BHP Pilbara Strategic Assessment

Validation Notice
Jimblebar Optimisation Project

8 May 2020

Forward

Validation Notice

Rev	Description of Amendment	Organisation	Name	Date Validation Notice Finalised	Date Validation Notice Effective From	Date of Validation Notice Expiry*
Rev 0	Draft for public consultation	BHP Billiton Iron Ore Pty Ltd	Chris Serginson	10 March 2020	-	-
Rev 1	Final report	BHP Billiton Iron Ore Pty Ltd	Chris Serginson	8 May 2020	8 June 2020	8 June 2025

* The Validation Notice expires if the activity is not substantially commenced within 5 years.

Glossary and Abbreviations

Term	Meaning
Activity or activities	The activity includes Jimblebar mining expansions and associated infrastructure (Section 2).
Activity Area	The area which the activity (or activities) will be undertaken within and includes Jimblebar mining exemption areas as described in Section 1.4
Agreement, the	The agreement dated 18 September 2012 (including the Variation to the Agreement dated 21 October 2015) between the Commonwealth Minister for the Environment and BHP for the strategic assessment of the impacts of the Proposal on Matters of National Environmental Significance (MNES).
ANC	Acid Neutralising Capacity
Approval	The approval of the taking of an action or class of actions granted by the Minister on 19 June 2017 in accordance with the Program given under section 146B of the EPBC Act.
Approval Holder	Any person or persons named in an Approval as an Approval Holder who may take action in accordance with the Program.
Assurance Plan	The plan that provides further detail on the process described in the Program, including management of Program Matters, stakeholder management, reporting and auditing requirements and governance arrangements, as approved on behalf of the Minister on 11 May 2018.
BC Act	*Biodiversity Conservation Act 2016*
BHP	BHP Billiton Iron Ore Pty Ltd, as manager and agent for and on behalf of BHP Billiton Minerals Pty Ltd, BHP Iron Ore (Jimblebar) Pty Ltd, United Iron Pty Ltd, the participants of the Mount Goldsworthy Joint Venture, Mount Newman Joint Venture and Yandi Joint Venture.
CALM Act	*Conservation and Land Management Act 1984*
CDP	Community Development Plan
CPWRMP	BHP Central Pilbara Water Resource Management Plan.
Commence, commenced or commencement	Any preparatory works required to undertake a Notifiable Action including clearing, the erection of any onsite temporary structure and the use of heavy duty equipment for the purpose of breaking the ground.
controlling provision	As defined in Part 7 Division 1 section 67 of the EPBC Act.
DAWE	Department of Agricultural, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions (formerly DPaW)
Department, the	The Australian Government Department responsible for the administration of the EPBC Act or successors.
Direct disturbance	The clearing of native vegetation and/or moving of earth as a result of activities undertaken within the Strategic Assessment Area in accordance with the Program.
Disturbance footprint	The area where the clearing of native vegetation and/or moving of earth as a result of activities is planned to occur.

Term	Meaning
DJTSI	Department of Jobs, Tourism, Science and Innovation
DMIRS	Department of Mines, Industry Regulation and Safety
DoEE	Department of the Environment and Energy (now DAWE).
DPaW	Department of Park and Wildlife (now DBCA)
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (Western Australia).
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).
EPWRMP	East Pilbara Water Resources Management Plan
ESD	Ecologically sustainable development.
Impact or impacts	As defined in section 527E of the EPBC Act.
Full conceptual development scenario	The conceptual direct disturbance footprint for the development of all current BHP mining tenures within the Strategic Assessment Area. Applied in the impact assessment report.
Impact Assessment Report or IAR	BHP Billiton Iron Ore Strategic Assessment: Impact Assessment Report (BHP 2016).
Implementation Framework	Comprises this Assurance Plan and the Offsets Plan, which are designed to support the implementation of the Program.
LPP	Local Participation Plan
MAR	Managed Aquifer Recharge
Minister	Minister responsible for administering the EPBC Act and includes a delegate of the Minister.
MS	Ministerial Statement
New Listings	Any new listed threatened species or existing species that have been included in a higher endangerment category identified in accordance with Section 4.1.2 of the Program.
New Matters	Other matters protected by a controlling provision of Part 3 of the EPBC Act (other than listed threatened species) that may be identified in accordance with Section 4.1.2 of the Program.
NGO	Non-Government Organisation
Notifiable Action	An activity that is considered likely to have a relevant impact on a Program Matter based on an assessment of the proposed activity against the thresholds defined for Program Matters in the Assurance Plan. In relation to the voluntary part of the Program, this includes an activity that is considered likely to have a relevant impact on a New Listing or a New Matter.
Notifiable Action completion	The point at which a Notifiable Action has been implemented in full, such as the time identified in a Validation Notice or at an earlier point as agreed between BHP and the Department.

Term	Meaning
Offsets Plan	The plan that provides further detail on the processes that will be implemented to identify and deliver offsets associated with a Notifiable Action, as approved on behalf of the Minister on 11 May 2018.
OSA	Overburden Storage Area
Other controlling provisions	Any controlling provision under the EPBC Act that is not already considered in accordance with the Program, this Assurance Plan and/or the Offsets Plan.
PAF	Potentially Acid Forming
Practicable	Reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge.
PEAHR	Project Environmental and Aboriginal Heritage Review - The PEAHR system manages the implementation of environmental, Aboriginal heritage, land tenure and legal commitments prior to and during land disturbance. All ground disturbance activities will meet the requirements of the PEAHR. All personnel carrying out works associated with clearing activities are required to comply with the Sustainable Development Policy, environmental approvals, the PEAHR requirements and conditions and any other relevant legislative and licensing requirements.
PEOF	Pilbara Environmental Offsets Fund
Program	The BHP Billiton Iron Ore Pilbara Strategic Assessment Program endorsed by the Minister on 11 May 2017. Whilst the Agreement refers to a Plan, it was agreed with the Department that the term Program is a better reflection of the systems and processes to be delivered by BHP.
Program Matters	The listed threatened species Pilbara Leaf-Nosed Bat (*Rhinonicteris aurantius*), Northern Quoll (*Dasyurus hallucatus*), Greater Bilby (*Macrotis lagotis*), Ghost Bat (*Macroderma gigas*), and Pilbara Olive Python (*Liasis olivaceus barroni*).
Protected Matters	Matters protected by a provision of Part 3 of the EPBC Act.
PMO	Program Matter Outcome.
Strategic Assessment Area (SAA)	The geographical extent of the assessment and boundaries within which the Program must be implemented, as depicted in Appendix 1.
Validation Notice	This Validation Notice under Part C of the endorsed Program.
WA	Western Australia
WC Act	*Wildlife Conservation Act 1950* (WA).

Contents

1 Introduction

1.1 Background

BHP Billiton Iron Ore Pty Ltd (BHP) currently operates iron ore mines and associated rail and port infrastructure within the Pilbara region of Western Australia (WA). Current mining operations include:

- Newman hub - located approximately 2 km west of Newman township and consists of Mount Whaleback, and Orebodies 29, 30 and 35;
- Mining Area C – Northern and Southern Flanks - located approximately 100 km northwest of Newman Township;
- Wheelarra Hill (Jimblebar) Mine, Orebody 18 and Orebody 31 (Jimblebar hub) - located approximately 35 km east of Newman township;
- Eastern Ridge hub - located approximately 5 km east of Newman township and consists of Orebodies 23, 24, 25 and 32; and
- Yandi Mine - located approximately 100 km north northwest of Newman township.

Ore from the NJV hub, Mining Area C – Northern and Southern Flanks, Jimblebar hub, Eastern Ridge hub and the Yandi mine is transported by rail to Port Hedland via the BHP Newman to Port Hedland Mainline (and associated spur lines). Ore is then shipped overseas via Port Hedland at the BHP facilities at Nelson Point and Finucane Island.

1.2 Framework

The BHP Pilbara Strategic Assessment Program was endorsed by the Minister for the Environment and Energy on 11 May 2017 and an Approval Decision (the Approval) for taking actions in accordance with the Program was issued on 19 June 2017. The Approval applies to the development of new iron ore mines and associated infrastructure and the expansion of existing iron ore mines and associated infrastructure within a defined Strategic Assessment Area (SAA) (Appendix 1). Key commitments of the endorsed Program and conditions of approval include preparation and approval of an Assurance Plan and Offsets Plan, and undertaking a validation process including preparation of a Validation Notice for each Notifiable Action undertaken in accordance with the Program.

The Assurance Plan, which was approved on 11 May 2018 defines the environmental objectives, procedures and governance arrangements to ensure that all future activities within the scope of the Program are undertaken in accordance with the endorsed Program and achieve the Program's objectives. The Plan includes Program Matter Outcomes (PMO) which are measureable outcomes that BHP must meet to achieve the objectives developed for each Program Matter. Notifiable Action triggers are set out within the plan to prompt the requirement for a Validation Notice.

The Offsets Plan, which was approved on 11 May 2018, ensures that appropriate offsets are applied to address residual adverse impact(s) of actions under the Program at an appropriate time. In accordance with Part C of the Program, BHP has undertaken a validation process for the Jimblebar Optimisation Project (the activity), to ensure that the PMO are met across the SAA.

For an activity to require a Validation Notice, the activity must:

- be within the scope of the Program; and
- meet one or more of the Notifiable Action triggers identified in the Assurance Plan.

1.3 Program, Assurance Plan and Offsets Plan Requirements

The endorsed Program, Assurance Plan and Offsets Plan specifies the requirements and content of the Validation Notice.

Table 1.1: Content of Validation Notice

	Strategic Assessment Program, Assurance Plan and Offsets Plan Requirements	Sections which address these Requirements
1	Decision whether a validation notice is required for the activity	1.5
2	BHP authorisation and date the Validation Notice will take effect	Foreword
3	Program Matters and triggers relevant to the Validation Notice	1.5 and 4
4	Project description including activity location and timeframes for the duration of activities	1.6 and 2
5	Stakeholder engagement and public consultation	3
6	Review of baseline and contemporary data with a description of the direct and indirect impacts	4
7	Estimates of disturbance and residual impacts	2 and 4
8	Application of the mitigation hierarchy	4
9	Outline the objective/s of the offset project/s, consistent with the scope of actions to offset impacts stated in the Program and Offsets Plan	NA
10	Outline how the offset project/s will support the long-term persistence and viability of the relevant Program Matters	NA
11	Commitment to measurable offset project milestones	NA

1.4 Activity to which this Validation Notice applies

The Jimblebar mining operation is located approximately 30 km west of the Newman township, in the Pilbara region of Western Australia (Figure 1.1). BHP has prepared this Validation Notice for the development and operation of additional Overburden Storage Areas (OSAs) and the Caramulla Managed Aquifer Recharge (MAR) and creek discharge area associated with the existing Jimblebar mining operation (Figure 1.2, Figure 1.3 and Section 2).

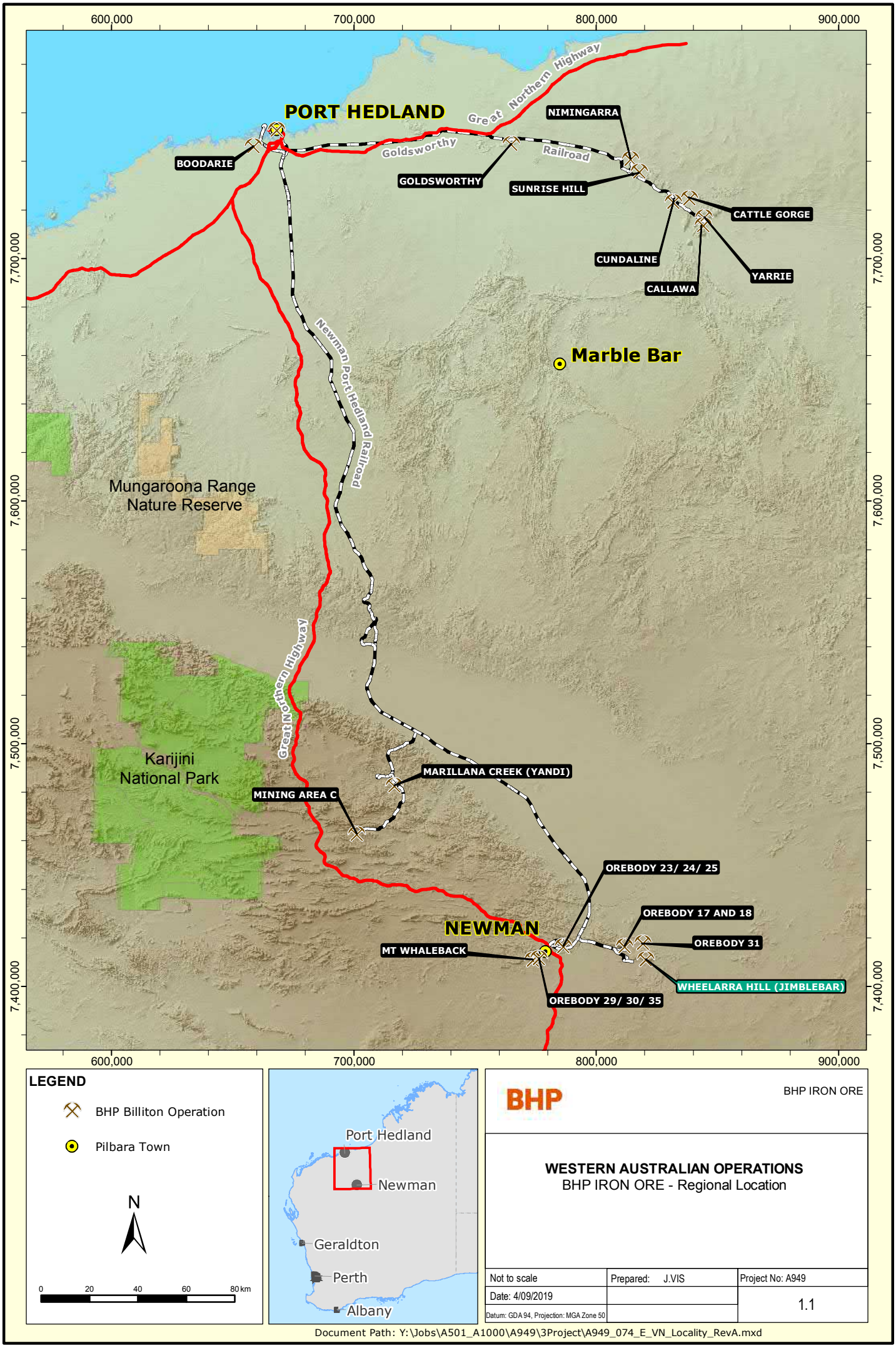
The Jimblebar existing operations within the activity area are outside the scope of the Program as described in Section 2.3 of the Program via the following:

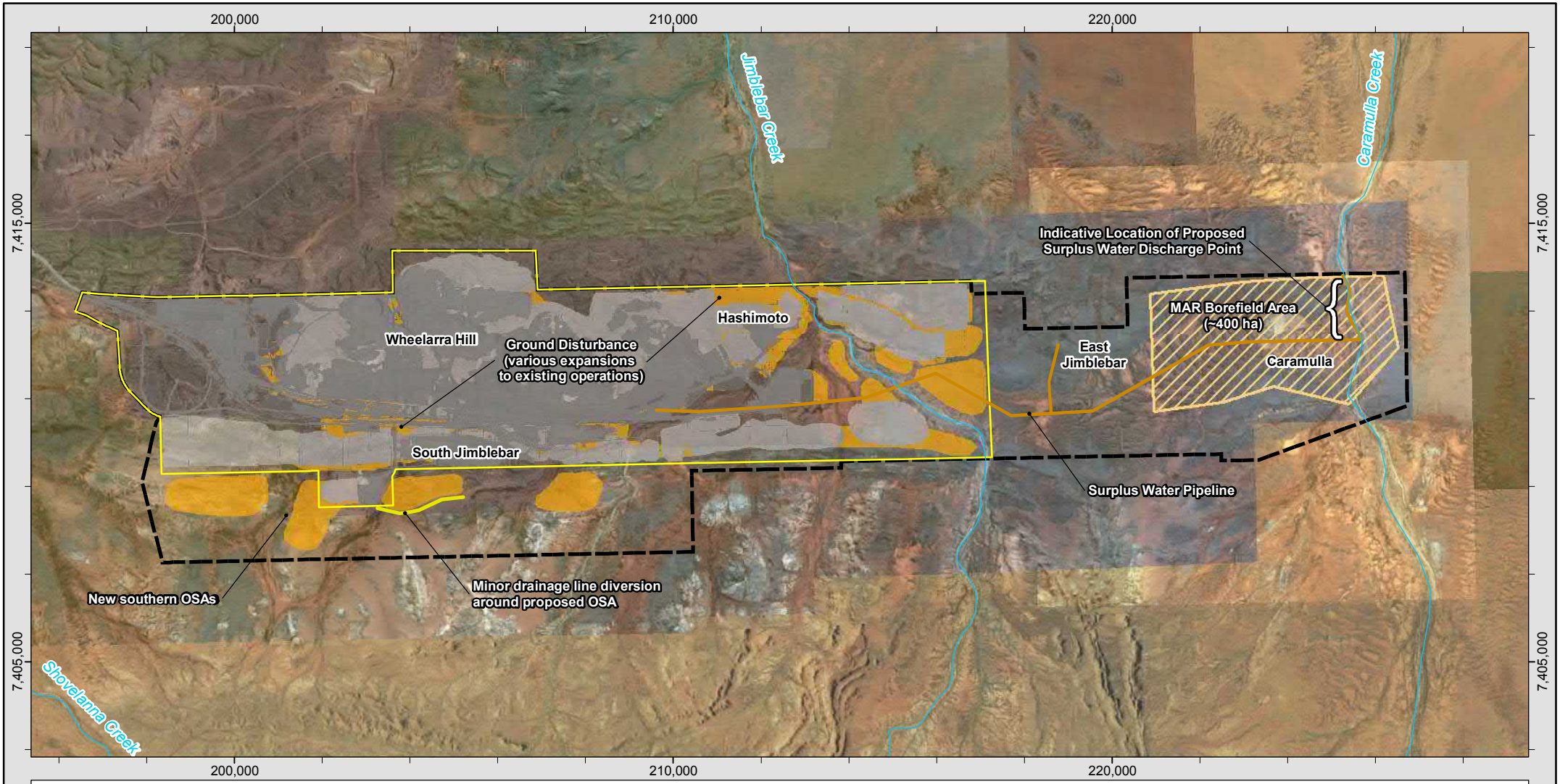
- The areas were approved under Part IV of the *Environmental Protection Act 1986* (WA) (EP Act) under Ministerial Statements (MS) 683 (16 August 2005), MS 809 (7 October 2009) and MS 857 (18 February 2011).

BHP does not seek any changes to the following:

- Mine pits and mining rates approved under MS 857, MS 809 and MS 683.
- Groundwater abstraction (including dewatering) rate of 22 GL/a approved under Rights in Water and Irrigation Act 1914 (RiWI Act) 5C Licence GWL158795(9).
- Surplus water discharge rate of 45 ML/d (16.425 GL/a) to Ophthalmia Dam approved under MS 857.

The Jimblebar Optimisation Project infrastructure outlined in Section 2 are hereafter referred to as the ‘activity’. The activity excludes Jimblebar existing operations. The activity area is the area where the activity will be undertaken.


