Jarrah and Marri and the mid-storey is dominated by *Banksia grandis* trees, all of which are known feeding resources for black cockatoos. Jarrah and Marri are also known to support suitable breeding hollows for black cockatoos. Evidence of foraging by all three species of black cockatoo has been recorded within the MDE as evidenced by chewed Marri nuts and Banksia cones. The most evidence of feeding signs within the MDE was from the FRTBC, and this is the only species of black cockatoo to be directly observed within the MDE (Biologic 2011, Biologic 2018a, Kirkby 2018a).

Based upon the Biologic (2011) and Kirkby (2018a and 2018b) survey of black cockatoo habitat there are approximately 605.8 ha of suitable habitat for foraging and breeding (Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats) within the MDE. Two roost sites (FRTBC) were recorded within the MDE by Biologic 2018a, one near Cowan Brook Dam and the other at the southeast boundary of the MDE. Both roost sites are near permanent water sources and outside the proposed development footprint for the Mine expansion and will therefore be avoided. The nearest known roosting site (FRTBC) outside the MDE is at Schwenkes Dam to the north west (Kirkby 2018a). This area has a higher incidence of roost trees than the MDE with up to 15 roost trees recorded in the area which are being utilised by the FRTBC. The FRTBC has also frequently been observed drinking from a small island within the Schwenkes water (Christensen 2018).

The Kirby (2018a) assessment also found that feeding residues observed from FRTBC ranged from fresh through to old and grey indicating the site is used throughout the year by this species. Feeding residues observed from Baudin's and Carnaby's Black Cockatoo were all older (brown and grey) and more recent residue would have been expected had these species been present in the last breeding season (~Aug-Nov egg laying). Very few feeding residues from Carnaby's Black Cockatoo were observed within the MDE and these were old and grey indicating the species is most likely an intermittent and non-breeding visitor. Although the species using hollows within the MDE has not been confirmed, based on the sedentary nature of the FRTBC, the presence of two roost sites, and the varying age of FRTBC foraging debris observed, it is highly likely to be the FRTBC.

A total of 75 potential breeding trees with hollows were identified within the Greenbushes Study Area during ground based habitat tree assessments undertaken by Biologic (2011). No assessment of whether the hollows had any evidence of use was included in the survey. The Kirkby (2018a) survey covered nine blocks ranging from 30 ha to 158 ha within the MDE. A total of 47 (46 Marri, 1 Jarrah) potential breeding trees with hollows were identified. Twenty-one of the hollows showed evidence of use which ranged from recent to old chewing and wear, indicating potential use by black cockatoos, although none were active at the time of the survey (January/February). Only one had signs of recent chewing). Hollows within the remaining 26 trees identified were not observed to have any signs of use. Kirkby undertook a follow up survey of the location surrounding the MSA in November 2018 and identified three trees with hollows however the trees had no signs of use and whole the hollows had a suitable entrance they appeared to be unsuitable for nesting based on their depth (Kirkby 2018b)

Due to limitations on ground level assessment of the suitability of hollows for breeding, and potential for trees to have been lost in the intervening period since the Biologic 2011 survey (as a result of logging, dieback, storm impact and fire), Talison engaged Greg Harewood to conduct an aerial (drone) survey of the recorded hollow locations. The survey covered 83 previously identified potential black cockatoo breeding trees with hollows within a 1 km buffer of the MDE (Biologic 2011 and Kirkby 2018a). The results of the aerial survey of the potential breeding hollows are summarised in Table 20. Further detail is included in the survey report in Appendix C. The revised number of suitable nest hollows within the MDE based on the aerial survey is 30 (Harewood 2018a).

Table 20 Assessment of hollow suitability of identified potential breeding trees within 1 km of the MDE (Harewood 2018a, Kirkby 2018b)

Hollow Status	Location recorded within the MDE	Located recorded outside the MDE (within 1 km buffer)
Known nesting tree – (chew marks or scratches observed)	14	0
Suitable nest hollow – (adequate size but no observed signs of use)	16	0
Hollow Appears Unsuitable	25	8
No Hollow Seen	8	2
Status Unknown	1	12

Note – the aerial (drone) assessment by Harewood (2018a) was conducted prior to further survey for potential breeding trees outside the MDE by Onshore Environmental (2018d). The table above therefore does not include the additional potential breeding trees with hollows identified by Onshore Environmental in areas outside the MDE (refer to Appendix C for the location of the Onshore Environmental survey transects and potential breeding trees identified). The table also includes three unsuitable hollows recorded within the MDE in the vicinity of the proposed MSA. Survey of these hollows was undertaken by Kirkby (2018b) after the Harwood (2018a) survey was completed.

Biologic (2011) and Kirkby (2018a) conducted an assessment of the number of potential breeding trees (DBH >500mm by counting trees) within the respective survey areas. The Biologic survey (2011) found the density of potential breeding trees to be much higher in the surrounding mining tenure (27 trees/ha) than the Active Mining Area (11 trees/ha). The density of potential breeding trees within the Kirkby (2018a) survey areas ranged from 2.9 to 10.7 trees/ha and averaged approximately six trees/ha.

Further survey effort for potential black cockatoo trees outside the MDE was undertaken by Onshore Environmental (2018e) to compare to the tree density found by Kirkby (2018a) within the MDE. Six transects were assessed in total, ranging between 500 metres and 1.25 kilometres in length, and up to 250 metres in width. The density of potential black cockatoo trees in state forest outside the MDE was found to be higher than within the MDE, ranging from 10.6 to 21.7 trees/ha (average 17.3 trees/ha). Between 7% and 34% of the potential breeding trees identified by Onshore Environmental supported hollows or potential hollows. This compares with the MDE where 0% to 3% of potential breeding trees supported hollows or potential hollows. This is likely due to the past mining and logging activities which have removed many of the larger habitat trees from the MDE (Onshore Environmental 2018e).

Talison continues to fund the maintenance and monitoring of 30 black cockatoo artificial nesting hollows installed in Greenbushes in 2014 and 2015. The artificial nesting hollows were established during the Priority Bittern and Waterbird Biodiversity Enhancement Project (undertaken in an area adjacent to the MDE). Talison has committed to maintaining and monitoring the artificial nesting hollows while they are viable for up to 8 years from installation until at least the end of 2023. The monitoring and maintenance of artificial hollows is important as it can determine the effectiveness of the hollows, can detect the presence of any pest species, and can identify any maintenance or safety requirements. The BBG has been engaged

by Talison to perform monitoring and maintenance of the artificial nesting hollows. The monitoring is scheduled to coincide with the peak breeding season of black cockatoos (between September and December). Studies to date have shown no utilisation of the artificial nest hollows by black cockatoos.

5.3.6 Western Ringtail Possum

The WRP was formerly distributed throughout much of the south western Australia (de Tores, 2008) but is now confined to five regional locations the near-coastal area between Bunbury and Augusta, the south coast between Walpole and Albany, the lower Collie River Valley, Harvey River, and at the Perup Nature Reserve and the surrounding forest blocks near Manjimup (de Tores 2008).

Habitat preference differs across its known range. The WRP is associated with peppermint dominated forest and woodland with a tuart *Eucalyptus gomphocephala* canopy in some areas along the coast south of Bunbury, in peppermint forest in the Busselton area and in Jarrah, Wandoo (*Eucalyptus wandoo*) and Marri forest in inland localities (de Tores 2008). The Jarrah Forest is well known to have low stocking rates of WRP in unmanaged areas (pers comm A. Wayne 2018, DBCA). Three management zones have been identified as areas known to currently or previously support large numbers of this species. These include the Swan Coastal Plain zone (1), Southern Forest zone (2) and South Coast zone (3) (DPAW 2017). The Mine is located approximately 13 km to the north of the Southern Forest Zone.

The MDE falls within the distribution of WRP. Six records of WRP have been recorded within the vicinity of the Mine (DBCA, 2018). There are two records of the species approximately 320 m north of the Mine from August and December 2014 (DBCA, 2018). The remaining four records are located within 20 km of the Mine (DBCA, 2018). There is a notable density of NatureMap records between Balbarrup and Mayanup (~30km south east of the Mine) as well as around Manjimup (~40 km south of the Mine). Home ranges for the species vary between 0.5 and 2.5 hectares and consist of 3-8 nesting sites.

Scats possibly belonging to WRP (owing to their size and shape) were found in two locations in the Jarrah/Marri Forest habitat in the north-western portion of the MDE. The scats could not be confirmed as from the WRP due to similarity with scats of the Common Brushtail Possum (*Trichosurus vulpecula)* within the Jarrah forest. The Common Brushtail Possum was abundant throughout the MDE (Biologic 2018a, Onshore 2018d). Undisturbed habitat located in the north-west and south-east of the MDE were assessed by Biologic (2018a) as being likely to support the species, particularly as these areas adjoin large expanses of similar, relatively undisturbed habitat.

As the presence of WRPs was not confirmed by the Biologic survey, Greg Harewood was engaged to undertake a further targeted survey for WRPs and suitable habitat both within the MDE, and at the nearby Schwenke's Dam (outside the MDE). The survey identified three old and unmaintained WRP dreys in paperbark trees near the Schwenke's Dam (outside the MDE) (Harewood 2018b). The dreys are in close proximity to two records of WRP made on motion camera's by the Blackwood Basin Group in 2014 (P. Christensen pers. comm 2018.). No other evidence of WRP was found during the survey work in and around the MDE. Harewood concluded that *"much of the vegetation observed seems to represent poor or marginal habitat for WRPs at best".* The conclusion was based on the fact that much of the area has been historically logged and lacks a coherent mid-storey component, a structural unit most often favoured by WRPs (Harewood 2018b). Based on the paucity of WRP records shown in NatureMap for the wider area, it appears that even if WRPs are present in the general area, densities are likely to be very low (Harewood 2018b).

A further desktop study was undertaken by Onshore Environmental (2018c) to assess the areas of the MDE most likely to be suitable habitat for WRP. The study mapped the logging and fire history classes within the MDE and surrounding area to identify areas of remnant vegetation that were classed as both long unburnt (last burn prior to 1985) and unlogged for at least 58 years (last logged prior to 1960). Such areas are considered to potentially represent high quality habitat for WRP. The assessment found that within the MDE there are no large consolidated remnant vegetation areas that are considered critical WRP habitat based on the burn and logging history of the area. Within the MDE only one small fragment of long unburnt and unlogged forest remains within the Floyd's WRL expansion footprint (Onshore Environmental 2018c). Photographs of habitat throughout the MDE and surrounds potentially suitable for WRP were assessed as part of the study to determine the likely suitability for WRP based on canopy connectivity, refuge availability and under/mid storey coverage with the findings aligning with the Biologic (2018a) study that in addition to the fragment of long unburnt and unlogged forest within the Floyd's WRL, only the north-west and south-east corners of the MDE are possibly suitable for WRP.

Following on from the desktop study Onshore Environmental (2018d) conducted a targeted WRP survey during September and November of 2018. The survey included targeted searches (including nocturnal searches) for dreys and other evidence of WRP (i.e. scats) and assessment of the suitability of the habitat for WRP. During the survey no evidence of WRP was recorded (i.e. no scats or dreys were observed during the active searches, and no individuals were observed). Additionally, no hollows suitable for WRP were identified during the survey. Observed hollows were not of a suitable size and/or were within areas of open vegetation that lacked the connectivity between the mid-storey and canopy which is required to provide suitable habitat for WRP (Onshore Environmental 2018d).

The vast majority of the MDE was characterised during the survey as unsuitable for WRP. This was largely due to the lack of dense well-connected mid-storey and upper-storey vegetation, and/or lack of mature trees due to historical logging and post-mining rehabilitation. Some small areas of remnant bush (18 ha) were assessed as providing poor or marginal habitat for WRP. The areas contained large old Eucalyptus trees, but lacked mid-storey structure and canopy connectivity that WRPs require. It is considered unlikely that a population of WRP would inhabit the MDE, and if individuals are occasionally present they are not considered to be dependent on the habitats present with the MDE (Onshore Environmental 2018d).

5.3.7 Western Quoll/Chuditch

The Chuditch, or Western Quoll, formerly occurred over nearly 70% of Australia including arid and semi-arid regions; however now has a patchy distribution in approximately 5% of their former range. Chuditch are found in varying densities throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA. They also occur at lower densities in the Goldfields and Wheatbelt, as well as in Kalbarri National Park (translocated) (DEC, 2012).

The MDE falls within the distribution of the Chuditch. Thirty-five records of the Chuditch have been recorded within the vicinity of the Mine (DBCA 2018). One, from 1987, is located approximately 570 m north of the MDE. The remaining 34 records are within approximately 21 km, with the majority from north of the Mine (DBCA, 2018).

Chuditch use a range of habitats including forest, mallee shrublands, woodland and desert. The most dense populations have been found in riparian Jarrah Forest (DEC, 2012). The MDE contains preferred habitats of the species and is located well within the species core-range.

During the recent survey by Biologic (2018a), 21 records of Chuditch were recorded on five motion cameras set in a single targeted transect in the north-west section of the MDE. Visually comparing spot patterning, it appears the captures may represent a single individual; however

this has not been confirmed (Biologic 2018a). The survey was undertaken prior to the mating season (April to July), extinguishing the possibility that records represent transient or passing individuals. This is further supported by the number and frequency of the records obtained on the one transect (Biologic 2018a).

Both the Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitat types within the MDE provide suitable habitat for the species. Given the species typically large home-range (3–15 km^2 for females and males respectively), it is possible that the species may occur throughout the MDE. However, it appears that within the MDE, the north-west portion, which adjoins several waterbodies (Cowan Dam, Southampton Dam and Austin's Dam) and a portion of undisturbed forest, provides preferred habitat for individuals. This area is also connected to the Schwenke's area (outside the MDE) which may be a preferred habitat of the species due to availability of more reliable food sources and cover. The Schwenke's area is a historic mining void which has been converted into an artificial wetland area by the Blackwood Basin Group with the aim of attracting wetland species, primarily birds, to the area (Christensen 2016).

5.3.8 Wambenger Brush-tailed Phascogale

The Wambenger Brush-tailed Phascogale was formerly distributed over a wide region of south Western Australia, from Lake Hinds in the north to Kalgan in the southeast however its present distribution is believed to have reduced to approximately 50% of its former range. It is now known from Perth and south to Albany, west of Albany Highway (Biologic 2018a). It occurs at low densities in the northern Jarrah forest and in highest densities in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (Biologic 2018a). The MDE falls within the distribution of the Wambenger Brush-tailed Phascogale. Five records have been captured less than 1 km north of the MDE (DBCA, 2018). A further 62 records are within 20 km of the MDE (DBCA 2018).

This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees and sparse ground cover (DEC 2010). It has been observed nesting in Jarrah, Marri, Flooded Gum (*Eucalyptus rudis*) and Wandoo; however, their preference for nesting habitat appears less dependent on the species of tree and more dependent on the availability of suitable hollows (Rhind 1996). During the recent survey by Biologic (2018a), Wambenger Brush-tailed Phascogale was recorded on 21 occasions from 15 locations.

Home-ranges during the non-breeding season span 20-70 ha and do not typically overlap, suggesting that the MDE contains a sizeable population (Biologic 2018a). The species was captured primarily within the Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitat types, with one record within Mine rehabilitation (Biologic 2018a). The Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats are considered to provide essential habitat for this subspecies (Biologic 2018a).

5.3.9 Short Range Endemic Invertebrates

An assessment of the potential presence of SRE's was undertaken by Biologic (2018a). Due to the high habitat complexity in leaf litter, woody debris and scattered rock formations, and the prevalence of shade offered by the dense vegetation, the fauna habitat types featuring Jarrah/ Marri forest and Jarrah/Marri forest over Banksia are considered to have a moderate potential to host SRE fauna. Areas disturbed by mining, farming or plantation forestry are considered to have a low suitability for SRE fauna due to the disturbance of the natural vegetation and soil (Biologic 2018b). Based on the moderate potential for SRE to occur, 12 locations with the Jarrah/Marri forest habitats of the MDE were sampled for SRE's (Biologic 2018a). At each site active foraging, leaf litter sifting and soil sifting, and targeted searches for spider and scorpion burrows were undertaken over an area approximately 25 m in diameter.

Twenty specimens belonging to SRE groups were collected during the survey (Biologic 2018a). This comprised specimens from four broad taxonomic groups: Two Mygalomorph spiders, two isopods, four scorpions, and twelve millipedes (Biologic 2018a). Three of the taxa collected (representing five specimens) have been identified as 'Potential SRE' as they could not be identified to a species level due to the absence of diagnostic features which are only present on mature male specimens (Biologic 2018a). The 'Potential SRE' collected included:

- Mygalomorph Spider, *Nemesiidae* sp. indet. - two specimens collected from the Jarrah/Marri forest habitat type;
- Millipede, *Paradoxosomatidae* sp. indet. – two specimens collected from the Jarrah/Marri forest over Banksia habitat type; and
- Millipede, *Siphonotidae* sp. indet. - - single specimen collected from the Jarrah/Marri forest habitat type.

Owing to the poor state of taxonomy for the species collected, assessment of the local and regional significance of the fauna collected is somewhat limited. The taxa regarded as 'indet.' (*Nemesiidae, Paradoxosomatidae, Siphonotidae*) cannot be fully assessed for SRE status until significant knowledge gaps are resolved at various taxonomic levels. Although limited, the current information for these taxa indicates that there is a reasonable likelihood that they may be range restricted, therefore they are considered Potential SREs as a precaution. In each instance, genetic analysis would be required to determine the species and/or if the specimens are unique to what has previously been recorded within the region.

In the absence of firm taxonomic identifications, it is reasonable to use habitats as a surrogate to assess the potential impact of the Proposal to Potential SRE species (Biologic 2018a). Each of the moderately suitable SRE habitat zones (Jarrah/Marri forest and Jarrah/Marri forest over Banksia) are well represented beyond the MDE (approximately 5,187 ha within the Talison tenements). Areas immediately beyond the MDE have not yet been sampled for SRE fauna, although based on the similar habitats present, it would be reasonable to assume that the Potential SRE fauna present within the MDE may also occur within the surrounding area (Biologic 2018a).

5.3.10 Introduced Fauna

- Biologic (2018a) recorded six introduced mammals within the MDE:
  - Pig (*Sus scrofa*);
  - Cat (*Felis catus*);
  - Rabbit (*Oryctolagus cuniculus*);
  - Fox (*Vulpes vulpes*);
  - House Mouse (*Mus musculus*); and
  - Black Rat (*Rattus rattus*).

  In addition to those listed above a further two introduced mammals have been recorded within the surrounding Greenbushes mining leases (Biologic 2011)
  - European Cattle (*Bos taurus*); and
  - Horse (*Equus caballus*).

5.4 Potential impacts to terrestrial fauna

Expansion of the Mine will result in direct impact to terrestrial fauna through the loss of fauna habitat as a result of clearing up to 350 ha of native vegetation for the Mine expansion comprising Jarrah/Marri forest (157 ha) and Jarrah/Marri forest over Banksia (193 ha) terrestrial fauna habitats. The fauna habitat within this clearing footprint is suitable for foraging, breeding and roosting by three species of black cockatoos and provides habitat for other conservation significant fauna species including the Chuditch, Wambenger Brush-tailed Phascogale, Quenda, Western Brush Wallaby and also in part is considered suitable for WRP however the species has not been confirmed as present within the MDE. Vegetation clearing can also potentially lead to fragmentation of fauna habitats.

In addition to the loss of fauna habitat, other potential impacts to terrestrial fauna associated with the Proposal include;

- Reduced water availability or quality
- Death, injury or displacement of native fauna species due to vehicle interaction or entrapment associated with the mining operation;
- Disruption or disturbance to fauna as a result of noise, vibration, light and dust emissions from the mining operation;
- Increased competition or predation by introduced species;
- Indirect loss of habitat due to introduction or spread of weeds or *Phytophthora cinnamomi*(dieback)
- Temporary loss of habitat due to bushfire.

5.5 Assessment of impacts

5.5.1 Fauna Habitat Loss and Fragmentation

The MDE contains an estimated 671.2 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats. These habitats are suitable for a range of conservation significant fauna species including Black Cockatoos, Chuditch, Wambenger Brush-tailed Phascogale, Quenda, and Western Brush Wallaby which have all been recorded from the MDE and also, in some areas for the WRP, although this species presence within the MDE has not been able to be confirmed.

The Proposal will result in the direct loss of 350 ha of habitats comprising an estimated 157 ha of Jarrah/Marri forest, and 193 ha of Jarrah/Marri forest over Banksia. The mapped extent of these habitats within the broader Greenbushes Study Area is 3,946 ha of Jarrah/Marri forest and 1,241 ha of Jarrah/Marri forest over Banksia (Biologic 2011, 2018b). Based on these areas, an estimated 4.0% and 15.6% of these habitat types will be cleared from the Greenbushes region for the Proposal.

Approximately 85% of the vegetation within the MDE mapped as Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitat types (Biologic 2018a) corresponds to the Dwellingup D1 and Catterick CC1 vegetation complexes of Mattiske & Havel (1998) as updated by Webb *et al*. (2016). The current extent of these complexes remaining within the Shire of Bridgetown-Greenbushes is 4,533 ha and 8,482 ha respectively, totalling 13,015 ha (refer to Table 13). The proposed clearing of up to 350 ha of this vegetation equates to maximums of approximately 2.7% of the current extent within the Shire and 0.2% of the current extent remaining with the Darling Plateau subregion of the South West Forests (GoWA, 2018b).

The MDE forms part of a South West regional ecological linkage as defined in Molloy *et al* 2009. The proposed vegetation clearing footprint within the MDE will not result in complete fragmentation with fauna still able to travel through and around the MDE within the remaining vegetation and surrounds. The evidence of use of the habitat in the immediate surrounding area of the existing active mining operation by at least seven different conservation significant fauna species indicates the fauna are still able to utilise areas which have been impacted by an extensive history of mining and logging activity. Habitat fragmentation is therefore not considered to be a significant impact.

Black Cockatoos

The Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats are suitable foraging and potential breeding habitat for Carnaby's, Baudin's and FRTBC. Based on the mapped extent of these habitats, and the additional 1,211 ha of plantations mapped within the Greenbushes Study Area (Biologic 2011, 2018b,) there is an estimated 6,398 ha of suitable black cockatoo foraging habitat and 5,187 ha potential breeding habitat within the immediate Greenbushes region. Clearing of 350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats for the Proposal will reduce the available foraging habitat and potential breeding habitat for the black cockatoos by an estimated 5.5% and 6.7% respectively at this scale. This localised loss of habitat is considered unlikely to reduce the area of occupancy of black cockatoos

The extent of suitable habitat available for black cockatoos can be estimated based on the extent of representative vegetation. The vegetation (habitat) within the MDE is representative of Beard (1979) Vegetation Association 3 – Medium Forest; Jarrah-Marri, of which there is currently 67.86% of the Pre-European Extent remaining in WA (GoWA 2018) (Table 6). The current extent of this vegetation association within the Shire of Bridgetown-Greenbushes is 68,440 ha, which is 56.49% of its pre-European extent. Of this, 87% is in DBCA-managed land. Clearing of 350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats which align with this vegetation association is expected to reduce the overall Medium Forest; Jarrah-Marri habitat area (and therefore available black cockatoo foraging and potential breeding habitat) within the Shire by 0.5%.

A total of 55 potential breeding trees with hollows have been identified within the MDE (Biologic 2011, Kirkby 2018a and 2018b). Foraging remnants indicate that the MDE is predominantly used by FRTBC and that this species is the most likely to utilise potential breeding trees with hollows within the MDE. An aerial (drone) survey of identified hollows found that only thirty potential breeding trees contained hollows assessed as being suitable for breeding. Fourteen of the identified hollows had evidence of chew marks and have therefore been assessed as 'Known Hollows' while the remaining 16 showed no evidence of use and are considered 'Suitable Hollows' (Harewood 2018a). The hollows within the remaining 25 trees were assessed (based on aerial drone images and pole camera images for the MSA) as unlikely to be suitable for black cockatoo breeding generally due to the entrance appearing to be too small or because the actual hollow appears to be too shallow and/or too small (Harwood 2018a and Kirkby 2018b).

Based on the proposed development footprint for the Mine expansion it is expected that the Proposal will result in the removal of up to seven of the identified trees with 'Known Hollows; and up to seven of the identified trees with 'Suitable Hollows'. These trees are all located within the TSF4 and Floyd's WRL expansion areas which are fixed. Two of the trees with 'Known' hollows are located very close to the proposed toe of the Floyd's WRL and cannot be sufficiently buffered to ensure they are retained, as to do so would result in a significant increase to the clearing required to step the WRL back at these locations. The location of remaining linear infrastructure (roads/pipelines/powerlines) and the explosives and MSA infrastructure is yet to

be confirmed but will be designed to avoid all 'Known' and 'Suitable' hollows identified. The CGP3/4 plant area is fixed but no potential breeding hollows have been identified in this area.

The Proposal will also result in the removal of potential breeding habitat comprising trees with DBH >50 0mm. Based on the Kirkby assessment of the MDE it is estimated that approximately six trees/ha will be removed meeting this classification. The total number of potential breeding trees with DBH >500 mm within the 350 ha clearing area is therefore estimated to be 2,100. Two roost sites recorded within the MDE will not be impacted by the Proposal as they occur outside the proposed development footprint, and will therefore be avoided.

Given the factors outlined below, the clearing of 350 ha of suitable black cockatoo foraging and breeding habitat for the Proposal is considered unlikely to result in a decline in the density of any of the three black cockatoo species within the broader Greenbushes region as there is suitable habitat available in the surrounding area which can support birds currently utilising habitat within the MDE.

- The species which appears to have highest utilisation of foraging resources within the MDE is the FRTBC, which usually forages within 4 km of roost sights. There is estimated to be 5,895 ha of State Forest and other DBCA managed lands within 5 km of the MDE with available Jarrah/Marri habitat suitable for breeding and foraging (Ennovate 2018).
- The field assessment of potential breeding trees undertaken by Onshore Environmental (2018e) found that there is a higher density of potential breeding trees outside the MDE than within, and potential breeding trees outside the MDE had a higher incidence of breeding hollows (7-34%, average 21%) when compared with the potential breeding trees within the MDE (0-12%, average 2%) . This indicates habitat outside the MDE has greater capacity to support breeding than the area which will be impacted.
- The Project will impact on no more than 7 Known breeding hollows and a further 7 suitable breeding hollows. Thirty artificial nesting hollows established near the Schwenke's area between 2014 to 2016, and monitored by the BBG, have not shown any evidence of use by Black Cockatoos to date (Christensen 2018) indicating there may be an excess of suitable breeding hollows within the broader Greenbushes region.
- Monitoring of black cockatoo roosting in the Schwenke's area has found a far higher proportion of roost trees in this area (maximum count of 15) than within the MDE indicating the water resource at this location is preferred to those within the MDE (Christensen 2018).
- Given the low utilisation of suitable nesting hollows within the MDE and surrounding area, the lack of natural water sources in the MDE, and the small number of hollows that will be impacted in comparison to the surrounding area the habitat loss will have limited impact on the density of the three black cockatoo species within the region.

Western Ringtail Possum

There is no confirmed evidence of WRP occurring within the MDE. Two records of scats either belonging to the WRP or Common Brushtail Possum, which is abundant throughout the MDE, were noted (Biologic 2018a). The scats were found within the Jarrah/Marri forest habitat in the north-west corner of the MDE. While the Jarrah, Wandoo and Marri forests in inland localities are considered suitable habitat for the WRP anthropogenic impacts such as fire, logging, feral animal predation impact on the suitability of these habitat types (DPaW 2017). Biologic concluded that if WRP are utilising the MDE they are likely to occur in low numbers or on a transient basis as populations and resources fluctuate in the surrounding areas (Biologic 2018a). The areas assessed as most likely to be suitable habitat for the WRP are in the north-west and south-east of the MDE (Biologic 2018a).

Harewood also concluded that much of the vegetation observed seems to represent poor or marginal habit for WRPs (Harewood 2018b). The Onshore Environmental (2018c) desktop assessment of the suitability of habitat within the MDE for WRP based on fire and logging history, vegetation types and habitat assessment of canopy connectivity, refuge availability and under/mid storey coverage also concluded that much of the habitat within the MDE was unsuitable or marginal for the species. Only the north-west and south-east corners of the MDE, and a small area of long unburnt and unlogged habitat within the Floyd's WRL footprint were considered to be potentially suitable for WRP (Onshore Environmental 2018c). This assessment was further supported by a subsequent field survey of the MDE for the presence of WRP where no evidence of WRP or suitable hollows for the WRP were found. The majority of the MDE was found to be unsuitable for WRP with only 18 ha being classed as poor to marginal WRP habitat.

Based on these assessments it is concluded that only the clearing for the Floyd's WRL will impact upon poor to marginal WRP habitat resulting in the loss of approximately 18 ha of his habitat type. It is unlikely that a population of WRP would inhabit this area given the lack of suitable habitat in the surrounding area therefore WRP are not considered to be dependent on this habitat (Onshore Environmental 2018d).