600,000
700,000
800,000
900,000
7,700,000
7,600,000
7,500,000
7,400,000
PORT HEDLAND
BOODARIE
Great Northern Highway
Goldsworthy Railroad
GOLDSWORTHY
NIMINGARRA
SUNRISE HILL
CATTLE GORGE
CUNDALINE
YARRIE
CALLAWA
Marble Bar
Newman Port Hedland Railroad
Mungaroona Range Nature Reserve
Great Northern Highway
Karijini National Park
MARILLANA CREEK (YANDI)
MINING AREA C
OREBODY 23/ 24/ 25
OREBODY 17 AND 18
OREBODY 31
NEWMAN
MT WHALEBACK
WHEELARRA HILL (JIMBLEBAR)
OREBODY 29/ 30/ 35
LEGEND
BHP Billiton Operation
Pilbara Town
N
0 20 40 60 80 km
Port Hedland
Newman
Geraldton
Perth
Albany
BHP
BHP IRON ORE
WESTERN AUSTRALIAN OPERATIONS
BHP IRON ORE - Regional Location
Not to scale
Prepared: J.VIS
Project No: A949
Date: 4/09/2019
Datum: GDA 94, Projection: MGA Zone 50
1.1
Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_074_E_VN_Locality_RevA.mxd



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Activity Area and Indicative Footprint

Scale @ A4: 1:125,000	Prepared: J. VIS	Project No: A949/073 REV B
Date: 31/10/2019	Checked:	Figure : 1.2
Revision: REV B	Reviewed: ENVIRO. A&I	

- Watercourse
- Existing Project Boundary
- Activity Area
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Cleared Area as at FY2019 (Out of Scope)

Indicative Disturbance Footprint

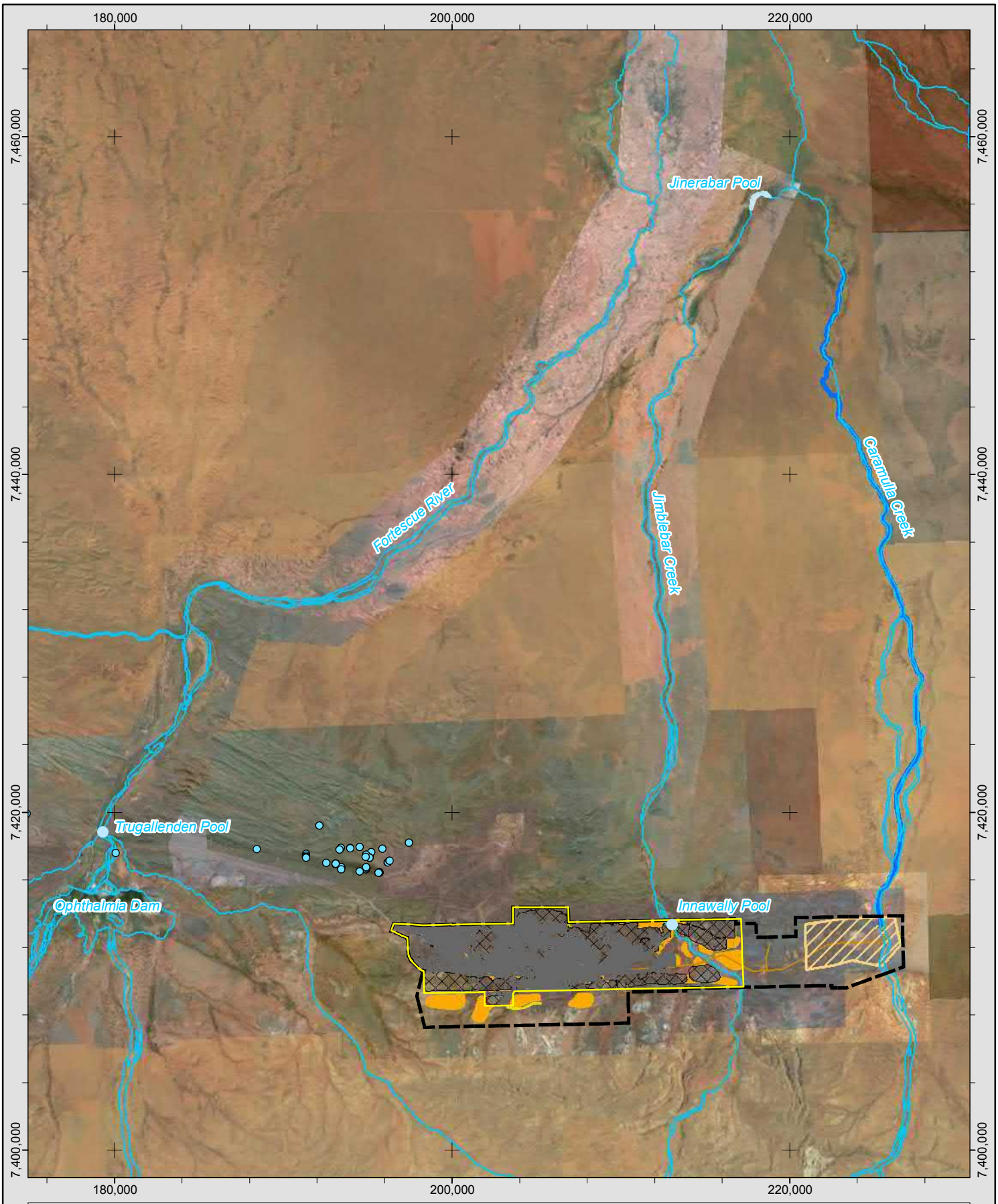
- Drainage Line Diversion
- Surplus Water Pipeline
- MAR Borefield Area
- OSA, various expansions and associated activities

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_073_E_VN_ProposedDevelopmentEnvelope_RevB.mxd



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Surface Water Features

Scale @ A4: 1:300,000	Prepared: J.VIS	Project No: A949/082 Rev A
Date: 8/11/2019	Checked:	Figure: 1.3
Revision: REV A	Reviewed: ENVIRO. A&I	

- Waterholes
- Unnamed Waterhole
- Watercourse
- Existing Project Boundary
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Estimated Wetting Front Extent

Indicative Disturbance Footprint

- Drainage Line Diversion
- MAR Borefield Area
- OSA, various expansions and associated activities
- Indicative Surplus Water Pipeline

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_082_E_VN_WettingFront_RevA.mxd

1.5 Decision for a Validation Notice

A Validation Notice is required for actions that are notifiable, in accordance with notifiable action triggers set out in the Assurance Plan (BHP 2018) and reproduced in Table 1.2. The Jimblebar Optimisation Project is a notifiable action as it fulfils the triggers of the Assurance Plan for the Greater Bilby *(Macrotis lagotis)*, Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-Nosed Bat (*Rhinonicterus aurantia)*, Ghost Bat *(Macroderma gigas) and* Pilbara Olive Python (*Liasis olivaceus barroni*). The Validation Notice will demonstrate how the implementation and operation of the activity will meet each of the PMOs.

Amendments to the Threatened Species List effective under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) on 15 February 2018 included the delisting of *Lepidium catapycnon.* Under Section 4.1.1 of the Program, BHP is not required to continue to manage any species under the Program Matters that has become delisted. On this basis, no validation of impacts to *Lepidium catapycnon* has been undertaken for the activity.

Table 1.2: Notifiable Action Triggers and Jimblebar Optimisation Project

Program Matter	Notifiable Action trigger	Jimblebar Program Matter Data	Applicable Trigger?
Greater Bilby (*Macrotis lagotis*)	Presence of Greater Bilby habitat[1] within or adjacent[2] to the activity; or	1,836 ha of sand plain habitat, identified within the activity area (Figure 4.6).	Yes
	Presence[3] of Greater Bilby individuals within or adjacent to the activity; or	No evidence of the Greater Bilby within or adjacent to the activity area during survey (Biologic 2018, 2019 and GHD 2019).	No
	A recorded Greater Bilby population or habitat within or adjacent to the activity; or	No records of the Greater Bilby during the on ground baseline surveys. Nearest record 5-10 km, including an inactive burrow 5.5 km east (2018), a trapped individual 23 km west (in 1979) and secondary evidence recorded in 2010, 35 km east of the activity area.	No
	A circumstance that the approval holder considers may prejudice the Program Matter Objective for the Greater Bilby[4].	Not applicable to this activity.	No
Northern Quoll (*Dasyurus hallucatus*)	Presence of Northern Quoll habitat[5] within or adjacent[6] to the activity; or	4.5 ha of gorge and gully habitat and 210 ha of major drainage line habitat within the activity area (Figure 4.9).	Yes
	Presence[7] of Northern Quoll individuals within or adjacent to the activity; or	No evidence of the Northern Quoll within or adjacent to the activity area during survey (Biologic 2018, 2019).	No
	A recorded Northern Quoll population or habitat within or adjacent to the activity; or	No records of the Northern Quoll during the on-ground baseline surveys. Nearest record of the Northern Quoll is 100 km north of the activity area.	No

[1] Determined by baseline survey. Habitat as defined in the National Recovery Plan for the Greater Bilby.

[2] For the purpose of the Greater Bilby, *adjacent to* means within 1 km from the activity.

[3] Presence is detected with evidence of Greater Bilby scat, digging, track, etc

[4] Circumstances may include site specific matters related to potential indirect impacts identified in Section 3.3 of the Assurance Plan

[5] Determined by baseline survey. Habitat as described in the National Recovery Plan for the Northern Quoll.

[6] For the purpose of the Northern Quoll, *adjacent to* means within 1 kilometre from the activity.

[7] Presence is demonstrated with evidence of northern quoll scat, digging, track, etc

Program Matter	Notifiable Action trigger	Jimblebar Program Matter Data	Applicable Trigger?
	A circumstance that the approval holder considers may prejudice the Program Matter Objective for the Northern Quoll.	Not applicable to this activity.	No
Pilbara Leaf-Nosed Bat *(Rhinonicterus aurantia)*	Presence of Pilbara Leaf-Nosed Bat roosting or foraging habitat[8] within or adjacent[9] to the activity; or	4.5 ha of gorge and gully habitat within the activity area (Figure 4.7).	Yes
	Presence[10] of Pilbara Leaf-Nosed Bat individuals within or adjacent to the activity; or	No evidence of the Pilbara Leaf-Nosed Bat within or adjacent to the activity area during survey (Biologic 2018, 2019).	No
	A recorded Pilbara Leaf-Nosed Bat population or habitat within or adjacent to the activity; or	No records of the Pilbara Leaf-Nosed Bat within or adjacent to the activity area. Nearest recording of this species is approximately 32 km northwest of the activity area.	No
	A circumstance that the approval holder considers may prejudice the Program Matter Objective for the Pilbara Leaf-Nosed Bat.	Not applicable to this activity.	No
Ghost Bat *(Macroderma gigas)*	Presence of Ghost Bat roosts[11] or foraging habitat within or adjacent[12] to the activity, or	4.5 ha of gorge and gully foraging habitat, 210 ha of major drainage line foraging habitat and 2,665 ha of mulga woodland foraging habitat within the activity area (Figure 4.10)	Yes
	Presence[13] of Ghost Bat individuals within or adjacent to the activity; or	Ghost Bat individuals have been recorded adjacent to the activity area during survey (Biologic 2018, 2019 and GHD 2019).	Yes
	A recorded Ghost Bat population or habitat within or adjacent to the activity; or	There are two potential day roosts (one adit and one cave) located within the proposed activity area. Despite surveys occurring over a number of years, neither structure has any evidence of use by Ghost Bats. Three caves to the north and one to the south of the proposed activity area have evidence of Ghost Bat use.	No
	A circumstance that the approval holder considers may prejudice the Program Matter Objective for the Ghost Bat.	Not applicable to this activity.	No
Pilbara Olive Python	Presence of Pilbara Olive Python habitat[14] within or adjacent[15] to the activity; or	4.5 ha of gorge and gully habitat and 210 ha of major drainage line habitat within the activity area (Figure 4.5).	Yes

[8] Determined by baseline survey. Roosting habitat is defined as Priorities 1-4 in the Conservation Advice

[9] For the purpose of the Pilbara leaf-nosed bat, *adjacent to* means (a) within 10 km from the activity or (b) to the extent of a modelled groundwater drawdown from implementing the activity.

[10] Presence is demonstrated with evidence of Pilbara leaf-nosed bat scat, bat survey data etc

[11] Determined by pre-disturbance survey. Roosting habitat as described in the Conservation Advice for the Ghost bat.

[12] For the purpose of the Ghost bat, *adjacent to* means (a) within 5 km from the activity and (b) to the extent of a modelled groundwater drawdown from implementing the activity.

[13] Presence is detected with evidence of Ghost bat guano, bat survey data, etc.

[14] Determined by baseline survey. Habitat as defined in Conservation Advice for the Pilbara olive python.

[15] For the purpose of the Pilbara olive python, *adjacent to* means (a) within 1.5 km from the activity and (b) to the extent of a modelled groundwater drawdown from implementing the activity.

Program Matter	Notifiable Action trigger	Jimblebar Program Matter Data	Applicable Trigger?
(Liasis olivaceus barroni)	Presence[16] of Pilbara Olive Python individuals within or adjacent to the activity; or	No evidence of the Pilbara Olive Python within or adjacent to the activity area during survey (Biologic 2018, 2019).	No
	A recorded Pilbara Olive Python individual or habitat within or adjacent to the activity.	No records of the Pilbara Olive Python within or adjacent to the activity area. Nearest recording of this species is approximately 4 km northwest of the activity area.	No
	A circumstance that the approval holder considers may prejudice the Program Matter Objective for the Pilbara Olive Python.	Not applicable to this activity.	No

1.6 Timeframes

This Validation Notice takes effect 20 business days from the date of authorisation (see Forward page). If the notifiable action has not substantially commenced within a period of five-years from that authorisation, BHP or a subsequent Approval Holder must not implement the action until either:

- The Department authorises commencement of the action by BHP or the Approval Holder; or
- BHP issues a new Validation Notice for the action in accordance with this Program. This process extends the commencement timeframe for another five years.

The activity, including construction, operation and closure, is forecast to be completed within approximately 50 years from the date of this notice.

[16] Presence is detected with evidence of Pilbara olive python scat, track, etc

2 Project Description

Mining within the existing Jimblebar mine site is undertaken utilising conventional open-cut mining for iron ore. Mining involves drilling, blasting, and categorisation of blasted material into iron ore or waste rock. The following additional infrastructure will be constructed and operated at the existing Jimblebar mining operation as part of the proposed activity:

- new OSAs and expansions to existing OSAs;
- supporting infrastructure associated with Mine Pits;
- new haul roads including across Jimblebar Creek;
- new surplus water management options:
    - discharge of surplus mine dewater from Jimblebar mining operations into a new MAR borefield east of Jimblebar (in Caramulla);
    - discharge of surplus mine dewater from Jimblebar mining operations into Caramulla Creek;
- a new pipeline from Jimblebar mine to transfer surplus dewater from Jimblebar mining operations to new Caramulla MAR and Caramulla Creek; and
- a small diversion of a creek tributary to maintain surface water flow to Copper Creek around the proposed new southern OSAs.

Disturbance of up to 2,000 ha will be required for the activity, from the SAA allocation upper disturbance limit of 110,000 ha (limit as outlined within Section 2.4 of the Program and Condition 7 of Annexure 2 of the Approval). The disturbance allocated to the SAA upper disturbance limit to date and including as consequence of this Validation Notice is detailed in Table 2.1.

Table 2.1: SEA Program Disturbance Allocation (BHP 2019)

Project	Effective Date	Disturbance Allocated (ha)	SEA Remaining Disturbance (ha)
Mining Area C / South Flank Validation Notice	14 June 2018	16,000	94,000
Non-Validation Notice Projects	2018/19	135	93,865
Jimblebar Optimisation Project (this Validation Notice)	February 2020	2,000	91,865

The Jimblebar Optimisation Project was referred to the Western Australian Environmental Protection Authority (EPA) under section 38 of the EP Act as a Revised Proposal to incorporate the three existing Ministerial Statements for the Jimblebar Mining area. The EPA set the level of assessment for the project as 'Assess - Referral Information'. Jimblebar Optimisation Project Revised Proposal was approved under Ministerial Statement (MS) 1126 on the 17 March 2020.

2.1 Overburden Management

Overburden will be stockpiled in OSAs or will be progressively placed back into the pit void, in accordance with the mine plan. In general, the proportions of high potentially acid-forming (PAF) material within the materials to be mined were assessed as low. OSAs and stockpiles therefore, were generally assessed as having a low potential to generate acidity and SRK Consulting (2016) considered it likely that localised areas of higher sulfur materials within an OSA would be neutralised by interaction with ANC encountered along flow paths within the OSA.

2.2 Surplus Water Management

Surplus mine dewater will be transferred from Jimblebar to the Caramulla Valley at a planned maximum capacity of 75 ML/d. The proposed transfer system is likely to include the following components:

- a polyethylene trunkmain pipeline from the Jimblebar mine to Caramulla, with a buried creek crossing at Jimblebar Creek and minor drainage lines; and
- pump stations, consisting of duty pumps and standby pumps and power supply.

Borrow material will also be sourced from various locations within the proposed Caramulla area to provide suitable material needed to support the construction of the infrastructure for the pipeline and the creek discharge and MAR schemes. Final borrow locations are yet to be confirmed, however, the proposed disturbance has been factored into the overall disturbance allocated as part of this activity.

Caramulla Creek discharge

The proposed creek discharge system is likely to include the following components:

- a discharge structure adjacent to the creek; and
- a portable solar monitoring station to provide power to discharge instruments.

The predicted wetting front extent from the proposed discharge of surplus water into Caramulla Creek at a rate of 75 ML/d is 34 km. BHP considers that this prediction is conservative, as low infiltration rates are assumed. For any modelled scenario, the predicted wetting front would not reach any identified river pools (Jinerabar Pool) under natural no-flow conditions. The peak flow rate of water discharged would be much smaller than peak flows generated during natural flood events. The existing discharge in Jimblebar Creek together with the proposed discharge in Caramulla Creek would result in surface water flows during natural no-flow conditions and increased duration of flows.

Caramulla Managed Aquifer Recharge

The proposed MAR borefield is likely to include the following components:

- duty injection bores and standby bores;
- spur pipelines from the trunkmain supplying water to each injection bore; and
- solar monitoring stations at each bore to provide power to bore headwork instruments.

2.3 Closure and Decommissioning

A Mine Closure Plan has been developed in consultation with the Department of Mines, Industry Regulation and Safety (DMIRS). This document outlines the proposed decommissioning, rehabilitation and closure strategy for existing Jimblebar and proposed mining operations. Recognising the importance of mine planning in facilitating the completion criteria for rehabilitation has been critical in planning and implementing successful rehabilitation practices. Embedding closure and rehabilitation planning in the Life of Asset and 5 Year Planning process for the business has resulted in rehabilitation being included as part of the mining process rather than being considered an add on or separate from mining. This allows identification of areas available for rehabilitation so that plans for executing final landform earthworks and rehabilitation within the subsequent five year timeframe are integrated with mine plans. To allow appropriate landform design, planners now use waste characterisation information and with site input, model design options to identify the most appropriate rehabilitation plan for any given situation.

BHP has revised the Mine Closure Plan for the Jimblebar mining operation, as part of the Jimblebar Optimisation Project Revised Proposal submission for approval through Part IV of the EP Act.

3 Stakeholder Engagement

BHP's commitment to community engagement is articulated in the Company's *Communications, Community and External Engagement Our Requirements* (BHP 2019), which states:

> '*Working openly with the communities in which we operate and with governments contributes to economic and social development and enhancement of BHP's reputation and social licence to operate..*'

To support this commitment, BHP has comprehensive Company standards and dedicated resources to ensure its activities are underpinned by continuous community engagement and feedback.

3.1 Stakeholder Consultation

BHP is required to maintain a register of interested parties for the purpose of stakeholder consultation. Interested parties have been identified through the formal Strategic Assessment public consultation period or have self-identified after the consultation period. Members of the community and groups are able to self-identify through local stakeholder engagement activities such as Community Consultative Groups in Port Hedland and Newman, and regular meetings with Traditional Owner groups and non-government organisations, or through www.bhp.com/contact. The BHP community team will advise on any enquiries or requests to be included in stakeholder engagement activities relating to the Strategic Assessment.