Given the following factors the clearing of 18 ha of poor to marginal WRP habitat for the Proposal is considered unlikely to result in a decline in species density.

- the WRP has not been able to be confirmed as being present within the MDE;
- the MDE is not within any of the key management zones for WRP;
- the WRP is known to have low stocking rates within the Jarrah Forest (pers comm A. Wayne 2018); and
- the availability of suitable habitat where WRP is known to occur in close proximity to the MDE (Schwenke's).

Chuditch

The Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats are considered to be suitable habitats for the Chuditch within the MDE and surrounding areas. Although the habitat within the MDE has been heavily logged and in areas is fragmented, it remains usable and has connectivity to larger remnant areas in the surrounding state forest. During the recent survey by Biologic (2018a), 21 records of Chuditch were documented which are considered likely to be from a single individual (Biologic 2018a). Given the large home range of this species (females – 55-120 ha and males – 400 ha) it is expected that at most only a few individuals would be utilising the MDE.

The north-west portion of the MDE, which adjoins several waterbodies (Cowan, Southampton and Austin's Dams) and a portion of undisturbed forest outside the MDE, is considered likely to be the preferred habitat for individuals within the MDE (Biologic 2018a). This area is also connected to the Schwenke's wetland area (outside the MDE) which may be a preferred habitat of the species due to the riparian type of habitat present which typically provides more reliable food sources and cover. Clearing of 350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitat suitable for Chuditch, in which at least one individual is known to occur, will result in a localised loss of habitat critical to the survival of this species. Given the species' wide range of habitats, number of records within the vicinity of the MDE and availability of mapped forest areas within the local area (5,187 ha) (Biologic 2011, 2018b) this habitat loss is not expected to cause a decline in the species density.

Wambenger Brush-tailed Phascogale

The Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats are considered to provide essential habitat for the Wambenger Brush-tailed Phascogale based on the high number of records and locations observed in these habitats during the fauna survey of the MDE (Biologic 2018a). The subspecies was also observed in mine rehabilitation suggesting the current rehabilitation methods are able to replicate suitable habitat for this subspecies over time. Hollows for nesting are however unlikely to develop in mine rehabilitation in the short term therefore retainment of trees with hollows in the surrounding area is likely to be needed for suitable nesting habitat. The number of records and home range of Wambenger Brush-tailed Phascogale suggest a sizeable population is present which may be impacted by the Proposal.

Clearing of 350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitat suitable for Wambenger Brush-tailed Phascogale in which a sizeable population potentially occurs will result in a localised loss of habitat for this subspecies. Given the availability of mapped forest areas within the local area (5,187 ha) (Biologic 2011, 2018b) it is expected that individuals, if located with the MDE, will be able to be relocated to the surrounding state forest. The state forest outside the MDE is known to have nesting habitat in the form of tree hollows (Onshore Environmental 2018d). Given that the species has also been recorded within Mine rehabilitation it is expected that in time, with progressive rehabilitation which includes appropriate native tree species, suitable habitat for the Wambenger Brush-tailed Phascogale can be rehabilitated.

5.5.2 Reduced water availability or quality

There are seven water sources (ponds, constructed reservoirs and old mine pits) within the MDE that are potentially suitable for fauna use. The Cowan Brook Dam and Southampton/ Austin's Dam are the most likely to be accessed by fauna owing to their location at the periphery of the MDE and adjoining large expanses of native vegetation within State Forest 20. The Southampton/ Austin's Dam overflows to the Cowan Brook Dam when full. These water sources are part of the mine water circuit with water being stored in these reservoirs to supply the mine. The Mine expansion is not expected to reduce the availability of water within these reservoirs.

Through implementation of a Surface Water Management Plan, Talison has reduced its impact on Cowan Brook Dam and Southampton/ Austin's Dam water quality. Talison is in the process of constructing a Water Treatment Plant near the Southampton/Austin's dams to improve water quality within. There have been no recorded incidents fauna illness or death as a result of ingesting water from these storages, therefore through maintaining the current water availability and quality in these reservoirs, the Mine expansion is not expected to reduce suitable water availability to fauna dependant on resources within the MDE.

Talison, will increase water monitoring activities based on the expanded MDE and implement additional updates with respect to proposed infrastructure and associated operating rules, monitoring and maintenance requirements. These changes will be captured in an updated Surface Water Management Plan.

5.5.3 Death, Injury or Displacement

Fauna within the MDE are at risk of death, injury or displacement due to interaction with heavy and light vehicles undertaking vegetation clearing, transportation or mining activity associated with the Proposal. Fauna may also potentially become entrapped within mining infrastructure such as water storages or excavations. This impact is not new as mining activity is already occurring within the area, and has been for over 30 years. The likelihood of the impact occurring is expected to increase as a result of the expansion as there will be an increase in the number of mining vehicles and equipment operating on the site, and clearing of native vegetation (fauna habitat) is required.

Interaction between vehicles/machinery and fauna species, is most likely to occur during vegetation clearing activities as resident fauna could potentially be struck by vehicles undertaking the activity. Due to the Proposal's location within State Forest 20 there is suitable similar native vegetation for fauna to take refuge/find habitat within and outside the MDE when clearing activities occur provided they are allowed the opportunity to escape. Suitable management practices during planning and undertaking vegetation clearing will reduce the likelihood of death or injury to native fauna occurring as a result of this activity.

Fauna interaction with vehicles may also occur along transport routes within the MDE although the risk is considered to be low, given that fauna are more likely to inhabit areas away from mining activity and transport routes due to the associated noise, vibration and dust impacts.

5.5.4 Noise, Vibration, Light and Dust

Mining activity results in the generation of noise, vibration, light and dust emissions which can disturb or displace fauna, causing them to avoid using habitat in impacted areas. This impact effectively reduces the habitat available in the local area due to fauna avoiding areas affected by these impacts. The proposed expansion occurs within an area which has been subject to mining activity since the late 19th Century. The current open cut mining operations have been undertaken for over 30 years therefore fauna residing in the local area are already accustomed to noise, vibration, light and dust impacts associated with the operation, or already avoid the mining area as a result of these impacts. As the boundary of mining activity will increase from the current area of 1,591 ha to a MDE of 1,919 ha there will be an increase to the area of fauna habitat subject to these impacts potentially causing some fauna to move to new habitat further from the operation. There are large areas of habitat area available in the surrounding State Forest 20 which fauna displaced by these impacts can move into.

5.5.5 Increased competition or predation by introduced species

Mining activity can potentially lead to an increase in the presence of introduced fauna species within an area primarily due to the ready availability of access to food and water supplies. Introduced fauna compete with native fauna for food and shelter, and also predate native fauna, particularly smaller mammals, reptiles and birds. As previously mentioned, the MDE has been subject to an extended period of mining activity, as well as tree harvesting, and is adjacent to the Greenbushes townsite each of which has resulted in introduced fauna species already being present and established within the local area. Talison has an established program of feral animal control activities which are implemented each year to prevent introduced species from increasing their spread or density. Continued implementation of the feral animal control program is anticipated to prevent increases in introduced fauna as a result of the Proposal, and will potentially result in an overall reduction in feral animal numbers in the local area.

5.5.6 Fauna habitat loss due to introduction or spread of weeds and dieback

As discussed in section 4.5.2, the Proposal has the potential to introduce and/or spread *Phytophthora cinnamomi* (dieback) and invasive flora species (weeds) as a result of vehicle or heavy equipment movements, land clearing activities or movement of soil and plant materials. *Phytophthora cinnamomi* is known to be present within the MDE and could potentially result in widespread vegetation death (given the vegetation present is known to be susceptible to the effects of this pathogen). The MDE also has a high degree of weeds and further spread, introduction or lack of control over existing populations could result in weeds outcompeting native vegetation. Reduced availability or suitability of native vegetation habitat in the MDE could occur as a result of the effects of dieback or increased weed abundance.

Spread and introduction are mostly likely to occur as a result of poor hygiene for vehicles and equipment or as a result of mismanagement of dieback or weed infested soils. Effective management of land clearing, vehicle hygiene and soil/vegetation movement can effectively mitigate this risk which is demonstrated by the limited weed and dieback impacts associated with the existing mining operation.

5.5.7 Fauna displacement and death due to bushfire

As discussed in section 4.5.5 the Proposal has a low risk of causing accidental bushfire as a large proportion of the MDE is cleared, and therefore unlikely to support a fire. Native vegetation clearing is the activity most likely to cause a bushfire as it occurs in vegetated areas where fuel loads could potentially support one. If mining activities cause a bushfire, native fauna present within the MDE will be at risk of displacement and/or death from the fire. Due to the large area of surrounding state forest, there is suitable refuge fauna can escape to in the event of a fire. There are no significant fences to impede the escape of fauna to surrounding areas.

It is expected that in the event a fire is caused by the mining activities it is likely to be quickly controlled due to Talison's robust emergency management procedures. Any loss of fauna habitat due to bushfire is therefore expected to be small and temporary. When clearing activities have been completed, the risk of bushfire will reduce as mining activities will, with the exception of exploration and monitoring, be confined to disturbed areas.

5.6 Mitigation

5.6.1 Avoid

As per discussion in section 4.6.1, the location of the Proposal is restricted due to the constraints of the surrounding landscape, and position of the ore body therefore the proposed clearing of 350 ha of fauna habitat for the Proposal cannot be avoided as it is required to enable the mine expansion to occur. Talison will wherever practicable use existing cleared or disturbed and rehabilitated areas for the development in preference to clearing new areas. The disturbance footprint for the Floyd's WRL expansion, TSF4 and CGP3/CGP4 areas are final therefore fauna habitat loss is confirmed within these development areas. The MSA, explosives infrastructure and linear infrastructure corridors are flexible and will be adjusted where necessary to avoid significant fauna habitat such as trees with known and suitable hollows for black cockatoo breeding. Talison will implement tree protection zones around the two known roost trees and 10 m buffer zones around known nest trees (refer: Appendix E: Conservation Significant Fauna Management Plan).

The key measures to avoid potential impacts to terrestrial fauna associated with the Proposal are summarised in Table 21.

Table 21 Mitigation measures to avoid terrestrial fauna impacts

Potential impact	Mitigation Measures to Avoid Impact
Fauna habitat loss	• The initial location planned for the MSA was in the area to the east of TSF 4 and south of Floyd's WRL. Due to the presence of potential breeding trees with hollows in this location, and the area being suitable for WRP, The MSA was moved to the North of the mine to an area which has previously been disturbed, is considered unsuitable/marginal for WRP habitat, and where no suitable breeding hollows have been identified. • Talison will maintain a spatial record of all identified potential breeding trees with suitable hollows which will be considered during the design and planning of disturbance footprints. Where practical to do so, modifications to the footprint of developments will be made to avoid identified potential breeding trees with suitable hollows. This is not practical for large landforms such as the TSF 4 and Floyd's WRL, but will be undertaken for more flexible developments including linear infrastructure corridors, the MSA and Explosives infrastructure. • Talison will establish Black Cockatoo Tree Protection Zones (TPZs) of 10 m around trees with 'Known' and 'Suitable' breeding hollows which will be retained. TPZ's will also be established around identified Roost trees.

5.6.2 Minimise

The key measures to minimise potential impacts to terrestrial fauna associated with the Proposal are summarised in Table 22. The management plans and procedures listed are currently implemented at the Mine as part of Talison's ISO 14001 certified EMS and therefore undergo review in accordance with the EMS requirements.

Table 22 Mitigation measures to minimise terrestrial fauna impacts

Potential impact	Mitigation Measures to Minimise Impact

Fauna habitat loss and fragmentation	• Talison has preferentially located landforms and infrastructure in existing cleared areas (or areas which have previously been disturbed and rehabilitated) where possible to avoid unnecessary habitat removal.
	• Talison will implement a Conservation Significant Fauna Management Plan (Appendix E).
	• Talison will continue to fund the BBG to undertake the monitoring and maintenance of 30 artificial black cockatoo nesting hollows installed near Schwenke's Dam. Monitoring will continue until at least the end of 2023.
	• Roads and infrastructure corridors in particular will maximise use of existing cleared, or disturbed and rehabilitated areas, to avoid habitat clearing where practical.
	• Implementation of the Talison Clearing/Disturbance Procedure. Key requirements of the procedure include:
	  • Internal permits must be granted before clearing can occur;
	  • All clearing areas must be demarcated prior to clearing; and
	  • All clearing areas must be surveyed after clearing to confirm the area cleared is within the approved area and for entry into the GIS clearing database.
	• A database of conservation significant fauna species sightings will be maintained.
	• Progressive clearing will be undertaken so areas where development is scheduled to occur will be cleared of habitat.
	• Fauna habitat trees with potentially suitable hollows for black cockatoo or WRP) occurring within 20 m of a proposed clearing area will have a Tree Protection Zone (TPZ) of at least a 10 m buffer clearly marked around them for the duration of clearing activities in the area.

Reduced water availability or quality	• Continue to implement the Surface Water Management Plan to minimise (and monitor) impact to water quality and availability. • Following commissioning, the Water Treatment Plant will be operated to improve water quality within the Mine Water Circuit.
Death, injury or displacement	• Implementation of the Talison Conservation Significant Fauna Management Plan (Appendix E). Key requirements of the Plan include: • The site induction will include information on conservation significant fauna which may be encountered at the operation. This includes descriptions of the fauna, specific management measures intended to protect them, and responsibilities for reporting sightings and incidents.

Potential impact	Mitigation Measures to Minimise Impact
	• All native fauna injuries or mortalities will be recorded and reported internally and to appropriate regulatory agencies, where required. • All ponds will have appropriate fauna egress to prevent native fauna becoming trapped. • Where trenches are established (i.e for pipelines or services), which native fauna are unable to escape from, they will be inspected by a “fauna spotter” on a regular basis (i.e. dawn, midday and prior to sunset). Any entrapped fauna will be removed and relocated to surrounding vegetation. If trenches are left open overnight, ramps will be established to permit native fauna to escape. • Implementation of traffic management rules to minimise the likelihood of fauna injury or mortality due to interaction with vehicles. Rules include prohibition of off-road driving unless authorised for a specific purpose (i.e. exploration and land clearing) and reduced speed limits on internal roads. • A fauna capture and release program will be undertaken prior to clearing (subject to DBCA approval) by a suitably qualified, experienced and licensed environmental professional. • A suitably qualified environmental professional (fauna spotter) will be present during all land clearing. The person will hold a permit to handle and move significant fauna under Regulation 15 of the WC Act, and have access to a care facility that can be used to rehabilitate injured fauna. • Clearing will be timed outside the black cockatoo breeding seasons if possible. • Prior to clearing potential breeding trees with hollows suitable for breeding, a suitably qualified environmental professional (fauna spotter) will identify and check all hollows suitable for (Black Cockatoos, Western Ring Tail Possum or Wambenger Brush-tailed Phascogale). Where nesting animals are identified the tree will be marked and excluded from clearing until the resident animals have moved from the hollow. • In addition to checking of hollows, prior to the commencement of clearing, ground searches of clearing areas will be undertaken, and any native fauna found will be relocated, or encouraged to move to neighbouring vegetation. • Wherever practical land clearing will be undertaken on one front only in a direction which provides an opportunity for fauna to escape the clearing area to surrounding vegetation.

Potential impact	Mitigation Measures to Minimise Impact
Disruption or disturbance to fauna as a result of noise, vibration, light and dust emissions	• Lights will be strategically placed and designed to shine towards plant operations and minimise light spill to the surrounding environment. • Noise will be limited to comply with the Talison Regulation 17 Approval through implementation of the Noise Management Plan. Further details on the Plan requirements are included in section 7.6.1. • Dust emissions will be minimised through the implementation of the Talison Dust Management Plan. Further details on the Plan requirements are included in section 6.6.1.
Increased competition or predation by introduced species	• Domestic animals are not allowed to be brought onto the Mine. • Continued implementation of the Talison feral animal control program on an annual and ad hoc basis as required. The program involves annual baiting for foxes and rabbits and feral cat trapping. The program will be conducted in conjunction with DBCA where the opportunity exists. • Putrescible waste will be stored within lidded bins which prevent fauna entry to prevent attracting feral animals. • Domestic waste facilities will be fenced and putrescible waste covered on a minimum weekly basis. • Quarterly monitoring of feral predator abundance will be undertaken of landfill areas, and key water sources to determine control program effectiveness.

Indirect fauna habitat loss due to introduction or spread of weeds and dieback	• Implementation of the Talison Weed and Hygiene Management Plan. Key requirements of the Plan include:
	  • Adhere to the Talison Vehicle Hygiene Form which requires vehicles/equipment to be clean on entry to the Mine, subject to inspection and cleaned down if required. Vehicles leaving the mine site that have been working in the field are required to be cleared prior to leaving.
	  • Adhere to the Talison Dieback Work Procedure.
	  • Signage and traffic controls at entry points into uninfected areas.
	  • Treatment of uninterpretable areas to be uninfected for the purposes of hygiene management.
	  • Requirements for clean down points and cleaning of vehicles prior to entering uninfected areas or if travelling from an infected area to an uninfected or uninterpretable area.
	  • Inclusion of information on weeds, dieback and vehicle hygiene requirements in the Site Induction.
	  • Greencard training for relevant employees.
	  • GIS records of weed and dieback infestation
	  • Inspection of proposed clearing areas for weed infestations.
	  • Lists key known weeds within the MDE and recommended controls.

Potential impact	Mitigation Measures to Minimise Impact
	• Proposed clearing areas will have been assessed for dieback presence within two years prior to clearing occurring. • In accordance with Talison's Working Arrangements with DBCA, prior to any new disturbance within state forest areas a DBCA Dieback Management Plan is submitted for approval. • Employment of a full time Weed Control Officer who assesses weed presence and develops the annual weed control plan. Additional control resources are employed where necessary to implement weed control.
Fauna displacement and death due to bushfire	• Implementation of the Talison Greenbushes Operations Hot Work Permit System. • Implementation of the Talison Emergency Management Plan in the event of a fire. • Clearing activities will not be undertaken when the Fire Danger Rating is severe or higher. • Equipment and vehicles undertaking native vegetation clearing activities will be fitted with a fire extinguisher.

5.6.3 Rehabilitate

Talison implements a DMIRS approved Mine Closure Plan (2016 REG ID 60857) which undergoes review of a three yearly basis. The Mine Closure Plan details the rehabilitation and closure requirements for the Mine. A revised plan incorporating the Mine expansion is currently in development and will be submitted to DMIRS with the Mining Proposal for the expansion. The key measures to rehabilitate potential impacts to terrestrial fauna associated with the Proposal are summarised in Table 23.

Table 23 Mitigation measures to rehabilitate terrestrial fauna impacts

Potential Impact	Measures to Rehabilitate Impact
Fauna Habitat Loss and Fragmentation	• Update the DMIRS approved 2016 Mine Closure Plan to include the Mine expansion (in progress) and submit with the Mining Proposal. The plan includes closure objectives and completion criteria related to rehabilitation. • Progressive rehabilitation of disturbed areas where possible, as per the DMIRS approved Mine Closure Plan. This includes the Floyds WRL and outer batters of the existing TSFs that are in their final form. Areas active for the duration of mining activity (such as TSF4 and the surface of existing TSFs) will be rehabilitated at the end of life. • The objective of rehabilitation is to establish a self-sustaining heath community with selected attributes compatible with surrounding Jarrah/Marri forest, and

	landforms that blend with the Mine's undulating scarp location. • Growth medium is applied to rehabilitation areas to improve the likelihood of suitable habitat establishing. Growth medium can comprise topsoil and/or weathered regolith material that has proven suitable for rehabilitation of current mining landforms. • Rehabilitation areas are planted with seedlings, including *Corymbia calophylla* (Marri), *Eucalyptus marginata* (Jarrah), *Eucalyptus patens* (Blackbutt) and *Eucalyptus rudis* (Flooded Gum). The rehabilitation areas are direct sown with provenance seed by hand which is typically sourced from within 50 km of Greenbushes. • Completion criteria will incorporate fauna and habitat restoration objectives • Fauna habitat structures (logs, wood debris and rocky outcrops) are incorporated into rehabilitated areas to encourage the early return of native fauna such as reptiles and small mammals.

5.7 Predicted outcome

The proposed expansion of the Mine will directly impact terrestrial fauna primarily as a result of habitat loss. The Proposal will result in the direct loss of up to 350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia habitats. This will result in a reduction in the extent of available fauna habitat at a local scale. However, the habitats present within the MDE are considered to be well represented in the surrounding region, in particular in the neighbouring Greenbushes, Wilga and Nannup State Forests. The loss of fauna habitat is therefore unlikely to have a significant impact on the extent of fauna habitat, or density of fauna species at a regional scale. In addition, Talison conduct an ongoing rehabilitation program for mining disturbance which will result in replacement of the cleared habitat in the long term.

The Proposal will result in the loss of habitat for conservation significant fauna, including foraging and breeding habitat for black cockatoos. Evidence of foraging within the MDE is primarily from FRTBC and considered to be the most likely species to be using breeding habitat within the MDE. Baudin's and Carnaby's Black Cockatoos are likely to only use the area for foraging. Fauna habitat which will be cleared is also suitable for Chuditch, Wambenger Brush-tailed Phascogale, Quenda, Western Brush Wallaby and in part for the WRP although there is no confirmed evidence of the WRP occurring in the MDE. Direct impacts to fauna (in particular conservation significant fauna) as a result of habitat loss associated with the Mine expansion are unable to be avoided and a suitable area is proposed to be offset in accordance with principles of the WA Environmental Offsets Policy (2011) and the EPBC Act Environmental Offsets Policy (2012) (see Section 6) to counter balance this impact. Further details relating to the proposed offset are included in Chapter 9.

The Proposal is in relation to an existing mining operation therefore secondary impacts associated with noise, dust, and vibration to terrestrial fauna are not considered significant as they are not new, therefore fauna in the local area have likely adapted to these. Similarly, fauna injury or death due to interaction with the mining activities is not expected to have a significant occurrence as fauna are accustomed to the mining operation. This impact can be minimised through appropriate traffic controls and through checks of proposed clearing areas prior to commencing activity.

With the exception of habitat loss, residual impacts to terrestrial fauna are considered to be equivalent to those resulting from the existing Mine. Talison considers that the Project is able to meet the EPA's objective to protect terrestrial fauna so that biological diversity and ecological integrity are maintained through offsets and adequate management practices.

6. Key Environmental Factor – Air quality

6.1 EPA objective

The EPA applies the following objective in its assessment of proposals that may have a significant effect on air quality:

To maintain air quality and minimise emissions so that environmental values are protected.

For the purposes of EIA, the EPA defines the factor Air Quality as the chemical, physical, biological and aesthetic characteristics of air. 'Air' refers to all the air above the ground up to and including the stratosphere (EPA 2016g).

6.2 Policy and guidance

- Environmental Factor Guideline Air Quality (EPA 2016g).
- Guidance for the Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses No. 3 (EPA 2015).
- *National Environment Protection (Ambient Air Quality) Measure* (NEPC 2016).
- Air Quality Modelling Guidance Notes (DoE 2006)
- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. (NSW EPA 2017).
- Environmental Protection Bulletin No. 24 – Greenhouse Gas Emissions and Consideration of Projected Climate Change Impacts in the EIA Process.

6.3 Receiving environment

6.3.1 Climate

Greenbushes experiences a Mediterranean type climate characterised by warm dry summers and cool wet winters, with the majority of the rain falling in the winter. The nearest Bureau of Meteorology (**BoM**) climate station, which records wind speeds and directions, is Bridgetown (Site number: 9617). It is located approximately nine km to the southeast of the Mine. A summary of the rainfall and temperature data collected since 1998 is shown in Figure 15. Rainfall data have been taken from the BoM Greenbushes rainfall station (Site number 9552). The average maximum temperatures (1998-2017) for Bridgetown range from 15.7°C in July to 30.0°C in January. The average minimum temperatures range from 4.5°C in July to 13.5°C in February (BoM 2017). The majority of rainfall (>85%) is received between April and October. Rainfall averages 928.7 mm/year and mean monthly rainfall varies from 15.7 mm in February to 167 mm in July.

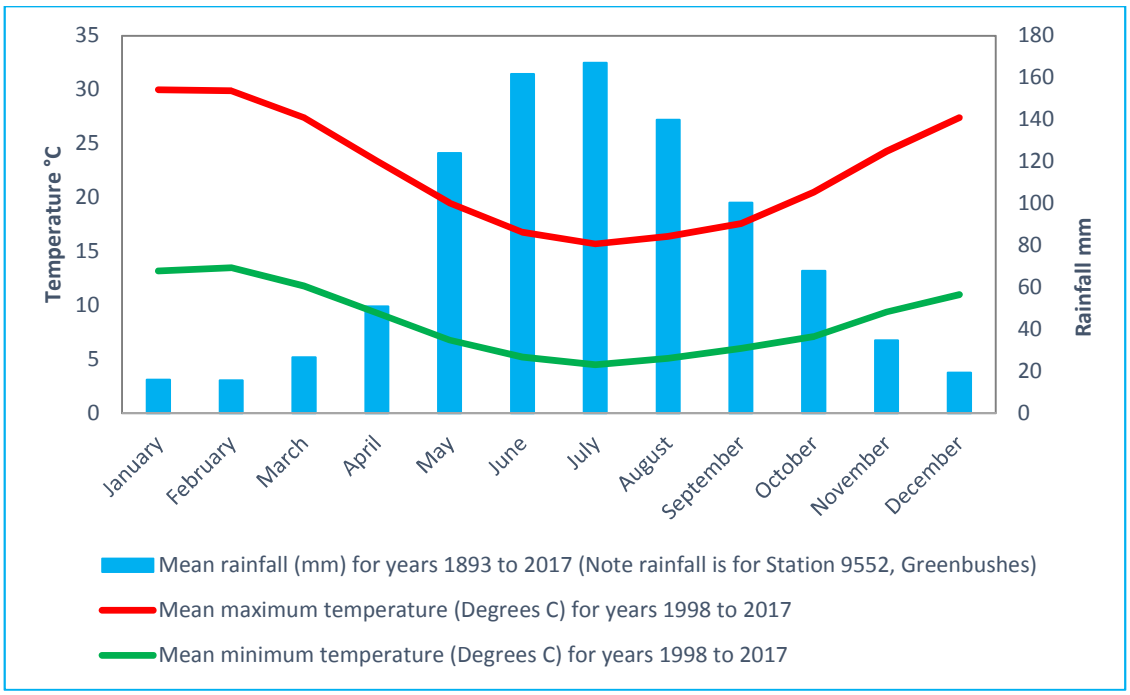


Figure 15 BoM Climate Statistics for Bridgetown (BoM 009617)

The average morning (9 am) wind speed reported during summer for Bridgetown BoM station is 13.0 km/h, prevailing predominately from the east and south east. The wind speed marginally increases in the afternoon (3 pm) with an average wind speed of 14.8 km/h reported which prevails from south east to south westerly direction. During winter months, winds abate to an average of 5.6 km/h during the morning prevailing from the north and north-west. Afternoon winds increase to an average of 12.5 km/hr and typically are from the north to north westerly direction (BoM 2017a). Storms during the winter period tend to approach from the north-west.

6.3.2 Background air quality

The Mine is located within State Forest 20 with agricultural properties located at the outskirts of the State Forest. Local air quality is predominantly influenced by dust emissions from the Mine and to a lesser extent agricultural activities in the surrounding area. Regional dust sources in the local airshed include:

- Mechanical land disturbance from surrounding pastoral properties;
- Vehicle movement along unsealed roads;
- Burning and incineration (backyard burning, residential wood fired heaters, prescribed burns and wildfires); and
- Emissions from the existing Mine, including wind erosion from the TSF1, TSF2, Floyds WRL, existing pits, stockpiles and haul roads. Other dust sources to a lesser extent include blasting, crushing, conveyors and loading/unloading activities.

The nearest industrial premises to the Mine (besides the GAMG tantalum operation which, as previously mentioned, is within the MDE) is the Greenbushes sawmill which is 3 km north of the Mine. The sawmill is not expected to influence the local air quality in the vicinity of the Mine due to its distance from the mine.

Talison implements a program of dust monitoring at the mine which has been ongoing since 1999. The monitoring network comprises a HiVol dust sampler and a Tapered Element Oscillating Microbalance (**TEOM**). The HiVol dust sampler records particulates less than or equal to 10 microns in diameter (**PM_{10}**) over a 24 hour period as per requirements of operating

licence L4247/1991/13. The sampler is situated at the end of Diorite Street on the northern boundary between the town and the MDE. It is operated every Tuesday, Thursday and Saturday for 24 hours between November and May, and every sixth day outside of this period.

The TEOM provides real time detection of PM_{10} levels which are monitored to detect and react to increasing dust levels. The TEOM is moved to where activity is occurring when needed. The background dust levels applied in this air quality assessment were determined from Talison's dust monitoring programme.

The ambient PM_{10} monitoring location is shown in Figure 17. The average maximum 24 hour PM_{10} concentration is 26 µg/m^3 and annual average PM_{10} concentration is 15 µg/m^3. Seasonal trends are evident in the monitoring results with the average maximum 24 hour PM_{10} concentration during the winter months being around 17 µg/m^3 and increasing to around 35 µg/m^3 during the summer months. Seasonal trends are likely to affect natural dust suppression due to rainfall and reduced winds in the winter time. Additionally, the prevailing winds in the winter tend to be away from the Greenbushes townsite where as in summer, winds prevail from the east to south east. A summary of PM_{10} monitoring results for the five years from 2013 to 2018 is shown in Figure 16.

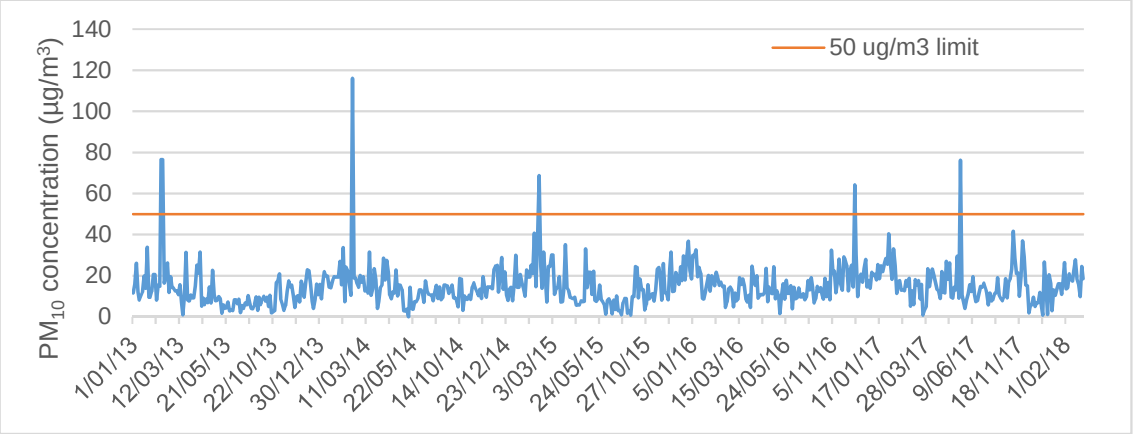


Figure 16 Daily time series PM_{10} concentrations recorded by the HiVol for years 2013 to 2018

Dust from mining and associated activities is subject to air quality standards as described by the *National Environment Protection (Ambient Air Quality) Measure* (**Air NEPM**) (NEPC 2016). The Air NEPM sets a criteria of 25 µg/m^3 for annual average and 50 µg/m^3 for 24-hour average PM_{10}. Occasional exceedances of the 24-hour average PM_{10} Air NEPM of 50 µg/m^3 were recorded between 2013 and 2018 but these have been associated with smoke resulting from fires in the region, or unrelated construction/earthworks activities occurring in proximity to the dust monitor.

Dust emissions from the operation are currently regulated through the premises operating licence L4247/1991/13 which specifies monitoring of PM_{10} through the period 1 November to 31 March and sets a limit of 90 µg/m^3 per 24 hour period at the HiVol monitoring location on Diorite Street in Greenbushes. No exceedances of the operating licence limit of 90 µg/m^3 PM_{10} have occurred since monitoring commenced

6.3.3 Sensitive receptors

Sensitive receptors who may be impacted by dust emissions attributable to the Mine include mine employees, Greenbushes residents, nearby rural residents, surrounding vegetation and fauna.

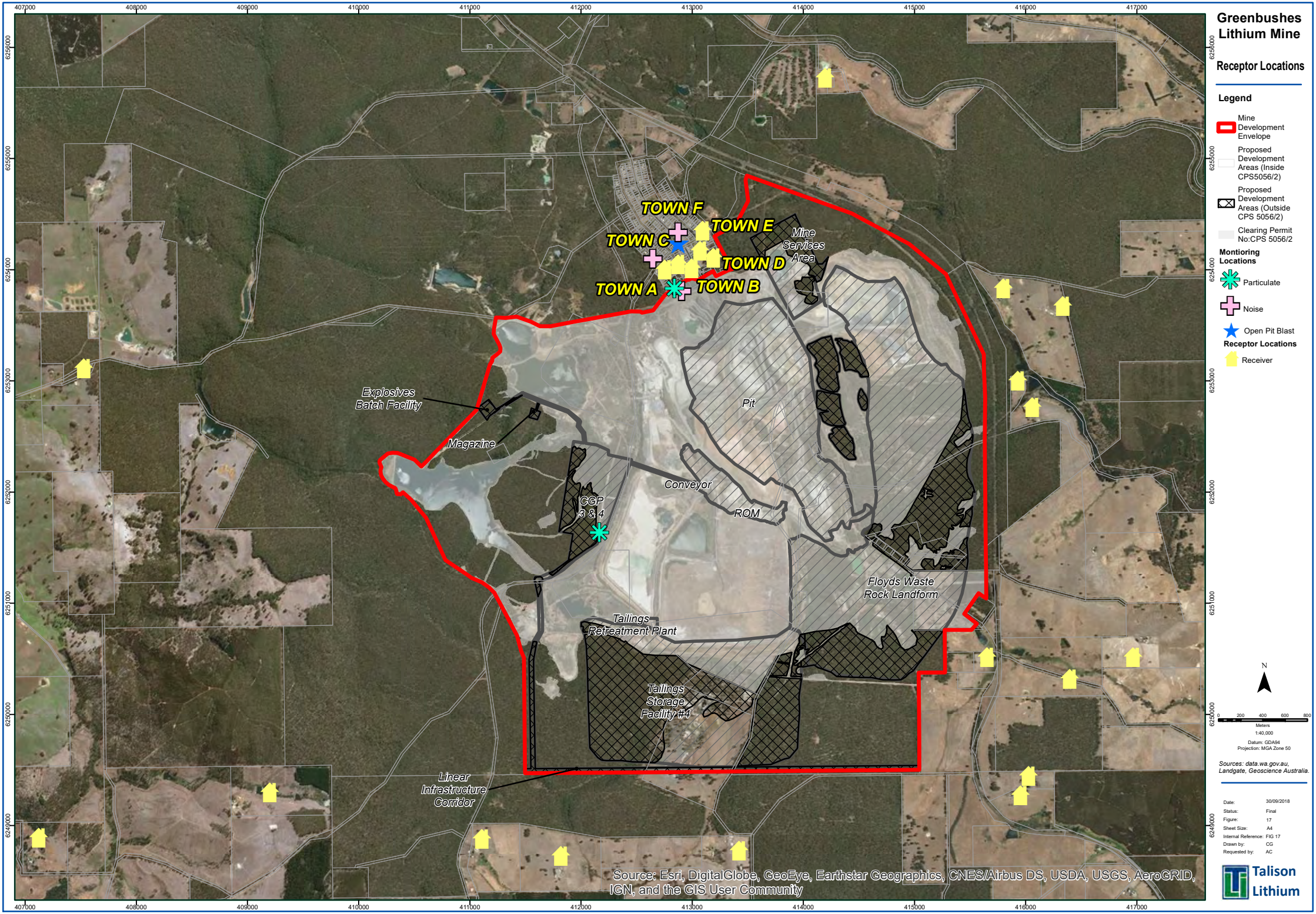
The Mine is located immediately south of the town of Greenbushes. All residences and businesses within the town are considered sensitive receptors due to the town's proximity to the

Mine. The location of the Greenbushes town site and surrounding sensitive receptors is shown in Figure 17. The closest residence to the MDE is approximately 80 m from the boundary. Outside the town site an additional 14 receptors have been identified within approximately 2 km of the MDE. These receptors are predominantly to the south and east of the Mine. The minimum separation distance recommended in the Department of Environment Regulation (now DWER) Draft Separation Distances Guidance Statement (2015) for noise and dust for Category 5 prescribed premises is 2 km. The closest receptors outside the town of Greenbushes are approximately 400 m from the MDE boundary and approximately 600 m from the closest mining activity (waste dumping at Floyds WRL).. Native vegetation and fauna are also considered sensitive receptors. Impacts to fauna and native vegetation are discussed in section 4.5.4 and 5.5.4.

6.4 Potential impacts

The potential impacts that may occur to air quality as a consequence of the proposed expansion of the Mine include:

- Reduced air quality due to dust emissions associated with:
  - vegetation clearing;
  - earthworks for infrastructure construction (CGP3, CGP4, TRP, Crusher 3, ROM Pad, MSA, TSF4, batching plant and magazine);
  - ore and waste haulage and other vehicle and equipment movements on unsealed roads;
  - extraction of ore and waste from the pit including drilling, blasting and material handling activities;
  - wind erosion from increased open areas including TSFs, WRL, haul roads, open pit and stockpiles; and
  - crushing, screening and transfer of ore within the processing circuit.
- amenity impacts to receptors as result of the nuisance and aesthetic impact of visible dust;
- health impacts on sensitive receptors and native fauna as a result of dust emissions;
- reduced air quality due to increased combustion emissions; and
- increase in greenhouse gas emissions associated with the increased mining fleet and ore processing required for the expanded operation.



Greenbushes Lithium Mine

Receptor Locations

Legend

- Mine Development Envelope
- Proposed Development Areas (Inside CPS5056/2)
- Proposed Development Areas (Outside CPS 5056/2)
- Clearing Permit No:CPS 5056/2

Montioring Locations

- Particulate
- Noise
- Open Pit Blast

Receptor Locations

- Receiver

N

0 200 400 600 800
Meters
1:40,000

Datum: GDA94
Projection: MGA Zone 50

Sources: data.wa.gov.au, Landgate, Geoscience Australia.

Date:	30/09/2018
Status:	Final
Figure:	17
Sheet Size:	A4
Internal Reference:	FIG 17
Drawn by:	CG
Requested by:	AC

Talison Lithium

6.5 Assessment of impacts

6.5.1 Reduced air quality, health and aesthetic impacts due to dust emissions

Dust emissions can reduce air quality in the surrounding area, cause acute and chronic health effects, as well as impact amenity as a result of reduced visibility and settling on surfaces causing soiling and staining (DEC 2011). The potential impact of dust is determined by particle size, chemical composition and concentration (DEC 2011).

The total suspended solid (**TSP**) fraction of dust is typically responsible for nuisance and amenity impacts whereas the smaller PM_{10} and $PM_{2.5}$ fractions are more commonly associated with the potential for health impacts due to their ability to penetrate the lungs (DEC 2011).

The majority of dust from mining activities consists of coarse particles (around 40%) and particles larger than PM_{10}, generated from activities such as mechanical disturbance of rock and soil materials by blasting and drilling, dozing, excavation, loading and dumping, and trucks on haul roads. A small amount of dust emissions can be associated with crushing and processing. Dust is also generated when wind blows over bare ground and different types of stockpiles (GHD 2018a). Overall dust emissions associated with the Mine are expected to increase as a result of the expansion. Increased dust emissions from the Mine will occur as a result of:

- mechanical vegetation clearing, up to 350 ha of native vegetation clearing will be undertaken;
- earthworks for infrastructure construction (CGP3, CGP4, Crusher 3, TRP, ROM Pad,MSA, TSF4, batching plant and magazine);
- increased ore and waste haulage and other vehicle and equipment movements on unsealed roads;
- increased extraction of ore and waste from the pit including drilling, blasting and material handling activities. The mining fleet is expected to more than double for the expanded Mine to meet the proposed production increase from 4.7 Mtpa to 9.5 Mtpa of ore with an associated increase in waste stripping. The current blasting frequency will increase to meet the increased production rate;
- wind erosion from increased open areas including TSFs, WRL, haul roads, open pit and stockpiles. The tailings surface and product stockpiles in particular are susceptible to dust generation due to the very fine particle size of the material; and
- increased crushing, screening and transfer of ore within the processing circuit associated with the production increase from approximately 4.7 Mtpa to 9.5 Mtpa of ore.

A dust impact assessment inclusive of air dispersion modelling was undertaken by GHD (2018a) in order to assess the potential impact of dust emissions from the expanded Mine on surrounding sensitive receptors. The assessment considered both the incremental impact of dust emissions from the Mine, and the cumulative impact based on current PM_{10} monitoring results from the Mine. A peer review of the first version of the dust impact assessment was undertaken by ERM (2018) in regards to both air quality and health risk. A revision of the dust impact assessment was then undertaken to address the findings of the peer review and the revised assessment is applied from here on.

One modelling scenario was produced for the year 2028 which is generally regarded to represent the maximum activity level for the expanded Mine, based on the predicted volume of material removed from the open pit. Full results of the air dispersion modelling are included in the revised Dust Impact Assessment Report in Appendix F (GHD 2018a). A summary of the modelling and assessment is presented below.

The impact of dust emissions from the expanded Mine was assessed by comparing air dispersion modelling results to relevant criteria. The criteria referred to include:

- *National Environment Protection (Ambient Air Quality) Measure* (**Air NEPM**), National Environment Protection Council (NEPC);
- *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* (**Kwinana Policy**), WA EPA;
- *State Environment Protection Policy (Air Quality Management)* (**SEPP-AQM**), EPA Victoria (2002); and
- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW Approved Methods**), NSW EPA (2005).

Additionally the premises operating licence (L4247/1991/13) conditions establish a limit for monitored PM_{10} levels (90 µg/m^3) which is referred to as an additional criteria.

The Air NEPM was developed to provide benchmark standards for ambient air quality to ensure all Australians have protection from the potential health effects of air pollution. Air NEPM standards for particulate matter only are referred to in this assessment. The Air NEPM does not outline any 1-hour PM_{10} criteria, TSP or monthly deposition criteria. Accordingly, the SEPP-AQM, Kwinana Policy and NSW Approved Methods have been referred to as a criteria for this assessment. The criteria used to assess the impact of dust emission from the Mine are detailed in Table 24.

Table 24 Criteria for cumulative ambient air quality at sensitive receptors

Pollutant	Averaging period	Maximum allowable concentration	Guideline/Criteria
TSP	24-hour	90 µg/m^3	Kwinana Policy
	Annual	90 µg/m^3	NSW Approved Methods
PM_{10}	1-hour (99.9th percentile)	80 µg/m^3	SEPP-AQM
	24-hour	50 µg/m^3	Air NEPM
	Annual	25 µg/m^3	Air NEPM
Deposited dust	Maximum increase	2 g/m^2/month	NSW Approved Methods
	Maximum total	4 g/m^2/month	NSW Approved Methods

The maximum incremental and cumulative results for TSP, PM_{10} and deposited dust from predictive air dispersion modelling are summarised in Table 25 including comparison to the maximum allowable concentration for the relevant criteria.

Table 25 Predicted maximum dust concentration (worst-case conditions) comparison with relevant air quality criteria for Greenbushes Lithium Mine

Pollutant	Averaging period	Maximum allowable concentration	Maximum predicted incremental concentration at sensitive receptors from expanded Greenbushes Mine	Maximum predicted cumulative concentration at sensitive receptors (includes background)
TSP	24-hour	90 µg/m^3	75 ug/m^3 (Town B)	119 ug/m^3 (Town B)
	Annual	90 µg/m^3	19 ug/m^3(G)	53 ug/m^3(G)
PM_{10}	1-hour (99.9th percentile)	80 µg/m^3	129 ug/m^3 (H)	141 ug/m^3 (H)
	24-hour	50 µg/m^3	30 ug/m^3 (E)	48 µg/m^3 (E)
	Annual	25 µg/m^3	7 µg/m^3(G)	21 µg/m^3(G)
	24-hour (L4247/1991/13 licence limit at monitoring station)	90 µg/m^3	19 µg/m^3 (HiVol)	37 µg/m^3 (HiVol)
Deposited dust	Maximum total	4 g/m^2/month	0.12 g/m^2/month (G)	NA – no background monitoring data available

The incremental and cumulative 1-hour 99.9th percentile concentration for PM_{10} are the most significant results with the maximum incremental concentration predicted to reach 129 µg/m^3, and cumulative concentration predicted to reach 141 µg/m^3 at Receptor H in worst case conditions. The criterion of 80 µg/m^3 is predicted to be exceeded both by incremental and cumulative emissions. The criterion is also predicted to be exceeded both incrementally (at six) and cumulatively at ten additional receptors (Town A, Town B, D, E, F, G, H, L, O and P) during worst case conditions. It is noted that only the residences within the town of Greenbushes which are closest to the mine were modelled therefore the predicted exceedance could potentially extend to other residences within the township. An analysis of the exceedances showed that all were predicted to occur during periods of low wind speed (2.2 m/s or less) and between the hours of 9 pm and 5 am when the atmosphere experiences stable conditions. These calm, stable conditions are associated with higher pollutant concentrations as the pollutants are not dispersed by wind or atmospheric convection.

The cumulative maximum 24-hour average TSP concentration is predicted to exceed the air quality criteria at seven receptors (Town A, Town B, Town C, D, E, G and H). The maximum predicted cumulative daily average for TSP is 119 µg/m3 at Town B, which is 32% higher than the air quality criteria (90 µg/m3).

These results are based on a single modelling scenario using worst case meteorological conditions and the operational year predicted to have the highest dust emissions, based on forecast mining rates in that year. Predicting air pollution is a complex application and there are limitations with advanced dispersion models used to undertake predictions, due to the variability and limited predictability of modelling inputs. Real air quality concentrations are likely to be highly variable depending on emission levels and the persistence of particular meteorological conditions. The predicted results are therefore not representative of the typical level of impact which would be expected in the surrounding area, and rather are a conservative prediction of the maximum level of impact which could potentially occur.

Although the modelling has predicted an exceedance of the 1-hour 99.9th percentile maximum allowable concentration for PM_{10}, the 24-hour and annual average PM_{10} concentrations were all predicted to be below the respective criteria during worst case meteorological conditions. It is

therefore expected that emission levels will remain within the criterion during typical mine operation and meteorological conditions. Implementation of additional monitoring and mitigation can, and will be used to identify and respond to conditions which are more likely to result in increased dust emissions which could potentially impact the air quality of nearby sensitive receptors.

6.5.2 Reduced air quality due to blasting, and vehicle and heavy equipment combustion emissions

Air quality may also be reduced as a result of combustion emissions. Blasting and the operation of typically diesel powered vehicles and heavy equipment at the Mine generates combustion emissions. Combustion emissions from blasting include Carbon Monoxide (**CO**) and oxides of nitrogen (**NOx**), and from vehicles typically comprises NOx, Sulphur dioxide (**SO_2**), PM_{10} and volatile organic compounds (**VOCs**). There will be an increase in combustion emissions as a result of the expansion as the mining fleet is expected to at least double to meet the proposed anticipated annual average mining rate for the expansion of 16 Mbcm. Blasting is also expected to increase to daily with larger volume blasts . Combustion and blasting emissions are typically short-lived and the majority will occur within the confines of the open pit therefore they unlikely to significantly impact air quality.

6.5.3 Reduced air quality due to dust emissions during transport

Increased production from the Mine will result in increased transport requirements for the operation. Dust emissions could potentially occur as a consequence of transporting the lithium mineral concentrate product from the site to customers. Lithium mineral concentrate dust emissions can potentially cause air quality impacts on a regional scale as the transport routes used are between the Mine, Bunbury Port, Kemerton Strategic Industrial Area and Fremantle Port. Dust emissions along transport routes can cause a nuisance impact for receptors in proximity to the route who may be affected by the emissions. Dust emissions are unlikely to occur however as trucks transporting the lithium mineral concentrate will be covered.

6.5.4 Reduced air quality due to bushfire

Mining activities have the potential to ignite bushfires through hot work, vehicle movements and vegetation clearing. Bushfires can cause a temporary reduction in regional air quality, depending on the extent of the fire. Over half of the MDE is currently comprised of cleared area for mining activity and water storage and therefore does not support high fuel loads and unlikely to support a fire. The cleared area will increase as the Mine is expanded further reducing fuel levels. Robust emergency planning and management measures will reduce the likelihood of fire spread beyond the MDE to the surrounding state forest.

There is no record of bushfires resulting from the Mine throughout the past 30 years of open pit mining activity and the risk of one being generated as a consequence of the Mine expansion is considered to be very low if fire preventative actions continue to be applied

6.5.5 Increase in greenhouse gas emissions

The operation of typically diesel powered vehicles and heavy equipment at the Mine, plus grid electricity consumption for primarily processing results in generation of greenhouse gas emissions. Talison proposes to at least double the mining fleet as a result of the Mine expansion which will result in a corresponding increase in greenhouse gas emissions. An estimate of the predicted greenhouse gas emissions associated with the expanded Mine has been undertaken by Greenbase Pty Ltd (2018, Appendix G) in accordance with the methods from the *NGER (Measurement) Determination 2008*.

This assessment estimates that greenhouse gas production from the mine (inclusive of Scope 1 and Scope 2 emissions) will increase from the reported 73,161 t CO_2-e for the 2017-18 assessment period to 436,481 t CO_2-e for the 2028-29 assessment period. It is noted this is an estimate and is dependent on production in that year. There will also be an increase in the emissions intensity of the Mine rising from the existing 105 kg CO_2-e/tonne concentrate to 183 kg CO_2-e/tonne concentrate in the 2028-29 assessment period. Based on the 2016 National Inventory by Economic Sector and 2016 State and Territory Greenhouse Gas Inventories the highest annual emissions predicted for the Mine are equivalent to 0.08% of Australia's 2017 greenhouse gas footprint, 0.53% of Western Australia's 2016 greenhouse footprint and 0.41% of the mining industry's 2016 greenhouse gas footprint.

Talison has included more efficient technology in the design of the new CGP3 and CGP4 processing plant to minimise greenhouse gas emissions which may reduce the predicted greenhouse gas emissions. Some of the changes which have been incorporated in the design include use of high pressure grinding rolls in place of a tertiary crusher and primary ball mill, use of conveyors in place of pumps where feasible and greater allowance for gravity flow in the plant design, as well as improved design of control rooms to reduce heating and cooling requirements. Additionally, a site power review was recently undertaken and as result a commitment to install power correction which is expected to improve the efficiency of the incoming power supply was made. These inclusions are anticipated to reduce greenhouse gas emissions from the predicted levels stated above.

Talison currently reports greenhouse gas emissions in accordance with the requirements of the *National Greenhouse and Energy Reporting Act 2007* and will be continue to do so for the expanded Mine.

6.6 Mitigation

Dust monitoring is undertaken using a HiVol in accordance with the requirements of operating licence L4247/1991/13 to measure PM_{10} levels at the boundary between the operation and the nearest receptors in the town of Greenbushes. Additional monitoring is undertaken within the Mine using a TEOM dust monitor to measure dust levels in real time so that dust controls can be increased when results indicate the levels are rising. Talison also has an onsite meteorological station to record meteorological conditions. The operating licence specifies a limit for PM_{10} levels at the monitoring location to protect the air quality of the Greenbushes townsite. Talison will continue to implement the current monitoring program for the duration of the operation in accordance with these requirements.

Talison proposes to establish additional dust monitoring in accordance with the recommendations of the Revised Dust Impact Assessment (GHD 2018a). The additional monitoring will be established prior to commencing the Proposal activities and will therefore apply through construction and operation of the expanded Mine. The expanded monitoring program will include:

- Up to four dust deposition gauges to monitor cumulative dust emissions around the MDE boundary.
- Operation of up to two TEOM dust monitors at locations identified as the most likely to be impacted by dust emissions. This includes one TEOM which will be located between the Mine and nearest residences within the town of Greenbushes. (Note: Monitoring locations will depend on availability of power and communications coverage, and a suitable location, free from interference by surrounding infrastructure or vegetation).
- Configuration of meteorological and dust level alerts for select dust monitors

Further mitigation and management measures for impacts to air quality which are currently implemented or will be undertaken as part of the Mine expansion include:

6.6.1 Minimise

The key measures to minimise potential impacts to air quality associated with the Mine expansion are summarised in Table 26. The management plans and procedures listed are currently implemented at the Mine as part of Talison's ISO 14001 certified EMS and therefore undergo review in accordance with the EMS requirements.

Table 26 Mitigation measures to minimise air quality impacts

Potential impact	Mitigation Measures to Minimise Impact
Reduced air quality, health and aesthetic impacts due to dust emissions	Talison will implement a Dust Management Plan throughout the construction and operational phase of the Proposal which will include monitoring, dust level triggers and response actions. The plan will be adaptive and will be updated as requires as activities change over time. Key mitigation measures to be included in the Plan include: • Use of water carts within the mining, haulage and construction areas to wet down dust generating surfaces. • Progressive clearing of areas, so there is limited opportunity for dust generation from open areas. • Topsoil stripping and spreading activities will be restricted during high winds if dust cannot be adequately controlled. • Watering prior to blasting when weather conditions are dry and windy. • Operation and maintenance of dust extraction units within the processing plants and crushers. • Road sweeping on an as needed basis on sealed roads, predominantly around the processing areas • Use of weather forecasting to predict extreme weather conditions likely to result in increased dust emissions so that Talison can minimise the impact through application of extra dust controls. • Consideration will be given to weather conditions where possible when planning blasting to avoid conditions likely to increase the impact of dust (i.e. strong winds in the direction of receptors). • Management of TSF deposition to maximise wet areas to suppress dust from the surface of the facility. • Application of binding agents (such as Gluon or RT5) to the TSF surface, particularly during the dry summer period, to minimise wind generated dust emissions. • Maintenance of a vegetated cover (grass) on inactive surface areas of the TSF. • Progressive rehabilitation of disturbed areas (which are at their final state) to minimise wind erosion from open areas

Potential impact	Mitigation Measures to Minimise Impact
	• Use of sprinklers on product and fine ore stockpiles to minimise dust emissions from these areas. • Storage of product stockpiles in covered areas where available.
Reduced air quality due to blasting, and vehicle and heavy equipment combustion emissions	• Blasting will be undertaken in accordance with a Blast Plan. • Vehicles and heavy equipment will be operated and maintained in accordance with manufacturers specification in order to minimise emissions.
Reduced air quality due to dust emissions during transport	• Trucks transporting lithium mineral concentrate will be enclosed or covered.
Reduced air quality due to bushfire	To minimise the risk of bushfire Talison will continue to implement a: • Hot Work Permit System • Emergency Management Plan, Procedures and training regime.
Increase in greenhouse gas emissions	• Consideration of energy efficiency when selecting mining equipment fleet and designing infrastructure to minimise greenhouse gas emissions. • Consideration of the use of renewable power generation as a component when procuring a new long term power supply agreement.

6.7 Predicted Outcomes

Expansion of the Mine will result in increased emissions of dust and combustion products which will impact on the local air quality. Based on the results of predictive air modelling dust emissions from the Mine may cause localised temporary exceedance of air quality criteria if worst case meteorological conditions occur. The town of Greenbushes is within the area where air quality is predicted to exceed the nominated criteria for 1-hour (99.9th percentile) PM_{10} levels and 24-hour TSP level. The remaining air quality criteria inclusive of daily and annual PM_{10} and deposited dust, are predicted to be met at all receptors.

The potential for reduced air quality (and exceedance of air quality criteria) as a result of dust emissions from the expanded Mine can be mitigated through expanding the existing dust monitoring system, establishing meteorological and dust levels alerts, and implementing mitigation actions to reduce dust emissions when the alerts are triggered. Continued monitoring of air quality (PM_{10} and TSP) will inform Talison of the impact of dust emissions on surrounding sensitive receptors.

There is not expected to be any permanent or significant impact on air quality resulting from the Mine expansion and Talison will continue to implement controls to ensure compliance with licence limits for PM_{10}.

7. Social Surroundings

7.1 EPA Objective

The EPA applies the following objective in its assessment of proposals that may have a significant effect on social surroundings:

To protect social surroundings from significant harm.

For the purposes of EIA, the EP Act defines social surroundings as the aesthetic, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by their physical or biological surroundings.

7.2 Policy and guidance

- Environmental Factor Guideline Social Surroundings (EPA 2016h).
- Guidance for the Assessment of Environmental Factors, Assessment of Aboriginal Heritage No. 41 (EPA 2004).
- *Environmental Protection (Noise) Regulations 1997*.
- *Aboriginal Heritage Act 1972.*
- *State Planning Policy 2: Environment and Natural Resources Policy*
- Visual Landscape Planning in Western Australia: A Manual for Evaluation, Assessment, Siting and Design (DPI 2007)

7.3 Receiving environment

7.3.1 Cultural heritage

European heritage

A database search was undertaken to determine whether the proposed Mine expansion will impact on any World or Commonwealth Heritage Sites. No sites on the Commonwealth or World Heritage lists occur within 5 km of the MDE. One site (Southampton Farm Homestead) on the Register of National Estate is located approximately 6.5 km from the MDE.