Key regulatory authorities, including the Department of the Environment and Energy (DoEE), and target stakeholders were consulted during the development of the draft Validation Notice. Consultation outlined the SAA, proposed submission, including a description of proposed activities of the Notifiable Action, the potential impacts on the Program Matters and the proposed management approach. The stakeholders consulted and level of stakeholder engagement undertaken depended on the location, complexity, size and risk of the particular activity, and the level of stakeholder interest. Table 3.1 summarises the relevant consultation undertaken by BHP regarding the aspects of this Validation Notice.

3.2 Public Consultation

BHP has made the draft Validation Notice publicly available on its website for a minimum period of 28 days. The public consultation period commenced on the 9 March 2020. Emails to all registered stakeholders advised that the Jimblebar Optimisation project public consultation period had commenced and included instructions on how to provide comments to BHP. These stakeholders included DWER, DBCA, DMIRS, Nyiyaparli Native Title Holders and DoEE.

A summary of the engagement undertaken for the Validation Notice, including the public consultation period, is included in Table 3.1.

Table 3.1: Stakeholder Engagement

Stakeholder	Date	Topics/issues discussed	BHP response and outcome
DoEE (now Department of Agriculture, Water and the Environment [DAWE])	11 March 2020	BHP invited DAWE to comment on the draft Jimblebar Validation Notice	BHP has included responses to DAWE feedback in Appendix 2 and the final Validation Notice.
	24 February 2020	DAWE provide key points of feedback arising from the review of the validation notice. DAWE feedback is provided in Appendix 2.	BHP has included responses to DAWE feedback in Appendix 2 and in this Validation Notice.
	7 February 2020	Overview of the Jimblebar Optimisation project draft Validation Notice. DoEE requested copies of the fauna surveys completed for the Validation Notice.	BHP provided the fauna surveys and requested final comments on the draft Validation Notice to be provided within 2 weeks.
	13 August 2019	Review of the implementation framework for the SAA. Recommendations of changes and approach to Assurance Plan (PMO review), Offset Plan, Validation Notices and Offsets Proposals. Additional information to be included in the Validation Notices Overview of the Jimblebar Optimisation project. DoEE queried if there was any evidence of Pilbara Olive Python or Northern Quoll detected within the activity area.	Prepare a review of the suitability of the PMO and how compliance against these can be demonstrated. Develop a process for calculating significant residual impacts. Pending the outcomes of the review and development of significant residual impact process, a revised Assurance Plan and Offsets Plan may be progressed. Ongoing consultation with the department on the Jimblebar Optimisation Project
DWER – EPA Services	11 March 2020	BHP invited DWER- EPA Services to comment on the draft Jimblebar Validation Notice. EPA provided the following feedback, via email, 'the draft validation looks very comprehensive and links well to the State assessment'.	
	13 August 2019	Presented the Project scope and the assessment outcomes for the preliminary key environmental factors (Inland Waters, Flora and Vegetation and Terrestrial Fauna). BHP confirmed it intended to provide sufficient information at the time of referral for a s38 'Assessment on Referral Information' assessment pathway for a Revised Proposal.	BHP has prepared an Environmental Review Document as a supplementary report with the referral, which provides sufficient information for the EPA's assessment.

Stakeholder	Date	Topics/issues discussed	BHP response and outcome
	13 February 2019	Discussed requirements for 'targeted surveys' as per the Strategic Proposal Recommended Environmental Conditions *Guidelines for submitting a Derived Proposal* – 1(b) and direction on level of survey required for various activities with EPA Services and Terrestrial Ecosystems Branch representatives. Advice was to present information detailing level of survey coverage across the proposed Development Envelope.	Since the decision to prepare a Revised Proposal, BHP has undertaken additional biodiversity surveys to meet the requirements of EPA survey guidance for standard s38 proposals.
	16 November 2018	BHP outlined the scope of the Project. Main points discussed were: • how a proposed Derived Proposal would condition an area also subject to existing Ministerial Statements • level of survey required for various different activities (i.e light infrastructure versus OSAs) and how to define 'targeted survey'.	EPA Services Branch requested BHP present a clear scope and level of survey coverage across the proposed Development Envelope.
DWER – Regulatory Services (Water)	5 June 2019	BHP discussed the surplus water strategy for the Project and presented the MAR modelling results. No specific feedback was received.	BHP finalised the MAR modelling report - *Caramulla MAR Injection Modelling* (BHP, 2019a).
Department of Biodiversity, Conservation and Attractions (DBCA)	11 March 2020	BHP invited DBCA to comment on the draft Jimblebar Validation Notice.	No comments regarding the Validation Notice were received from DBCA.
	16 August 2019	Discussion on the existing DBCA monitoring programs for Pilbara Leaf-Nosed Bat, Pilbara Olive Python and Ghost Bat projects. Opportunities to data share and support project to fill knowledge gaps for these species. Update on current on ground offsets projects for the Pilbara Leaf-Nosed Bat, Pilbara Olive Python and Ghost Bat and effectiveness of these projects to provide outcomes for the species.	BHP will consult with DBCA on the development of relevant monitoring and offset projects, if required
	27 June 2019	Discussed the Le Grange Greater Bilby project monitoring program and outcomes of this. Discussed potential On ground offsets opportunities for the Greater Bilby in the SAA.	Known occurrence of the Greater Bilby overlies the eastern portion of the SAA. BHP will consult with DBCA on the development of relevant monitoring and offset projects, if required

Stakeholder	Date	Topics/issues discussed	BHP response and outcome
	29 April 2019	Discussed BHP's request for a meeting to discuss the Derived Proposal. DBCA confirmed by email that DBCA recommends that all consultation planned for Derived Proposals involves EPA Services (until the process is clear and agreed to). DBCA suggested providing further information, if applicable, on the potential impacts of the Project on matters protected under the *Biodiversity Conservation Act 2016* (BC Act) and/or *Conservation and Land Management Act 1984* (CALM Act).	Following the finalisation of the impact assessment of the biodiversity factors, BHP has concluded that there is unlikely to be a significant impact on BC Act or CALM Act matters. BHP has developed a draft Flora and Vegetation Management Plan that addresses potential impacts to the Priority 1 flora species *Eremophila capricornica*. BHP will consult with DBCA on the development of relevant management plans, if required.
	24 April 2019	Discussed the 2 hectare survey techniques for Greater Bilby. Recent proponents have been requested to undertaken further surveys using this technique in prospective Greater Bilby areas. Discussed potential monitoring approaches for the Greater Bilby and known locations of Greater Bilby near to Jimblebar. Offsets and research opportunities for Greater Bilby, Ghost Bat, Pilbara Olive Python.	BHP included the 2ha survey methodology for Greater Bilby into all fauna survey scopes of works, including Jimblebar Optimisation Project.
	12 February 2019	BHP outlined the scope of this Project and intent to refer it as the first Derived Proposal; also whether DBCA would review a draft application and provide comments ahead of a formal referral. DBCA advised they would consider reviewing a draft application if resources were available at the time. DCBA also indicated their preference for BHP to only provide/highlight those aspects of the Project relevant to matters protected under the *BC Act* and/or *Conservation and Land Management Act 1984*. BHP sought also feedback from DBCA on current approach to management plans and definition of targeted surveys. DBCA advised that they will assess the application based on the approach endorsed by the EPA for management plans and targeted surveys.	Since the decision to prepare a Revised Proposal, BHP has completed additional biodiversity surveys to meet the requirements of EPA survey guidance for standard s38 proposals.
DWER, DBCA, DMIRS	6 March 2019	BHP (together with Syrinx Environmental consultants) presented and discussed the draft BHP WAIO rehabilitation completion criteria related to revegetation, developed as part of the work for the report on rehabilitation success required for the Strategic Proposal	BHP updated the Jimblebar Mine Closure Plan (Version 2), with the new completion criteria. This is consistent with the EPA's advice (EPA Report 1619, 2018d) on the Strategic Proposal, that information in the report on

Stakeholder	Date	Topics/issues discussed	BHP response and outcome
		Recommended Environmental Conditions *Guidelines for submitting a Derived Proposal* – 1(c). Meeting attendees were generally supportive of the approach proposed and the detail. During the meeting, DBCA noted that Buffel Grass (**Cenchrus ciliaris*) will need to be addressed, should it be listed as a Declared Pest.	rehabilitation success should be used to inform the development of mine closure plans.
Department of Jobs, Tourism, Science and Innovation (DJTSI)	29 January 2019	BHP briefed DJTSI on the new water management project at Jimblebar (Caramulla) and advised they would submit one State Agreement Proposal for the Jimblebar South OSAs and Caramulla surplus water project.	BHP advised they would draft the Local Participation Plan (LPP) and Community Development Plan (CDP) "6 month notice of intention" to submit a State Agreement Proposal in April 2019 for DJTSI review. BHP plans to submit the State Agreement Proposal in February 2020 (pending tenure conversion) with approval anticipated in April 2020.
Nyiyaparli Native Title Holders	11 March 2020	BHP invited the Karlka Nyiyaparli Aboriginal Corporation to comment on the draft Jimblebar Validation Notice	No comments from the Karlka Nyiyaparli Aboriginal Corporation were received.
	5 August 2019	BHP provided the Environmental Review Document, the draft Flora and Vegetation Management Plan, the Jimblebar Mine Closure Plan and the draft Water Management Plan in advance of referral of the Project to the EPA for assessment under s38 of the EP Act. In response, the Karlka Nyiyaparli Aboriginal Corporation provided general comments via email on 19 August around the key themes of water, fauna, vegetation and weeds and mine closure.	BHP acknowledges the long-term interest in these issues over the life of any mine and beyond for the Nyiyaparli. The referral documentation has been updated where required and any ongoing concerns can be discussed through the regular Implementation Committee forum. A letter was provided to the Nyiyaparli on 26 August summarising BHP's response to the comments. A site visit has been proposed to further discuss any specific concerns the Nyiyaparli may have with the implementation and the long-term on-ground management of this Project.
	16 April 2019 (Biannual Meeting)	During the meeting, BHP's presentation and discussion included BHP's water management approach and the Project. There was general discussion about the Project but no specific issues were raised.	BHP confirmed that they would provide copies of draft referral documentation prior to submission to allow Nyiyaparli to provide feedback.
	18 October 2018 (Biannual Meeting)	During the meeting, BHP's presentation and discussion included the following: • BHP's general approach to surplus water management in the Pilbara; and	BHP has addressed its approach to surplus water for this Project in Section – Inland Waters for the Revised Proposal BHP also offered a site visit in 2019.

Stakeholder	Date	Topics/issues discussed	BHP response and outcome
		• upcoming environmental approvals (including Jimblebar).	It was agreed at this meeting that BHP would provide further detailed information on the Project scope at the next meeting (April 2019).
	6 April 2018 (Biannual Meeting)	BHP presented the Project including the location, extent and nature of the project. No specific issues were raised. The recent ethno-biological site visit (March 2018) was also presented.	BHP offered further opportunity to discuss the Project on-site to identify if there were any specific environmental issues of interest/concern to the Nyiyaparli. It was proposed that this could occur in conjunction with upcoming Heritage surveys.
	March 2018	BHP's Heritage and Environmental Teams, with four Nyiyaparli representatives and Onshore Environmental consultants, undertook a survey to better understand the bush tucker within the Jimblebar area. A lot of time was spent at Innawally Pool.	
Department of Mines, Industry Regulation and Safety (DMIRS)	11 March 2020	BHP invited DMIRS to comment on the draft Jimblebar Validation Notice	No comments from DMIRS were received.
Local Expertise BatCall WA –Bob Bullen Biologic- Morgan O'Connell, Chris Knuckey Norm Mackenzie	19 August 2019	Ghost Bat Workshop: • Update on monitoring and survey methods • What information do we already know • Population definitions – how should they be defined • Limitations of monitoring and surveying • Future areas of research required	Utilise outcomes in the workshop for future BHP projects.

4 Applicable Program Matters

4.1 Guidance

Sixteen vertebrate fauna surveys were undertaken wholly or partially in Jimblebar/Caramulla between 1994 and 2019; key fauna surveys are shown in Appendix 2. These surveys involved habitat assessments, systematic vertebrate fauna sampling, motion detection cameras and targeted searches within habitats evaluated as suitable for conservation significant threatened fauna. Dedicated targeted surveys for the Ghost Bat, Northern Quoll, Greater Bilby, Pilbara Leaf-Nosed Bat and Pilbara Olive Python were undertaken in a manner consistent with the State and Commonwealth survey guidance at the time.

The most recent Commonwealth guidance considered included:

- Commonwealth of Australia 2013 Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act;
- Commonwealth of Australia 2017 EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species;
- Commonwealth of Australia 2016 EPBC Act referral guideline for the endangered northern quoll;
- Commonwealth of Australia 2011 Survey guidelines for Australia's threatened mammals;
- Commonwealth of Australia 2010 Survey guidelines for Australia's threatened bats; and
- Commonwealth of Australia 2011 Survey guidelines for Australia's threatened reptiles.

The most recent Western Australian guidance considered included:

- EPA Technical Guidance – Terrestrial Fauna Surveys, Perth, Environmental Protection Authority (EPA 2016a)
- EPA Technical Guidance – Sampling methods for terrestrial vertebrate fauna, Perth, Environmental Protection Authority (EPA 2016b).

Other guidance considered included:

- Southgate, R., Dziminski, M., Partridge, R., Schubert, A., and Gaikhorst, G. 2018. Verifying bilby presence and the systematic sampling of wild populations using sign-based protocols – with notes on aerial and ground based techniques and asserting absence. Australian Mammalogy.
- DBCA 2017. Guidelines for surveys to detect the presence of bilbies and assess the importance of habitat in Western Australia. DBCA.

4.2 Surveys and Studies

The 16 surveys comprise ten Level 2 surveys, five Level 1 surveys, and one targeted survey. Survey effort to date includes 6,795 Elliot trap nights, 1,164 cage trap nights, 5,167 funnel trap nights, 142 bat recording night (686 hrs), plus diurnal and nocturnal targeted searches over a period of 20 years. The most recent Level 2 surveys completed within the activity area include GHD, 2019; Biologic 2018 and 2019 and specifically targeted the Greater Bilby, Pilbara Olive Python, Pilbara Leaf-Nosed Bat, Northern Quoll and Ghost Bat. These surveys were undertaken in a manner consistent with the requirements of the Commonwealth and Western Australia guidance for surveys listed in Section 4.1. Consultation with the Department of Biodiversity Conservation and Attractions and BHP consultants regarding monitoring and surveying methodologies was undertaken during scoping of the surveys and adjustments to the programmes were made on this advice accordingly. Examples are the inclusion of the 2ha survey methodology for Bilby and emergence monitoring for the Ghost Bat. Table 4.1 summarises these surveys which were undertaken within and adjacent to the proposed activity area, to support the assessment of the PMO.

Table 4.1: Terrestrial Fauna – Recent Studies and Surveys

Title	Date	Summary
Jimblebar East and Caramulla Fauna Survey (GHD, 2019)	Apr-May 2019	Single season Level 2 survey of vertebrate fauna (including targeted survey for Greater Bilby and Ghost Bat) of east Jimblebar and Caramulla area.
Shearers West Targeted Vertebrate and Short-range Endemic Invertebrate Fauna Assessment (Biologic, 2019)	Apr-May 2018	Single season Level 2 survey of vertebrate and SRE fauna of Shearers West area (south of Jimblebar).
Caramulla Level 1 Vertebrate Fauna Assessment (Biologic, 2018)	Feb 2018	Single season Level 1 of Caramulla area.

In addition to the abovementioned surveys, a regional study to consolidate fauna habitat mapping within BHP's Pilbara tenements was undertaken to support the assessment of terrestrial fauna within the Pilbara: Consolidated Fauna Habitat Mapping (Biologic, 2014). Pre-clearing targeted surveys for the Greater Bilby were undertaken in 2019 within the eastern portion of and to the east of the proposed activity area as a requirement of the Native Vegetation Clearing Permit (NVCP) 8123/1 for the Caramulla drilling program.

BHP considers that the surveys and regional study meet the relevant Commonwealth and State guidance and provides adequate survey coverage to support the assessment of terrestrial fauna for the activity area. The surveys outlined in Table 4.1 fulfil the requirement of Section 7.1 of the Program for contemporary targeted on-ground surveys to supplement the surveys in Appendix 3.

4.3 Greater Bilby

4.3.1 General Species Information

The Greater Bilby was common throughout most of its range until the early 1900s when there was a sudden and widespread collapse (Abbott 2001; Johnson 2008). This collapse and range contraction has been attributed to predation from cats and foxes, habitat destruction from introduced herbivores and changed fire regimes. Feral cats have been linked to the reduced success of reintroduced populations (Pavey 2006b).

Within the Pilbara bioregion, the Greater Bilby exists along the Fortescue River and northeast to Shay Gap (Pavey 2006a) (see Figure 4.1). The extent of occurrence for the Greater Bilby is thought to have remained relatively stable over the last 20 years. Across its current distribution, the Greater Bilby occupies a variety of habitats that include Mitchell grass and stony downs country of cracking clays, the desert sandplains and dune fields sometimes containing laterite, with hummock grassland (spinifex) and massive red earths with Acacia shrubland (Southgate 1990; Southgate et al. 2007; Johnson 2008; Greatwich 2013). The presence of the Greater Bilby is strongly associated with substrate type as it is generally restricted to areas that contain suitable burrowing habitat, such as sandy loam plains, alluvial creeks, dunes and sand ridges (Threatened Species Scientific Committee [TSSC] 2016a).

The Greater Bilby shows a strong association with areas of higher rainfall and temperatures, which may be due to higher plant and food production; and these areas also coincide with areas less tolerated by feral predators, such as the fox (TSSC 2016a).

4.3.2 Regional Habitat and Habitat Modelling Data

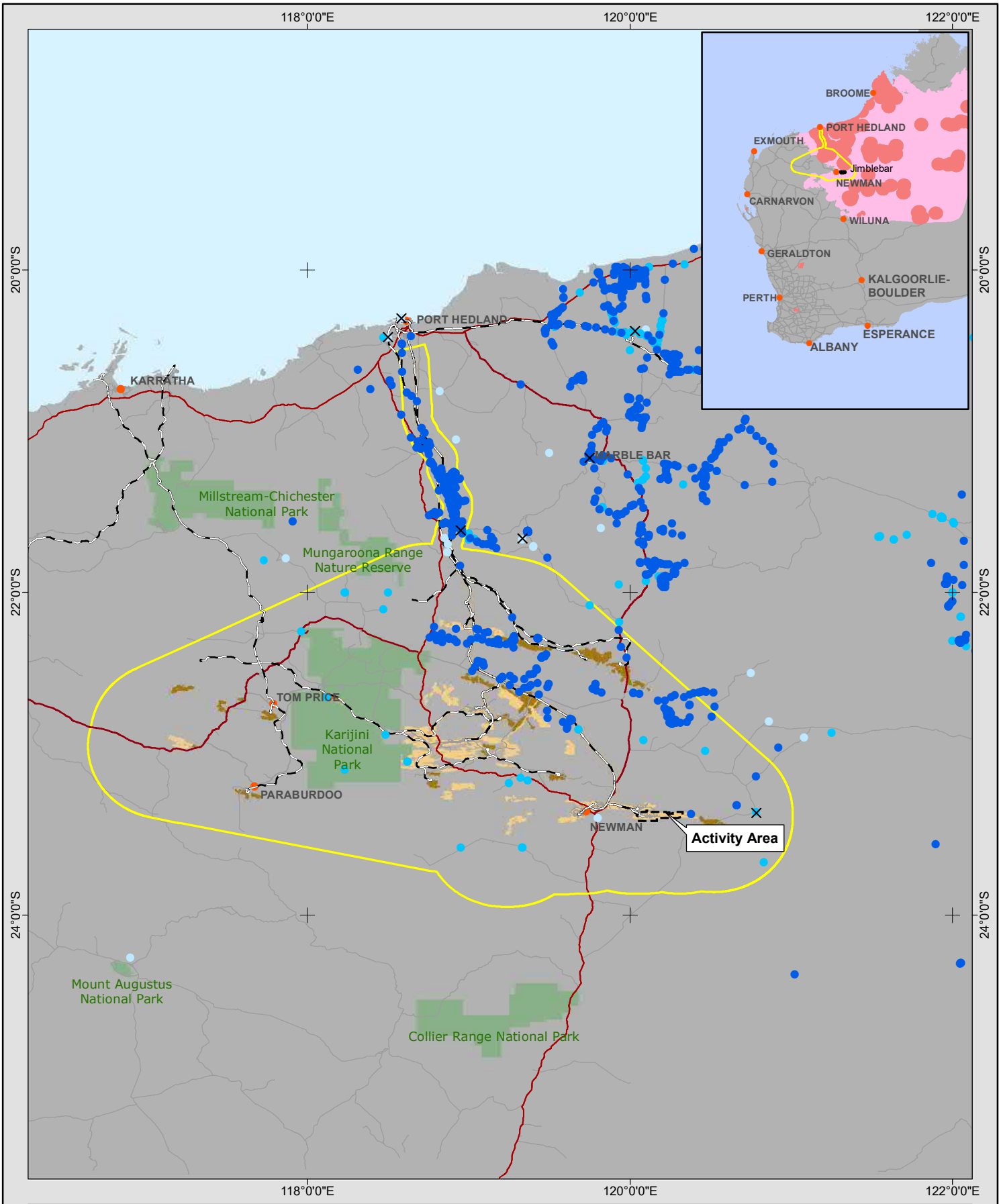
The most preferred Greater Bilby habitat (Habitat Rank 4 [H4]) is situated in the northern sections of the Pilbara region (Figure 4.2). The SAA intersects these preferred habitat areas where the existing rail corridor is located.