A search on the inHerit Western Australia database did not identify any registered sites within the MDE (Heritage Council 2017). The South Cornwall Pit, which is part of the operating mine, is listed as “Other Heritage Listings” on the municipal inventory. It is a Category 2 site of local significance due to the continuous history of mining activity at this location. The registered sites closest to the Mine, include:

- Numerous sites within the town of Greenbushes;
- Golden Valley Site approximately 8 km north-east; and
- Southampton Homestead approximately 6.5 km west.

A locally recognised site of historical significance, the ‘Lost and Found’ mine is located between the open pit and existing Floyds WRL, within the current Active Mine Area. The location is known to be locally significant although does not occur on the heritage register. The site is not currently accessible to the public. Talison has committed to investigate options for retaining this site within the Mine’s current Mine Closure Plan.

Another site of historical significance which is not listed is the Greenbushes cemetery. The cemetery is located outside the MDE approximately 100 m east of the proposed expansion

footprint for Floyds WRL. Talison contributes funding toward the upkeep and maintenance of this site.

Aboriginal heritage

The Project area occurs at the boundary of the South West Boojarah #2 Native Title Claim area (WC2006/004), and the Wagyl Kaip (WC1998/070) and Southern Noongar (WC1996/109) Native Title Claim area. Talison has a Noongar Standard Heritage Agreement in place with the South West Boojarah #2, and Wagyl Kaip and Southern Noongar claimant groups. A search of the Aboriginal Heritage Inquiry System identified one 'Registered' Site of Aboriginal heritage significance, the Blackwood River (ID 20434), and no Sites lodged as 'Other Heritage Places' in proximity to the Mine (DPLH 2017). The Blackwood River is a site of mythological significance in association with *Waugal* beliefs (Brad Goode & Associates 2016). The Blackwood River site occurs within mining tenements M01/2, M01/4, M01/5, M01/10 and L01/1 and is entirely outside the MDE for the Mine expansion. The site will not be directly or indirectly impacted by the Proposal.

An Aboriginal Heritage Survey within the existing active mining area boundary (M01/3, G01/1, G01/2, M01/6, M01/16 and M01/7) was conducted by Brad Goode & Associates in December 2015/ January 2016. The survey involved representatives of the Gnaala Karla Booja, South West Boojarah and Wagyl Kaip Native Title Groups (Brad Goode & Associates 2016). The survey included a desk top study, an archaeological inspection of the survey area, and ethnographic consultation with the nominated Noongar representatives. The survey did not identify any Aboriginal Sites of significance as defined under section 5 of the *Aboriginal Heritage Act 1972* (AH Act). Some areas of the expanded MDE for the Project were not covered by the 2015/2016 survey therefore an ethnographic and archaeological survey of areas not previously surveyed was undertaken involving representatives of the South West Boojarah Native Title Group in April 2018. The survey did not identify any Aboriginal heritage sites or places as defined by section 5 of the AH Act within the MDE.

7.3.2 Visual Amenity

The Mine is located directly south of the town of Greenbushes, is bounded to the west by the South Western Highway, and is traversed by the Maranup Ford Road through the western extent of the MDE. The MDE is predominately located within, and surrounded by State Forest 20, with undulating agricultural properties, the Greenbushes rural township and plantations also located within the surrounding area. The primary land uses occurring within the MDE are mining, agriculture forestry (State Forest), and water catchment. Other towns in proximity to the MDE include Bridgetown approximately 10 km south east, and Balingup approximately 10 km north west although the Mine is not visible from either township.

The MDE occurs within the Yilgarn Plateau Province and intersects the Darling Plateau system. The system is described as a lateritic plateau with duplex sandy gravels, loamy gravels and wet soils and a Jarrah marri wandoo forest and woodland (Onshore Environmental 2018f). The MDE is situated at a high point of the Darling Plateau which rises to approximately 320 m AHD. The Plateau is characterised as an expansive undulating landscape with green forest vegetation and occasional rocky outcrops and peaks. The open pits are located along a ridgeline at approximately 300 mAHD running from the Greenbushes town site to the south east.

Floyds WRL is located on the east facing hill slope of the ridgeline between the open pits and the South Western Highway. Vegetation on the hill slope, and the WRL act as a visual buffer to the lithium processing areas, TSFs and constructed reservoirs/dams which are located on the west facing hill slope, and the open pit along the ridge. The top of the existing Floyds WRL is currently visible from a section of the South Western Highway and elevated areas of the

operation such as the Floyds WRL are also visible from high points in the surrounding area, predominantly to the east of the MDE (Onshore Environmental 2018f).

The Greenbushes region is recognised as the longest continuously operated mining area in WA with mining having been undertaken since 1888. A large proportion (approximately 66%) of the MDE has already been disturbed due to the legacy of historic and modern of mining within the area, as well as forestry, water storage and supply, surrounding agriculture activities and edge effects from the town of Greenbushes. The visual landscape of the MDE and surrounds has been improved over the period of modern mining at Greenbushes through sustained progressive rehabilitation of historic mining disturbances. Examples of the Greenbushes area in the 1970's compared to the current day is included in Figure 18.

Figure 18 Greenbushes mining region circa 1970's (left) and current day (right)

7.3.3 Noise

The existing noise environment within the vicinity of the MDE is dominated by the following local noise sources:

- Mining and processing (currently from the Talison Greenbushes Lithium Mine, but historically and potentially in future can include the GAMG tantalum operation which is co-located with the Talison operations within the MDE);
- Traffic associated with South Western Highway, Maranup Ford Road and local Greenbushes townsite; and
- Natural (leaves rustling, wind in trees and bird and insect calls).

- The closest other industry in the surrounding area is the GAMG tantalum operation which is located within the MDE (currently has reduced production from the secondary process plant only), and Greenbushes sawmill approximately 3 km north. The closest sensitive receptors are located within the town of Greenbushes immediately north of the mining operation. In addition to receptors within the Greenbushes townsite, 14 sensitive receptors were identified within approximately 2 km of the MDE predominantly to the south and east (Figure 17). The closest of these is approximately 400 m from the MDE eastern boundary and 600 m from the closest mining activity (waste dumping at Floyds WRL).
- Due to the close proximity to sensitive receptors (and nature of activities undertaken), the Mine does not meet the noise limits specified by the *Environmental Protection (Noise) Regulations 1997* (**Noise Regulations**). Approval to exceed the specified limits was sought, and approval for increased noise limits was granted through *WA Government Gazette*, 27 February 2015, No. 31. *Environmental Protection (Talison Lithium Australia Greenbushes Operation Noise Emissions) Approval 2015* (referred to as **Talison Regulation 17 Approval**). GAMG tantalum operations also operate under an identical approval *Environmental Protection (Global Advanced Metals Greenbushes Operation Noise Emissions) Approval 2015*. As a result, when both companies are operating, the combined noise emissions can't exceed the limits specified in the Regulation 17 Approvals. The approved noise levels as per the Talison Regulation 17 Approval are summarised in Table 27.

Table 27 Talison Regulation 17 Approved noise limits

Type of premises receiving noise	Time of day	LA 10 approved level (dB)	A max approved level (dB)
A highly sensitive area	700 to 1900 hours all days	53	71
	1900 to 2200 hours all days	51	69
	2200 to 0700 hours all days	50	68
A noise sensitive premises other than a highly sensitive area Commercial premises	All hours	60	80

Continuous noise monitoring is undertaken at the 'Sound Wall' north of the Cornwall pit. The 'Sound Wall' is a noise bund, originally established to reduce noise impact when mining and processing activity was occurring closer to the Greenbushes townsite. The results of monitoring since 2001 are summarised in Figure 19. The Talison Regulation 17 Approval limits in Figure 19 include an additional 12dB attenuation factor to account for the predicted noise level at the nearest highly sensitive area based on the recorded noise level at the 'Sound Wall'.

Noise levels have reduced since the early 2000's as a result of the cessation of mining within the Cornwall open pit and primary processing activities which were the closest activities to the

townsite. Noise levels have started to increase over the past two years as a result of increased mining activity and construction of new processing infrastructure at the Mine, but are still well within the Regulation 17 Approval limits.

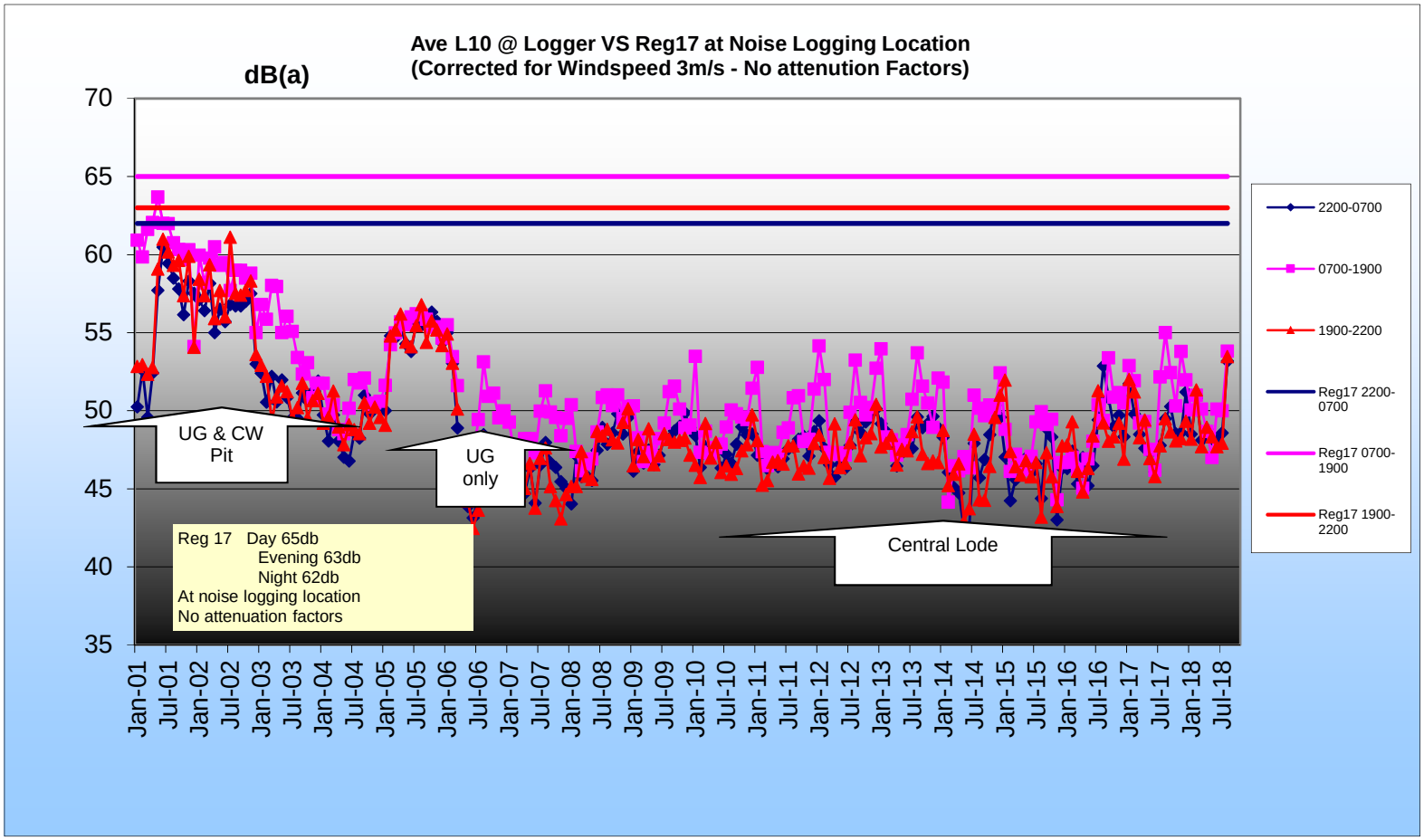


Figure 19 Summary of Noise Monitoring Results for the Greenbushes Operation in comparison with Regulation 17 limits

7.3.4 Vibration

Ground vibration and airblast produced from blasting can cause discomfort to sensitive receptors and potentially cause damage to structures, architectural elements and services of sufficient magnitude, or occurring over an extended period of time. Structural damage is not always the result of vibration and can also be the result of natural deterioration of structures or ground or foundation movements (Boucher 2018).

Ground vibration and airblast levels are influenced by a range of factors, not all of which are within the control of the person conducting the blast. These include the rock type, structure, topography, meteorological conditions, explosive type, blast design and geometry. Site based measurements are therefore needed for accurate prediction of ground vibration (Boucher 2018).

Talison is required to comply with ground vibration limits set out in AS2187 at sensitive receptors. The limits are 95% of ground vibration less than 5 mm/s and 100% of ground vibration less than 10 mm/s. Airblast level limits are set out in the Talison Regulation 17 Approval. The approved airblast level limits are summarised in Table 28.

Table 28 Talison Regulation 17 approved airblast level limits

Type of premises receiving noise	Time of day	Approved airblast level (dB Lz peak)	Approved airblast level (dB Lz peak) not to be exceeded for 9 in any 10 consecutive blasts
Sensitive receptor	0700 to 1800 Monday to Saturday	125	120
	0700 to 1800 Sunday or a public holiday	120	115

Compliance with ground vibration and air overpressure limits are verified using a ground vibration (geophone) and an air overpressure (microphone) sensor that are connected to data logger and transmission instruments. The monitoring station is located within the Greenbushes township and monitoring has been undertaken since the early 1990's.

A review of blast monitoring data from 2014 -2018 (900 blast events) was undertaken and found that ground vibration resulting from blasting activity is well within the limits set out in AS:2187 and is very low (<1.5 mm/s). Similarly the results for air overpressure monitoring were all within the approved airblast levels set out in Table 28 over the five year period of assessment. The monitoring results are illustrated in Figure 20 and Figure 21.

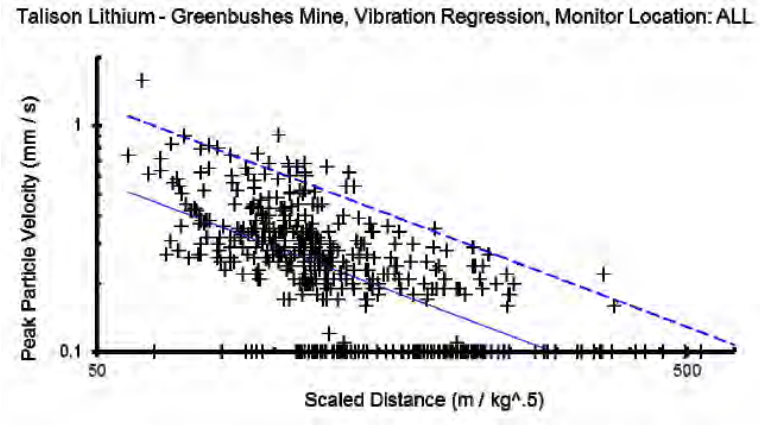


Figure 20 Ground vibration monitoring results 2014 to 2018

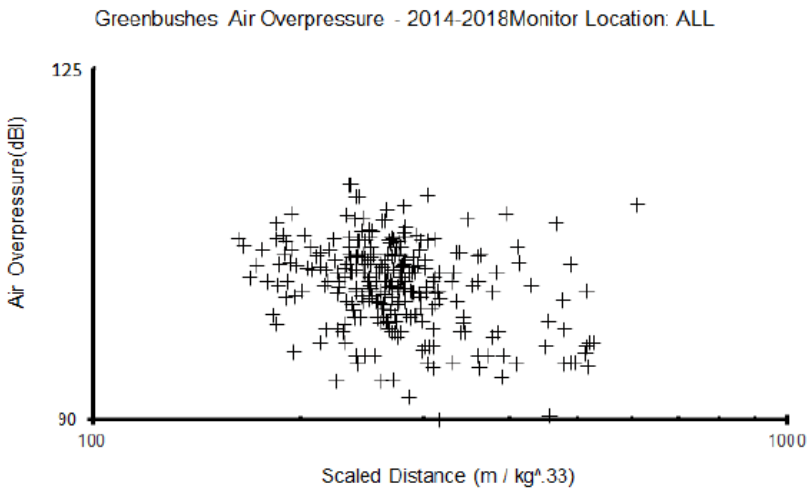


Figure 21 Air overpressure monitoring results 2014 to 2018

7.3.5 Traffic

Access to the mine is largely via the South Western Highway and through the town of Greenbushes along Stanifer Street/Maranup-Ford Road. Approximately 340 light vehicle movements travel through Greenbushes on a daily basis transporting staff to and from the mine. Less vehicle movements occur over weekends when only operational personnel are onsite.

Lithium mineral concentrate is currently transported, via truck, from the mine through the town of Greenbushes then along South Western Highway to the Port of Bunbury (or at times can also be transported to Fremantle). Supply trucks also access the mine via South Western Highway and through the town along Stanifer Street/Maranup-Ford Road however come from a variety of locations. The number of supply and product transport truck movements associated with the mine is currently estimated to be approximately 60 movements. Transport trucks are currently B Double size, 27.5 m (66 t).

Developments directly impacting the traffic movements to and from the Mine include establishment of lithium hydroxide production plants at Kwinana (currently under construction) and Kemerton (currently undergoing approvals). A proportion of the lithium mineral concentrate product transported from the Mine will be diverted to these two plants instead of being delivered to the Port of Bunbury.

7.4 Potential impacts to social surroundings

The potential impacts that may occur to social surroundings as a consequence of the proposed expansion of the Mine include:

- Disturbance of unidentified heritage sites during clearing and/or excavation works;
- Reduced visual amenity at night as a result of increased lighting at the operation;
- Reduced visual amenity from additional and increased mining footprint, specifically the Floyds WRL and TSF4;
- Noise impacts to sensitive receptors through increased noise emissions;
- Vibration impacts associated with increased frequency and potential size of blasting; and
- Amenity impact resulting from increased traffic on local networks (Greenbushes town and South Western Highway).

Assessment of the potential impacts identified above and mitigation measures to address these are detailed in the following sections.

7.5 Assessment of impacts

7.5.1 Cultural heritage

There are no known protected European or Aboriginal heritage places within the MDE. It is considered unlikely that indirect impacts to the Blackwood River (Registered Site of Aboriginal heritage significance) will occur as the mine water circuit is designed to contain water impacted by mining within the MDE for water supply to the operation. Unknown artefacts or burial locations of potential heritage significance could potentially be uncovered during earthworks and excavations. Given that that the area has been subject to recent archaeological and ethnographic surveys however, discovery of artefacts or buried locations is considered unlikely.

Sites of cultural significance outside of, but within close proximity to the MDE, such as the Greenbushes cemetery have been excluded from the MDE boundary and avoided during the design of the expansion to ensure mining activities do not cause an impact. Buildings within the town on Greenbushes could potentially be indirectly impacted as a result of vibration from blasting at the Mine however this is considered unlikely to occur. Talison has been undertaking property/structural inspections (performed by an independent consulting engineer) at the Greenbushes Primary School and six private residences closest to the Mine since 1993 on a biannual basis when operating in close proximity and annual basis in recent time since mining has moved further from the town. The inspection records show that deterioration of these buildings is a result of the age and type of structures and is not impacted by vibration. Further details on vibration impacts are included in section 7.5.4.

7.5.2 Visual amenity

There is currently a limited view of the Mine from the immediate sounding area due to the screening effect of the surrounding State Forest 20 and the natural topography. Floyd's WRL is elevated in the landscape and therefore sections of the landform can been seen from the South Western Highway, rural residences to the east and high points in the surrounding area. Floyds WRL will become a more dominant feature of the landscape as the height of the WRL increases to the final approved height of 330 m AHD and the landform extends to the south. The TSF landforms are also elevated and as they increase in height, and an additional TSF (TSF4) is established, they will also become more dominant features and increasingly visible from surrounding areas. The TSFs do not however pose a visual risk because there are limited receptors to this amenity. The development of these landforms will result in a permanent change to the local landscape which has already been altered through the legacy of mining, forestry and agricultural activities in the area.

A visual impact assessment (**VIA**) was undertaken (Onshore Environmental 2018f, Appendix I) to evaluate the visual amenity impact associated with the Mine expansion. The VIA was conducted in three stages:

- Desktop assessment to understand the existing and future landscape and identify viewpoints accessible to the public.
- Field assessment to understand the visual characteristics from viewpoints that would commonly be experienced by receptors.
- Impact Assessment (based on photo montage produced from computer modelling).

The desktop assessment was used to select twelve suitable viewpoints for the VIA and develop a regional digital elevation model (**DEM**) using regional contours, LIDAR data and Talison project landform development data to analyse using 3D visualisation software and photographs from each viewpoint. The field assessment involved visitation to each viewpoint and undertaking

a qualitative assessment of the characteristics of the viewpoint for a range of criteria as well as photograph the current view.

Viewshed analysis was used to determine potentially visible areas of the Mine from the selected viewpoints accessible/visible to the public. Photographs and GPS coordinates from the viewpoints were used in computer modelling, together with the proposed site infrastructure footprint superimposed on the photographs, to illustrate a simulated view of what the expanded Mine will look like from each viewpoint. A formalised Visual Impact Risk Assessment determined the potential visual impact of the Mine expansion from each viewpoint during various stages of the operation including the current form, construction/development and at the predicted end of mine life.

The assessment found that there is currently limited visual impact to surrounding receptors due to the screening effects of the surrounding state forest and topography. The most prominent feature of the Mine is Floyds WRL, as the landform is elevated in the landscape and can be seen from sections of the South Western Highway and from rural properties located along the eastern side of the landform. Current rehabilitation efforts have reduced the visual impacts significantly with only the active dumping area at the top of Floyds WRL creating a disconnect at a distance (Onshore Environmental 2018f).

The risk assessment indicates that the potential visual impact of current mining operations on local receptors is a low to moderate risk. The highest potential visual impact is associated with the Floyds WRL where active dumping areas can impose on residents and motorists at various vantage points along the eastern side of operation. Visual impacts from Floyds WRL are most noticeable along Catterick Road and can be viewed with negligible impacts along South Western Highway. There is no predicted impact to the other sensitive receptors assessed (Onshore Environmental 2018f).

During the construction/development phase of the Mine expansion potentially high visual risks have been identified associated with the TSF4 and Floyds WRL. Without management measures being implemented, these visual impacts are likely to have a significant consequence on receptors such as residences and road users. Extensions of the Floyds WRL may be noticeable from nine of the 12 assessed viewpoints in 2022. Talison proposes to implement progressive rehabilitation, community consultation, land acquisition and management of night activities to reduce this impact (Onshore Environmental 2018f).

Following construction/development Talison will continue to progress with development of the mine and progressive rehabilitation which will see the impact to visual amenity decline particularly as the Mine moves toward closure and rehabilitation ages. It is expected that the final TSF design will have moderate visual impacts however receptors will be minimal to none. In addition, once the Floyds WRL has been completely rehabilitated it is expected that the visual impact to receptors will be low. The final landform will blend into the landscape with a level of congruency (Onshore Environmental 2018f).

Light spill during night operations

Lighting requirements, in particular for waste dumping at Floyds WRL, and construction of TSF 4 (if undertaken during night periods) may cause light overspill to surrounding receptors in close proximity. Talison has developed a light management plan to ensure activities are appropriately managed to limit light overspill. Light spillage from processing areas, and mining and haulage within the pit is expected to be minimal as these areas occur lower in the topographic profile and are shielded by the surrounding forest and other landforms.

Figure 22 Visual impact viewpoints

7.5.3 Noise

The primary noise sources at the Mine include blasting, operation of mining equipment and vehicles, rock breaking on the ROM, crushing and processing activities. The expansion involves construction and operation of an additional crusher and processing plants, and an increase of the mining fleet. Blasting frequency will also increase to daily. Accordingly, it is anticipated that noise emissions associated with the operation will increase as the expansion progresses.

Construction noise associated with CGP3, CGP4, Talison CR3, TRP, the MSA and explosive infrastructure is not expected to impact on receptors as it is unlikely to be distinguishable from the existing background mining noise. Earthmoving associated with construction of the starter embankment for TSF4 could potentially impact on receptors located to the south of this infrastructure.

Herring Storer Acoustics (HSA) developed the initial "SoundPlan" noise model for the Mine, which has been maintained over time. The model is updated when planning new activities at the Mine to predict the likely noise levels and assess the impact associated with proposed changes. An update to the noise model was undertaken by Herring Storer Acoustics to include the proposed Mine expansion and predict noise levels in the surrounding area as the expansion progresses (Appendix J).

As part of the assessment measurement of current noise levels was also undertaken in April 2018 to confirm existing noise levels for inclusion in the model update (HSA 2018) and current compliance with the Talison Regulation 17 Approval. The noise modelling included operation of GAMG's primary crusher to account for the cumulative impact of the potential scenario of the tantalum primary processing operation recommencing. The results found the Mine currently applies with the criteria specified.

The initial modelling conducted predicts that noise levels associated with the expanded Mine have the potential to exceed the Regulation 17 Approval limits in worst case conditions. Analysis of the initial noise emissions was undertaken to identify areas where the potential exceedances may have occurred. Further predictive noise modelling of various noise control options identified the most efficient areas to implement noise bunding to achieve the greatest impact on attenuating noise levels for each stage of the expansion (HSA 2018). With the installation of additional noise bunding, it was found that compliance with the Regulation 17 Approval limits can be achieved (HSA 2018).

The two areas identified as being the most effective locations for the noise bunds are:

- Northern end of the existing ROM Pad.
- Eastern extension of the existing noise bund at the northern end of the MDE

The bund on the north end of the existing ROM is proposed to be built first. Following this an extension of the existing noise bund ('Sound Wall') will be established. The proposed height of the bunds is approximately 10 m and their proposed location is shown in Figure 23.

Figure 23 Proposed location for two noise bunds

Monitoring and management of noise emissions is currently undertaken in accordance with a Noise Management Plan to prevent exceedance of the Regulation 17 Approval Limits. Talison and GAMG implement the joint Noise Management Plan which is approved by the DWER CEO (Appendix J). The Noise Management Plan has been updated based on the proposed addition of noise bunds. The updated Plan will be submitted to DWER for approval.

The Noise Management Plan includes trigger levels based on the Regulation 17 Approval limits which are summarised in Table 29. The triggers require investigation and reporting in some instances. The plan also specifies continuous monitoring of noise is undertaken at the Sound Wall, which overlooks the open pit. The results of monitoring are also used to confirm and refine the accuracy of the noise model.

Table 29 Talison Regulation 17 noise trigger levels

LA Max Trigger	Peak noise events at the noise monitoring station on the sound wall. These levels correspond to the Regulation 17 approved levels + 12dB Attenuation Factor. The LA Max triggers are as follows:	
	0700-1900 Hours	83 dB
	1900-2200 Hours	81 dB
	2200-0700 Hours	80 dB
Primary LA10 Trigger	The Primary response is triggered by noise levels at the noise monitoring station exceeding the Regulation 17 selected levels in greater than 20% of hours for that time period. i.e. 80% of hours will have levels less than the selected value. These levels correspond to a noise level 4dB below the approved levels + 12dB attenuation Factor	
	0700-1900 Hours	61 dB
	1900-2200 Hours	59 dB
	2200-0700 Hours	58 dB
Secondary LA 10 Trigger	Noise levels at the noise monitoring station exceeding the Regulation 17 selected levels in greater than 2% of that time period will trigger the secondary response. i.e. 98% of hours will have noise levels less than the selected level. These levels correspond to the approved levels + 12dB Attenuation Factor	
	0700-1900 Hours	65 dB
	1900-2200 Hours	63 dB
	2200-0700 Hours	62 dB

Attenuation Factor - An Attenuation Factor of 12 dB (A) is applied to the Regulation 17 limits to assess noise levels recorded at the noise logger on the sound wall to allow for noise decay between the noise logger and the closest modelled location within the Greenbushes Town site.

7.5.4 Vibration

Blast sizes and frequency are expected to increase as the mine production is increased which may cause vibration which could potentially impacts on surrounding sensitive receptors. An analysis of Blast Induced Ground Vibration and Air Overpressure was undertaken for the Mine expansion (Boucher 2018, Appendix K). A review of actual blast vibration measurements recorded from 2014 to 2018 was undertaken to try to develop a vibration prediction equation.

The analyses showed that blasting at the Mine will very probably achieve compliance with ground vibration limits as stipulated in AS:2187 (5 mm/s ppv) (Boucher 2018) based upon the use of similar techniques to those previously applied to blasting at the Mine. Vibration impacts can be effectively managed through consideration during blast design.

The regression relationship developed for air overpressure limits was not sufficiently reliable to derive a prediction of conformance with the air blast limits set within the Regulation 17 Approval. This finding is consistent with industry experience and is due to the poor correlation coefficients that result from the influence of ambient environmental conditions and cannot be taken into account. However, it is anecdotally indicated that compliance with air overpressure limits should be achievable using techniques already used at the Mine. These include:

- Very accurate QA/QC applied to loading and stemming operations;
- Use of specific row and face orientation relative to sensitive receivers;

- Use of individual blast hole logs to customise the charge and stemming length for each blast hole to localised geologic character;
- Use of longer than normal stemming length;
- Survey of face shape and conformity of face row holes (to achieve minimum confineable face burden;
- Use of reduced MIC, hole diameter and bench height;
- Use of sand covering within and over presplit hole collars;
- Use of longer than normal interhole delay time;
- Use of specific initiation point location relative to sensitive receivers;
- Assessment of atmospheric stratification prior to blasting; and
- Embargo of blasting during times of specific wind direction relative to sensitive receivers.

The Talison Noise Management Plan (Appendix J) includes further details on actions to be implemented to minimise ground vibration and air overpressure).

7.5.5 Traffic

Traffic associated with the Mine is expected to increase within the town of Greenbushes, along the South Western Highway and in towns along South Western Highway as this is the main transport route for the Mine. Road train movements carting lithium mineral concentrate and supplies are anticipated to increase from approximately 60 per day (30 trucks to and from site) to a maximum of 200 per day total (100 trucks each way to and from the mine) when the expansion reaches peak production. Additionally light vehicle movements transporting employees to and from the mine through Greenbushes are predicted to increase from approximately 340 per day to 1,100 per day.

Recognising that the increased frequency of vehicle movements is likely to cause an amenity impact and potential safety concern for the residents of Greenbushes, Talison proposes to establish a mine access road between the South Western Highway and Maranup Ford Road to reduce the number of vehicles needing to travel through the town. Talison is consulting with Main Roads WA to determine the optimal access road route. Further consultation with the local community will be conducted when a preferred route has been identified. Talison is also committed to investigating the viability of re-establishing rail transport to Bunbury as a possible alternative to road transport of product from the mine.

7.6 Mitigation

7.6.1 Minimise

The key measures to minimise potential impacts to social surroundings associated with the Mine expansion are summarised in Table 30. The management plans and procedures listed are currently implemented at the Mine as part of Talison's ISO 14001 certified EMS and therefore undergo review in accordance with the EMS requirements.

Table 30 Mitigation measures to minimise social surroundings impacts

Potential impact	Mitigation Measures to Minimise Impact
Disturbance of unidentified heritage sites during clearing and/or excavation works;	• Implementation of the Talison Clearing/Disturbance Procedure and Permit whereby permit conditions specify that works are stopped in the event of actual and/or suspected Aboriginal artefacts or bones being uncovered during earthworks. • The relevant authority (DPLH) will be contacted immediately by Talison in the event of actual and/or suspected Aboriginal artefacts or bones being uncovered.
Reduced visual amenity at night as a result of increased lighting at the operation;	Talison will implement a Light Management Plan and undertake review of the Plan where required as the expansion progresses. The Plan includes the following key requirements: • The location and orientation of lighting plant will direct illumination away from public roads and residences wherever practical. • Night tipping on the Floyds WRL will be on the internal side of the dump to minimise light overspill to the highway and adjacent residences.

Potential impact	Mitigation Measures to Minimise Impact
Noise impacts to sensitive receptors through increased noise emissions;	Talison will submit the updated Noise Management Plan (Appendix J) to DWER for approval and will implement the approved Plan. Key mitigation measures which are included in the Plan are: • Continuous monitoring of noise emissions at the Sound Wall; • Noise attenuation methods will be considered for plant and equipment design; • Selection of equipment and Plant items to limit noise emissions where feasible; • Noise emissions will be a consideration when designing haul road and infrastructure locations; • Maximum sound power levels are specified for Contractor equipment; • Respond to community noise complaints and queries as per the Talison Incident Management Procedure; • Rock breakers will only be used during day time periods; • Consideration will be given to weather conditions when planning blasting to avoid conditions likely to increase the impact of noise (i.e. strong winds in the direction of receptors or very still conditions); and • Establishment of two additional noise bunds approximately 10 m in height located at the northern end of the existing ROM and to the east of the existing 'Sound Wall'. Additional noise management measures which will be implemented include: • Consider alternate locations for the Rock Breaker which will reduce the impact of this noise source; • Update of the noise model to account for any additional noise mitigation strategies undertaken; and • Establish an additional permanent noise monitoring station (potentially to the east of Floyd's WRL).
Vibration impacts associated with increased frequency and potential size of blasting; and	• When designing blasts, modelling will be undertaken to predict airblast and ground vibration levels. Blast design will be adjusted where required to reduce predicted levels to within those specified within the Talison Regulation 17 Approval and Australian Standard 2187. • Blasting will occur within daylight hours 0700 to 1800. • Consideration will be given to weather conditions when planning blasting to avoid conditions likely to increase the impact of noise (i.e. strong winds in the direction of receptors or very still conditions) or airblast levels (cloud cover).

Potential impact	Mitigation Measures to Minimise Impact
Amenity impact resulting from increased traffic on local networks (Greenbushes town and South Western Highway).	• Undertake consultation with Main Roads WA and Shires along the transport route between Greenbushes and Bunbury in relation to haulage along the South Western Highway. • Undertake consultation with Main Roads WA, the Shire of Bridgetown-Greenbushes and the Greenbushes community in relation to the planned mine access road. • Participate in a study into the feasibility of recommissioning the Bunbury – Greenbushes rail line.

7.6.2 Rehabilitate

Talison will implement appropriate rehabilitation strategies to minimise the visual impact of the Mine expansion on the surrounding receptors. Details of these strategies are included in Table 31. The overall objective of Talison's rehabilitation program is to establish a self-sustaining heathy community with selected attributes compatible with surrounding Jarrah/Marri forest, and landforms that blend with the mine's undulating scarp location.

Table 31 Rehabilitation measures to minimise visual impact to social surroundings impacts

Potential impact	Rehabilitation Measures to Minimise Impact
Reduced visual amenity from additional and increased mining footprint	• Continue to liaise with relevant government agencies including DBCA, DMIRS and DWER in regards to Closure Planning and rehabilitation of the Mine; • Update the 2016 Mine Closure Plan to include the Mine expansion and submit the updated plan to DMIRS with the Mining Proposal for the Mine expansion. • Consult with the Greenbushes community when undertaking changes likely to impact on the visual landscape. • Progressive rehabilitation of Floyds WRL slopes and upstream constructed TSF batters to minimise the visual impact (progressive rehabilitation of TSF4 is not proposed due to the upstream construction method). • Rehabilitation aims to blend the shape and vegetative cover of landforms with the surrounding landscape where possible through profiling of the landforms and use of a local provenance seed mix based on the surrounding vegetation community. • Seed mixes include a fast growing Acacia species component to provide a fast growing cover which senesces within five years and is then replaced by longer living, but slower establishing understorey species. Vegetated slopes have less visual impact than bare rock.

7.7 Predicted outcome

It is considered unlikely that the expansion will have an impact on cultural heritage given that there are no known protected European or Aboriginal heritage Sites within the MDE for the Proposal.

The proposed expansion of the Mine will increase the local noise levels potentially impacting on the amenity of surrounding residents. Talison aims to operate within the limits specified in the Talison Regulation 17 Approval through continued management of noise emissions as per the site Noise Management Plan. The establishment of two additional noise bunds is predicted to maintain noise emissions within the Regulation 17 Approval limits.

The expanded Mine will impact local visual amenity, in particular when viewed from high points in the surrounding landscape, as a result of the expansion of Floyds WRL and construction of TSF4. The update and continued implementation of Talison's Mine Closure Plan and Rehabilitation Plans, which include consideration of visual amenity, aim to minimise the long term visual impact of the operation, although it is acknowledged that there will be an impact on visual amenity while landforms are being constructed and vegetation is being re-established on the landforms. Progressive rehabilitation will reduce the timeframe of the visual impact to receptors.

8. Matters of National Environmental Significance

8.1 Policy and guidelines

- *Environment Protection and Biodiversity Conservation Act 1999.*
- *Environment Protection and Biodiversity Conservation Regulations 2000.*
- Significant impact guidelines 1.1 - Matters of National Environmental Significance. (Department of the Environment 2013).

Under the EPBC Act, Proposal's which have the potential to significantly impact Matters of National Environmental Significance (**MNES**) trigger the requirement for referral to the Commonwealth Department of the Environment and Energy (**DotEE**) for potential assessment as a 'controlled action'. Matters of National Environmental Significance which trigger the requirement for referral include:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the RAMSAR Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- A water resource, in relation to coal seam gas or coal mining; and
- Nuclear actions (including uranium mines).

8.2 Controlled action provisions

The Proposal was referred to the DotEE and advertised for public comment on 9 May 2018 as a potential controlled action under the EPBC Act due to impacts on listed threatened species.

On 17 June 2018, the DotEE determined the Proposal to be a 'Controlled Action' requiring approval due to impacts on listed threatened species and communities (EPBC reference: 2018/8206). Specifically the DotEE requested Talison to consider impacts of the Proposal on the following MNES:

- Black Cockatoos: the Vulnerable Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), the Endangered Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and the Endangered Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
- Western Quoll/Chuditch (*Dasyurus geoffroii*) – Vulnerable;
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – Vulnerable;
- Pink Spider Orchid *(Caladenia harringtoniae)* – Vulnerable.

The DotEE advised on 19 August 2018 that under section 87 of the EPBC Act the Proposal would be assessed by an accredited assessment with the WA Government.

The information presented in this chapter is intended to address the Additional Information for Assessment request sent by the DotEE to the EPA (in accordance with the *Bilateral agreement*

made under section 45 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) relating to environmental assessment [between the] *Commonwealth of Australia and the State of Western Australia*). The information request relates to impacts, mitigation of impacts, and consistency with Recovery and Threat Abatement Plans and Conservation Advice for the MNES listed above. Much of the information requested is found within Chapter 4 and 5 of this document.

8.3 Summary of existing environmental values that relate to MNES

Talison has undertaken a number of targeted surveys in order to assess the presence of EPBC Act listed species (MNES) within the MDE (the surveys are previously listed in sections 4.3 and 5.3).

Based on the outcomes of these surveys the following MNES could potentially be impacted by the Proposal.

- Threatened Black Cockatoo species (**5.3.5**):
  - Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered;
  - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable; and
  - Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Endangered;
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – Critically Endangered (**5.3.6**);
- Western Quoll/Chuditch *(Dasyurus geoffroii*) – Vulnerable (**5.3.7**);
- Pink Spider Orchid *(Caladenia harringtoniae)* – Vulnerable (**4.3.8**).

The relevant section of this report containing details of the environmental values for these MNES are noted in brackets above.

8.4 Assessment of potential impacts on MNES

The potential impacts on MNES have previously been assessed within sections 4.5 and 5.5.

The potential impacts or threats to MNES identified as a result of the Proposal are listed below together with the relevant section of this report where the impact has been assessed

- Loss of 350 ha native vegetation (Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia):
  - suitable for foraging and breeding by three species of threatened black cockatoos which are known to use the habitat (5.5.1); and
  - Suitable for Chuditch with at least one individual present (5.5.1);
- Loss of approximately 2,100 potential breeding trees inclusive of 7 trees with 'Known' nesting hollows and 7 trees with 'Suitable' nesting hollows (5.5.1);
- Loss of 18 ha native vegetation which has been classed as poor to marginal habitat for the WRP (the species may occur within the MDE but has not been confirmed as being present) (5.5.1);
- Possible introduction and/or spread of invasive pathogens causing habitat decline (5.5.6);
- Possible introduction/spread and/or abundance increase of invasive plant species (weeds) causing habitat decline (5.5.6);
- Changes to surface water hydrology causing habitat decline (4.5.3);
- Changes to surface water quality or quantity impacting on availability for fauna use (5.5.2);

- Habitat decline as a result of smothering by dust generated from the operational activities (4.5.4);
- Damage to, and loss of habitat or mortality of fauna through accidental generation of a bushfire (5.5.7);
- Death, injury or displacement of native fauna species due to vehicle interaction or entrapment associated with the mining operation (5.5.3);
- Increased competition or predation by introduced species (5.5.5); and
- Disruption or disturbance to fauna as a result of noise, vibration, light and dust emissions from the mining operation (5.5.4).

8.5 Mitigation measures

Mitigation measures to address the potential impacts on MNES are discussed in Section 4.6 relating to mitigating impacts to vegetation which is habitat to fauna and Section 5.6 relating directly to fauna and fauna habitat impacts.

8.6 Recovery Plans, Threat Abatement Plans and Conservation Advice

Recovery Plans, Threat Abatement Plans and Conservation Advice which is relevant to the MNES the Proposal may impact upon have been listed in Table 32. A discussion of how the Project conforms to the Advice or Plan requirements is included.

Table 32 Relevant Recovery Plans, Threat Abatement Plans and Conservation Advice for MNES

Plan/Conservation Advice	Talison Proposal
Western Australian Department of Parks and Wildlife (2013), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan.	<u>*Known and Potential Threats 1: Loss of Breeding habitat*</u> The Proposal may exacerbate this threat however the Proposal is designed to maximise use of existing disturbed areas to minimise loss of potential breeding habitat. • Up to 350 ha of native vegetation will be removed for the Proposal which has been assessed as potential black cockatoo breeding habitat. This habitat consists of habitat described in the recovery plan as critical to the survival of black cockatoos, and therefore its clearing could have a significant impact on the species. • A total of 55 potential breeding trees with hollows have been identified within the MDE and of these, 30 contained hollows assessed as being suitable for black cockatoo breeding. Fourteen trees with suitable hollows will be removed for the Proposal inclusive of seven considered to be Known hollows due to chew marks observed at the hollow. • Very few feeding residues from Carnaby's Black Cockatoo were observed within the MDE Foraging evidence also indicates this species is most likely an intermittent and non-breeding visitor (Kirkby 2018). • There is an estimated 5,187 ha of potential black cockatoo breeding habitat within the immediate Greenbushes region. Approximately 6.7% of this potential breeding habitat will be cleared for the expansion. • Clearing controls (internal permits) and Tree Protection Zones will be in place to prevent accidental clearing of suitable breeding trees with hollows.

Plan/Conservation Advice	Talison Proposal
	Known and Potential Threats 2: Loss of Non-breeding, Foraging and Night roosting Habitat The Proposal may exacerbate this threat however the Proposal is designed to maximise use of existing disturbed areas to minimise loss of non-breeding, foraging and night roosting habitat; • Up to 350 ha of native vegetation will be removed for the Proposal which has been assessed as suitable black cockatoo foraging habitat. This habitat consists of habitat described in the recovery plan as critical to the survival of black cockatoos, and therefore its clearing could have a significant impact on the species. • However, black cockatoo habitat is well represented locally with 68,440 ha of suitable foraging habitat within the Shire of Bridgetown-Greenbushes, • No known roosting habitat will be removed as a result of the Proposal. Two roosts (FRTBC) have been identified at the boundary of the MDE.
	Known and Potential Threats 3: Tree Health The Proposal may exacerbate this threat as dieback is known to occur within the MDE. Mitigation measures are proposed to reduce this risk. • Talison are experienced in working within the area and have established dieback management procedures. • A Weed and Hygiene Management Plan will be implemented as part of Talison's ISO 14001 accredited EMS. In addition, DBCA approved area specific dieback management plans are prepared for activities within state forest. • Dieback surveys are undertaken prior to undertaking disturbance in areas not previously surveyed and updated surveys are conducted where required.
	Known and Potential Threats 4: Mining and Extraction Activities The Proposal is to expand an existing mining operation and required removal of 350 ha of foraging and breeding habitat inclusive of 14 suitable breeding hollows therefore the Proposal may exacerbate this threat: • Progressive rehabilitation will be undertaken in accordance with the Mine Closure Plan. This will, over time return some of the foraging habitat lost as a result of native vegetation clearing for the mine expansion. Breeding habitat (hollows) is expected to take 100-200 years to develop within the rehabilitation. • Offsets are proposed to mitigate the loss of habitat.
	Known and Potential Threats 5: Illegal Shooting The Proposal will not exacerbate this threat: • No firearms will be allowed on site (unless with Registered Manager approval).
	Known and Potential Threats 6: Illegal Taking The Proposal will not exacerbate this threat: • Only feral animal traps deployed by dedicated environmental employees/contractors are allowed on site. • Interference with native fauna is not allowed and staff will be educated not to interfere with native wildlife during the site induction. • Talison will implement a Conservation Significant Fauna Management Plan.

Plan/Conservation Advice	Talison Proposal
	Known and Potential Threats 7: Climate Change The Proposal is not expected to exacerbate this threat: • The Proposal will increase the emission intensity of the mine however, the highest annual emissions predicted are equivalent to 0.08% of Australia's 2017 greenhouse gas footprint, 0.53% of WA's 2016 greenhouse footprint and 0.41% of the mining industry's 2016 greenhouse gas footprint therefore the Proposal is considered unlikely to exacerbate this threat. • The Proposal may indirectly reduce this threat as the product of Mine will undergo further processing and then be used in the development of rechargeable batteries to power Electric Vehicles, Energy Storage systems and other rechargeable items.
	Known and Potential Threats 8: Collisions with Motor Vehicles The Proposal will not exacerbate this threat. • Vehicle speeds will be reduced on internal roads and off-road driving will be prohibited unless authorised for a specific purpose (i.e. exploration, biological surveys or monitoring). This will be conveyed to staff via the induction process. • All fauna strikes will be reported and investigated.
	Known and Potential Threats 9: Disease (Biological Threats) The Proposal will not exacerbate this threat: • No domestic animals (i.e. dogs) are allowed to be brought into the MDE.
Western Australian Department of Environment and Conservation (2008), Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan.	*Threat 1: Killing by Illegal Shooting* The Proposal will not exacerbate this threat. • No firearms are allowed on site (unless with Registered Manager approval).
	Threat 2: Feral Honeybees The Proposal may exacerbate this threat: • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • The FRTBC is the most likely black cockatoo species using the potential breeding trees within the MDE (Kirkby 2018). • A general reduction in the amount of tree hollows may increase competition between fauna using hollows (i.e. competition between the European Honeybee and FRTBC) however assessments outside the MDE have found a higher density of potential breeding trees DBC >500mm and trees with hollows in the surrounding state forest (refer to section 5.3.5. It is thought that there is ample availability of hollows within the surrounding area. • Significant tree density in state forest outside the MDE ranged up to 21.7 trees per hectare with as many as 34% of significant trees supporting hollows or potential hollows • The planning for the final layout of the Mine expansion will consider suitable breeding trees with hollows and avoid clearing (i.e. for linear infrastructure and explosives infrastructure). • There are no plans to control European Honeybee populations.

Plan/Conservation Advice	Talison Proposal
	• There have been limited observations of feral honeybee at the Mine by consultants undertaking tree hollow surveys (Kirkby 2018).
	Threat 3: Habitat loss The Proposal may exacerbate this threat however the Proposal is designed to maximise use of existing disturbed areas to minimise loss of potential breeding, foraging and night roosting habitat: • 350 ha black cockatoo foraging and potential breeding habitat which is described in the recovery plan as critical to the survival of black cockatoos will be removed for the Proposal. • However, black cockatoo habitat is well represented locally with 68,440 ha of suitable foraging (and potential breeding) habitat estimated to occur within the Shire of Bridgetown-Greenbushes, • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • Clearing controls (internal permits) will be in place to prevent accidental clearing outside approved areas. • Tree Protection Zones will be in place to prevent accidental clearing of suitable breeding trees with hollows. • No known roosting habitat will be removed as a result of the Proposal. Two roosts (FRTBC) have been identified at the boundary of the MDE.
	Threat 4: Nest Hollow Shortage The Proposal may exacerbate this threat. • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • A further 7 trees with 'Known' and 9 trees with 'Suitable' hollows will be retained within the MDE. • The FRTBC is the most likely black cockatoo species using the potential breeding trees within the MDE (Kirkby 2018). • Assessments outside the MDE have found a higher density of potential breeding trees DBH >500mm and trees with hollows in the surrounding state forest (refer to section 5.3.5). It is thought that there is ample availability of hollows within the surrounding area. • The planning for the final layout of the Mine expansion will consider suitable breeding trees with hollows and avoid clearing these (i.e. for linear infrastructure and explosives infrastructure).
	Threat 5: Nest Hollow Competition The Proposal may exacerbate this threat. • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • The FRTBC is the most likely black cockatoo species using the potential breeding trees within the MDE (Kirkby 2018). • Assessments outside the MDE have found a higher density of potential breeding trees DBH >500mm and trees with hollows in the surrounding state forest (refer to section 5.3.5. It is thought that there is ample availability of hollows within the surrounding area. • There are also various other birds (e.g. other black cockatoo species, Galahs and Wood Ducks) and other fauna (WRP and

Plan/Conservation Advice	Talison Proposal
	Wambenger Brush-tailed Phascogale) which may compete for hollows with the black cockatoo. • The planning for the final layout of the Mine expansion will consider suitable breeding trees with hollows and avoid clearing these (i.e. for linear infrastructure and explosives infrastructure).
Department of the Environment, Water, Heritage and the Arts (2009). *Approved Conservation Advice for Calyptorhynchus banksii naso (Forest Red-tailed Black Cockatoo).* Canberra: Department of the Environment, Water, Heritage and the Arts.	*Threat 1: Illegal Shooting* The Proposal will not exacerbate this threat: • No firearms are permitted on site (unless with Registered Manager approval).
	Threat 2: Habitat loss The Proposal may exacerbate this threat however the Proposal is designed to maximise use of existing disturbed areas to minimise loss of potential breeding, foraging and night roosting habitat: • 350 ha black cockatoo foraging and potential breeding habitat which is described in the recovery plan as critical to the survival of black cockatoos will be removed for the Proposal. • FRTBC is considered the most abundant of the three threatened black cockatoo species identified within the MDE and is the likely species utilising the breeding habitat within the area (Kirkby 2018) • However, black cockatoo habitat is well represented locally with 68,440 ha of suitable foraging (and potential breeding) habitat estimated to occur within the Shire of Bridgetown-Greenbushes, • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • Clearing controls (internal permits) will be in place to prevent accidental clearing outside approved areas. • Tree Protection Zones will be in place to prevent accidental clearing of suitable breeding trees with hollows. • No known roosting habitat will be removed as a result of the Proposal. Two roosts (FRTBC) have been identified at the boundary of the MDE.
	Threat 3: Nest Hollow Shortage The Proposal may exacerbate this threat. • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • A further 7 trees with 'Known' and 9 trees with 'Suitable' hollows will be retained within the MDE. • The FRTBC is the most likely black cockatoo species using the potential breeding trees within the MDE (Kirkby 2018). • Assessments outside the MDE have found a higher density of potential breeding trees DBC >500mm and trees with hollows in the surrounding state forest (refer to section 5.3.5). It is thought that there is ample availability of hollows within the surrounding area. • The planning for the final layout of the Mine expansion will consider suitable breeding trees with hollows and avoid clearing these (i.e. for linear infrastructure and explosives infrastructure).
	Threat 4: Competition from other species The Proposal may exacerbate this threat.

Plan/Conservation Advice	Talison Proposal
	• The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • The FRTBC is the most likely black cockatoo species using the potential breeding trees within the MDE (Kirkby 2018). • Assessments outside the MDE have found a higher density trees with hollows in the surrounding state forest (refer to section 5.3.5. It is thought that there is ample availability of hollows within the surrounding area. • There are also various other birds (e.g. other black cockatoo species, Galahs and Wood Ducks) and other fauna (WRP and Wambenger Brush-tailed Phascogale) present which may compete for hollows with the black cockatoo.
	Threat 5: Injury or death from Apis mellifera (European Honeybees) The Proposal may exacerbate this threat: • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • The FRTBC is the most likely black cockatoo species using the potential breeding trees within the MDE (Kirkby 2018). • A general reduction in the amount of tree hollows may increase competition between fauna using hollows (i.e. competition between the European Honeybee and FRTBC) however assessments outside the MDE have found a higher density of trees with suitable hollows in the surrounding state forest (refer to section 5.3.5). It is thought that there is ample availability of hollows within the surrounding area. • There are no plans to control European Honeybee populations. • There have been limited observations of feral honeybee at the Mine by consultants undertaking tree hollow surveys (Kirkby 2018).
Threatened Species Scientific Committee (2018). Conservation Advice *Calyptorhynchus baudinii Baudin's* cockatoo. Canberra: Department of the Environment and Energy.	*Threat 1: Land clearing and tree harvesting for agriculture, forestry and mining* The Proposal may exacerbate this threat however the Proposal is designed to maximise use of existing disturbed areas to minimise land clearing: • 350 ha black cockatoo foraging and potential breeding habitat which is described in the recovery plan as critical to the survival of black cockatoos will be removed for the Proposal. • However, black cockatoo habitat is well represented locally with 68,440 ha of suitable foraging (and potential breeding) habitat estimated to occur within the Shire of Bridgetown-Greenbushes, • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • Clearing controls (internal permits) will be in place to prevent accidental clearing outside approved areas. • Tree Protection Zones will be in place to prevent accidental clearing of suitable breeding trees with hollows. • No known roosting habitat will be removed as a result of the Proposal. Two roosts (FRTBC) have been identified at the boundary of the MDE.. • Tree harvesting will be undertaken by Forest Products Commission prior to land clearing however no further tree harvesting is planned within the MDE following this as it is an active mining operation.

Plan/Conservation Advice	Talison Proposal
	Threat 2: Destruction of nesting and foraging trees from fire events The Proposal is not expected to exacerbate this threat. • There is considered to be low risk of accidental fire as a result of mining activities. More than half of the MDE is unlikely to support a fire as it is cleared land. • Clearing activities pose the greatest risk of fire generation. To minimise the risk of fire clearing activities will not be undertaken when the Fire Danger Rating it severe or higher. • A Hot Work Permit System and Emergency Management Plan will be implemented to minimise bushfire risk.
	Threat 3: Loss of hollows from European honey bees (Apis mellifera) The Proposal may exacerbate this threat: • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • A general reduction in the amount of tree hollows may increase competition between fauna using hollows (i.e. competition between the European Honeybee and FRTBC) however assessments outside the MDE have found a higher density of trees with suitable hollows in the surrounding state forest (refer to section 5.3.5). It is thought that there is ample availability of hollows within the surrounding area. • There are no plans to control European Honeybee populations. • There have been limited observations of feral honeybee at the Mine by consultants undertaking tree hollow surveys (Kirkby 2018).
	Threat 4: Nest hollow shortage due to competition with native bird species The Proposal may exacerbate this threat. • The Proposal will result in the clearing of 7 trees with 'Known' and 7 trees with 'Suitable' hollows for black cockatoo breeding. • Assessments outside the MDE have found a higher density trees with hollows in the surrounding state forest (refer to section 5.3.5. It is thought that there is ample availability of hollows within the surrounding area. • There are other birds (e.g. other black cockatoo species, Galahs and Wood Ducks) present which may compete for hollows with the black cockatoo. • A number of other hollows not considered suitable for black cockatoos, but suitable for other bird species, may be cleared. A general reduction in the number of available hollows may increase competition between bird species.
	Threat 5: Illegal shooting The Proposal will not exacerbate this threat: • No firearms are permitted on site (unless with Registered Manager approval).
	Threat 6: Phytopathogens (Dieback) The Proposal may exacerbate this threat as dieback is known to occur within the MDE. Mitigation measures are proposed to reduce this risk. • Talison are experienced in working within the area and have established dieback management procedures.