Eco Logical (2015) modelled the habitat preference (the probability of that species being located in certain habitats) for the Greater Bilby using 21 species records from publicly available and BHP data. The model indicated that preferred habitat (representing the highest probability of potential habitat, H4) was strongly associated with hotter regions in the eastern part of the SAA. Within this range, lower, less rocky areas were identified as higher potential Greater Bilby habitat.

Potential impacts to the Greater Bilby as a result of the Full Conceptual Development Scenario are considered minor at the regional scale given that less than 1% (114 ha) of the most preferred habitat (H4) will be potentially impacted by the Program (Table 4.3). The majority of the habitat occurring within the mining footprint associated with the Full Development Scenario is Habitat Rank 1 (H1) the lowest probability of potential habitat for the Greater Bilby.

The Rangeland land systems within 25 km of the activity area are detailed in Table 4.2 and Figure 4.3. Of these land systems, the Divide land system indicate a significant quantity (104,579 ha) of preferred Greater Bilby sand plain habitat adjacent to the activity area. The sand plain area located to the north and east of the activity area is not currently subject to mining or mining exploration, which makes this a long term habitat for the Greater Bilby. Mulga Woodlands are present within Laterite, Boolgeeda and Fan land systems that indicate additional Greater Bilby habitat (21,673 ha) from land systems that support Mulga.

Figure 4.1: Greater Bilby Regional Records and Distribution



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Greater Bilby regional records and distribution

Scale @ A4: 1:3,500,000	Prepared: J.VIS	Project No: A949/083 Rev B	
Date: 19/11/2019	Checked:	Figure: 4.1	
Revision: REV B	Reviewed: ENVIRO. A&I		

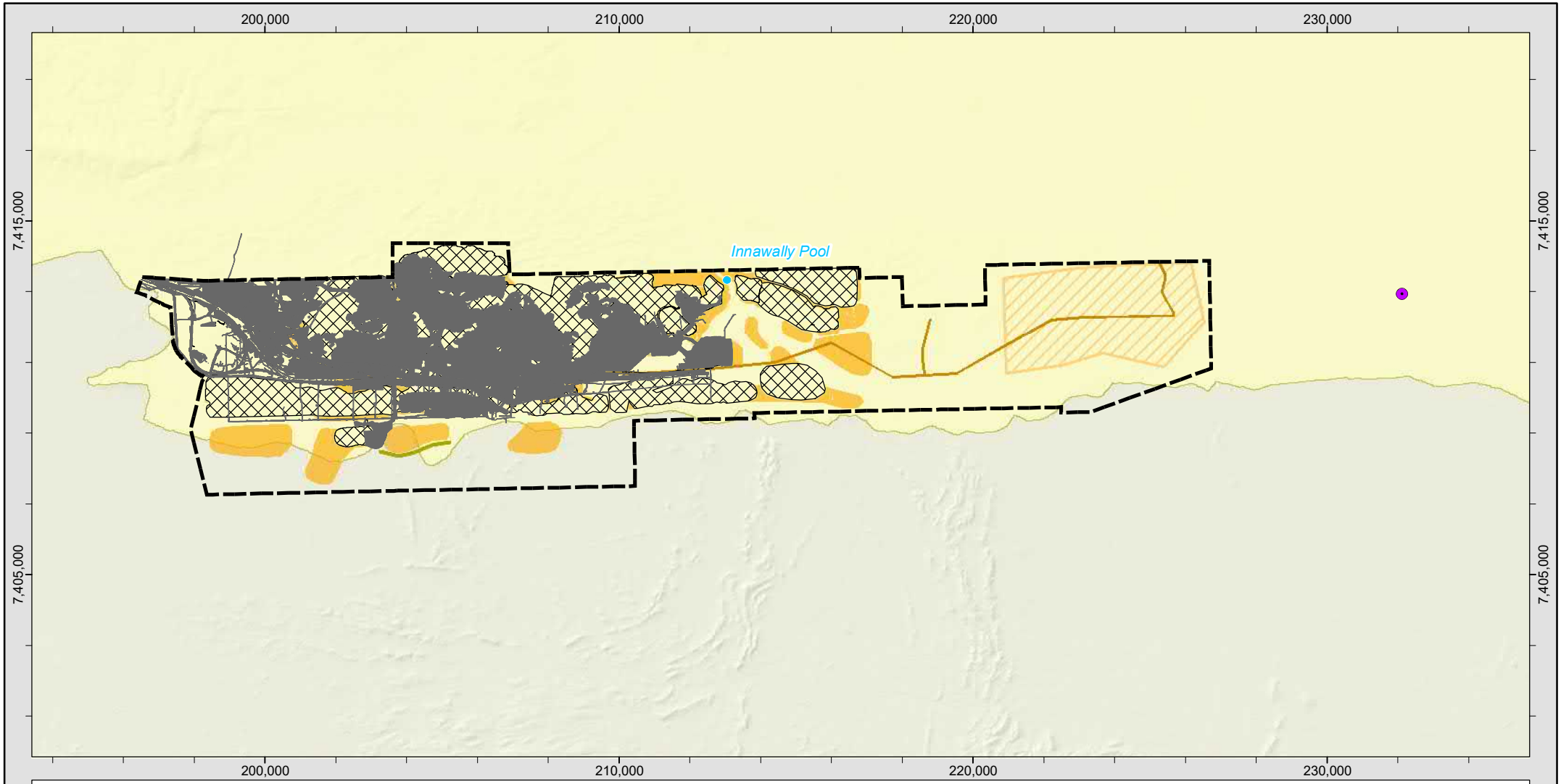
Greater Bilby records
- Records After 2005
- Records between 1980 - 2004
- Records Prior 1979
- Records Missing Date
- Town
- Species or species habitat likely to occur
- Species or species habitat may occur

- Major Road
- Minor/Regional Road
- Rail Centreline
- Strategic Assessment Area
- BHP LOA Mine Plan disturbance footprint
- Third Party disturbance footprint
- Activity Area

N

0 25 50 75
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994



Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Greater Bilby Modelled Habitat
and Regional Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/22 REV C
Date: 2/12/2019	Checked:	Figure : 4.2
Revision: REV C	Reviewed: ENVIRO. A&I	

- Innawally Pool
- BHP Greater Bilby Species Record
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)

Indicative Disturbance Footprint
- Drainage Line Diversion
- Surplus Water Pipeline
- MAR Borefield Area
- OSA, various expansions and associated activities

Greater Bilby Potential Habitat Modelling
- 1 - Lowest Potential

N

0 1 2 3
Kilometres

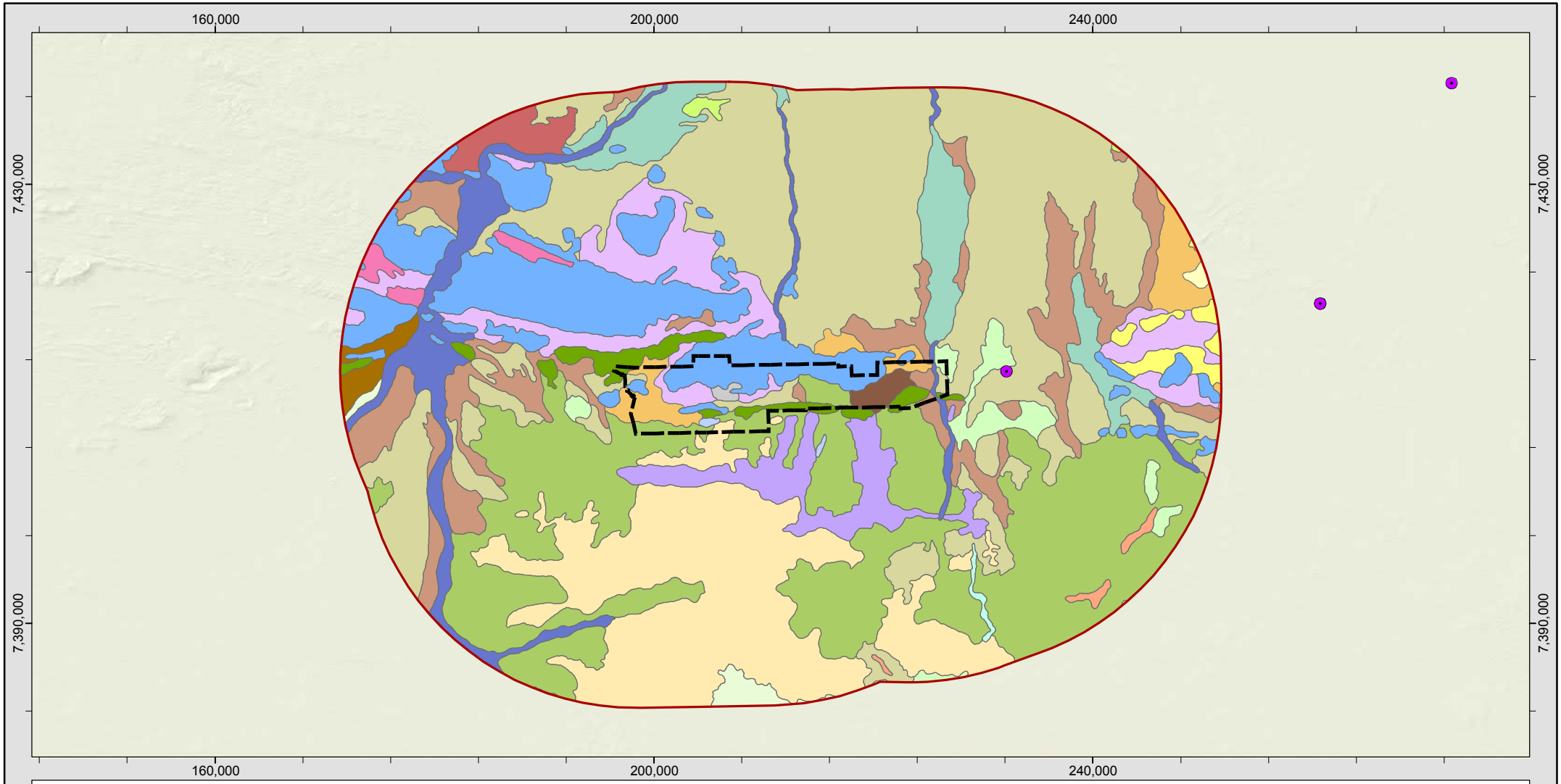
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_022_E_JDP_VN_BilbyModelled_RevC.mxd

Table 4.2: Land System within 25km radius of activity area

Land System	Description	Area (ha)
River	Active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	14,026.58
Fortescue	Alluvial plains and flood plains supporting patchy grassy woodlands and shrublands and tussock grasslands.	13,974.02
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.	1,887.67
Charley	Dolerite hills and ridges and restricted plains supporting mulga and cassia shrublands or spinifex grasslands.	441.92
Spearhole	Gently undulating gravelly hardpan plains and dissected slopes supporting groved mulga shrublands and hard spinifex.	1,889.65
Prairie	Gently undulating stony plains and granite hills supporting acacia-eremophila-cassia shrublands and minor soft spinifex grasslands.	49,220.40
Sylvania	Gritty surfaced plains and low rises on granite supporting acacia-eremophila-cassia shrublands.	77,851.81
Washplain	Hardpan plains supporting groved mulga shrublands.	27,878.51
Zebra	Hardpan plains with large linear gravelly sand banks supporting acacia shrublands with soft and hard spinifex.	1,222.27
Cadgie	Hardpan plains with thin sand cover and sandy banks supporting mulga shrublands with soft and hard spinifex.	5,362.63
Robertson	Hills and ranges of sedimentary rocks supporting hard spinifex grasslands.	2,656.84
Talga	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	10,193.56
McKay	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands.	4,734.72
Table	Low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.	784.72
Laterite	Low lateritic plateaux, mesas, buttes and gravelly rises and plains supporting mulga shrublands and short grass forbs.	210.77
Newman	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	35,260.73
Divide	Sandplains and occasional dunes supporting shrubby hard spinifex grasslands.	104,579.60
Balfour	Shale, gravel and clay plains supporting eremophila-cassia shrublands, tussock grasslands, and halophytic shrublands.	316.86

Land System	Description	Area (ha)
Jamindie	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.	6,931.13
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	18,040.79
Adrian	Stony plains and low silcrete hills supporting hard spinifex grasslands.	535.54
Elimunna	Stony plains on basalt supporting sparse acacia and cassia shrublands and patchy tussock grasslands.	2,088.30
Disturbed Land	Disturbed area, mining activity etc	294.16
Fan	Washplains and gilgai plains supporting groved mulga shrublands and minor tussock grasslands.	3,421.81
Total		**383,804.99**



BHP

Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTMISATION PROJECT
Greater Bilby Regional Land Systems

Scale @ A4: 1:500,000	Prepared: J.VIS	Project No: A949/81 REV A
Date: 13/11/2019	Checked:	Figure : 4.3
Revision: REV A	Reviewed: ENVIRO. A&I	

Greater Bilby Species Record (After 2005)
Activity Area
Activity Area Buffer 25km

Land System

- Adrian
- Balfour
- Boolgeeda
- Cadgie
- Charley
- Disturbed Land
- Divide
- Elimunna
- Fan
- Fortescue
- Jamindie
- Laterite
- McKay
- Newman
- Prairie
- River
- Robertson
- Rocklea
- Spearhole
- Sylvania
- Table
- Talga
- Washplain
- Zebra

N

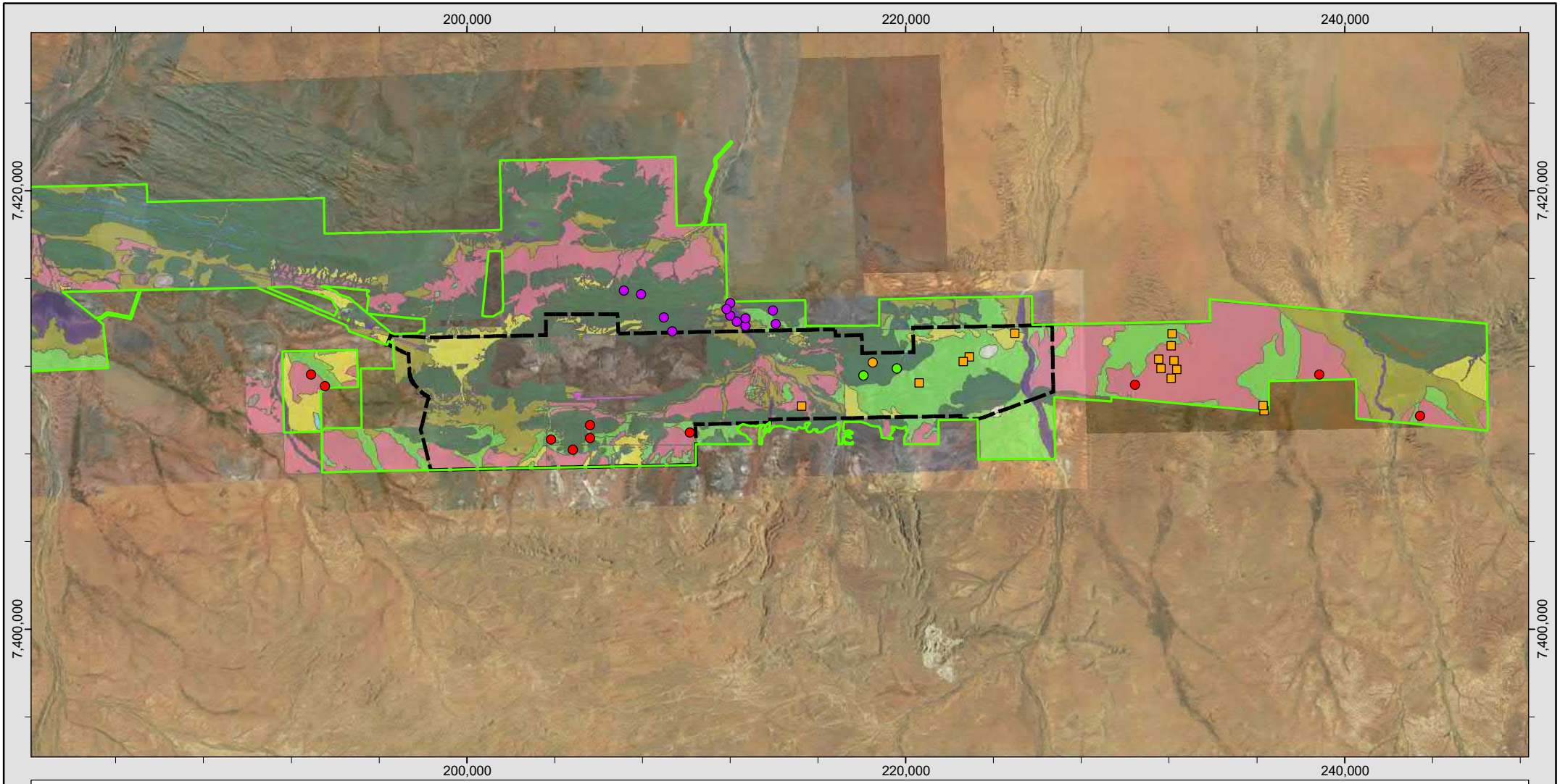
0 2 4 6
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_081_E_VN_RangelandsLandSystems_RevA.mxd

4.3.3 Species Specific Surveys

For the most recent GHD survey (conducted in accordance with DBCA 2017 guidance), fourteen 2 ha plots (either 50 m x 400 m or 100 m x 200 m), within sand plain and mulga woodland habitats were traversed on foot for evidence of Greater Bilby activity indicating recent presence. The survey locations are detailed in Figure 4.4. Searching was carried out by a minimum of two personnel. Personnel walked in a line spaced approximately 20 - 30 m apart providing adequate on-ground coverage to target the Greater Bilby. During the traverses, all evidence of Greater Bilby was recorded including burrows, footprints, foraging signs and scats using targeted and opportunistic searches.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROPOSAL
Greater Bilby Survey Coverage

Scale @ A4: 1:250,000	Prepared: J. VIS	Project No: A949/084 REV B
Date: 20/02/2020	Checked:	Figure : 4.4
Revision: REV B	Reviewed: ENVIRO. A&I	

Targeted Greater Bilby 2ha Survey plot (GHD, 2019)

Targeted Greater Bilby Search Sites
- 2005
- 2006
- 2008
- 2018
- 2019

Greater Bilby Survey Coverage

Activity Area

Habitat Type
- Artificial Wetlands
- Breakaway/ Cliff
- Calcrete Plain
- Claypan
- Drainage Area/
- Gorge/ Gully
- Hardpan Plain
- Hillcrest/ Hillslope
- Major Drainage Line
- Medium Drainage Line
- Minor Drainage Line
- Mulga Woodland
- Sand Plain
- Stony Plain

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_084_E_VN_VertebrateFauna_SurveyCoverage_RevB.mxd

4.3.4 Local Habitat

The sand plain and mulga woodland are habitat types located in the east of the proposed activity area which represent potential Bilby habitat for burrowing and foraging (GHD, 2019). These habitat types are located within the proposed MAR borefield area where the required clearing is estimated to be approximately 400 ha within an indicative area of 1,455 ha. The sand plain habitat (presented in Figure 4.5) is continuous and extensive to the east of the proposed activity area. The mulga woodland habitat type extends west and south of the proposed activity area (Figure 4.6).