Plan/Conservation Advice	Talison Proposal
	• A Weed and Hygiene Management Plan will be implemented as part of Talison's ISO 14001 accredited EMS. In addition, DBCA approved area specific dieback management plans are prepared for activities within state forest. • Dieback surveys are undertaken prior to undertaking disturbance in areas not previously surveyed and updated surveys are conducted where required.
	Threat 7: Infestation of bullseye borer (Phoracantha acanthocera) The Proposal is considered unlikely to exacerbate this threat.
	Threat 8: Climate change The Proposal is considered unlikely to exacerbate this threat. • The Proposal will increase the emission intensity of the mine however, the highest annual emissions predicted are equivalent to 0.08% of Australia's 2017 greenhouse gas footprint, 0.53% of WA's 2016 greenhouse footprint and 0.41% of the mining industry's 2016 greenhouse gas footprint therefore the Proposal is considered unlikely to exacerbate this threat. • The Proposal may indirectly reduce this threat as the product of Mine will undergo further processing and then be used in the development of rechargeable batteries to power Electric Vehicles, Energy Storage systems and other rechargeable items.
Australian Government Department of the Environment (2014), Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*. Canberra, ACT.	*Objective 1: Identify and prioritise for protection biodiversity assets that are, or may be, impacted by Phytophthora cinnamomi* The Proposal is considered consistent with this objective: • Flora, fauna and ecological communities at risk of dieback caused by *P. cinnamomi* have been prioritised in terms of preventing further spread of dieback to the areas within and surrounding the MDE through implementation of a Weed and Hygiene Management Plan (Appendix E) and area specific DBCA approved Dieback Management Plans for activities within state forest.
	Objective 2: Protect priority biodiversity assets through reducing the spread and mitigating the impacts of Phytophthora cinnamomi The Proposal is considered consistent with this objective: • A Weed and Hygiene Management Plan will be implemented (Appendix E). • Area specific DBCA approved Dieback Management Plans will be implemented for activities within state forest.
	Objective 3. Communication and training The Proposal is considered consistent with this objective. • All staff and contractors are informed of hygiene requirements through the site induction. • Greencard training is undertaken for supervisors working in areas at risk of spread or introduction of dieback.
Department of Parks and Wildlife (2017). Western Ringtail Possum	*Threat 1: Habitat loss and fragmentation* The Proposal may exacerbate this threat: • There is no confirmed evidence of the WRP currently occurring within the MDE, however previous records indicate their

Plan/Conservation Advice	Talison Proposal
(*Pseudocheirus occidentalis*) *Recovery Plan.* Wildlife Management Program No. 58. Department of Parks and Wildlife, Perth, WA.	presence in the surrounding area and old dreys have been located near the Schwenke's Dam (outside the MDE) (Harewood 2018b). • A small area of the MDE(18 ha) is considered poor to marginal habitat (but not critical for survival due to anthropogenic impacts) for the WRP (refer to section 5.3.6 for further details). • It is considered unlikely that a population of WRP would inhabit the MDE, and if individuals are occasionally present they are not considered to be dependent on the habitats present and more likely to occupy preferred habitat areas such as that surrounding the Schwenke's Dam (outside the MDE). • Clearing of habitat considered potentially suitable for WRP will be limited to 18 ha and will not cause additional fragmentation as expansion is adjacent to the existing mine.
	Threat 2: Predation The Proposal is unlikely to exacerbate this threat. • Domestic animals are not allowed to be brought onto the Mine. • A feral animal control program is implemented on an annual and ad hoc basis as required. The program involves annual baiting for foxes and rabbits and feral cat trapping.
	Threat 3: Climate change The expansion may have indirect effects on the climate change response of the Western Ringtail Possum: • Projected 2050 climate modelling predicts a decline in WRP largely due to the reduction in suitable habitat. • Modelling statistics appears to indicate that the Greenbushes area will be included in the possible remaining extent of suitable WRP habitat by 2050 (Molloy et al. 2014), although due to existing anthropogenic impacts current habitat conditions of the MDE are not considered optimum to support the species.
	Threat 4: Timber harvesting The Proposal is not considered to exacerbate this threat as timber harvesting will not be undertaken within the MDE (other than to recover the timber resource within the proposed clearing footprint, prior to ground clearing occurring) as it is deemed an active mining operation. • The surrounding State Forest 20 has previously been subject to logging and plantation areas. • Where possible, the expansion footprint is preferentially located within existing disturbed areas to reduce the amount of habitat removal required.
	Threat 5: Fire The Proposal is not expected to exacerbate this threat. • There is considered to be low risk of accidental fire as a result of mining activities. More than half of the MDE is unlikely to support a fire as it is cleared land. • Clearing activities pose the greatest risk of fire generation. To minimise the risk of fire clearing activities will not be undertaken when the Fire Danger Rating it severe or higher. • A Hot Work Permit System and Emergency Management Plan will be implemented to minimise bushfire risk.
	Threat 6: Competition for tree hollows The Proposal may exacerbate this threat:

Plan/Conservation Advice	Talison Proposal
	• There are 30 tree hollows which have been identified within the MDE that are suitable for black cockatoos and other trees with hollows deemed unsuitable for black cockatoos have been identified that may be suitable for WRP. • Clearing of trees with hollows may increase competition with other hollow-using fauna (i.e. Common Brushtail Possum, European Honeybee, black cockatoos). • There is a greater density of trees with hollows in state forest surrounding the MDE than within the areas of impact. • The WRP is only expected to occur at low density if present therefore does not require a large number of hollows.
	Threat 7: Habitat tree decline The Proposal may exacerbate this threat as dieback is known to occur within the MDE. Mitigation measures are proposed to reduce this risk. • Talison are experienced in working within the area and have established dieback management procedures. • A Weed and Hygiene Management Plan will be implemented as part of Talison's ISO 14001 accredited EMS. In addition, DBCA approved area specific dieback management plans are prepared for activities within state forest. • Dieback surveys are undertaken prior to undertaking disturbance in areas not previously surveyed and updated surveys are conducted where required. • No known habitat trees for WRP have been identified within the MDE.
	Threat 8: Un-regulated relocation of orphaned, injured and rehabilitated western ringtail possums The Proposal is not expected to exacerbate this threat. No confirmed evidence of the WRP has been found within the MDE therefore it is considered unlikely to find any during the expansion. • A fauna capture and release program will be undertaken prior to clearing (subject to DBCA approval) by a suitably qualified, experienced and licensed environmental professional prior to vegetation clearing. • A suitably qualified environmental professional (fauna spotter) will be present during all land clearing. The person will hold a permit to handle and move significant fauna under Regulation 15 of the WC Act, and have access to a care facility that can be used to rehabilitate injured fauna. • Injured animals will be reported to the Environmental Department.
	Threat 9: Disease The Proposal is not expected to exacerbate this threat. Mitigation measures to reduce the risk of disease spread include: • Domestic animals are not allowed to be brought onto the Mine. • A feral animal control program is implemented on an annual and ad hoc basis as required. The program involves annual baiting for foxes and rabbits, and feral cat trapping.
	Threat 10: Gaps in knowledge The Proposal will not directly impede on this objective.
Threatened Species Scientific Committee (2018). *Conservation*	*Threat: Climate change leading to a drying climate* The Proposal is considered unlikely to exacerbate this threat.

Plan/Conservation Advice	Talison Proposal
Advice Pseudocheirus occidentalis Western ringtail possum. Canberra: Department of the Environment and Energy.	• The Proposal will increase the emission intensity of the mine however, the highest annual emissions predicted are equivalent to 0.08% of Australia's 2017 greenhouse gas footprint, 0.53% of WA's 2016 greenhouse footprint and 0.41% of the mining industry's 2016 greenhouse gas footprint therefore the Proposal is considered unlikely to exacerbate this threat. • The Proposal may indirectly reduce this threat as the product of Mine will undergo further processing and then be used in the development of rechargeable batteries to power Electric Vehicles, Energy Storage systems and other rechargeable items.
	Threat: Groundwater depletion and altered hydrology The Proposal is considered unlikely to exacerbate this threat. • Due to the underlying geology groundwater resources are not significant in the area, with limited groundwater available for use. • Surface water flow regimes may be altered by the establishment of new or expanded landforms and infrastructure associated with the expansion however the effects are generally limited to within the MDE.
	Threat: Increasing temperature The Proposal is not considered to exacerbate this threat.
	Threat: Land clearing and habitat fragmentation caused by urbanisation The Proposal is not considered to exacerbate this threat.
	Threat: Feral predators The Proposal is unlikely to exacerbate this threat. • Domestic animals are not allowed to be brought onto the Mine. • A feral animal control program is implemented on an annual and ad hoc basis as required. The program involves annual baiting for foxes and rabbits and feral cat trapping.
	Threat: Fire The Proposal is not expected to exacerbate this threat. • There is considered to be low risk of accidental fire as a result of mining activities. More than half of the MDE is unlikely to support a fire as it is cleared land. • Clearing activities pose the greatest risk of fire generation. To minimise the risk of fire clearing activities will not be undertaken when the Fire Danger Rating it severe or higher. • A Hot Work Permit System and Emergency Management Plan will be implemented to minimise bushfire risk.
	Threat: Tree decline and insect outbreaks The Proposal may exacerbate this threat as dieback is known to occur within the MDE. Mitigation measures are proposed to reduce this risk. • Talison are experienced in working within the area and have established dieback management procedures. • A Weed and Hygiene Management Plan will be implemented as part of Talison's ISO 14001 accredited EMS. In addition, DBCA approved area specific dieback management plans are prepared for activities within state forest.

Plan/Conservation Advice	Talison Proposal
	• Dieback surveys are undertaken prior to undertaking disturbance in areas not previously surveyed and updated surveys are conducted where required.
	Threat: Competition for tree hollows The Proposal may exacerbate this threat: • The clearing of trees with hollows and reduction in potential habitat may increase competition with other hollow-using fauna (i.e. Common Brushtail Possum, European Honeybee, black cockatoos) • According to the Conservation Advice, fox baiting leading to increased numbers of Brushtail Possums leads to competition of nest hollows. The Talison feral animal control program includes targeting foxes which may indirectly cause increased competition for hollows.
	Threat: Logging The Proposal will not exacerbate this threat: • The surrounding forest has already undergone extensive logging in the past. Most areas proposed for clearing are already disturbed as a result.
	Threat: Domestic dogs The Proposal will not exacerbate this threat: • Domestic animals are not allowed to be brought onto the Mine.
	Threat: Ravens Not applicable.
	Threat: Myrtle rust The Proposal will not exacerbate this threat: • Myrtle rust is not currently known to occur in the area.
	Threat: Injury and mortality due to vehicle strike The Proposal will not exacerbate this threat. • Vehicle speeds will be reduced on internal roads and off-road driving will be prohibited unless authorised for a specific purpose (i.e. exploration, biological surveys or monitoring). This will be conveyed to staff via the induction process. • All fauna strikes will be reported and investigated.
	Threat: Unregulated relocation of orphaned, injured and rehabilitated western ringtail possums The Proposal is not expected to exacerbate this threat. No confirmed evidence of the WRP has been found within the MDE therefore it is considered unlikely to find any during the expansion. • A fauna capture and release program will be undertaken prior to clearing (subject to DBCA approval) by a suitably qualified, experienced and licensed environmental professional prior to vegetation clearing. • A suitably qualified environmental professional (fauna spotter) will be present during all land clearing. The person will hold a permit to handle and move significant fauna under Regulation 15 of the WC Act, and have access to a care facility that can be used to rehabilitate injured fauna. • Injured animals will be reported to the Environmental Department.
Department of the Environment (2015).	*Objective 1: Effectively control feral cats in different landscapes* This Proposal should not impede this objective:

Plan/Conservation Advice	Talison Proposal
Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia.	• Traps are laid for feral cats on an ad hoc basis. This is considered a low level control.
	Objective 2: Improve effectiveness of existing control options for feral cats The Proposal will not impede on this objective. • Talison feral animal control program (involving feral cat trapping) will continue on an ad hoc basis.
	Objective 3: Develop or maintain alternative strategies for threatened species recovery The Proposal will not impede on this objective.
	Objective 4: Increase public support for feral cat management and promote responsible cat ownership The Proposal will not impede on this objective.
Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). *Threat abatement plan for predation by the European red fox.*	*Objective 1: Prevent foxes occupying new areas in Australia and eradicate foxes from high-conservation-value 'islands'* The Proposal will not impede on this objective. • Foxes are already known to occur within the MDE and surrounds. • A program for feral animal control (targeting foxes and rabbits) is carried out annually. The program utilises 1080 infused bait to target foxes. • This is considered low level fox control and is better suited to controlling populations rather than eradicating them.
	Objective 2: Promote the maintenance and recovery of native species and ecological communities that are affected by fox predation The Proposal will not impede on this objective. • Talison will implement a Conservation Significant Fauna Management Plan
	Objective 3: Improve knowledge and understanding of fox impacts and interactions with other species and other ecological processes The Proposal will not impede on this objective.
	Objective 4: Improve the effectiveness, target specificity, integration and humaneness of control options for foxes The Proposal will not impede on this objective
	Objective 5: Increase awareness of all stakeholders of the objectives and actions of the TAP, and of the need to control and manage foxes The Proposal will not impede on this objective. • Employees are informed during the site Environmental Induction to report any sightings of feral animals within the MDE to the Environmental Department.
Department of the Environment and Energy (2017). *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017).* Canberra, ACT:	*Objective 1: Prioritise key species, ecological communities, ecosystems and locations across Australia for strategic feral pig management* The Proposal will not impede on this objective.
	Objective 2: Encourage the integration of feral pig management activities at regional, state and territory, and national levels The Proposal will not impede on this objective. • Talison implement a feral animal control program on an annual and ad hoc basis as required however this does not currently target pigs.

Plan/Conservation Advice	Talison Proposal
Commonwealth of Australia.	• Talison will work in conjunction with DBCA where the opportunity exists to target feral pig control within the MDE.
	Objective 3: Encourage further scientific research into feral pig impacts on nationally threatened species and ecological communities, and feral pig ecology control The Proposal will not impede on this objective.
	Objective 4: Record and monitor feral pig control programs, so their effectiveness can be evaluated The Proposal will not impede on this objective. • Talison will work in conjunction with DBCA where the opportunity exists to monitor the effectiveness of feral pig control undertaken within the MDE or immediate surrounds.
	Objective 5: Build capacity for feral pig management and raise feral pig awareness amongst landholders and land managers The Proposal will not impede on this objective. • Employees are informed during the site Environmental Induction to report any sightings of feral animals within the MDE to the Environmental Department.
	Objective 6: Improve public awareness about feral pigs and the environmental damage and problems they cause The Proposal will not impede on this objective.
Department of Environment and Conservation (2012). *Chuditch (Dasyurus geoffroii) Recovery Plan. Wildlife Management Program No. 54.* Department of Environment and Conservation, Perth, Western Australia.	*Threat 1: Land clearing and habitat alteration* The Proposal may exacerbate this threat however the Proposal is designed to maximise use of existing disturbed areas to minimise loss of suitable habitat. • 350 ha of Jarrah/ Marri forest and Jarrah/Marri forest over Banksia will be removed for the Proposal that is considered suitable habitat for the Chuditch. • The presence of the Chuditch was confirmed in the north-west sector of the MDE (Jarrah/Marri habitat). Habitat where the Chuditch occurs, or may occur is considered critical habitat and therefore loss of this habitat is considered a significant impact. • The MDE comprises relatively fragmented 'blocks' of vegetation (total 10 to 11 main 'blocks', 30-159 ha in size) which are considered to be too small in area to support a large Chuditch population. • Chuditch is only expected to only be present at low density within the MDE. • During the rehabilitation phase, fauna habitat structures including logs, wood debris and rocky outcrops are incorporated to encourage the early the return of native fauna including the Chuditch and some of its prey species.
	Threat 2: Predation by, and competition from, introduced foxes and cats The Proposal is not considered to exacerbate this threat: • A feral animal control program is in place which targets foxes, rabbits and cats. This is considered a low level control program. • The Chuditch is known to eat mammals the size of rabbits so indirectly, the low level of rabbit control may provide a larger food source for the species.

Plan/Conservation Advice	Talison Proposal
	Threat 3: Deliberate and accidental death The Proposal is not considered to exacerbate this threat: • All efforts are made to ensure the protection of native fauna within the MDE. • Staff and contractors are educated on the native fauna values present within the MDE during the site Environmental Induction. • Domestic animals (including dogs and cats) are not allowed on the site. • Firearms are not permitted on site (unless with Registered Manager approval). • Native fauna injuries and deaths are required to be reported as an incident and investigated. • The speed of vehicles is restricted on site and along access roads to reduce the likelihood of native fauna fatality as a result of vehicle strike. Off-road driving is not permitted unless for an exempt purpose (monitoring or exploration).
Australian Government Department of the Environment and Energy (2016). *Threat abatement plan for competition and land degradation by rabbits.* Canberra, ACT.	*Objective 1: Strategically manage rabbits at the landscape scale and suppress rabbit populations to densities below threshold levels in identified priority areas.* The Proposal will not impede on this objective. • A Feral Animal Control program is in place and will continue to be implemented. The program involves baiting using the preferred 'Rabbait' on an as needed basis, approximately annually and ad hoc where required.
	Objective 2: Improve knowledge and understanding of the impact of rabbits and their interactions with other species and ecological processes. The Proposal will not impede on this objective.
	Objective 3: Improve the effectiveness of rabbit control programs. The Proposal will not impede on this objective.
	Objective 4: Increase engagement of, and awareness by, the community of the impacts caused by rabbits, and the need for integrated control. The Proposal will not impede on this objective.
Department of the Environment, Water, Heritage and the Arts (2008). *Approved Conservation Advice for Caladenia harringtoniae* (Harrington's Spider-orchid). Canberra: Department of the Environment, Water, Heritage and the Arts.	*Threat: Fire during active growth period* There is considered to be low risk of accidental fire as a result of mining activities due to the highly disturbed and cleared nature of the MDE: • Targeted searches have not identified any populations of *C. harringtoniae* within the MDE to date, and in the unlikely event of fire generating on site, it would have to spread outside the MDE (560 m south-west) to damage a known population. • Talison implement a Hot Work Procedure and Emergency Management Plan to mitigate the risk of bushfire.
	Threat: Grazing by feral pigs (Sus scrofa) The Proposal is not expected to exacerbate this threat. • As orchid populations were not identified within the MDE, Talison's feral animal control program may not cover existing orchid populations off site which are within State Forest 20.

Plan/Conservation Advice	Talison Proposal
	Threat: Road maintenance activities The Proposal is not expected to exacerbate this threat. • Mine access roads will not be located near known populations of Harrington's Spider Orchid.

8.7 Predicted outcome

The proposed environmental outcomes for threatened fauna species (MNES) potentially impacted by the Proposal are:

- No mortality of threatened fauna species as a result of clearing activities associated with the Project;
- No detrimental impact on habitat of threatened fauna species outside of proposed clearing areas within the MDE as a result of weed or disease spread to adjacent areas, sedimentation from runoff, reduced availability or quality of surface or groundwater, or accidental clearing beyond approved areas of outside the MDE which is associated with the implementation of the Proposal;
- No detrimental impact on habitat of the Pink Spider Orchid outside the MDE as a result of weed or disease spread to adjacent areas, sedimentation from runoff, reduced availability of surface or groundwater, or accidental clearing beyond the MDE which is associated with the implementation of the Proposal; and
- Counterbalance the loss of up to 350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia (fauna habitat suitable for MNES), inclusive of seven trees with 'Known' breeding hollows and seven trees with 'Suitable' breeding hollows for black cockatoos, through implementation of a suitable environmental offset which aligns with the Principles of the WA Environmental Offsets Policy (2011) and the EPBC Act Environmental Offsets Policy (2012). Details of the Offset Proposal are included in the following chapter.

9. Offsets

9.1 Significant residual impact

Environmental offsets are conservation actions that provide environmental benefits intended to counterbalance the significant residual environmental impacts associated with a Proposal (EPA 2014). Offsets differ to mitigation measures in that they are undertaken outside of the area of development (Mine Development Envelope). They are applicable where a Proposal has a significant residual impact after the hierarchy of mitigation measures (avoid, minimise and rehabilitate) has been applied. Offsets should directly correlate to the impacts of a Proposal.

Talison's mitigation measures intended to avoid, minimise and rehabilitate impacts to flora, vegetation and fauna have been described within section 4.6 and 5.6 of this document. After application of these measures, Talison believes the Proposal will have a significant residual impact due to direct impacts to MNES and other conservation significant fauna species through removal of up to 350 ha of native vegetation, which is considered suitable habitat for these species. The majority of the native vegetation which will be removed is State Forest (275 ha), removal of which is also considered a significant residual impact. Talison has considered the Proposal's potential for indirect impacts to native vegetation and fauna habitat outside the proposed clearing footprint (such as dieback and weed spread, excess clearing, changes to hydrology) but believes the mitigation measures proposed in sections 4.6 and 5.6 of this document will minimise the risk of indirect impacts occurring. The vegetation monitoring program proposed in the Conservation Significant Flora and Native Vegetation Management Plan (Appendix E) will be implemented and is designed to detect if indirect impacts occur.

Residual impacts associated with the Proposal have been determined through application of the residual impact significance model detailed in the WA Environmental Offsets Guidelines (GoWA 2014). A summary of the application of this model to the Proposal is included in Table 33 with further discussion included in the following sections (9.1.1 to 9.1.4).

Talison intends to counterbalance the significant residual impact of the Proposal through implementation of an environmental offset strategy that is relevant and proportionate to the significance of the environmental impact.

Table 33 Residual impact significance model assessment

Part IV Environmental Factors	Vegetation and flora			Terrestrial fauna			
Part V Clearing Principals	**Rare Flora**	**Threatened Ecological Communities**	**Remnant Vegetation**	**Wetlands and Waterways**	**Conservation Areas**	**High Biological Diversity**	**Habitat for Fauna**
Residual impact that is environmentally unacceptable and cannot be offset							
Significant residual impacts that will require an offset.					There are no formal conservation reserves or areas under conservation covenant within or in close proximity to the MDE. The Proposal occurs within State Forest 20 and will result in the removal of 275 ha of protected vegetation within the South West Region. The State Forest is currently managed in accordance with the 2014-2023 Forest Management Plan under the Regional Forest Agreement for the South-West Forest Region of WA. See section 9.1.3 for further detail.		The Proposal will have a significant residual impact as it will result in the removal of 350 ha of native vegetation which is known habitat for five fauna species declared as specially protected under the WC Act, including four species which are also listed as threatened species under the EPBC Act. The 350 ha of proposed clearing is known foraging and potential breeding habitat for the following three species of threatened black cockatoo: • Carnaby's Cockatoo (Endangered, Cwth and WA), • Forest Red-tailed Black Cockatoo (Vulnerable, Cwth and WA) • Baudin's Cockatoo (Endangered, Cwth and WA); Within the clearing footprint there are 7 known and an additional 7 suitable breeding hollows. It is unconfirmed which species utilise the hollows but based on foraging evidence is most likely to be the FRTBC. The proposed 350 ha clearing area is also known habitat for the following protected species: • Western Quoll/Chuditch - Vulnerable (Cwth and WA); • Wambenger Brush-tailed Phascogale – Conservation Dependent (WC Act, WA); See section 9.1.4 for further detail.
Significant residual impacts that may require an offset							Clearing for the Proposal will potentially impact upon the Western Ringtail Possum (Critically Endangered, Cwth and WA). Eighteen hectares of habitat which will be cleared for the Proposal has been assessed as poor to marginal habitat for WRP. There are no confirmed records of WRP or hollows confirmed as suitable for WRP within the MDE and it is considered unlikely that a population of WRP would inhabit the MDE and if individuals are occasionally present they are not considered to be dependent on the habitats present. See section 9.1.4 for further detail.

Part IV Environmental Factors	Vegetation and flora			Terrestrial fauna			
Part V Clearing Principals	**Rare Flora**	**Threatened Ecological Communities**	**Remnant Vegetation**	**Wetlands and Waterways**	**Conservation Areas**	**High Biological Diversity**	**Habitat for Fauna**
Residual impacts that are not significant	No species declared as rare flora under the WC Act (WA) or listed as threatened under the EPBC Act (Cwth) have been identified within the MDE or will be impacted by indirect impacts from the Proposal • The closest known population of threatened flora is *Caladenia harringtoniae* (Vulnerable, Cwth and WA) 560 m south west of the MDE boundary. • The DBCA Priority 4 listed *Acacia semitrullata* occurs as two populations (231 individuals) within the MDE. One population will be removed to develop the TSF4. Direct clearing of the second population will be avoided where practicable. The species is widely distributed and can grow in disturbed areas. See section 9.1.1 for further discussion.	No environmentally sensitive areas listed under the EP Act, threatened ecological communities (TEC) listed under the EPBC Act or TEC or Priority Ecological Communities (PEC) listed under the WC Act have been identified within the MDE. The closest ESA is approximately 500 m south west of the MDE and there are no predicted direct or indirect impacts to this location as a result of the Proposal.	350 ha of native vegetation will be cleared as a result of the Proposal. The vegetation is in predominantly Good or Very Good condition and comprises the following vegetation communities (refer to Table 9 for full descriptions and Table 15 for the vegetation condition): • Hs Bo (214.7 ha) • DL Er (1.21 ha) • DL EpCc Tp (0.5 ha) • HS Bg (83.13 ha) • HS Xp (4) • HS Pd TpBl (38 ha) • DF MpEp AsTl (4.89 ha) • DF Pe (3.57 ha) The mapped vegetation complexes (Mattiske and Havel 1998, updated by Webb et al 2016) in which these vegetation communities occur (Dwellingup, Goonaping, Catterick, Grimwade and Hester) are not considered highly cleared as >30% of their pre-clearing extent remains at a local scale and >50% remains at a regional scale. See section 9.1.2 for further details.	There are no conservation significant wetlands within or in proximity to the MDE. The 350ha of vegetation which will be cleared for the Proposal will not remove vegetation that is watercourse or wetland dependant. There are limited significant water courses within the MDE with water being harvested within two major dams Cowan Brook and Austin's/ Southampton.		The Proposal occurs within Jarrah/Marri forest of the Southern Jarrah Forest sub-region. This area is not recognised as a biodiversity hotspot.	The Proposal will result in the removal of 350 ha of native vegetation which is known habitat for two fauna species on the DBCA Priority Fauna list: • Western Brush Wallaby – Priority 4 (DBCA Listing, WA); and • Southern Brown Bandicoot – Priority 4 (DBCA Listing, WA). In total 47 native vertebrate fauna species have been recorded in the MDE and could utilise habitat within the 350 ha proposed clearing area.

9.1.1 Rare Flora

The Proposal is not expected to have a significant residual impact on rare flora. There are not expected to be any direct or indirect impacts to the *Caladenia harringtoniae* (Vulnerable, Cwth and WA) population due to its distance (560 m) from the MDE and mitigation measures which will be in place to minimise indirect impacts associated with the Proposal (refer to section 4.6.2). Mitigation measures include implementation of the Talison Lithium Pty Ltd Conservation Significant Flora Management Plan and the Weed and Hygiene Management Plan as well as the Surface Water Management Plan which is implemented as per the requirements of the Talison EP Act Part V Operating Licence (L4247/1991/13, and associated Amendment Notices).

One of two known populations of *Acacia semitrullata* will be directly removed as a result of the Proposal. The remaining population will be avoided where practicable however it is located in close proximity to an existing track which will be expanded to provide an access road to the explosive batching facility. Some individuals in close proximity to the existing track may not be able to be avoided. Other individuals in close proximity to the proposed explosive batching facility access road may receive indirect impacts such as dust and sedimentation from road runoff but mitigation measures described in section 4.6.2 will be implemented to minimise the risk of indirect impact. As per section 4.5.1, the species is widely distributed and can grow within disturbed areas, therefore the loss of one population of the species from the MDE is not considered significant.

9.1.2 Remnant vegetation

Clearing of 350 ha of native vegetation within the MDE is not expected to significantly reduce the extent of any vegetation complexes mapped (Mattiske and Havel (1998) and updated by Webb et al (2016)) within the MDE at the regional or local scale therefore the Proposal is not expected to have a significant residual impact on remnant vegetation. Proposed clearing will primarily (76.9%) occur within the Dwellingup complex. Over 85% of the pre-European extent of this complex is remaining, of which over 80% is within DBCA managed lands within the South West Forest Region. The remaining vegetation complexes (Goonaping, Catterick, Grimwade and Hester) have over 50% of the pre-European extent remaining at a regional scale (South West Forest Region) and over 30% remaining at a local scale (Shire of Bridgetown-Greenbushes) (refer to Table 12 and Table 13). The 350 ha of vegetation clearing represents less than 0.3% of the current extents of all mapped vegetation complexes at a regional scale and less than 3.5 % of the current extents of all mapped vegetation complexes at a local scale.

The proposed clearing will not cause a high degree of fragmentation as it is adjacent to/at the outer extents of the existing mining operation, resulting in the mine footprint expanding out.

9.1.3 Conservation areas

The Proposal will have a significant residual impact as it will result in the removal of 275 ha of native vegetation in predominantly good or very good condition from State Forest 20. Tenement conditions require that Talison pay compensation (currently at a rate of $5,167.91/ha adjusted annually for CPI) to the Executive Director, CALM for state forest destroyed by or in connection with mining. Monetary compensation for the destruction of forest in connection with mining has been a requirement of the Greenbushes mining tenements since 1984.

Talison is proposing to offset the significant residual impact associated with the direct removal of 350 ha of conservation significant fauna habitat through acquisition of suitable land containing native vegetation with very similar fauna habitat values to the clearing footprint and transfer the land to DBCA to manage consistent with the CALM Act. As the area of land required to offset the significant residual impact to conservation significant fauna is in excess to the 275 ha of state forest which will be removed, there will be no net loss of state forest.

As Talison has an existing requirement for monetary compensation for the destruction of state forest, and there will be no net loss of state forest due to offset requirements for Terrestrial Fauna, Talison is not proposing a further offset for the clearing of 275 ha of state forest.

9.1.4 Habitat for fauna

The Proposal will result in the removal of 350 ha of Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia which is known habitat for the following conservation significant fauna species:

- Carnaby's Cockatoo (Endangered, Cwth and WA),
- Forest Red-tailed Black Cockatoo (Vulnerable, Cwth and WA)
- Baudin's Cockatoo (Endangered, Cwth and WA);
- Western Quoll/Chuditch - Vulnerable (Cwth and WA);
- Wambenger Brush-tailed Phascogale – Conservation Dependent (WC Act, WA);

Talison has preferentially planned development for the Mine expansion to occur within areas which have previously been disturbed to minimise the total area of habitat loss associated with the Proposal. The habitat removal associated with the Proposal is considered a significant residual impact because the species listed above which are known to utilise the habitat are listed as threatened species under the EPBC Act and/or are declared specially protected under the WC Act.