Sand plains provide potential habitat for the Greater Bilby in Western Australia. The Greater Bilby has also been recorded from mulga woodlands and stony plain habitats. Surveys identified approximately 1,836 ha of potentially suitable sand plain habitat within the activity area (Biologic 2018; 2019) (Figure 4.6). Approximately 2,665 ha of mulga woodland was identified as suitable for opportunistic dispersal or foraging habitat for the Greater Bilby (GHD, 2019), however, heavy grazing was most evident in the mulga woodlands. Approximately 1,073 ha of stony plain occur within the activity area. These areas were not identified as suitable habitat for the Greater Bilby during the surveys, due to presence of hard soils and large rocks (GHD, 2019), therefore stony plains are not considered habitat for the Greater Bilby in this Validation Notice. Table 4.3 details the habitat assessment.

Figure 4.5: Sand Plain Habitat

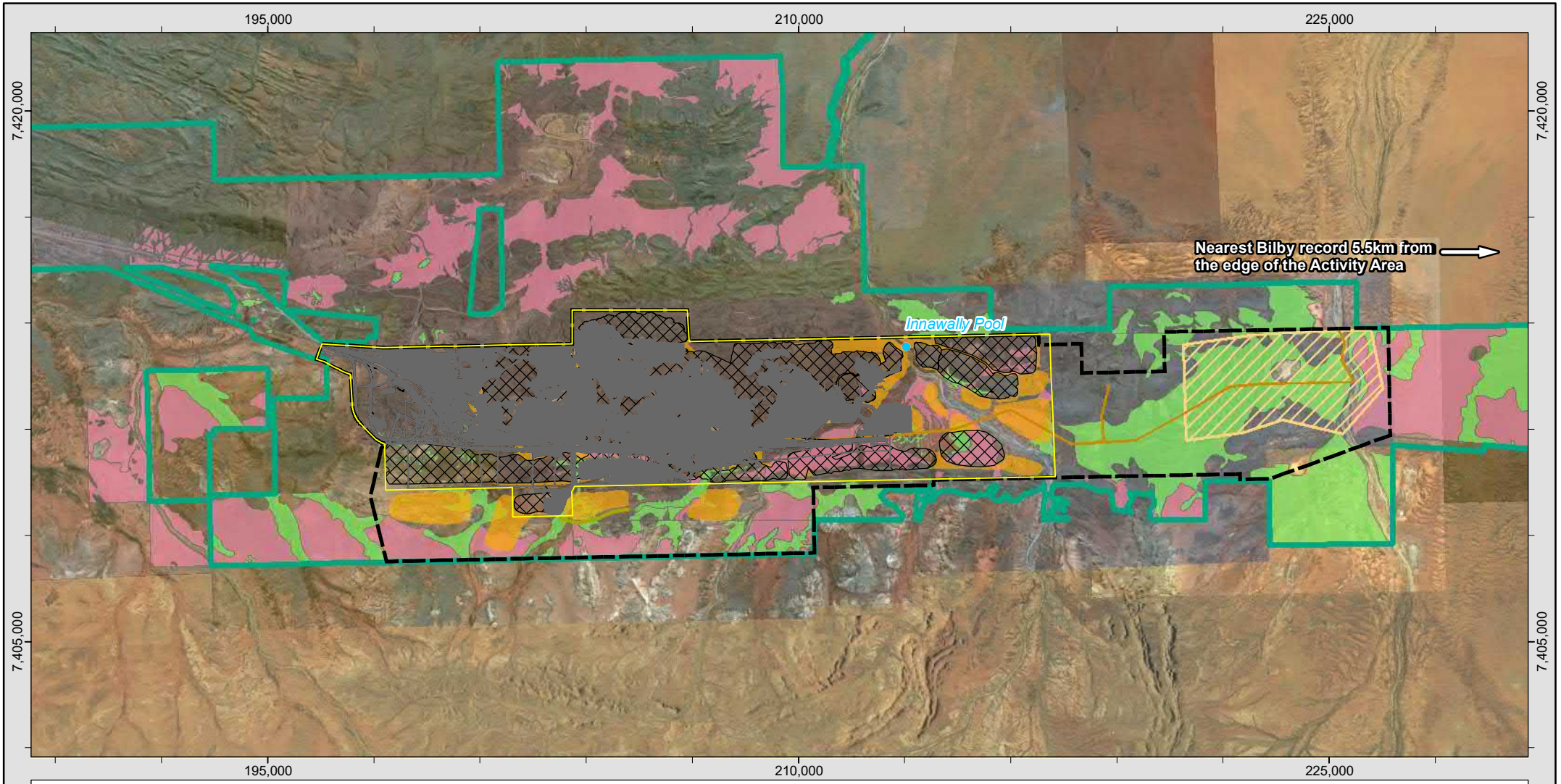
Table 4.3: Greater Bilby Habitat Assessment

Modelled Habitat Assessment (ha)					Survey Habitat Assessment (ha)		
Habitat Description	Modelled Habitat Area Pilbara bioregion	Modelled Habitat in Strategic Assessment Area	Modelled Habitat within the Full Development Scenario	Modelled within Activity Area^	Habitat Description	Within the Activity Area	Within disturbance footprint of the Activity^
H4	1,751,623	346,501	114	0	Sand Plain	1,836	261
H3	1,513,018	317,289	2,709	0	Mulga Woodland	2,665	447
H2	877,696	134,086	4,659	0	NA	-	-
H1	13,650,278	5,160,202	1,835	6,268			

^ excluding the Jimblebar existing operations

4.3.5 Greater Bilby Records

Currently, there is no evidence of any individuals or populations of Greater Bilby within the activity area. Although suitable habitat is present within the activity area (sand plains and mulga woodland), extensive surveys indicate this species is not currently occupying the area, with no evidence of presence of the species or individuals recorded, during two recent fauna surveys (Biologic 2018 and GHD 2019) and pre-clearing surveys (for MAR drilling activities) undertaken as part of the requirements for Native Vegetation Clearing Permit (NVCP) 8123/1. Recent targeted surveys (see Figure 4.4 for details of locations) were undertaken within, and adjacent to, the proposed activity area in its preferred habitat (i.e. sand plain and mulga woodland) (Biologic, 2018; GHD, 2019). No new or recent evidence of this species was recorded (Figure 4.6). The nearest record of the Greater Bilby is from an historical inactive burrow located over 5.5 km to the east of the proposed activity area (Biologic, 2018). The burrow was revisited and re-assessed to determine current use in 2019. No fresh or current activity was recorded in the burrow area. Additionally a camera was set on the burrow for eight nights and did not record any Greater Bilby activity. The camera did identify a large Sand Goanna (*Varanus panoptes*) near the burrow (GHD, 2019).



Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Greater Bilby Habitat and Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/75 REV B
Date: 15/11/2019	Checked:	Figure : 4.6
Revision: REV B	Reviewed: ENVIRO. A&I	

- Innawally Pool
- Existing Project Boundary
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)

Indicative Disturbance Footprint

- Drainage Line Diversion
- Surplus Water Pipeline
- MAR Borefield Area
- OSA, various expansions and associated activities
- Fauna Survey Extent

Habitat Type

- Mulga Woodland
- Sand Plain

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_075_E_VN_BilbyHabitat_Records_RevB.mxd

4.3.6 Impact Assessment

The potential direct and indirect impacts to the Greater Bilby from the surplus water management options and development (see section 2) are outlined below.

Removal of Habitat from Land Clearing

The key direct impact to the Greater Bilby arising from implementation of the activity is loss of potential habitat. Suitable habitat for Greater Bilby within the activity area is sand plain and mulga woodland habitats (Figure 4.6 and Table 4.3). The activity will require removal of approximately 708 ha of potential habitat from direct disturbance (sand plain [262 ha] and mulga woodland [447 ha]) for the development of the OSAs and MAR infrastructure.

Habitat Fragmentation from Land Clearing

Habitat fragmentation resulting from the installation of the MAR pipeline and other linear infrastructure, may restrict the movement of Greater Bilby within the activity area. BHP anticipates that the pipeline will be buried at a shallow depth (less than 1.8 m). Where the pipeline is buried, the land will be contoured to mimic the topography prior to excavation. If excavation conditions are not suitable, the pipeline will include raised sections of the pipeline above the ground and/or placing environmental culverts at adequate distances to allow fauna movement across the pipeline. The construction of the pipeline will allow fauna to move across the pipeline and therefore limit the habitat fragmentation.

The predicted wetting front extent from the proposed discharge of surplus water into Caramulla Creek at a rate of 75 ML/d is 34 km. BHP considers that this prediction is conservative, as low infiltration is assumed. The peak flow rate of water discharged would be much smaller than peak flows generated during natural flood events. The existing discharge in Jimblebar Creek together with the proposed discharge in Caramulla Creek would result in surface water flows during natural no-flow conditions and increased duration of flows. The wetting front may fragment the habitat across Caramulla Creek, however, the sand plan habitat is continuous on each slide of the creek and flow conditions will be minor which will allow fauna to cross the creek.

Introduced Species

The decline in the Greater Bilby has been attributed to a number of threats working directly or in combination with each other. These threats include predation by introduced cats and foxes (Paltridge 2002; Bradley et al. 2015), changed and inappropriate fire regimes (Southgate and Carthew 2006; Southgate and Carthew 2007; Southgate et al. 2007; Bradley et al. 2015), and the degradation of Greater Bilby habitat through pastoralism, introduced herbivores, and clearing (Southgate 1990a; Pavey 2006; Bradley et al. 2015; Department of Environment 2016). The recent surveys completed within the activity area identified the presence of feral cats and cattle. The presence of feral cats and cattle within the activity area, may limit the utilisation of the activity area by the Greater Bilby.

Vehicle Collisions

Haul roads and access roads may be a cause of Greater Bilby mortality at a local scale due to the combination of vehicles operating throughout the night (when the Greater Bilby is most active) and in locations where roads are adjacent to suitable Greater Bilby habitat. Haul roads and access roads will be required to support the activity. Currently there is no evidence of any individuals or populations of Greater Bilby within the activity area.

Surface Water Changes

Changes to surface water flows may cause changes to fauna habitat values, particularly in riparian zones. This can occur due to increased temporal availability of surface water from discharge of surplus water. The presence of water from the discharge may temporarily alter the fauna habitat, particularly in major drainage lines, and increase fauna visitation to the area. The estimated discharge flow depth within Caramulla Creek is 200mm, which would not result in a physical barrier for movement of the Greater Bilby across the creek. Given that the Greater Bilby preferred habitat is sand plain and mulga woodland, rather than major drainage lines, and therefore changes to surface water flows are unlikely to impact Greater Bilby habitat areas.

Groundwater Changes

Potential impacts to groundwater through mining activities may affect the Greater Bilby via indirect impacts to the species' habitat. MAR will increase the groundwater levels at Caramulla, where Mulga Woodland habitat is present. Caramulla MAR will be managed with a view to limiting mounding to a maximum of 25m below the ground surface (bgs). Given the root zone depth of vegetation species within the Mulga Woodland habitat (Mulga - up to 3 mbgs), the groundwater mounding from the Caramulla MAR (up to 25 mbgs) will limit any impacts to vegetation and therefore any indirect impact to potential Greater Bilby habitat. As there are no groundwater-fed surface water features within the activity area the MAR is unlikely to change the hydrogeological features (e.g. extent or duration of water present) of the pools.

4.3.7 Mitigation Hierarchy

Avoid

In early 2018, BHP identified a need for additional disturbance for OSAs south of the Jimblebar South pits due to:

- a lack of available area to allow expansion of OSAs, specifically adjacent to South Jimblebar, with the northern area constrained by existing infrastructure and the southern area constrained by the existing approved project area;
- a higher waste to ore ratio at South Jimblebar;
- backfill options being limited by pit stage sequencing requirements (a partial backfill schedule was developed to reduce the size of the OSAs required);and.
- long-term impracticality of hauling waste material to backfill the depleted pit WH4 at the Wheelarra Hill deposit area.

Initial overall project disturbance requirements was estimated to be 3,000 ha. The initial mine plan was developed to maximise pit availability during the life of mine, therefore backfilling of mine pits was restricted. From this point, the mine plan was optimised to maximise the backfilling of pits. This involved scheduling the early completion of pits so they can be immediately backfilled. This optimisation of backfilling reduces the disturbance required to construct OSAs to 2,000 ha, which avoided the clearing of approximately 500 ha of potential Greater Bilby habitat.

Pre-clearing surveys will be undertaken to avoid any Greater Bilby's that may move into the activity area. The identification of a Greater Bilby within the activity area may result in one or more of the following:

- re-design of infrastructure to avoid the area;
- discussion with DBCA on potentially translocating the Greater Bilby; and
- revision of this Validation Notice.

Minimise

The key direct impact to the Greater Bilby from the activity is loss of suitable habitat. The management measures proposed to minimise this impact include:

- avoiding direct impacts to suitable habitat, where practicable through planning and implementing the Project Environmental and Aboriginal Heritage Review (PEAHR)[17] internal process prior to land disturbance; and
- minimise clearing of native vegetation, by utilising existing infrastructure, facilities and cleared areas, and maximising the disposal of waste rock within mine pits, where practicable.

[17] PEAHR is the BHP internal disturbance approval process, to address regulatory requirements and take into account stakeholder expectations and potential impacts to areas of important biodiversity and/or ecosystems and cultural significance. The PEAHR system manages the implementation of environmental, Aboriginal heritage, land tenure and legal commitments prior to and during land disturbance. A PEAHR must be in place prior to the start of any land disturbance or construction activities that involves the clearing of vegetation and/or a change in land-use or discharge to the environment. All ground disturbance activities will meet the requirements of the PEAHR. All personnel carrying out works associated with clearing activities are required to comply with BHP requirements , environmental approvals, the PEAHR requirements and conditions and any other relevant legislative and licensing requirements.

Rehabilitate

Successful rehabilitation of the MAR borefield infrastructure and the other linear infrastructure included within the activity area will allow habitat to return for use by the Greater Bilby post mining. The construction and installation of MAR and other linear infrastructure will result in shallow linear disturbance, with minor changes to the topography of the landscape. This type of disturbance, which is very similar to the disturbance undertaken during mineral exploration drilling activities, has historically resulted in rehabilitation success.

Successful rehabilitation will be facilitated by the following management approaches relating to terrestrial fauna, particularly in relation to fauna habitat:

- integrate fauna habitats (e.g. sandy surfaces) into landform design;
- design the revegetation program to establish native vegetation that blends with the surrounding areas and will provide habitat and foraging areas for native fauna; and
- choose appropriate surface treatments, including ripping of compacted surfaces, to provide suitable burrowing habitat areas for Greater Bilby's.

4.3.8 Residual Impact

The indicative disturbance footprint requiring direct disturbance of sand plain and mulga woodland habitats consists of MAR borefield infrastructure (290 ha), other infrastructure (roads, laydown area etc.) (66 ha), OSAs (322 ha) and mine pits (30 ha) (see Table 4.4). Successful rehabilitation of the MAR borefield infrastructure and the other infrastructure areas will return the habitat for potential use by the Greater Bilby. This results in an estimated residual impact to Greater Bilby habitat, from OSAs and mine pits, of 352 ha (204 ha of sand plain and 148 ha of mulga woodland).

Table 4.4: Indicative Disturbance Footprint by Habitat and Activity

Habitat Description	Mine Pits (ha)	OSAs (ha)	MAR Borefield Infrastructure (ha)	Other Infrastructure (ha)	Indicative Disturbance (ha)	Residual Impact (ha)	Habitat Remaining within Activity Area (ha)
Sand Plain (H4)	29	175	27	30	261	204	1,632
Mulga Woodland (H3)	1	147	263	36	447	148	2,517
Total	30	322	290	66	708	352	4,149

The sand plain habitat is continuous and extensive to the east of the proposed activity area. GHD 2019 describes the sand plain habitat as:

- regionally an extensive habitat type occurring to the north in association with the Fortescue subregion;
- locally extensive in the eastern Hamersley subregion; and
- very extensive to the east where it is associated with the Little Sandy Desert.

Given the minor residual impact area of 204 ha to sand plain habitat, compared to the existing adjacent sand plain habitat (104,579 ha), the risk of impact to the Greater Bilby from the activity is considered minor.

The mulga woodland habitat type extends west of the indicative footprint within the proposed activity area and extends south of the proposed activity area (Figure 4.6). The mulga woodland is a regionally very extensive habitat type occurring throughout the Hamersley subregion, wider Pilbara and adjacent bioregions (GHD 2019). Given the

minor residual impact area of 148 ha to mulga woodland, compared to the existing adjacent mulga woodland habitat (21,673 ha), the risk of impact to the Greater Bilby from the activity is considered minor.

The significance of the total residual impact of 352 ha was assessed against the Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act (CoA 2013) and is presented in Table 4.5. Based on the available information the activity will not result in significant residual impact to the Greater Bilby. Application of the mitigation hierarchy has predicted that the residual impact to Greater Bilby is not significant at a species or population level.