The majority of the MDE has been assessed through field and desktop assessment as unsuitable for the WRP (Critically Endangered, Cwth and WA) (Harewood 2018b and Onshore Environmental 2018c and 2018d) which has been previously recorded in close proximity (~320 m north) to the MDE (DBCA 2018). Through these assessments only a small area within the proposed clearing footprint in the MDE (18 ha) is potentially suitable for WRP and has been classified as poor to marginal habitat for WRP. This area has limited anthropogenic impact from logging and fire as it has had an extended period of time without these activities. It contains large old Eucalyptus trees, but lacks mid-storey structure and canopy connectivity that WRPs require (Onshore Environmental 2018d). There are no confirmed records of WRP or hollows considered suitable for WRP within the MDE and it is largely considered unsuitable for the species. However, as the WRP is listed as a threatened species under the EPBC Act, and specially protected under the WC Act, Talison has taken a precautionary approach and has considered that significant residual impact to the WRP may require an offset.

9.2 Quantum of Impact

In order to quantify the offset required to counterbalance the significant residual impact of the Proposal, the quantum of the impact first needs to be determined. The quantum of impact is based on the area and quality of habitat which will be removed by the Proposal for each fauna species that will have a significant residual impact. Detailed descriptions of habitat quality for each fauna species are included in Talison's Offset Proposal in Appendix L. The DotEE Offset Assessment Guide was used to assess the quantum of residual impact associated with the Proposal, and quantify offset requirements. Completed assessment calculators are also included in Appendix L. Table 34 summarises the calculated quantum of impact for each fauna species which the Proposal will have a significant residual impact upon. More detailed descriptions are included in the WA Offset Template (Table 38).

Table 34 Calculated quantum of impact summary for the Proposal (fauna)

Aspect	Total calculated quantum of impact
Carnaby's Cockatoo	315 ha foraging and potential breeding habitat
Forest Red-tailed Black Cockatoo	315 ha foraging and breeding habitat inclusive of 7 known and 7 suitable (14 total) breeding hollows
Baudin's Cockatoo	315 ha foraging and potential breeding habitat
Western Quoll/Chuditch	210 ha habitat
Wambenger Brush-tailed Phascogale – Conservation Dependent	315 ha habitat
Western Ringtail Possum	9 ha habitat

9.3 Offset Proposal

Talison's Offset Proposal is provided in Appendix L. It includes a more detailed description of the offsets proposed. A summary of the Offset Proposal is included here.

Talison proposes an offset strategy which includes both direct and indirect offsets.

The following direct offsets are proposed;

1. Acquisition of three properties identified by Talison and the DBCA which have native vegetation containing identical or very similar fauna habitat values to the MDE. Following acquisition Talison proposes to transfer the title of each property to the DBCA for management consistent with the CALM Act 1984 which includes management for the purposes of conservation.

Talison aims to have purchased suitable offset properties within 12 months of receiving approval to undertake the Proposal. It is expected it may take up to two years to vest the land with the DBCA and suitably protect the area.

The following indirect offsets are proposed;

1. Provide $250,000 funding toward a partnership program managed by Talison in conjunction with the BBG and the Greenbushes community. The objective of the program will be to enhance black cockatoo, Chuditch and WRP habitat values in areas surrounding the town of Greenbushes. This will include further enhancement of Schwenke's water bird project precinct to the west of the town and Mine.
2. Provide $250,000 funding toward a mitigation plan to counteract the impact of the clearing of Known and Suitable black cockatoo breeding hollows. Talison will fund research into the use of natural and artificial hollows in the Greenbushes region

The proposed offsets will be formalised through the preparation of a Talison Expansion Project Offsets Management Strategy, to be submitted to, and approved by the DotEE and EPA within twelve months of receiving approval for the Proposal to proceed.

9.4 Proposed offset properties

Through a desktop review, Talison has worked with the DBCA to identify over 20 properties with environmental qualities that may contribute to satisfying the offset requirements of the Proposal.

After a preliminary site inspection of the most prospective sites an initial three properties have been selected as proposed direct offsets which will be subject to further assessment. The properties are:

- Property L : Adjoining the Beaton State Forest, approximately 50 km southwest of the mine;
- Property R: Tone Bridge region, approximately 80 km east of the mine; and
- Property S : Enclave of State forest, 20 km northeast of the mine;

A preliminary desktop assessment of the potential offset value of each property has been undertaken using the DotEE Offset Assessment Guide. The details of this assessment are included in Appendix L.

Talison and the DBCA are continuing assessment of these properties in respect to:

- Fauna habitat values;
- Conservation value; and
- Availability and suitability for inclusion in the state conservation estate.

Detailed assessments of the fauna habitat values of each proposed offset property will be completed prior to acquisition to confirm suitability as an offset property, and reassess the quantum of impact which can be offset. The assessments and revised calculation of the offset value of the properties will be provided to the DWER-EPA services and DotEE for comment prior to acquisition of each property. The updated assessments will be included in the Talison Expansion Project Offsets Management Strategy.

Should any of the properties under consideration be found through the assessment process to be unsuitable as an offset, Talison will identify an alternative property from the list of over 20 which were identified in conjunction with the DBCA. Offset management plans will be prepared for each property when they have been assessed as suitable as an offset (contain the required fauna values) and acquired. As the properties will be vested with the DBCA, the department will be consulted in regards to the offset management plan requirements.

The Net Present Value (NPV) of the potential offset properties determined through the desktop assessment of the properties indicates that the required offset (to counterbalance significant residual impacts) is likely to be attainable through acquisition of the three properties under consideration, and implementation of the proposed indirect offset program. The outcomes of the desktop assessment of NPV are included in Table 35.

The number of suitable breeding hollows within the proposed offset properties is unknown therefore assessment of the offset value for suitable breeding hollows is not able to be made at this point in time. Talison proposes to offset the loss of 7 known and 7 suitable breeding hollows, in part through suitable hollows located on the direct offset properties and in part through an indirect offsets research program into the use of natural and artificial hollows (refer to section 9.3). Talison will confirm the number of suitable breeding hollows within each property (and their risk of loss) during the detailed site assessments which will include a hollow survey.

Table 35 Preliminary desktop based assessment for three proposed offset properties

Offset Site	Actual (ha)	Preliminary NVP of site (ha)					
		Carnaby's BC	Baudin's BC	FRTBC	Chuditch	WRP	Phascogale
Property 'L'	145.6	54.97 *(17.45%)*	54.97 *(17.45%)*	58.37 *(18.53%)*	33.38 *(15.90%)*	22.66 *(251.72%)*	33.92 *(10.77%)*
Property 'R'	563	119.59 *(37.96%)*	119.59 *(37.96%)*	129.07 *(40.97%)*	123.66 *(58.89%)*	86.09 *(956.58%)*	125.55 *(39.86%)*
Property 'S'	297.4	143.90 *(45.68%)*	143.90 *(45.68%)*	171.35 *(54.40%)*	144.58 *(68.85%)*	50.76 *(564.05%)*	149.62 *(47.50%)*
TOTAL (% quantum of impact)		**318.46 *(101.09%)***	**318.46 *(101.09%)***	**358.79 *(113.90%)***	**301.62 *(143.62%)***	**159.91 *(1776.78%)***	**309.09 *(98.12%)***

9.5 Offset Policy Principles

Talison's Environmental Offset Proposal has been developed in line with the Principles of the WA Environmental Offsets Policy (GoWA 2011) and the EPBC Act Environmental Offsets Policy (DSEWPaC 2012b). The application of the six principles of the WA Environmental Offsets Policy (DSEWPaC 2011) to the proposed strategy are summarised in Table 36 and the eight principles of the EPBC Act Environmental Offsets Policy (DSEWPaC 2012b) are summarised in Table 37.

Table 36 Application of the WA Offset Policy Principles to the proposed offset strategy

Principle	Application to the Talison Greenbushes Lithium Mine Expansion Proposal
Environmental offsets will only be considered after avoidance and mitigation options have been pursued.	Strategies which have been or will be implemented to avoid and mitigate environmental impacts are described in sections 4.6 and 5.6 of this document.
Environmental offsets are not appropriate for all projects.	The Mine has been in operation for over 30 years without evidence of any significant environmental impact. The company and its predecessors have actively worked to improve the State Forest surrounding the mine through progressive rehabilitation of legacy mining areas, gradually reducing the area of disturbance associated with the mine. Talison believe the expanded mining operation can continue to be operated in an environmentally responsible manner but the expansion will have a significant residual impact associated with the loss of fauna habitat of species declared as specially protected under the WC Act, and listed as threatened species under the EPBC Act. Offsets are considered an appropriate counterbalance to enable the Proposal to meet the EPA's objective for Terrestrial Fauna. Talison is working closely with the DBCA to identify suitable properties which can be secured as direct offsets for the Mine expansion.

Principle	Application to the Talison Greenbushes Lithium Mine Expansion Proposal
Environmental Offsets will be cost effective, as well as relevant and proportionate to the significance of the environmental value being impacted	The value of fauna habitat which will be cleared for the Proposal has been assessed to calculate the required offset using the Commonwealth Offsets Assessment Guide and associated guidance. The rationale behind the input values to calculate the offset area are described in the Offset Proposal in Appendix L. Talison has worked with the DBCA to identify areas offset properties that have appropriate fauna habitat values and are suitable for inclusion in the Conservation Estate.
Environmental offsets will be based on sound environmental information and knowledge	Detailed ecological assessment of the proposed offset properties will be undertaken to confirm they contain suitable environmental values to offset the significant residual impact of the Proposal. The ecological assessments will also be used to determine what the quality of the offset site is for relevant species.
Environmental offsets will be applied within a framework of adaptive management.	It is intended that the land identified for offset will be acquired by Talison and vested with the DBCA. The land would be managed by DBCA and management would be undertaken and reported on in accordance with the requirements of the CALM Act which includes management for the purposes of conservation. Offset management plans will be prepared for each direct offset property in consultation with the DBCA.
Environmental offsets will be focussed on longer term strategic outcomes.	As the direct offset properties will be vested with the DBCA they will add to the area of reserved vegetation within the South West Forest in perpetuity. The properties proposed for purchase are adjacent to existing State Forest, not fragmented and can therefore be incorporated into the existing management framework for each region. The indirect offsets proposed will contribute to understanding of black cockatoo breeding which is intended to aid conservation of these species. The Partnership Program will be implemented over a period of time and through its implementation is intended to enhance the conservation skills and knowledge of the local community as well as improve fauna habitat in the local area.

Table 37 Application of the EPBC Act Environmental Offsets Policy Principles to the proposed offset strategy

Principle	Application to the Talison Greenbushes Lithium Mine Expansion Proposal
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	Habitat quality assessments have been undertaken to quantify the habitat value of the area which will be cleared for the Proposal. The offset area requirements have been calculated using the Commonwealth Offsets Assessment Guide and associated guidance. The rationale behind the input values to calculate the habitat values and value of the proposed offset properties provided in the Talison offset Proposal in Appendix L.

Principle	Application to the Talison Greenbushes Lithium Mine Expansion Proposal
Suitable offsets must be built around direct offsets but may include other compensatory measures	Talison proposes to acquire suitable offset areas (direct offset) which will be vested with the DBCA conservation estate to be managed consistent with the CALM Act. The identified areas will achieve a direct offset of at least 90% of the significant residual environmental impacts associated with land clearing for the Mine expansion. The remaining 10%, if unable to be met through the direct offset, will be made up through an Indirect Offset program comprising a community partnership program and research involving Black Cockatoo breeding.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	Offsets for impacts on affected MNES have been calculated using the DotEE Offset Assessment Guide which includes IUCN data on the probability of annual extinction for different categories of threatened species as a multiplier in the offset calculations (DSEWPaC 2012). The higher the level of statutory protection and associated probability of annual extinction the greater the quantum of biodiversity offset required. Based a desktop assessment of the proposed offset properties it is expected that more than 90% of the residual impact of the Proposal can be offset through acquisition of land as a direct offset. The value of the properties proposed as direct offsets will be confirmed through detailed ecological assessment.
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	The DotEE Offset Assessment Guide has been used to determine the value of the proposed offset sites and proportion of the residual impact that can be offset for each MNES.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding	Talison proposes to vest the acquired offset land to DBCA conservation estate in perpetuity. Areas vested to DBCA would be managed consistent with the CALM Act which includes management for the purposes of conservation. Offset management plans will be prepared for each offset property in consultation with the EPA.
Suitable offsets must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The direct offsets proposed will be for the WA and Commonwealth environmental impact assessment of the Mine expansion and not the result of any other legal requirement that applies to the Proposal.

Principle	Application to the Talison Greenbushes Lithium Mine Expansion Proposal
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	The offset area requirements have been calculated using the DotEE Offset Assessment Guide and associated guidance. The rationale behind the input values to the guide are described in the Talison Offset Proposal in Appendix L. Talison has worked closely with the DBCA to identify suitable offset properties. Detailed ecological assessment of the proposed offset properties will be undertaken prior to acquiring the land for offset purposes and will be included in the Talison Expansion Project Offsets Management Strategy which will be submitted to the DotEE and EPA for assessment. The ecological assessment will be used to confirm the properties have the required fauna habitat values and quality to be a suitable offset. Full details of Talison's Indirect Offset Program will also be included in the Talison Expansion Project Offsets Management Strategy.
Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	It is intended for the land identified for offset to be acquired and vested with the WA conservation estate vested with DBCA. The land would be managed by DBCA consistent with the CALM Act which includes management for the purposes of conservation. Talison will publically report on the outcomes of the implementation of the Indirect Offset Program on an annual basis.

9.6 Offset Proposal Summary

Talison's Offset Proposal has been included in Appendix L. The Proposal contains further details of the assessment of the quantum of residual impacts, and the values of the offset properties. The Offset Proposal has been summarised in the WA Offset Template included in Table 38.

Table 38 WA Offset Template for Talison Mine Expansion Proposal

Project Name: Greenbushes Lithium Mine Expansion									
Existing environment/ Impact	***Mitigation***			***Significant Residual Impact***	***Offset Calculation Methodology***				
	Avoid and minimise	***Rehabilitation Type***	***Likely Rehab Success***		***Type***	***Risk***	***Likely offset success***	***Time Lag***	***Offset Quantification***
350 ha of native vegetation clearing for expansion of the Greenbushes Lithium Mine									
350 ha of native vegetation will be removed as a result of the Proposal. The vegetation types occurring within the clearing footprint include the following (refer to Table 9 for full descriptions and Table 15 for the vegetation condition): • Hs Bo (214.7 ha) • DL Er (1.21 ha) • DL EpCc Tp (0.5 ha) • HS Bg (83.13 ha) • HS Xp (4) • HS Pd TpBl (38 ha) • DF MpEp AsTl (4.89 ha) • DF Pe (3.57 ha) The vegetation is mostly in good or very good condition but has been impacted by past mining, forestry and exploration activity and dieback and weeds are known to be present.	Talison has planned disturbance to occur within existing disturbed or rehabilitated areas, close to the existing Mine, wherever practicable in preference to clearing undisturbed areas. Talison will implement a Weed and Hygiene Management Plan and Conservation Significant Flora Management Plan to minimise impacts associated with the mine. These plans detail the mitigation strategies that will be implemented to avoid, minimise and monitor impacts to native vegetation.	Talison has an established record of progressive rehabilitation which is evident at the existing Mine. Progressive rehabilitation of areas disturbed as a result of the mine expansion will be undertaken where practicable. Some areas which are in use for the duration of mining (infrastructure, roads, TSF) cannot be rehabilitated until closure. Rehabilitation will be undertaken in accordance with the Department of Mines, Industry Regulation and Safety (DMIRS) Approved Mine Closure Plan for the Greenbuses Mine. The Mine Closure Plan will be updated for the Mine Expansion and submitted to DMIRS for review and approval with the Mining Proposal which is due to be submitted to the DMIRS in late 2018/early 2019.	Talison is experienced in successful rehabilitation of extensive areas of disturbance ranging from historical mining disturbance through to more recent mining disturbance such as waste rock landforms. Rehabilitation performance is reported annually to the Department of Mines, Industry Regulation and Safety (DMIRS). The objective of Talison's rehabilitation program is to establish a self-sustaining heath community with selected attributes compatible with surrounding Jarrah/Marri forest. Rehabilitation areas are direct sown with provenance seed and planted with seedlings, including *Corymbia calophylla* (Marri), *Eucalyptus marginata* (Jarrah), *Eucalyptus patens* (Blackbutt) and *Eucalyptus rudis* (Flooded Gum). Rehabilitation progress at the existing Greenbushes Mine is evidence of the success of Talison's current rehabilitation strategy. Conservation significant fauna have been recorded utilising areas rehabilitated by Talison which is further evidence of their ability to successfully rehabilitate disturbance to return a native vegetation community able to support native fauna.	350 ha of Jarrah/Marri forest native vegetation, in predominantly very good (59.2%) or good (27.9%) condition will be removed as a result of the Proposal. Progressive rehabilitation of areas will be undertaken where practicable however some area will not be able to be rehabilitated until the end of mine life in 20 years or more. *According to the agreed significance framework (WA Environmental Offsets Guidelines 2014), residual impact is not considered to be significant as no Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act, Commonwealth) or Wildlife Conservation Act 1950 (WC Act, WA) listed threatened or priority ecological communities will be impacted by the Proposal.*					
The MDE is located in State Forest 20, freehold land, unallocated crown land and Mining Reserves. The Proposal will result in the removal of 275 ha of protected vegetation from State Forest 20. The vegetation is mostly in good or very good condition but has been impacted by past mining, forestry and exploration activity and dieback and weeds are known to be present. Tenement conditions require that Talison pay compensation ($5,167.91/ha adjusted annually for CPI) to the Executive Director, CALM on an annual basis for state forest destroyed by or in connection with mining. Monetary compensation for the destruction of forest in connection with mining has been a requirement of the Greenbushes mining tenements since 1984.	All vegetation clearing will be undertaken in accordance with a Clearing Disturbance Criteria and Permit Procedure which requires an internal permit to authorise clearing, demarcation of clearing areas and survey of areas following clearing.			275 ha of State Forest in predominantly very good or good condition will be removed as a result of the Proposal. Progressive rehabilitation of areas will be undertaken where practicable however some area will not be able to be rehabilitated until the end of mine life in 20 years or more. *According to the agreed significance framework (WA Environmental Offsets Guidelines 2014), residual impact is considered to be significant as an area reserved under statute (State Forest 20) will be impacted by the Proposal.*	**Land acquisition (direct offset)** The offset required for the loss of 350 ha of conservation significant fauna habitat is larger than the 275 ha of state forest removed by the Proposal. The significant residual impact to fauna is proposed to be offset through acquisition of 3 properties which will be vested with the Department of Biodiversity, Conservation and Attractions (DBCA) . The properties contain over 1,000 ha of native vegetation therefore there will be no net loss of state forest and accordingly, **no additional offset** is proposed for this impact.	**Low** In consultation with DBCA, Talison has identified three potentially suitable direct offset properties (within 100 km of the Mine) with a total native vegetation/fauna habitat area of 1006 ha. A preliminary assessment of the properties has been undertaken and they have have native vegetation containing identical or very similar fauna habitat values to the MDE (refer to Appendix L). Further detailed assessment of the lots is planned to confirm their suitability as a direct offset. Talison has commenced consultation with relevant landholders in relation to acquisition of the lots.	**High** The likelihood of offset success is considered to be high given that a land acquisition offset is proposed which will be transferred to the DBCA for management consistent with the *Conservation and Land Management Act 1984* (CALM Act) which includes management for conservation. Vesting the land with the DBCA will provide protection in perpetuity. DBCA has established land management practices that are implemented to ensure appropriate protection of areas. The practices are adapted over time in accordance with developments in environmental knowledge.	It is anticipated to take approximately 2 years to arrange for the purchase and vesting of the land with the DBCA. Additional time will be needed to implement any necessary controls to address threats/risks at the chosen offset locations (such as fencing). Rehabilitation of the Mine disturbance will be undertaken progressively over the more than 20 year life of the Project in accordance with the approved Mine Closure Plan.	There will be no net loss of state forest as a result of the Proposal. An estimated 275 ha of state forest vegetation will be removed as a result of the proposal. The proposed direct offset for significant residual impacts to fauna (acquisition of three properties containing over 1000 ha of native vegetation in similar or better condition than the MDE vested to the DBCA) will result in no net loss of state forest as a result of the Proposal.

Table 38 WA Offset Template for Talison Mine Expansion Proposal

Project Name: Greenbushes Lithium Mine Expansion									
Existing environment/ Impact	***Mitigation***			***Significant Residual Impact***	***Offset Calculation Methodology***				
	Avoid and minimise	***Rehabilitation Type***	***Likely Rehab Success***		***Type***	***Risk***	***Likely offset success***	***Time Lag***	***Offset Quantification***
350 ha of native vegetation clearing for expansion of the Greenbushes Lithium Mine									
350 ha of Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia which is known foraging and potential breeding habitat for Carnaby's Cockatoo. Approximately 2,100 potential breeding trees with DBH>500 mm are estimated to be within the proposed clearing area. Seven of the trees have been identified to have 'Known' breeding hollows (assessed as hollows with evidence of chew marks) and seven have been identified with 'Suitable' breeding hollows which will be removed as a result of the Proposal. Although all three species of threatened black cockatoo are known to use the area records are predominantly for the Forest Red-tailed black cockatoo and this is thought the be the species most likely to use the breeding habitat (Kirkby 2018a).	Talison has planned disturbance to occur within existing disturbed or rehabilitated areas, close to the existing Mine, wherever practicable in preference to clearing undisturbed areas. Talison will implement a Weed and Hygiene Management Plan and Conservation Significant Fauna Management Plan to minimise impacts associated with the mine. These plans detail the mitigation strategies that will be implemented to avoid, minimise and monitor impacts to native fauna habitat. All vegetation (fauna habitat) clearing will be undertaken in accordance with a Clearing Disturbance Criteria and Permit Procedure which requires an internal permit to authorise clearing, demarcation of clearing areas and survey of areas following clearing. Known and suitable black cockatoo hollows cannot be avoided within the TSF4 and Floyd's WRL footprints however will be avoided for the development of the remaining infrastructure (roads, CGP3/4, MSA, Explosive infrastructure). The remaining trees with known and suitable hollows, and two roost trees will have tree protection zones (10m) established around them to minimise the risk of impact.	As per above	As per above	350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia which is known foraging habitat and potentially breeding habitat for Carnaby's Cockatoo. The habitat within the area of impact is considered to have a quality of 9 for Carnaby's Cockatoo . The Carnaby's Cockatoo is listed as Endangered under the EPBC Act and WC Act. *According to the agreed significance framework, residual impact is considered to be significant due to removal of habitat which is used by threatened fauna species listed under the EPBC Act and the WC Act .*	**Land acquisition (direct offset)** Acquisition of suitable land containing identical or very similar fauna habitat values to the MDE, which will be vested with the DBCA for management consistent with the CALM Act which includes management for conservation. **Indirect offset** 1. Provide $250,000 funding toward a partnership program managed by Talison in conjunction with Blackwood Basin Group (BBG) and the Greenbushes community. The objective of the program will be to enhance Black cockatoo, Chuditch and WRP habitat values in areas surrounding the town of Greenbushes. 2. Provide $250,000 funding to research into the use of natural and artificial hollows to counteract the impact of the clearing of Known and Suitable Black Cockatoo breeding hollows.	**Low** In consultation with DBCA, Talison has identified three potentially suitable direct offset properties (within 100 km of the Mine) with a total native vegetation/fauna habitat area of 1006 ha. A preliminary assessment of the properties has been undertaken and they have have native vegetation containing identical or very similar fauna habitat values to the MDE (refer to Appendix L). Further detailed assessment of the lots is planned to confirm their suitability as a direct offset. Talison has commenced consultation with relevant landholders in relation to acquisition of the lots.	**High** The likelihood of offset success is considered to be high given that a land acquisition offset is proposed which will be transferred to the DBCA for management consistent with the CALM Act which includes management for conservation. Vesting the land with the DBCA will provide protection in perpetuity. DBCA has established land management practices that are implemented to ensure appropriate protection of areas. The practices are adapted over time in accordance with developments in environmental knowledge.	It is anticipated to take approximately 2 years to arrange for the purchase and vesting of the land with the DBCA. Additional time will be needed to implement any necessary controls to address threats/risks at the chosen offset locations (such as fencing). Rehabilitation of the Mine disturbance will be undertaken progressively over the more than 20 year life of the Project in accordance with the approved Mine Closure Plan.	The DoEE Offset Assessment Guide has been used to assess the quantum of residual impact associated with the mine expansion . The calculator predicts a residual impact of 315 ha of suitable foraging and breeding habitat for each of the three Black Cockatoo species based on removal of 350 ha Black Cockatoo habitat. The preliminary assessment of the three potential offset properties indicates that through acquisition of the properties over 100% of the residual impact to FRTBC, Carnaby's and Baudin's Cockatoo foraging and potential breeding habitat can be offset. The properties are expected to also contain suitable breeding hollows which will partly offset the impact associated with the removal of known and suitable hollows. An indirect offset package which is 10% of the value of the offset properties has been developed. Part of the package includes research into breeding hollow usage to mitigate the impact to known and suitable hollows within the MDE. Further assessment details are included in Appendix L.
350 ha of Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia which is known foraging and potential breeding habitat for Forest Red-tailed Black Cockatoo (FRTBC). The FRTBC is the only Black Cockatoo species to be directly recorded within the MDE. Approximately 2,100 potential breeding trees with DBH>500 mm are estimated to be within the proposed clearing area. Seven of the trees have been identified to have 'Known' breeding hollows (assessed as hollows with evidence of chew marks) and seven have been identified with 'Suitable' breeding hollows which will be removed as a result of the Proposal. Although all three species of threatened black cockatoo are known to forage within the MDE records are predominantly for the Forest Red-tailed black cockatoo and this is thought to be the species most likely to use the breeding habitat (Kirkby 2018a). Two roost trees are located at the west and east boundary of the MDE. The species using the trees is unconfirmed but likely to the the FRTBC which is known to roost at the nearby Schwenke's dam area. These are not within the clearing footprint.		As per above	As per above	350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia which is known foraging habitat and potentially breeding habitat for FRTBC. The habitat within the area of impact is considered to have a quality of 9 for FRTBC . The FRTBC is listed as Vulnerable under the EPBC Act and WC Act. *According to the agreed significance framework, residual impact is considered to be significant due to removal of habitat which is used by threatened fauna species listed under the EPBC Act and the WC Act .*					
350 ha of Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia which is known foraging and potential breeding habitat for Baudin's Cockatoo. Approximately 2,100 potential breeding trees with DBH>500 mm are estimated to be within the proposed clearing area. Seven of the trees have been identified to have 'Known' breeding hollows (assessed as hollows with evidence of chew marks) and seven have been identified with 'Suitable' breeding hollows which will be removed as a result of the Proposal.		As per above	As per above	350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia which is known foraging habitat and potentially breeding habitat for Baudin's Cockatoo. The habitat within the area of impact is considered to have a quality of 9 for Baudin's Cockatoo. The Baudin's Cockatoo is listed as Endangered under the EPBC Act and WC Act. *According to the agreed significance framework, residual impact is considered to be significant due to removal of habitat which is used by threatened fauna species listed under the EPBC Act and the WC Act .*					