Table 4.5: Significance of Residual Impact (Greater Bilby)

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
Comparison of loss to regional representation of habitat	The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	Total of 204 ha residual impact to sand plain habitat from the activity. 1,632 ha of sand plain habitat remain within the activity area. Regionally there is 104,579 ha of sand plain habitat. Total of 148 ha residual impact to mulga woodland habitat from the activity. 2,517 ha of mulga woodland habitat remain within the activity area. Regionally there is 21,673 ha of mulga woodland habitat.	L
Pre-existing condition of habitat impacted	The availability or quality of habitat to the extent that the species is likely to decline	The proposed habitat to be impacted is in 'good to excellent condition' (GHD 2019). Approximately 50% of the sand plain habitat has previously been burnt with the remainder appearing to be a mosaic of previous fire scars (GHD 2019). Mulga woodland habitats showed evidence of grazing and soil compaction from cattle (GHD 2019)	M
Fragmentation of surrounding habitat	Fragment an existing important population^ into two or more populations	No individuals have been identified within the impacted habitat area. Surrounding habitat areas extend to the north, and east and south of the impact areas. Habitat fragmentation from the activity is unlikely as large areas of habitat will remain intact and continuous. See section 4.3.2 and 4.3.4	L
Presence of records in the habitat impacted	Reduce the area of occupancy of an important population^	No individuals have been identified within the impacted habitat area. The nearest record of the Greater Bilby is from an historical inactive burrow located over 5.5 km to the east of the proposed activity area (Biologic, 2018). See section 4.4.5. Surrounding habitat areas extend to the north, and east and south of the impact areas. Habitat fragmentation from the activity is unlikely as large areas of habitat will remain intact and continuous. See section 4.3.2 and 4.3.4	L

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
Presence of breeding individuals in the habitat impacted	Disrupt the breeding cycle of an important population^	No individuals have been identified within the impacted habitat area. Lack of records of the Greater Bilby suggest that the species is not breeding within the activity area. See section 4.3.5.	L
Value as a breeding or foraging area	Disrupt the breeding cycle of an important population^ The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	Total of 204 ha residual impact to sand plain habitat from the activity. 1,632 ha of sand plain habitat remain within the activity area. Regionally there is 104,579 ha of sand plain habitat. Total of 148 ha residual impact to mulga woodland habitat from the activity. 2,517 ha of mulga woodland habitat remain within the activity area. Regionally there is 21,673 ha of mulga woodland habitat. Lack of records of the Greater Bilby suggest that the species is not breeding within the activity area. See section 4.3.5.	L
Avoid the introduction of disease and invasive species	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat Introduce disease that may cause the species to decline	Mulga woodland habitats showed evidence of grazing and soil compaction from cattle (GHD 2019) Due to the area currently being subject to mining and pastoral activities, no new diseases or invasive species are likely to be introduced that could cause a decline in the species.	L
Long term viability of the species	Interfere substantially with the recovery of the species.	No individuals have been identified within the activity area. The nearest record of the Greater Bilby is from an historical inactive burrow located over 5.5 km to the east of the proposed activity area (Biologic, 2018). Regionally there is sufficient habitat to allow recovery of the species. See section 4.3.5.	L

[+] Significant impact guidelines 1.1 (DoE, 2013)

[#] Biologic 2018, 2019 and GHD 2019

* L/M/H – low/moderate/high

^ 'a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range. '

4.3.9 Review of Program Matter Outcomes

Following the impact assessment (section 4.3.6 and 4.3.8) and application of the mitigation hierarchy (section 4.3.7) a review of the activity against the PMO was undertaken. Table 4.6 details a review and identifies which of the PMO are relevant for the activity and considers further management.

Table 4.6: Review of Program Matter Outcomes (Greater Bilby)

Program Matter Outcome	Applicable Notifiable Action Trigger	Assessment
No loss of Greater Bilby population/s as a result of Program activities.	None applicable	No individuals have been identified within the impacted habitat area. The nearest record of the Greater Bilby is from an historical inactive burrow located over 5.5 km to the east of the proposed activity area. Overall, no Greater Bilby populations have been identified within the activity area, therefore no loss of Greater Bilby populations will result from the activities.
Loss of Greater Bilby habitat is offset by measures that maintain or enhance the distribution and conservation status of the Greater Bilby.	Presence of Greater Bilby habitat within or adjacent to the activity.	Total of 204 ha residual impact to sand plain habitat from the activity. 1,632 ha of sand plain habitat remain within the activity area. Regionally there is 104,579 ha of sand plain habitat. Total of 148 ha residual impact to mulga woodland habitat from the activity. 2,517 ha of mulga woodland habitat remain within the activity area. Regionally there is 21,673 ha of mulga woodland habitat. The loss of Greater Bilby habitat is minimal and does not constitute a significant residual impact, therefore no offset is required to maintain or enhance the distribution and conservation status.

4.3.10 Monitor

Due to the absence of Greater Bilby population within and adjacent to the activity area, the distance to the nearest Greater Bilby record (5 km east) and the significant continuous existing preferred habitat to the north, south and east of surrounding the activity area, no monitoring of the species is considered to be required.

4.3.11 Summary

BHP considers the activity will meet the PMO for Greater Bilby population, as no individuals have been identified within or adjacent to the activity area to indicate the presence of a population. Pre-ground disturbance clearance surveys, required by NVCP for the Greater Bilby as described in section 4.3.7 will continue during implementation of the activity.

BHP considers the activity will meet the PMO for Greater Bilby habitat loss. The mitigation hierarchy has limited the loss of habitat to 708 ha in activity area, with 352 ha being residual impact. Given the extensive suitable habitat surrounding the activity area to the north and east, this residual impact is not considered significant. Therefore, there is no requirement to offset habitat loss as per section 3.2 of the Program.

4.4 Ghost Bat

4.4.1 General Species Information

The Ghost Bat is the largest microbat in Australia and the second largest in the world (DotE 2016a). In the Pilbara region, the species occurs in all four sub-regions, and was recorded in 21 of the 24 areas surveyed by the Department of Parks and Wildlife during the Pilbara Biological Survey (2002-2007; see McKenzie & Bullen 2009). The largest populations occur within the Chichester sub-region, where known populations are largely restricted to disused mines.

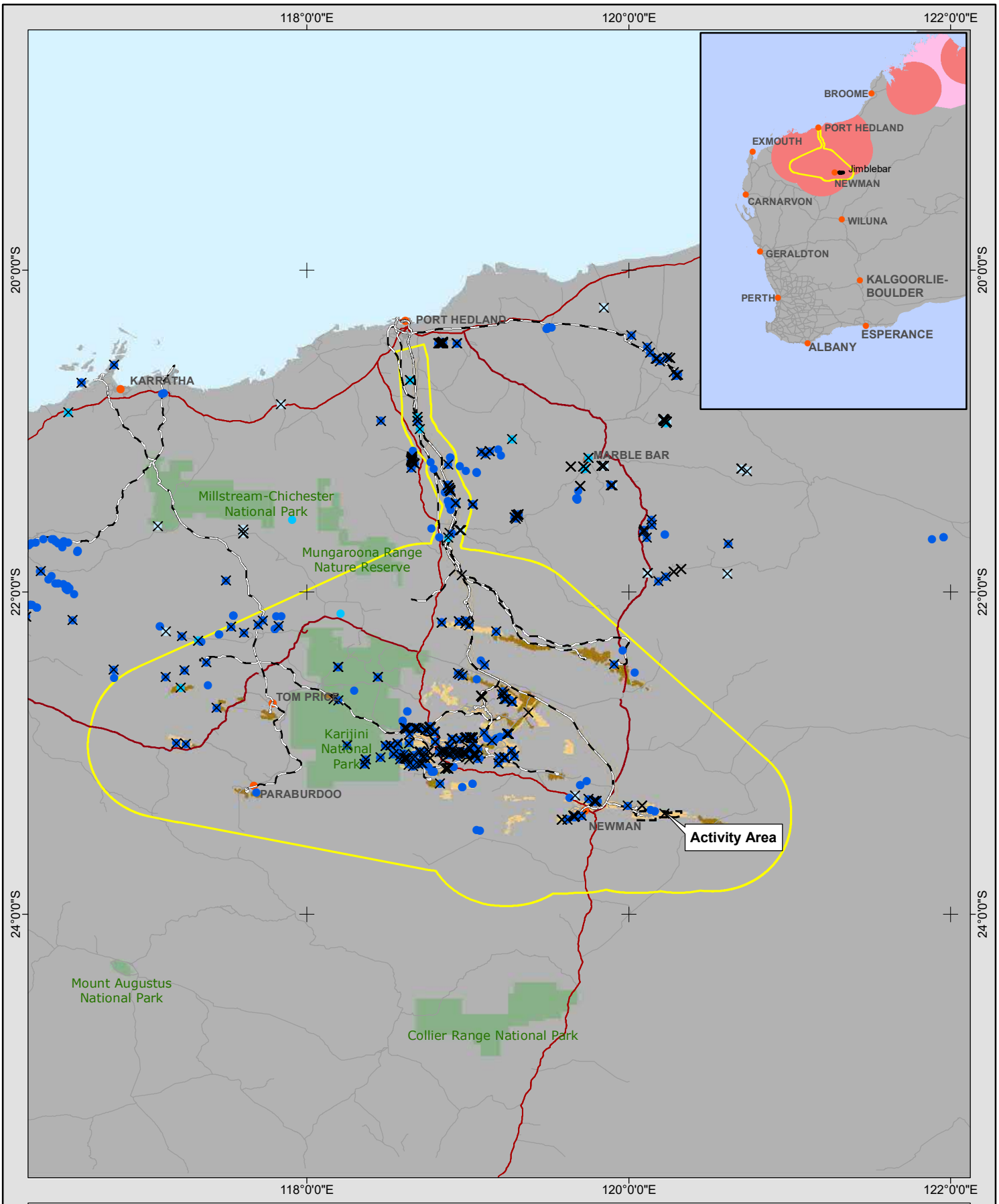
The largest colonies of Ghost Bats in the Pilbara occur outside the SAA where they mostly roost in abandoned mines. Colonies within the SAA are much smaller, and available data suggest that they likely depend on a number of roosts within their range. Ghost Bat populations in the Chichester subregion, which occur outside of the Strategic Assessment Area, are considered significant; if impacted by habitat loss (due to collapse or reworking of mine adits) or from the arrival of cane toads, those populations within the Strategic Assessment Area will over time potentially become more important regionally. Figure 4.7 details the regional records of Ghost Bat.

4.4.2 Regional Habitat

During the Strategic Environmental Assessment, the Ghost Bat was listed as a Vulnerable species under the EPBC Act on 5 May 2016 and was therefore included as a program matter for the Impact Assessment Report. As this species was a late inclusion in the Impact Assessment Report, a regional model was not developed; however, BHP conducted an impact assessment based on species records in order to determine cumulative impacts of the Program on the Ghost Bat.

BHP conducted a review of Ghost Bat records from the company's database and publicly available data supplied by the State Department of Parks and Wildlife (DPaW) (now DBCA) and Western Australian Museum in December 2015 and January 2016 respectively. The review identified 1,028 records for Ghost Bats, of which 465 occurred within the SAA. One hundred and seventy-five (175) records are predicted to be directly impacted by iron ore mining (reasonable foreseeable third party and BHP Full Conceptual Development) in the Pilbara. The data shows that the majority of the potential impact would be from BHP.

The Rangeland land systems within 25 km of the activity area are detailed in Table 4.2 and Figure 4.8. Of these land systems, the River, Fortescue and Newman land systems provide a significant quantity (63,261 ha) of preferred Ghost Bat foraging and roosting habitat adjacent to the activity area. The River, Fortescue and Newman land systems located to the north, west and south of the activity area are not currently subject to mining or mining exploration, which makes this a long-term habitat for the Ghost Bat.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Ghost Bat regional records and distribution

Scale @ A4: 1:3,500,000	Prepared: J.VIS	Project No: A949/093 Rev A	
Date: 19/11/2019	Checked:	Figure: 4.7	
Revision: REV A	Reviewed: ENVIRO. A&I		

Ghost Bat records
- Records After 2005
- Records Between 1980 - 2004
- Records Prior 1979
- Records Missing Date
- Town
- Species or species habitat likely to occur
- Species or species habitat may occur

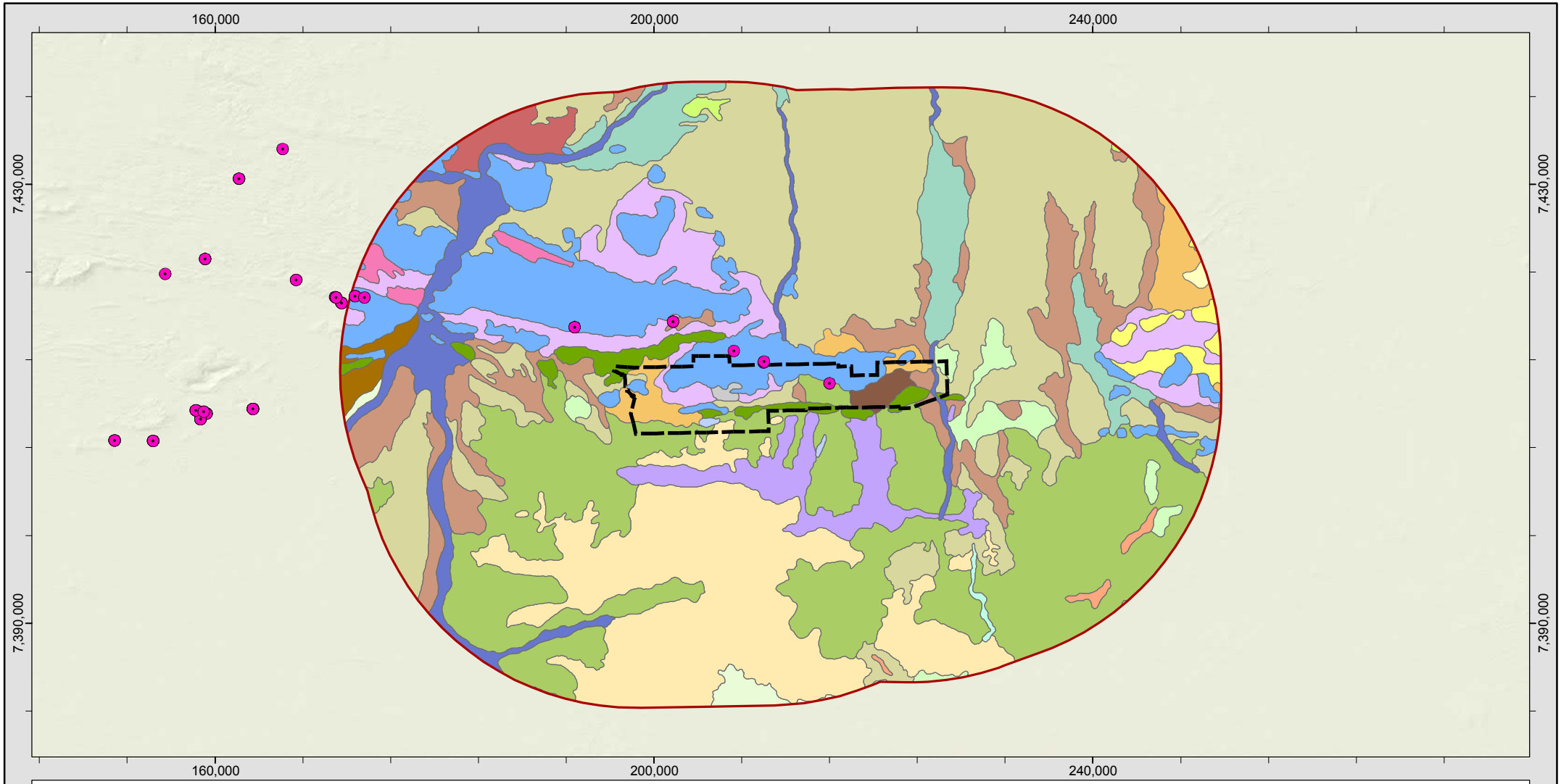
- Major Road
- Minor/Regional Road
- Rail Centreline
- Strategic Assessment Area
- BHP LOA Mine Plan disturbance footprint
- Third Party disturbance footprint
- Activity Area

N

0 25 50 75
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_093_E_VN_SEA_Species_Ghost_Bat_RevA.mxd



Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTMISATION PROJECT
Ghost Bat Regional Land Systems

Scale @ A4: 1:500,000	Prepared: J.VIS	Project No: A949/97 REV A
Date: 13/11/2019	Checked:	Figure : 4.8
Revision: REV A	Reviewed: ENVIRO. A&I	

Ghost Bat records
Activity Area
Activity Area Buffer 25km

Land System

- Adrian
- Balfour
- Boolgeeda
- Cadgie
- Charley
- Disturbed Land
- Divide
- Elimunna
- Fan
- Fortescue
- Jamindie
- Laterite
- McKay
- Newman
- Prairie
- River
- Robertson
- Rocklea
- Spearhole
- Sylvania
- Table
- Talga
- Washplain
- Zebra

N
0 2 4 6
Kilometres
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_097_E_VN_GhostBat_RangelandsLandSystems_RevA.mxd

4.4.3 Species Specific Surveys Completed

The bat search and acoustic recorder locations are shown in Figure 4.9.

Cave searches

Caves identified as potentially suitable for Ghost Bat were first observed opportunistically while driving through the site, and then further investigated by foot where possible. Assessment of suitability for Ghost Bat included cave dimensions, the presence of guano and evidence of feeding. If possible, Song Meters and/or cameras were set within or at the mouths of caves to collect further evidence of cave use. Where potential roost sites were located a visual inspection for signs of use by Ghost Bat and other microchiropteran bat species was undertaken including:

- evidence of current or historical occupation (e.g. bat species within the cave; presence, age, type and amount of scat; presence of Ghost Bat feeding);
- preliminary assessment of cave structure and microclimate characteristics; and
- evidence of other species occupying the site.

Adit

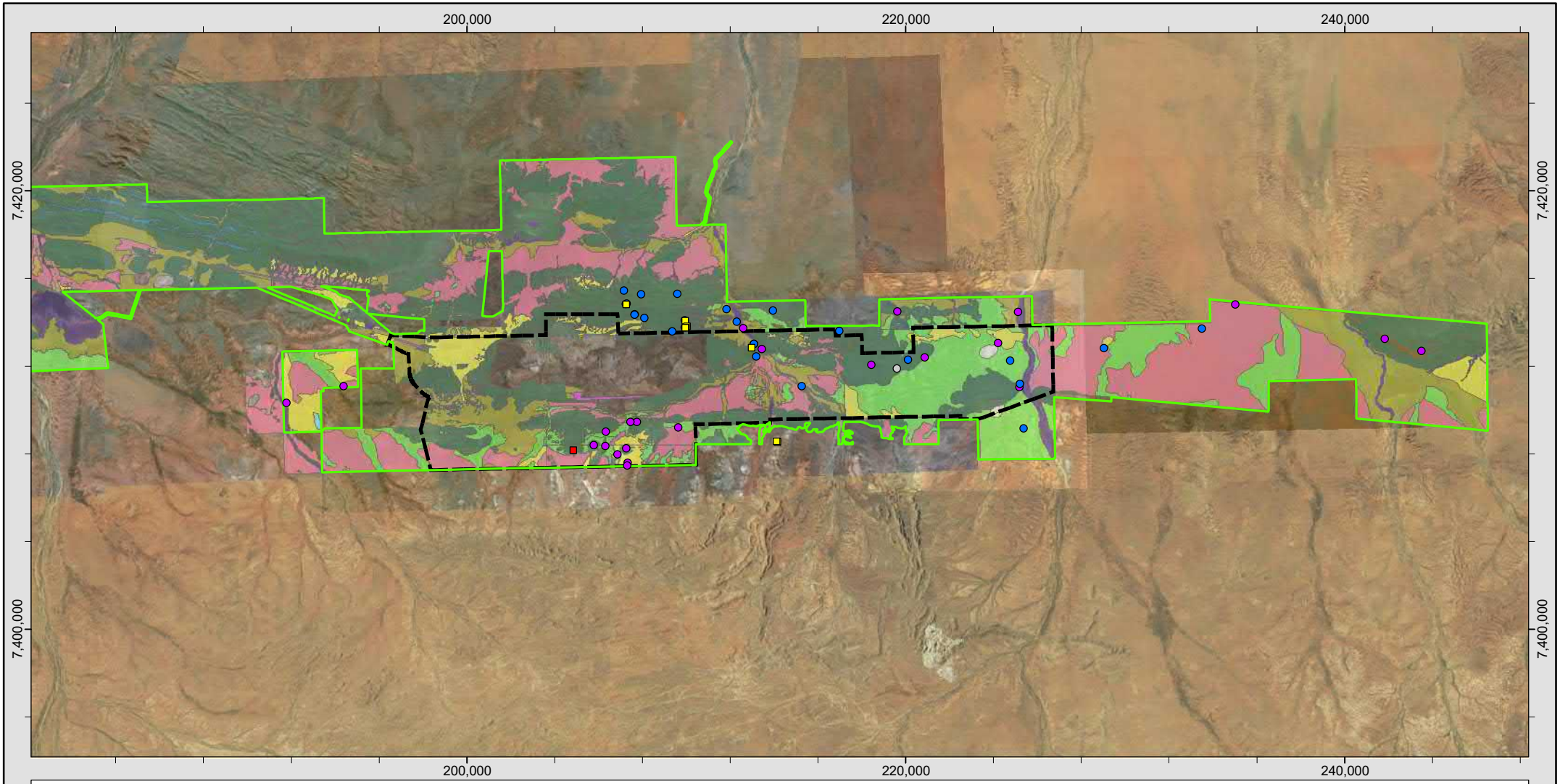
A survey of an adit was undertaken using three complementary survey methods:

- Visual inspection – The adit was inspected by a Senior Ecologist on the 2 May 2019 to undertake a preliminary assessment of the roost type and determine the siting of survey equipment. Surveys were not undertaken of the adit structure or microclimate beyond the entrance due to safety concerns.
- Acoustic monitoring – A full spectrum Titley Scientific AnaBat Swift bat detector was placed just inside the entrance of the adit for four consecutive nights (2 – 5 May 2019). The detector was placed inside the adit behind a dirt mound to target Ghost Bat, increasing the likelihood of recording calls from bats occupying the adit and to record calls from bats emerging in the evening and during the re- emergence period early morning.
- Emergence monitoring – Counts of emerging bats from the adit were undertaken over two consecutive nights (5 – 6 May 2019) for at least 40 minutes following sunset using infrared night vision goggles or a red filtered torch. The purpose of undertaking the counts was to record the number of bats exiting the roost during the emergence period and attempt to discriminate between the different species using the roost through comparison of different sized bats. A hand held EchoMeter Touch (EMT) bat detector was used to record and actively monitor bat calls during the emergence survey (5 May 2019).

Bat acoustic recorders

Bat Detectors (SM4 Songmeters) were deployed targeting a range of micro bats, including Ghost Bat. Detectors were set for a minimum of one night at each of the systematic trapping sites. Additional recorders were set at selected locations such as Jimblebar Creek or the adit, where sampling over six nights was undertaken. Bat detectors were positioned in areas where bat species were likely to be present i.e. water bodies, fly-ways such as rocky gullies, and at potential roost caves. Bat detectors were programmed to record from 25 minutes pre-dusk to 25 minutes post-dawn. For each detector the time and date deployed and recovered, and the GPS coordinates were recorded.

Data from the bat detectors were downloaded to a computer and analysed for the presence of animals following the field survey. Data from the detectors was analysed by Specialised Zoologists to determine species using Kaleidoscope ® bat analysis software and a series of graphical reference comparison calls.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROPOSAL
Ghost Bat Survey Area

Scale @ A4: 1:250,000	Prepared: J. VIS	Project No: A949/101 REV B
Date: 21/02/2020	Checked:	Figure : 4.9
Revision: REV B	Reviewed: ENVIRO. A&I	

Targeted Bat Cave Site
- 2018
- 2019

Bat Sample Site
- 2006
- 2018
- 2019
- Ghost Bat Survey Coverage
- Activity Area

Habitat Type
- Artificial Wetlands
- Breakaway/ Cliff
- Calcrete Plain
- Claypan
- Drainage Area/ Floodplain
- Gorge/ Gully
- Hardpan Plain
- Hillcrest/ Hillslope
- Major Drainage Line
- Medium Drainage Line
- Minor Drainage Line
- Mulga Woodland
- Sand Plain
- Stony Plain

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_101_E_VN_GhostBat_SurveyCoverage_RevB.mxd

4.4.4 Local Habitat and Ghost Bat Records

Armstrong and Anstee (2000) refer to the presence of two natural maternity roosts in the Hamersley Range, with one further roost in the Chichester Range. Recent work undertaken by Biologic in conjunction with the University of Queensland has documented the presence of pregnant females at seven caves in BHP's tenure in the eastern Hamersley Range during 2014 and 2015.

A single Ghost Bat was recorded from within the proposed activity area as a sighting of an individual traversing over the Hillcrest/ Hillslope habitat type (Ecologia, 2006a), east of Jimblebar Creek within the Existing Project Boundary (Figure 4.9). A subsequent review of recordings taken from the nearby adit during the ecologia (2006a) survey determined that this survey falsely recorded the Ghost Bat (Outback, 2009; Specialised Zoological, 2009) and therefore this historical record is considered unconfirmed.

There are two potential day roosts (one adit and one cave) located within the proposed activity area (Figure 4.11). Despite surveys occurring over the last 15 years, neither structure has any evidence of use by Ghost Bats, i.e. scats, feeding remains or acoustic records (Biologic, 2018 and 2019; GHD, 2019). Additionally, the entrance to the adit is a small oblong shaped opening (approximately 0.75 m high x 1.5 m wide) (GHD 2019) and been assessed as potentially being too small to allow Ghost Bats to enter (Biologic, 2018).

Seven caves have been recorded outside of the proposed activity area in two locations to the north and one location to the south (Figure 4.11). Five caves recorded to the north have been classified as potential day roosts, based on the structure and features of the caves and their suitability to support Ghost Bats. Of these, three have evidence of 'old' or 'very old' Ghost Bat scats and the remaining two caves have no evidence of use (GHD, 2019). A small amount of feeding evidence (assessed as potentially from Ghost Bats) was recently recorded under an overhang (GHD, 2019) north of the proposed activity area (Figure 4.11). Approximately 70 m from the feeding evidence is a potential cave in the rock face that was not possible to be investigated safely (GHD, 2019). To the south, two caves have been recorded; one as a potential day roost with no evidence of use and the other as a large potential day roost or potential maternity roost (GHD, 2019). Recent scats from the Ghost Bat have been recorded at this cave.

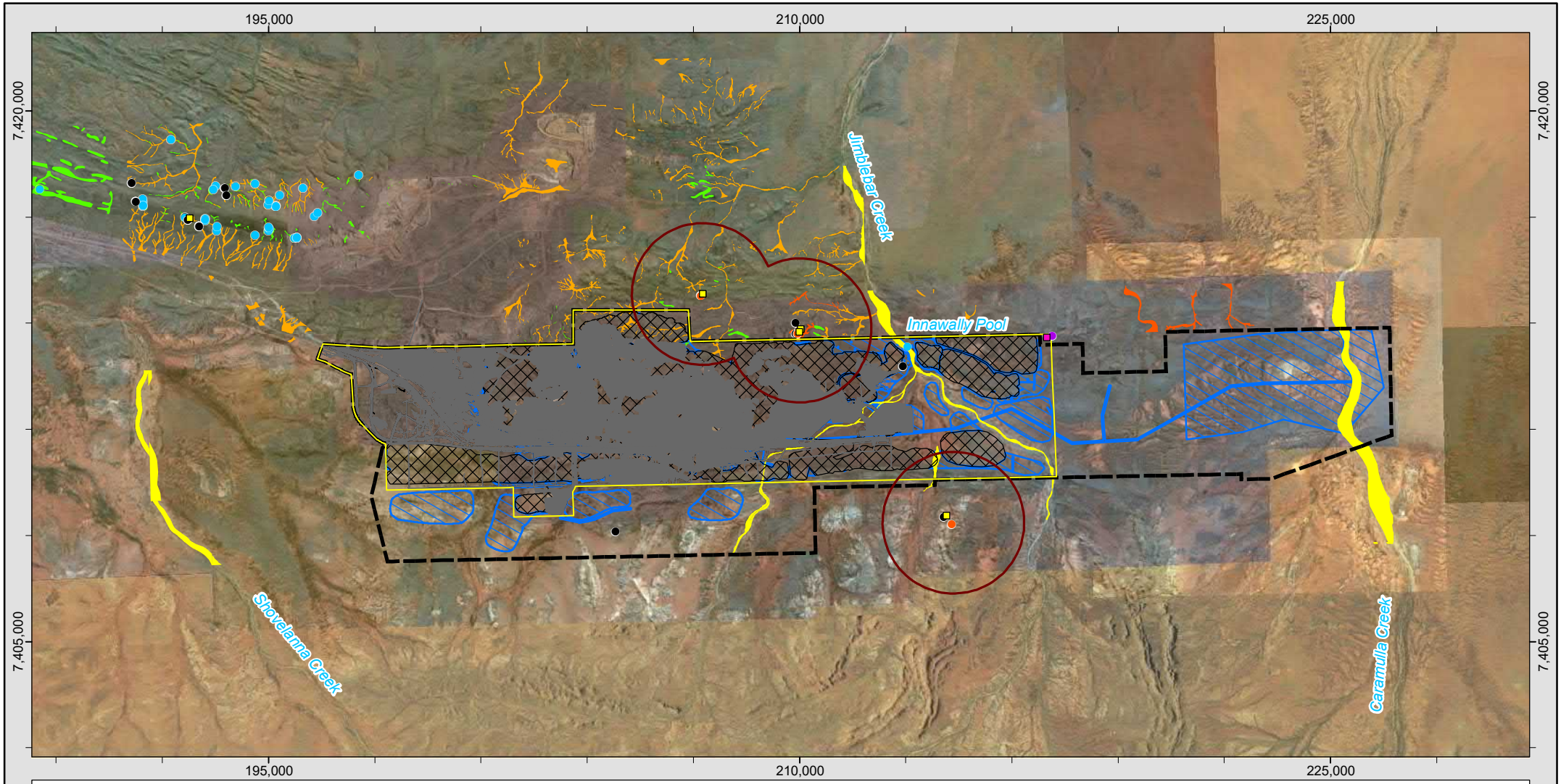
Potential foraging habitat for the Ghost Bat within the proposed activity area was identified as the gorge/gully (4.5 ha), major drainage line (210 ha), which support large trees (e.g. along Jimblebar and Caramulla Creek) or within the breakaway and along the valleys with deep gullies (GHD, 2019) (Figure 4.10). The small areas of breakaway within the hillslope and hillcrest habitat type provide potential foraging habitat for the Ghost Bat, but typically the low hills of the hillslope and hillcrest in the proposed activity area do not have the vegetation structure to support the species' foraging habits (GHD, 2019). Breakaways and hillslope and hillcrest habitats are not considered suitable habitat for the Ghost Bat in this Validation Notice.

Figure 4.10: Major Drainage Line Habitat

Due to the likely presence of Ghost Bats within nearby caves, there is the potential that Ghost Bats may forage over suitable habitat within the proposed activity area. Studies on Ghost Bat foraging found that the species move up to 2 km from a roost cave utilising large trees as vantage points to hunt (Churchill, 1998). This foraging estimate is based on studies of the species in the Northern Territory that showed that Ghost Bats were foraging a distance of approximately 1.9 km from the roosts (Tidermann et al, 1985). Based on roosts that have evidence of use by Ghost Bats (Figure 4.11), the estimated total foraging area within 2km of roosts is calculated to be 3,599 ha. Approximately 974 ha of the 3,599 ha is located within the activity area, of which 898 ha is located within the existing Jimblebar Operations (already cleared or previously assessed) and considered out of scope of this Validation Notice. Of the 76 ha remaining area, 4.5 ha is suitable Ghost Bat foraging habitat (major drainage line [3.5 ha] and gorge/gully [1 ha]) for this species. There are a total of 1 ha of gorge and gully and 33 ha of major drainage line habitats within the total indicative disturbance footprint of the Activity Area. Table 4.7 details the total suitable habitat within the activity area and the suitable habitat proposed for disturbance within a 2km radius of known roosts.

Table 4.7: Ghost Bat Habitat Assessment

Habitat Description	Total within the Activity Area (ha)	Indicative Disturbance within a 2km radius of known roosts within the Activity Area (ha)	Indicative Disturbance within the Activity Area (ha)
Gorge and Gully	4.5	1	1
Major drainage line	210	3.5	33
Caves (with evidence of potential roosting)	0 (7 outside)	0 (0 outside)	0 (7 outside)



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Potential Ghost Bat Caves and Regional Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/72 REV B
Date: 15/11/2019	Checked:	Figure : 4.11
Revision: REV B	Reviewed: ENVIRO. A&I	

- Existing Project Boundary
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Disturbance Footprint

Habitat Types
- Gorge/ Gully
- Major Drainage Line
- Medium Drainage Line
- Minor Drainage Line

Significant Fauna Species Observations
- Ghost Bat
- Ghost Bat (Unconfirmed)

Habitat Feature
- Cave with evidence of Ghost Bat
- Cave with no evidence of Ghost Bat
- Cave unable to be accessed
- Water features
- Ghost Bat foraging range (2km)

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_072_E_VN_FaunaHabitatMappingCaveBuffer_RevB.mxd

4.4.5 Impact Assessment

Habitat Loss

The primary direct impact to the Ghost Bat from the activity is the loss of foraging habitat. The activity construction will require disturbance of approximately 4.5 ha of foraging habitat. 177 ha of major drainage line habitat will remain intact within the activity area, with 3.5 ha to be disturbed within the 2km Ghost Bat buffer foraging range, and less than 33 ha, overall, in total to be disturbed in the activity area. Ground disturbance for the activity will result in the loss of foraging habitat for the Ghost Bat, and may consequently cause a reduction in its area of occupancy. The suitable foraging habitat found within the activity area is contiguous with surrounding areas and are not considered uncommon in this region.

The Ghost Bat is highly mobile and regularly moves from cave to cave. Roost selection seems to be subject to environmental influence and may occur across the landscape subject to resource / food availability. No roosts will be directly impacted by the activity. The retention of the major drainage line habitat will retain the connectivity between identified potential roosting areas north and south of the activity area. There are no important breeding or roosting populations, or critical habitat for the Ghost Bat within the proposed activity area, therefore BHP considers that the activity will not have a significant impact on this species at a local or regional scale.

Noise and Vibration

Noise and vibration are potential indirect impacts to the Ghost Bat. Responses to noise and vibration vary among vertebrate fauna species and individuals according to a number of factors (Busnel and Fletcher 1978). These include:

- the characteristics of the noise and its duration;
- life history characteristics of the species;
- habitat type;
- season;
- activity at the time of exposure;
- sex and age of the individual;
- level of previous exposure; and
- whether other stresses are present at the time of exposure.

Ghost bats are utilising caves within 1 km of the existing Jimblebar mining operations. The MAR and OSAs are not expected to increase the noise and vibration at these locations to an extent that would result in Ghost Bats leaving their roosts. Therefore, the impacts from sound emissions are unlikely to be significant.

Groundwater Changes

Potential impacts to groundwater through mining activities may affect the Ghost Bat via indirect impacts to the species' habitat. MAR will increase the groundwater levels at Caramulla, where Major Drainage Line habitat is present. Caramulla MAR will be managed with a view to limiting mounding to a maximum of 25m below the ground surface (bgs). Given the root zone depth of vegetation species within the Major Drainage Line habitat (Eucalyptus victrix and Eucalyptus camaldulensis - up to 15 m below ground level), the groundwater mounding from the Caramulla MAR (up to 25 mbgs) will limit any impacts to vegetation and therefore any indirect impact to potential Ghost Bat habitat. As there are no groundwater-fed surface water features within the activity area the MAR is unlikely to change the hydrogeological features (e.g. extent or duration of water present) of the pools.

Dust

Vegetation clearing, hauling and vehicle movements may result in an increase in airborne particulate matter. Dust can indirectly affect fauna by altering the structure and composition of native vegetation. A result of this there could be a decline in vegetation quality, although no prior studies have been able to detect a significant adverse impact of airborne dust on plant function in the Pilbara (Grierson 2015). If vegetation was to be affected this could impact fauna

assemblages by reducing both food and habitat resources. The impacts of dust on the Ghost Bat are considered to be low.

Light

Artificial light may indirectly impact fauna through disrupting navigation, causing a barrier to movement, impacting foraging activity, potentially restricting the use of roosts and nests and exposing animals to nocturnal predators (Rich and Longcore 2006). Lighting for the MAR and OSAs will be established to allow for safe working areas. The magnitude of the indirect impacts to Ghost Bats associated with artificial light are considered to be minor and will be managed according to existing management strategies.

Infrastructure

Ghost Bats are known to become entangled in barbed wire due to their low elevation flying pattern (Armstrong and Anstee, 2000). Recently, a mummified adult male was retrieved from a barbed wire fence in the Juna Downs pastoral lease approximately 120km northwest (Biologic, in prep). Barbed wire fencing will not be utilised in the activity area. With limited use of barbed wire across the activity area the impacts to the Ghost Bat are considered to be minor.

Surface Water Changes

Changes to surface water flows may cause changes to fauna habitat values, particularly in riparian zones. Alteration of fauna habitat may occur due to increased temporal availability of surface water from discharge of surplus water. The presence of water from the discharge may temporarily alter the fauna habitat, particularly in major drainage lines, and increase fauna visitation to the area.

Alterations to landforms and construction of infrastructure can lead to increased erosion and deposition of sediments in waterways. Only a minor drainage line diversion is required and the estimated cumulative decrease in runoff volume is less than 3%, which is within the natural variation of seasonal runoff. Therefore, the disruption to natural surface flows and reduction in the availability of surface water downstream will be minimal. The changes to surface water regimes from the construction of infrastructure are not considered to be significant.

Overall, the impact to the Ghost Bat from changes in surface water within the activity area is expected to be minor. BHP standard practices for surface water management will be implemented to minimise water quality impacts to downstream receptors.

4.4.6 Mitigation Hierarchy

Avoid

In early 2018, BHP identified a need for additional disturbance for OSAs south of the Jimblebar South pits due to:

- a lack of available area to allow expansion of OSAs, specifically adjacent to South Jimblebar, with the northern area constrained by existing infrastructure and the southern area constrained by the existing approved project area;
- a higher waste to ore ratio at South Jimblebar;
- backfill options being limited by pit stage sequencing requirements (a partial backfill schedule was developed to reduce the size of the OSAs required); and
- long-term impracticality of hauling waste material to backfill the depleted pit WH4 at the Wheelarra Hill deposit area.

Initial overall project disturbance requirements was estimated to be 3,000 ha. The initial mine plan was developed to maximise pit availability during the life of mine, therefore backfilling of mine pits was restricted. From this point, the mine plan was optimised to maximise the backfilling of pits. This involved scheduling the early completion of pits so they can be immediately backfilled. This optimisation of backfilling reduces the disturbance required to construct OSAs to 2,000 ha. OSAs have been located to avoid the disturbance of major drainage line habitat (177 ha retained of 210 ha within the activity area) which will maintain Ghost Bat foraging habitat corridors within the activity area and retain foraging corridors from potential roost to the north and south of the activity area.

Minimise

The primary potential impact to the Ghost Bat from the activity is loss of suitable habitat. The management measures proposed to minimise this impact include:

- minimise direct impacts to suitable habitat, where practicable through planning and implementing the PEAHR internal process prior to land disturbance;
- restrict groundwater mounding from MAR injection to 25 mbgl.
- limit the use of barbed wire fencing within and surrounding the activity area; and
- minimise clearing of native vegetation, by utilising existing infrastructure, facilities and cleared areas, and maximising the disposal of waste rock within mine pits, where practicable.

Rehabilitate

Successful rehabilitation will allow for the potential reinstatement of suitable Ghost Bat habitat at the end of the mine. The construction and installation of MAR and other linear infrastructure will result in shallow linear disturbance, with minor changes to the topography of the landscape. This type of disturbance, which is very similar to the disturbance undertaken during mineral exploration drilling activities, have historically resulted in rehabilitation success and therefore the likelihood that the resulting rehabilitated habitat may allow use by the Ghost Bat.

Successful rehabilitation will result from the following management approaches relating to terrestrial fauna, particularly in relation to fauna habitat:

- integrate fauna habitats into landform design;
- design the revegetation program to establish native vegetation that blends with the surrounding areas and provide habitat and foraging areas for native fauna; and
- choose appropriate surface treatments, including selective placement of logs or smaller woody debris and/or boulders (if available) across the re-profiled surface and/or constructing rocky cliff features (where potential exists) to provide additional habitat areas for fauna species.