Table 38 WA Offset Template for Talison Mine Expansion Proposal

Project Name: Greenbushes Lithium Mine Expansion									
Existing environment/ Impact	***Mitigation***			***Significant Residual Impact***	***Offset Calculation Methodology***				
	Avoid and minimise	***Rehabilitation Type***	***Likely Rehab Success***		***Type***	***Risk***	***Likely offset success***	***Time Lag***	***Offset Quantification***
350 ha of native vegetation clearing for expansion of the Greenbushes Lithium Mine									
350 ha of Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia which is known and suitable habitat for the Western Quoll/Chuditch (*Dasyurus geoffroii*) will be removed as a result of the Proposal. At least one individual Chuditch has been recorded utilising the habitat within the MDE.	Talison has planned disturbance to occur within existing disturbed or rehabilitated areas, close to the existing Mine, wherever practicable in preference to clearing undisturbed areas. Talison will implement a Weed and Hygiene Management Plan and Conservation Significant Fauna Management Plan to minimise impacts associated with the mine. These plans detail the mitigation strategies that will be implemented to avoid, minimise and monitor impacts to native fauna habitat. All vegetation (fauna habitat) clearing will be undertaken in accordance with a Clearing Disturbance Criteria and Permit Procedure which requires an internal permit to authorise clearing, demarcation of clearing areas and survey of areas following clearing.	As per above	As per above	350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia which is known habitat for at least one individual Chuditch. The habitat within the area of impact is considered to have a quality of 6 for Chuditch. The Chuditch is listed as Endangered under the EPBC Act and WC Act. *According to the agreed significance framework, residual impact is considered significant due to removal of habitat which is used by threatened fauna species listed under the EPBC Act and the WC Act.*	**Land acquisition (direct offset)** Acquisition of suitable land containing identical or very similar fauna habitat values to the MDE, which will be vested with the DBCA for management consistent with the CALM Act which includes management for conservation. **Indirect offset** 1. Provide $250,000 funding toward a partnership program managed by Talison in conjunction with Blackwood Basin Group (BBG) and the Greenbushes community. The objective of the program will be to enhance Black cockatoo, Chuditch and WRP habitat values in areas surrounding the town of Greenbushes.	**Low** In consultation with DBCA, Talison has identified three potentially suitable direct offset properties (within 100 km of the Mine) with a total native vegetation/fauna habitat area of 1006 ha. A preliminary assessment of the properties has been undertaken and they have have native vegetation containing identical or very similar fauna habitat values to the MDE (refer to Appendix L). Further detailed assessment of the lots is planned to confirm their suitability as a direct offset. Talison has commenced consultation with relevant landholders in relation to acquisition of the lots.	**High** The likelihood of offset success is considered to be high given that a land acquisition offset is proposed which would either be: Transferred to the conservation estate (DBCA) for protection in perpetuity. DBCA has established land management practices that are implemented to ensure appropriate protection of areas. The practices are adapted over time in accordance with developments in environmental knowledge. Alternatively a conservation covenant will be placed over the land which would be managed by the BBG. This Natural Resource Management group have demonstrated capability in managing an offset property through their experience managing Talison's existing offset site in the Shire of Boyup Brook.	It is anticipated to take approximately 2 years to arrange for the purchase and vesting of the land with the DBCA. Additional time will be needed to implement any necessary controls to address threats/risks at the chosen offset locations (such as fencing). Rehabilitation of the Mine disturbance will be undertaken progressively over the more than 20 year life of the Project in accordance with the approved Mine Closure Plan.	The DoEE Offset Assessment Guide has been used to assess the quantum of residual impact associated with the mine expansion . The calculator predicts a residual impact of 210 ha of Chuditch habitat. The preliminary assessment of the three potential offset properties indicates that through acquisition of the properties 100% of the residual impact to Chuditch can be offset. Further assessment details are included in Appendix L.
Approximately 18 ha of Jarrah/Marri Forest over Banksia assessed as poor to marginal habitat for the Western Ringtail Possum (WRP) (*Pseudocheirus occidentalis*) will be removed as a result of the Proposal. The species has not been confirmed as occurring within the MDE and suitable hollows have not been found (Onshore 2018d). If WRP is present it is likely to occur in low numbers or on a transient basis as populations and resources fluctuate in the surrounding areas (Biologic 2018a). It is considered unlikely to be dependent on the habitats present in the MDE.		As per above	As per above	18 ha of Jarrah/Marri forest over Banksia which is poor to marginal habitat which the WRP possibly occurs within. The habitat is considered to have a quality of 5 for WRP. The WRP is listed as Critically Endangered under the EPBC Act and WC Act. *According to the agreed significance framework, the residual impact may be considered significant as an area of poor to marginal habitat will be removed which a threatened fauna species listed under the EPBC Act and the WC Act (WRP) possibly occurs within at low density.*	As per above	As per above	As per above	As per above	The DoEE Offset Assessment Guide has been used to assess the quantum of residual impact associated with the mine expansion . The calculator predicts a residual impact of 210 ha of Chuditch habitat. The preliminary assessment of the three potential offset properties indicates that through acquisition of the properties 100% of the residual impact to Chuditch can be offset. Further assessment details are included in Appendix L.
350 ha of Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia which is known and suitable habitat for the Wambenger Brush-tailed Phascogale *(Phascogale tapoatafa wambenger*) will be removed as a result of the Proposal. Fifteen records of the Wambenger Brush-tailed Phascogale were made by Biologic (2018a) during the survey of the MDE within both native vegetation and rehabilitated environments.		As per above	As per above	350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia which is known habitat for Wambenger Brush-tailed Phascogale. The habitat within the area of impact is considered to have a quality of 9 for Wambenger Brush-tailed Phascogale. The Wambenger Brush-tailed Phascogale is listed as Conservation Dependant under the WC Act. *According to the agreed significance framework, residual impact is considered significant due to removal of habitat which is known to support fauna species listed as specially protected under the WC Act.*	**Land acquisition (direct offset)** Acquisition of suitable land containing identical or very similar fauna habitat values to the MDE, which will be vested with the DBCA for management consistent with the CALM Act which includes management for conservation.	As per above	As per above	As per above	The DoEE Offset Assessment Guide has been used to assess the quantum of residual impact associated with the mine expansion . The calculator predicts a residual impact of 315 ha of Wambenger Brush-tailed Phascogale habitat. The preliminary assessment of the three potential offset properties indicates that through acquisition of the properties 98% of the residual impact to the Phascogale can be offset. Further assessment details are included in Appendix L.

10. Conclusions

10.1 Flora and Vegetation

Flora and vegetation will be directly impacted by the Mine expansion due to the requirement to clear up to 350 ha of native vegetation for the expanded Mine disturbance footprint. Vegetation within the MDE has previously been impacted by a long history of mining activity in the region and forestry practices. The loss of vegetation will not impact on any threatened vegetation communities or flora species as none occur within the MDE. Two main populations of Priority 4 species, *Acacia semitrullata* occur within the MDE, one of which is expected to be removed entirely as it falls within the TSF4 footprint. Impact on the remaining population will be avoided where practicable.

The native vegetation which is proposed to be cleared is representative of vegetation complexes all of which have greater than 50% of their pre-European extent remaining within the South West Forest Region.

Dieback is known to occur within the MDE and the region has a high diversity and abundance of weeds due to the extensive history of disturbance. The proposed vegetation clearing will reduce the area of protected vegetation (State Forest 20) within the South West Region, albeit on a relatively small scale. As the vegetation impacted by the expansion is widespread throughout the region, Talison considers that impacts on flora and vegetation associated with the proposed Mine expansion do not significantly impact on the biological diversity and ecological integrity on a local or regional scale.

10.2 Terrestrial Fauna

The proposed expansion of the Mine will result in the direct loss of up to 350 ha of Jarrah/Marri forest and Jarrah/Marri forest over Banksia fauna habitats. The native vegetation to be cleared is suitable foraging and potential breeding habitat for three species of conservation significant black cockatoo species, although feeding evidence within the MDE indicates it is primarily used by the FRTBC for both foraging and breeding. Thirty potential breeding trees with hollows suitable for breeding have been recorded in the MDE of which up to 14 are expected to require removal for the Mine expansion (seven with ‘Known Hollows; and seven with ‘Suitable Hollows’). These trees are all located within the TSF4 and Floyd’s WRL expansion areas which are fixed. The potential breeding trees outside the Floyd’s WRL and TSF4 footprints will be avoided through the implementation of Tree Protection Zones which will be factored into planning of infrastructure alignments.

Other conservation significant fauna recorded from these habitats include Chuditch, Wambenger Brush-tailed Phascogale, Quenda and Western Brush Wallaby. The Critically Endangered (Cwth and WA) WRP has also been assessed as potentially occurring within the MDE, although its presence has not been confirmed through studies undertaken to date. The vast majority of the MDE has been characterised as unsuitable for WRP largely due to the lack of dense well-connected mid-storey and upper-storey vegetation, and/or lack of mature trees due to historical logging and post-mining rehabilitation. A small 18 ha area of remnant bush is the only habitat within the MDE considered to provide poor or marginal habitat for WRP and this area will be removed through clearing for the Proposal.

While the available fauna habitat in the local area will be reduced as a consequence of the Proposal, the habitats present within the MDE are considered to be well represented in the surrounding region, in particular in the neighbouring Greenbushes, Nannup and Wilga State Forests. The loss of fauna habitat is therefore unlikely to have a significant impact on the extent of fauna habitat at a regional scale but is considered a significant residual impact as there will

be a loss threatened species habitat at a local scale. The loss of threated fauna habitat to implement the Proposal is unable to be avoided and offset in accordance with Commonwealth and WA Offset Guidelines is proposed to mitigate this impact.

10.3 Air quality

The expansion of the Mine will increase the emissions of dust, combustion products and greenhouse gases from the Mine, which will impact on the local air quality. The increased emissions are not expected to cause a permanent or long term impact. Dust modelling indicates that short term 1-hour maximum PM_{10} concentrations during worst-case conditions are predicted to exceed nominated criteria at some sensitive receptors including residences in the town of Greenbushes. Additionally, the 24-hour TSP concentration during worst-case conditions is predicted to exceed nominated criteria at sensitive receptors. It is highlighted that these predictions are based on a single modelling scenario using worst case meteorological conditions and the operational year predicted to have the highest dust emissions. Predicting air pollution is a complex application and air quality concentrations are likely to be highly variable depending on emission levels and the persistence of particular meteorological conditions. The predicted results are therefore not representative of the typical level of impact, but are a conservative prediction of the maximum level of impact which could potentially occur.

Both predicted exceedance scenarios impact residents within the town of Greenbushes. The exceedance of short term (1-hour) PM_{10} levels is predicted to occur under worst case meteorological conditions and is not expected to have an ongoing impact on the overall health of receptors as the timeframe for the exceedance is short. The predicted 24-hour TSP exceedance is likely to cause a nuisance impact rather than a health impact. The remaining air quality criteria inclusive of daily and annual PM_{10} and deposited dust, are predicted to be met. Additional real-time monitoring of dust levels and meteorological conditions, and implementation of additional dust controls or modified activities at set trigger levels, is proposed to be implemented to effectively reduce the likelihood of the dust emissions impacting on the health or amenity of surrounding receptors, including the Greenbushes township.

10.4 Social Surroundings

The proposed expansion of the Mine will increase noise levels, potentially vibration and have an increased impact on visual amenity within the local area. Noise modelling predicts that Talison can comply with their current Regulation 17 Noise Approval under worst case conditions with the implementation of additional noise mitigation in the form of two noise bunds. Careful management of blasting activities is expected to limit vibration to the required levels.

The expansion involves an increase in the footprint of landforms (TSF4, Floyds WRL and the open pit) at the Mine which based on the outcomes of a VIA is expected to increase the visibility of the operation to receptors in the surrounding agricultural area. The visual impact of the Mine will increase in the short-term as landforms are developed but will progressively reduce as rehabilitation establishes. Talison proposes to minimise the visual impact of the Mine through continued implementation of Talison's Mine Closure Plan and progressive rehabilitation of the most visible areas where practical. An updated Mine Closure Plan is currently being developed for the expanded operation which will be submitted to the DMIRS in conjunction with a Mining Proposal for the Mine expansion.

Talison is currently undertaking a program of stakeholder engagement in relation to the expansion which aims to inform relevant stakeholders of the company's plans and seek their feedback. Stakeholder engagement will continue throughout the implementation of this Proposal.

10.5 Offset

Talison has identified three properties which appear, based on initial assessment, to be suitable as offset properties to counteract the significant residual impact on conservation significant fauna species resulting from the Proposal. Talison will undertake detailed assessments of the habitat values of each property and will use the results to reassess the value of the properties as offsets and confirm that the residual impacts of the Proposal can be offset through direct acquisition of land, and the proposed indirect offset program. Full details of each offset property and further information on the proposed indirect offset program will be included in a Talison Expansion Project Offsets Management Strategy which will be submitted to the EPA and DotEE for assessment and approval within 12 months of receiving approval for the Proposal. Talison has confidence in achieving the offset requirements for the Proposal.

11. References

ABS (2017). *Regional Population Growth, Australia, 2015-16* Prepared for the Australian Government. Retrieved in November 2017 online: [http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA50840?opendocument]

Beard, J. (1981). *Vegetation Survey of Western Australia - Swan, 1:1000 000 Vegetation Series.* UWA Press, Perth, WA, Australia. .

Biologic (2011). *Greenbushes Level 1 Fauna Survey.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Biologic (2018a). *Greenbushes Targeted Vertebrate and SRE Invertebrate Fauna Survey.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Biologic (2018b). *Greenbushes Vertebrate, SRE and Subterranean Fauna Desktop Assessment.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Brad Goode & Associates (2016). *Report of An Aboriginal Heritage Survey of Areas within Talison Lithium Greenbushes Operations at Greenbushes, Western Australia*. Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Brad Goode & Associates (2018). *Report of An Aboriginal Heritage Survey for the Talison Lithium Mine Expansion M01/2, M01/3, M01/6, M01/7 & L01/1 Greenbushes, Western Australia*. Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Brown, A., Dixon, K., French, C. and Brockman, G. (2013) *Field Guide To The Orchids of Western Australia*. Simon Nevill Publications. Perth, Western Australia.

Burbidge, A.A. & Zichy-Woinarski, J. (2017). *Pseudocheirus occidentalis*. The IUCN Red List of Threatened Species 2017: e.T18492A21963100. Retrieved September 2018: [http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T18492A21963100.en].

Bureau of Meteorology (BoM) (2017a). *Climate statistics for Australia locations. Monthly climate statistics, Bridgetown.* Prepared for Australian Government. Retrieved December 2017 from: [http://www.bom.gov.au/climate/averages/tables/cw_009617.shtml]

BoM (2017b). *Groundwater Dependent Ecosystems Atlas.* Australian Government. Retrieved, November 2017 from: [http://www.bom.gov.au/water/groundwater/gde/].

Christensen, P. (2016). *Greenbushes Wetland Bird Survey.* Unpublished report prepared for Blackwood Basin Group.

DSEWPaC, 2012b. *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. Prepared for the Commonwealth of Australia. Retrieved March 2018, from [http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy]

de Tores, P.J. (2008). Western ringtail possum. In: Van Dyck, S. and Strahan, R. (Eds) *The Mammals of Australia.* Reed New Holland, Sydney, Australia p 253-255.

Department of Biodiversity, Conservation and Attractions (DBCA) (2017). *Declared Rare Fauna List*. Prepared for the Western Australian Government.

Department of Environment and Conservation (DEC) (2010). *A Biodiversity and Cultural Conservation Strategy for the Great Western Woodlands.* Prepared for the Western Australian Government.

Department of Environment and Conservation (DEC) (2011). *A guideline for managing the impacts of dust and associated contaminants from land development Sites, contaminated Sites, remediation and other related activities*. Prepared for the Government of Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA) (2018). *Threatened and Priority Fauna Database (custom search).* Retrieved 2018 (in Biologic, 2018b)

Department of Environment (DoE) (2006). *Air quality modelling guidance notes*. Prepared for the Government of Western Australia.

Department of Environment (DoE) (2014). *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi.* Prepared for the Commonwealth of Australia. Retrieved March 2018 from: [http://www.environment.gov.au/biodiversity/threatened/publications/threat-abatement-plan-disease-natural-ecosystems-caused-phytophthora-cinnamomi]

Department of Environment and Conservation (2012). *Chuditch (Dasyurus geoffroii) Recovery Plan. Wildlife Management Program No. 54*. Department of Environment and Conservation, Perth, Western Australia.

Department of Environment and Conservation (DEC) (2013). *Quokka Setonix brachyurus Recovery Plan. Wildlife Management Program No. 56*. Department of Environment and Conservation, Perth, WA.

Department of Environment and Conservation (DEC) (2008) *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Redtailed Black Cockatoo Calyptorhynchus banksii naso) Recovery Plan. Wildlife Management Program No. 42.* Department of Environment and Conservation, Perth, WA.

Department of the Environment and Energy (DotEE) (2008). C*aladenia harringtoniae Conservation Advice*. Commonwealth of Australia, Australia.

Department of the Environment and Energy (DotEE) (2017) *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*. Prepared for the Commonwealth of Australia.

Department of the Environment (DotEE) (2018). *Calyptorhynchus banksii naso in Species Profile and Threats Database*. DotEE, Canberra. Available from: http://www.environment.gov.au/sprat.

Department of the Environment and Energy (DotEE) (2018a). *Caladenia harringtoniae — Harrington's Spider-orchid, Pink Spider-orchid in Species Profile and Threats (SPRAT) database*. Canberra: DotEE. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=56786

Department of the Environment and Energy (DotEE) (2018b). *Setonix brachyurus in Species Profile and Threats (SPRAT) database*. Canberra: DotEE. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=229

Department of Parks and Wildlife (DPAW) (2013) *Carnaby's cockatoo (Calyptorhynchus latirostris) Recovery Plan. Wildlife Management Program No. 52.* Department of Parks and Wildlife, Perth, WA

Department of Parks and Wildlife (DPAW) (2017). *Western Ringtail Possum (Pseudocheirus occidentalis) Recovery Plan. Wildlife Management Program No. 58*. Department of Parks and Wildlife, Perth, WA

Department of Parks and Wildlife (DPAW) (2017a). *Nature Map Database*. Accessed in November 2017 from: [https://naturemap.dpaw.wa.gov.au/].

Department of Planning, Lands and Heritage (DPLH) (2017). *Aboriginal Heritage Inquiry System Database*. Prepared for the Government of Western Australia. Retrieved November 2017: [https://maps.daa.wa.gov.au/ahis/].

Department for Planning and Infrastructure (DPI) (2007). *Visual Landscape Planning in Western Australia: A Manual for Evaluation, Assessment, Siting and Design*. Prepared for the Government of Western Australia. Retrieved September 2018 [https://www.planning.wa.gov.au/publications/1205.aspx].

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012a). *How to use the assessments offset guide*. Prepared for the Commonwealth of Australia. Retrieved March 2018, from [http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy]

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), (2012b). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. Prepared for the Commonwealth of Australia. Retrieved March 2018, from [http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy]

Department of the Environment (DotE) (2013). *Significant Impact Guidelines 1.1- Matters of National Environmental Significance.* DotE. Canberra, Australia.

Department of the Environment (2013a). *Draft survey guidelines for Australia's threatened orchids*. Prepared for the Commonwealth of Australia.

Dieback Working Group (2008). *What is Phytopthora Dieback*, Retrieved November 2017, from [https://www.dwg.org.au/what-is-phytophthora-dieback].

Ennovate (2018) *Black Cockatoo Habitat Quality Assessment - 2018 Expanded Mine Development Area*. Memo to Talison Lithium Australia.

Environmental Protection Authority (EPA) (2004). *Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016). *Statement of Environmental Principles, Factors and Objectives*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016a). *Environmental Factor Guideline: Flora and Vegetation*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016b). *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016c). '*Environmental Factor Guideline: Terrestrial Fauna*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016d). *Technical Guidance Sampling methods for terrestrial vertebrate fauna*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016e) *Technical Guidance Terrestrial Fauna Surveys*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016f). *Technical Guidance: Sampling of Short-range endemic invertebrate fauna*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016g). *Environmental Factor Guideline: Air Quality*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2016h). *Environmental Factor Guideline: Social Surroundings*. Perth, Western Australia.

ERM (2018). *Talison Lithium – Dust impact assessment – peer review services*. Correspondence to C Griffin, Ref 0477201, Perth WA.

GHD (2018). *Hydrogeological Investigation 2018 Site –wide hydrogeology report.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

GHD (2018a). *Talison Lithium Mine Dust Impact Assessment.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

GHD (2018b). *Tailings Storage Facility 4 Detailed Design Report.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Government of Western Australia (GoWA) (2011). *WA Environmental Offsets Policy*. Perth, Western Australia

Government of Western Australia (GoWA) (2014). *WA Environmental Offsets Guidelines*. Perth, Western Australia

Government of Western Australia (GoWA) (2017). *SLIP data portal.* Landgate. Accessed December 2017: [https://catalogue.data.wa.gov.au/dataset/].

Government of Western Australia (GoWA) (2018). NatureMap. Accessed November 2018: [https://naturemap.dpaw.wa.gov.au/]

Government of Western Australia (GoWA) (2018a). *2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report).* Current as of October 2017. WA Department of Biodiversity, Conservation and Attractions, Perth, Western Australia.

Government of Western Australia (2018b). *2017 Southwest Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report).* Current as of October 2017. WA Department of Biodiversity, Conservation and Attractions, Perth, Western Australia.

Harewood (2018a). *Greenbushes Black Cockatoo Tree Hollow Review, Talison Lithium Pty Ltd*. Unpublished report to Talison Lithium Australia.

Harewood (2018b). *Greenbushes - Preliminary Western Ringtail Possum Surveys – June 2018*. Unpublished report to Talison Lithium Australia.

Hatch Pty Ltd (2017). *Study for the Development of Western Australia's Lithium Resources and Related Research and Processing Activities*, Perth WA

Hearn, R., Williams, K., Comer, S., and Beecham, B. (2002). *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002 - Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion).* Department of Conservation and Land Management. Perth, Western Australia.

Hearn, R.W., Meissner, R., Brown, A. P., Macfarlane, T.D. and Annels, T.R. (2006). *Declared Rare and Poorly Known Flora in the Warren Region*. Department of Conservation and Land Management. Perth, Western Australia.

Heddle, E, Loneragan. O and Havel J, (1980).*Vegetation Complexes of the Darling System, Western Australia, in Atlas of Natural Resources, Darling System Western Australia*, Prepared for Department of Conservation and Environment.

Heritage Council (2017). *Search Results – Shire of Bridgetown-Greenbushes. Government of Western Australia.* Retrieved November 2017 from: [http://inherit.stateheritage.wa.gov.au/Public/Search/Results].

Herring Storer Acoustics (HSA) (2018). *Proposed Expansion Greenbushes – Acoustic Assessment*. Unpublished report prepared for Talison Lithium Ltd.

Hoffman, N & Brown, A (1992). *Orchids of South-west Australia*, Revised 2nd edition with supplement, University of Western Australia Press, Nedlands.

Kirkby, T. (2013). *Black Cockatoo Survey, Floyd's Extension, Talison Mining, Greenbushes.* Unpublished report to Talison Lithium Australia.

Kirkby, T. (2018a) *Black Cockatoo Survey, Talison Mining, Greenbushes*. Unpublished report to Talison Lithium Australia.

Kirkby , T. (2018b) *Additional Black Cockatoo Survey at the Mine Services Area, Proposed Mining Expansion, Greenbushes*. Unpublished report to Talison Lithium Australia.

Mattiske, E.M. and Havel J.J. (1998). *Vegetation Mapping in the South West of Western Australia and Region Forest Agreement vegetation complexes. Map sheets for Pemberton, Collie, Pinjarra, Busselton-Margaret River, Mt Barker, and Perth, Western Australia. Scale 1:250,000*. Department of Conservation and Land Management, Perth, Western Australia

Molly, S., Wood, J., Hall, S. and Whisson, G. (2009) *South West Regional Ecological Linkages Technical Report.* Published report prepared for Western Australian Local Government Association and Department of Environment and Conservation.

Molloy, S.W., Davis, R.A. & Van Etten, E.J.B. (2014) *Species distribution modelling using bioclimatic variables to determine the impacts of a changing climate on the western ringtail possum (Pseadocheirus occidentals; Pseudocheiridae)*. *Environmental Conservation*, vol. 41, no. 2, pp. 176-186.

NSW Environment Protection Authority (NSW EPA) (2017). *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Sydney, New South Wales.

Onshore Environmental (2012). *Flora & Vegetation Survey: Greenbushes Mining Leases*. Unpublished report prepared for Talison Minerals Pty Ltd.

Onshore Environmental Consultants (2018a). *Greenbushes Mining Operations Detailed Flora and Vegetation Survey*. Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Onshore Environmental Consultants (2018b). *Review of Previous Flora and Vegetation Survey (Onshore Environmental 2012).* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Onshore Environmental Consultants (2018c). *Western Ringtail Possum - Desktop Regional Habitat Mapping*. Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Onshore Environmental Consultants (2018d). *Targeted Western Ringtail Possum Survey Greenbushes Mine.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Onshore Environmental Consultants (2018e). *Significant Tree Survey Talison Lithium*. Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Onshore Environmental Consultants (2018f). *Greenbushes Mining Operations Expansion Visual Impact Assessment.* Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Project Dieback (2017). *Dieback Public Map. Natural Resource Management Western Australia*. Retrieved November 2017: [http://www.dieback.net.au/about/dieback-map.html].

Rhind, S. G. (1996). Habitat tree requirements and the effects of removal during logging on the marsupial brush-tailed phascogale (*Phascoqale tapoatafa tapoatafa*) in Western Australia. *The Western Australian Naturalist*, 21(1), 1-22.

Talison Lithium Australia (Talison) (2011). Retrieved November 2017 from: [http://www.talisonlithium.com/]

Talison Lithium Australia (Talison) (2014). *Greenbushes Operations 2013 Mining Proposal – Continuation of Hard Rock Mining III Tenement M01/3, M01/6, M01/7, M01/16, G01/1 & G01/2*. Report prepared for Talison Lithium Australia for submission to Department of Mines and Petroleum.

Talison Lithium Australia (Talison) (2015a). *Greenbushes Operations Surface Water Management Plan Version 5 – Site Management Plan ENV 1001*. Unpublished report prepared for Talison Lithium Australia Pty Ltd

Talison Lithium Australia (Talison) (2015b). *Talison Lithium Australia Pty Ltd Mining Proposal – 2015 Tailings Storage Expansion Tenement M01/6 & G01/2*. Report prepared for Talison Lithium Australia for submission to Department of Mines and Petroleum.

Talison Lithium Australia (Talison) (2017a). *2016-2017 Annual Environmental Report to DWER L4247/1991/13 and L8501/2010/2*. Unpublished report prepared for Talison Lithium Australia Pty Ltd.

Talison Lithium Australia (Talison) (2017b). *Talison Lithium Australia Pty Ltd Greenbushes Lithium Mine Site CG Plant #2 2016 Lithium Processing Plant Upgrade Tenements M01/6 & G01/2, Version 2*. Report prepared for Talison Lithium Australia for submission to Department of Mines and Petroleum.

Tille, P.J., Frahmand, M.A. and van Moort, J.C.P. (1994). *Soil-landscape map of the Wellington-Blackwood area (Scale 1:100,000 2 map sheets)*. Agriculture Western Australia Land Resource Map No. 24/2. To accompany "Wellington-Blackwood land resources survey", Land Resources Series No. 14.

Thackway and Cresswell (1995). *An Interim Biogeographic Regionalisation for Australia: A framework for setting priorities in the National Reserves System Cooperative Program Version 4*. Australian Nature Conservation Agency, Canberra.

Turner, G.F. (2013). 'Vulnerability of Vegetation to Mining Dust at the Jack Hills, Western Australia'. University of Western Australia.

Webb, A., Kinloch, J., Keighery, G. and Pitt, G. (2016). *The Extension of Vegetation Complex Mapping to Landform boundaries within the Swan Coastal Plain Landform and Forested Region of South West, Western Australia.* Department of Parks and Wildlife, Bunbury, Western Australia.

Appendices

Appendix A - Flora and Vegetation Studies (Onshore Environmental Consultants, 2018 and 2012)

Appendix B – Fauna Studies (Biologic Environmental Survey Pty Ltd, 2018 and 2011)

Appendix C – 2018 Black Cockatoo Studies (Tony Kirkby, Greg Harewood, Onshore Environmental Consultants, Blackwood Basin Group, Per Christensen)

Appendix D – Western Ringtail Possum Studies 2018 (Greg Harewood and Onshore Environmental Consultants)

Appendix E – Conservation Significant Flora and Native Vegetation, Conservation Significant Fauna, and Weed and Hygiene Management Plans (Talison Lithium Pty Ltd)

Appendix F – Dust Impact Assessment Peer Review (ERM 2018) and Revised Dust Impact Assessment (GHD 2018)

Appendix G – Greenhouse Gas Estimate for Greenbushes Expansion Project (Greenbase 2018)

Appendix H – Aboriginal Heritage Survey (Brad Goode and Associates 2018)

Appendix I – Visual Impact Assessment (Onshore Environmental Consultants 2018)

Appendix J – Talison Proposed Expansion Greenbushes Acoustic Assessment (Herring Storer Acoustics 2018) and Noise Management Plan (Draft) (Talison Lithium Pty Ltd 2018)

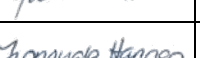
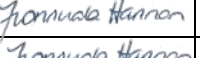
Appendix K – Greenbushes Mine Expansion Prediction of Vibration and Air Overpressure (George Boucher Consulting 2018)

Appendix L – Talison Greenbushes Mine Expansion Offset Proposal (Talison Lithium Pty Ltd)

GHD
1st Floor
10 Victoria Street
T: 61 8 9721 0700 F: 61 8 9721 0777 E: bunmail@ghd.com

6136579-65276/https://projects.ghd.com/oc/WesternAustralia/expansionlithiummine/Delivery/Documents/6136579_RPT_EPA-DoEE Additional Information Response Document_R2.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
RevA	A Callegari	G Gaikhorst A Napier		F Hannon		4/10/2018
R0	A Callegari			F Hannon		5/10/2018
R1	A Callegari			F Hannon		12/10/2018
R2	A Callegari	F Hannon		F Hannon		10/12/2018

www.ghd.com