4.4.7 Residual Impact

The indicative disturbance footprint requiring direct disturbance of foraging habitats within the 2km forage range consists of other infrastructure (roads, laydown area etc.) (1 ha) and mine pits (3.5 ha). However, the total indicative disturbance footprint requiring direct disturbance of gorge and gully and major drainage line habitats within the activity area consists of MAR borefield infrastructure (23 ha), other infrastructure (roads, laydown area etc.) (1 ha) and mine pits (10 ha) (see Table 4.8). Successful rehabilitation of the MAR borefield infrastructure areas will return the habitat for potential use by the Ghost Bat. This results in an estimated residual impact to Ghost Bat habitat, from mine pits, of approximately 11 ha.

Table 4.8: Indicative Disturbance Footprint by Habitat and Activity

Habitat Description	Mine Pits (ha)	OSAs (ha)	MAR Borefield Infrastructure (ha)	Other Infrastructure (ha)	Indicative Disturbance (ha)	Residual Impact (ha)	Habitat Retained within Activity Area (ha)
Gorge/gully	-	-	-	1	1	1	3.5
Major drainage line	10	-	23	-	33	10	200
Total	10	-	23	1	34	11	203.5

The significance of the 11 ha of foraging habitat was assessed against the Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act (CoA 2013) and is presented in Table 4.9. Based on the available information the activity will not result in significant residual impact to the Ghost Bat. Application of the mitigation hierarchy has predicted that the residual impact to Ghost Bat is not significant at a species or a population level and that ongoing presence in the area can be maintained.

Table 4.9: Significance of Residual Impact (Ghost Bat)

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
Comparison of loss to regional representation of habitat	The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	11 ha of residual impact to foraging habitat. Regionally there is 63,261 ha of suitable foraging habitat within the River, Fortescue and Newman Range land systems.	L
Pre-existing condition of habitat impacted	The availability or quality of habitat to the extent that the species is likely to decline	Major drainage lines are generally in 'poor to good condition' (due to grazing), with the overall quality of the remainder of the activity area being in 'good to excellent condition'.	L
Fragmentation of surrounding habitat	Fragment an existing important population^ into two or more populations	Surrounding foraging habitat areas extends to the north and south of the impact areas, with active caves located to the north and south of the activity area. Retaining the major drainage lines will ensure connectivity and limit habitat fragmentation from north to south of the activity area	L
Presence of records in the habitat impacted	Reduce the area of occupancy of an important population^	No individuals have been identified within the impacted habitat area. The nearest record of a Ghost Bat is to the north of the activity area.	L
Presence of breeding individuals in the habitat impacted	Disrupt the breeding cycle of an important population^	No individuals have been identified within the impacted habitat area. Lack of breeding area (i.e. caves) within the activity area suggest that the species is not breeding within the activity area.	L
Value as a breeding or foraging area	Disrupt the breeding cycle of an important population^ The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	11 ha of residual impact to foraging habitat. Regionally there is 63,261 ha of suitable foraging habitat within the River, Fortescue and Newman Range land systems. Lack of breeding area (i.e. caves) within the activity area suggest that the species is not breeding within the activity area.	L

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
Avoid the introduction of disease and invasive species	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat Introduce disease that may cause the species to decline	Major drainage lines are generally in 'poor to good condition' (due to grazing). Due to the area currently being subject to mining and pastoral activities, no new diseases or invasive species are likely to be introduced that could cause a decline in the species.	L
Long term viability of the species	Interfere substantially with the recovery of the species.	No individuals have been identified within the impacted habitat area. Lack of breeding area (i.e. caves) within the activity area suggest that the species is not breeding within the activity area. Regionally there is sufficient habitat to allow recovery of the species.	L

[+] Significant impact guidelines 1.1 (DoE, 2013)

[#] Biologic 2018, 2019 and GHD 2019

* L/M/H – low/moderate/high

^ 'a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range. '

4.4.8 Review of Program Matter Outcomes

Following the impact assessment (section 4.4.5 and 4.4.7) and application of the mitigation hierarchy (section 4.4.6) a review of the activity against the PMO was undertaken. Table 4.10 details a review and identifies which PMO are relevant for the activity and considers further management.

Table 4.10: Review of Program Matter Outcomes (Ghost Bat)

Program Matter Outcome	Applicable Notifiable Action Trigger	Assessment
No loss of Ghost Bat population/s as a result of Program activities.	Presence of Ghost Bat individuals within or adjacent to the activity	No individuals have been identified within the impacted habitat area. The nearest record of a Ghost Bat is to the north of the activity area. Due to the presence of Ghost Bat in close proximity to the activity, the PMO for population loss is considered applicable. The caves will be monitored for ongoing presence of Ghost Bat to demonstrate the program matter outcome is being achieved (see section 4.49).
Loss of Ghost Bat habitat is offset by measures that maintain or enhance the distribution and conservation status of the Ghost Bat.	Presence of Ghost Bat roosts or foraging habitat within or adjacent to the activity.	11 ha of residual impact to foraging habitat. Regionally there is 63,261 ha of suitable foraging habitat within the River, Fortescue and Newman Range land systems. The loss of Ghost Bat habitat is minimal and does not constitute a significant residual impact, therefore no offset is required to maintain or enhance the distribution and conservation status.

4.4.9 Monitor

Due to the sporadic and low number of records of Ghost Bats within and adjacent to the activity area and statistical limitation on analyses of abundance, monitoring will focus on demonstrating an ongoing presence in the area rather than monitoring population size.

Monitoring for Ghost Bat will utilise scat deposition to infer the usage of caves. The sheet monitoring method allows for a scat deposition rate to be estimated which can be linked to the usage of the cave and therefore importance, i.e. regularly vs. occasionally used. Genetic analyses of scats allows for the determination of individuals based on genotype and the estimation of effective population size if an adequate sample size of individuals exist. The proposed monitoring methods are detailed in Table 4.11, with the monitoring to be implemented as detailed in Table 4.12.

Table 4.11: Ghost Bat Monitoring Methods

Method	Monitoring parameters
Visual assessment/Sheet method	Presence (sighting of individuals, scats) Scat deposition rate/usage Habitat characteristics Local meteorological data
Scat genetic analysis	Number of individuals (based on genotypes) Cave use (visitation)

Table 4.12: Ghost Bat Monitoring

Program Matter Objective	To support the long-term persistence and viability of the Ghost Bat within the SAA.
Notifiable Trigger	• Presence of Ghost Bat roosts[1] or foraging habitat within or adjacent[2] to the activity, or • Presence[3] of Ghost Bat individuals within or adjacent to the activity.
Program Matter Outcome	• No loss of Ghost Bat population/s as a result of Program activities.

Monitoring	Parameters	Performance Targets	Management Response	Location	Timing
Monitoring Ghost Bat presence and usage of the activity area.	Presence/absence of Ghost Bat.	Presence or evidence of presence of Ghost Bat at all seven Ghost Bat caves during one monitoring event.	Response actions to performance targets not being met may include, but are not limited to: • compare changes to results from other Ghost Bat monitoring programs; • increase the frequency of the monitoring; and/or • remediate foraging habitat to ensure that it contains feeding trees and suitable habitat for prey species within 2km of cave locations.	Ghost Bat caves adjacent to the activity area and foraging habitat within the activity area (see Figure 4.11)	Six monthly monitoring.

[1] Determined by pre-disturbance survey. Roosting habitat as described in the Conservation Advice for the Ghost bat.

[2] For the purpose of the Ghost bat, *adjacent to* means (a) within 5km from the activity and (b) to the extent of a modelled groundwater drawdown from implementing the activity.

[3] Presence is detected with evidence of Ghost bat guano, bat survey data, etc.

4.4.10 Summary

BHP considers the activity will meet the PMO for Ghost Bat population loss. Adjacent caves will be monitored for ongoing presence to demonstrate the PMO is being achieved.

BHP considers the activity will meet the PMO for Ghost Bat foraging habitat loss. The mitigation hierarchy has limited the loss of foraging habitat to 11 ha in the activity area and minimised the disturbance of major drainage lines to maintain Ghost Bat foraging habitat corridors within the activity area. Given the extensive suitable habitat surrounding the activity area and the retention of major drainage line habitats, this residual impact is not considered significant. Therefore there is no requirement to offset habitat loss as per section 3.2 of the Program.

4.5 Pilbara Olive Python

4.5.1 General Species Information

The Pilbara Olive Python is described by DotE (2014c) as being restricted to ranges within the Pilbara bioregion, although an isolated population is thought to occur south on Mount Augustus in the Gascoyne region (Bush & Maryan 2011), and additional records exist in the north-eastern Carnarvon region. Within the Pilbara bioregion, the species has been recorded from the Hamersley Range, Dampier Archipelago, Pannawonica, Millstream, Tom Price, Burrup Peninsula, and 70 km east of Port Hedland (DotE 2014c). The species is also known from riparian areas along the Fortescue River (Doughty et al. 2011).

Pilbara Olive Pythons are known to occupy a distinct home range ranging from 85 ha to 450 ha and to move around frequently within their home range (Pearson 2003). Figure 4.12 details the regional records of Pilbara Olive Python.

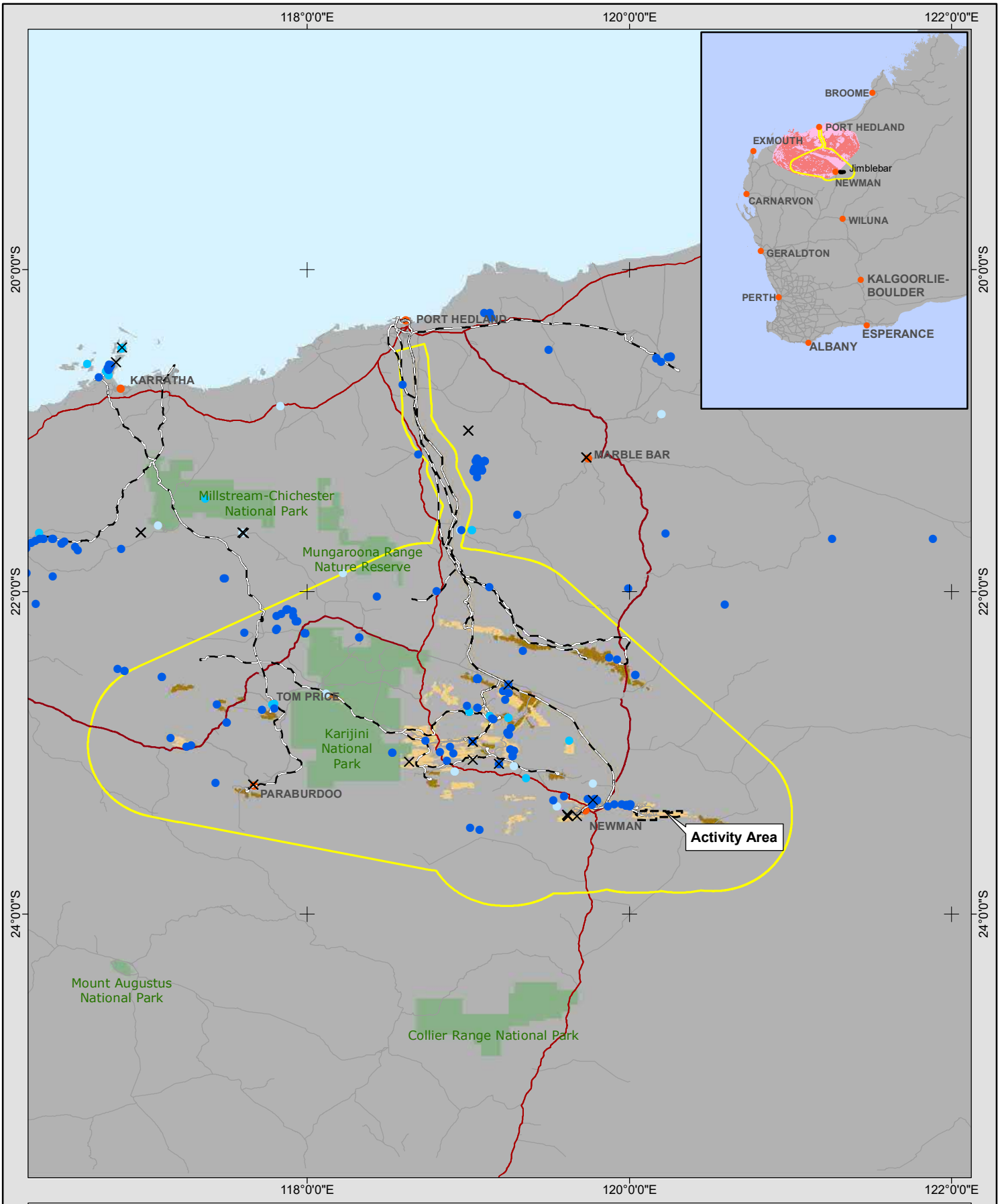
4.5.2 Habitat Modelling Data

In the Impact Assessment Report, Eco Logical (2015) modelled the habitat preference for the Pilbara Olive Python using 309 species records from publicly available and BHP data. The model indicated that preferred habitat (H4) was most heavily concentrated in the ranges of the southern and central areas of the Pilbara bioregion; however, preferred habitat was also predicted in association with river plains in the north and the ranges and outcrops of the eastern part of the Pilbara bioregion.

The cumulative impact assessment model predicted a potential decrease of 1,344 ha to H4 for the Pilbara Olive Python as a result of the Full Conceptual Development Scenario. This area of potential impact from the Program represents less than 1% of the area modelled as H4 within the Pilbara bioregion.

In addition to the regional modelling approach, BHP also conducted an impact assessment based on Pilbara Olive Python species records. The records data were obtained from the State DPaW and Western Australian Museum in December 2015 and January 2016 respectively. Based on the species records data, 22% of the known records within the Strategic Assessment Area are predicted to be impacted cumulatively by iron ore mining in the Pilbara. The data shows that the majority of the impact is from BHP. The python is a cryptic species that is difficult to specifically target during fauna surveys (TSSC 2008), so this number is unlikely to represent its abundance and distribution within the Pilbara. There is currently no population estimate for the Pilbara Olive Python although it is believed to have sizable populations in areas (e.g. the Burrup Peninsula), and some of these are restricted from threatening processes (Pearson 2003).

The baseline modelling data concluded that the cumulative impact to this species was considered to be moderate. Figure 4.13 and Table 4.13 shows the Pilbara Olive Python modelled habitat and regional records within the activity area.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Pilbara Olive Python regional records and distribution

Scale @ A4: 1:3,500,000	Prepared: J.VIS	Project No: A949/094 Rev A	
Date: 19/11/2019	Checked:	Figure: 4.12	
Revision: REV A	Reviewed: ENVIRO. A&I		

Pilbara Olive Python records
- Records After 2005
- Records Between 1980 - 2004
- Records Prior 1979
- Records Missing Date
- Town
- Species or species habitat likely to occur
- Species or species habitat may occur

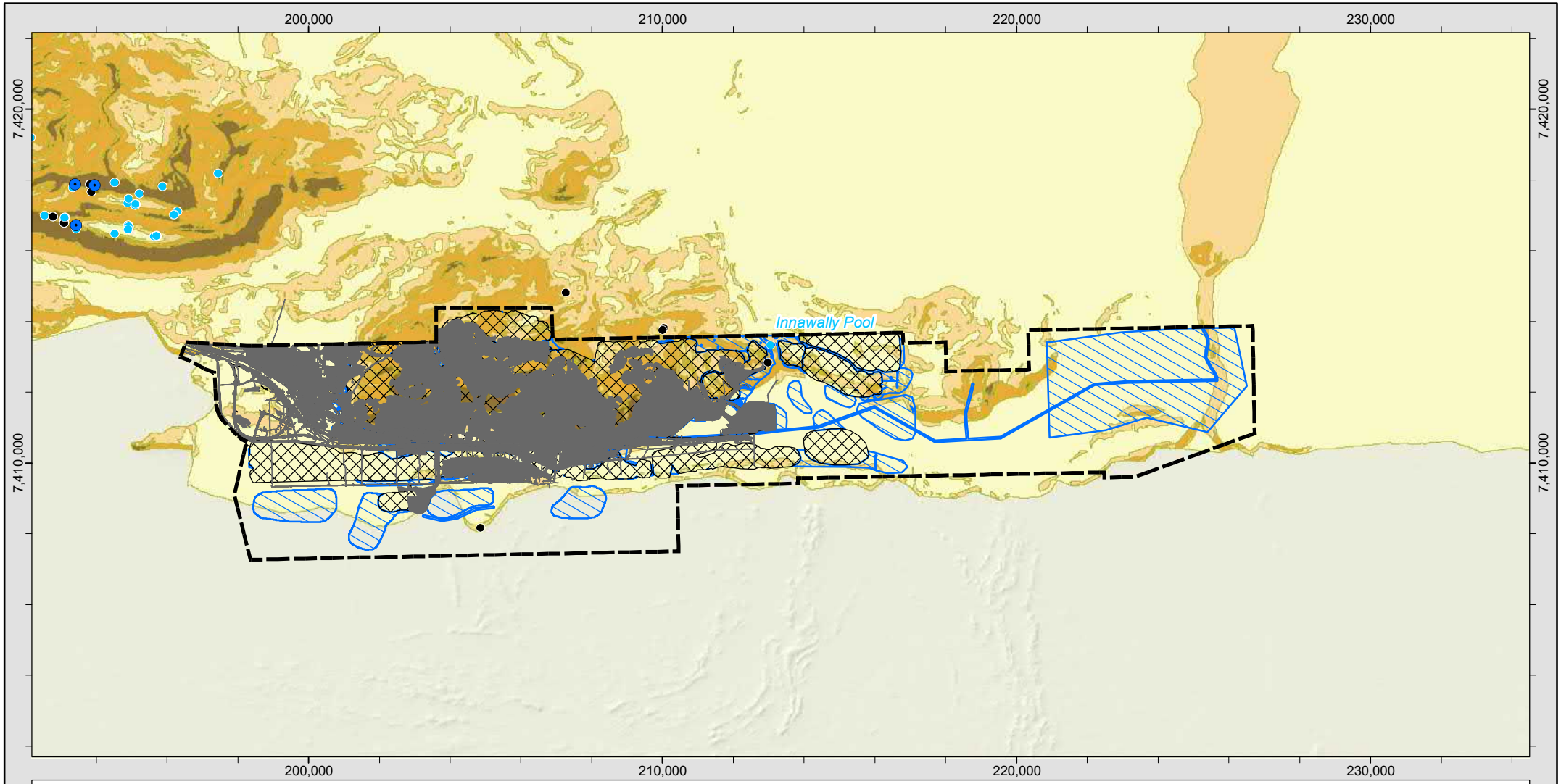
- Major Road
- Minor/Regional Road
- Rail Centreline
- Strategic Assessment Area
- BHP LOA Mine Plan disturbance footprint
- Third Party disturbance footprint
- Activity Area

N

0 25 50 75
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_094_E_VN_SEA_Species_Pilbara_Olive_Python_RevA.mxd



BHP

Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTMISATION PROJECT
Pilbara Olive Python Modelled Habitat and Regional Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/24 REV C
Date: 2/12/2019	Checked:	Figure : 4.13
Revision: REV C	Reviewed: ENVIRO. A&I	

- BHPIO Pilbara Olive Python Species Recording
- Cave
- Waterhole
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Disturbance Footprint

Pilbara Olive Python Potential Habitat Modelling

- 1 - Lowest Potential
- 2
- 3
- 4 - Highest Potential

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_024_E_JDP_VN_PythonModelled_RevC.mxd

4.5.3 Regional Habitat

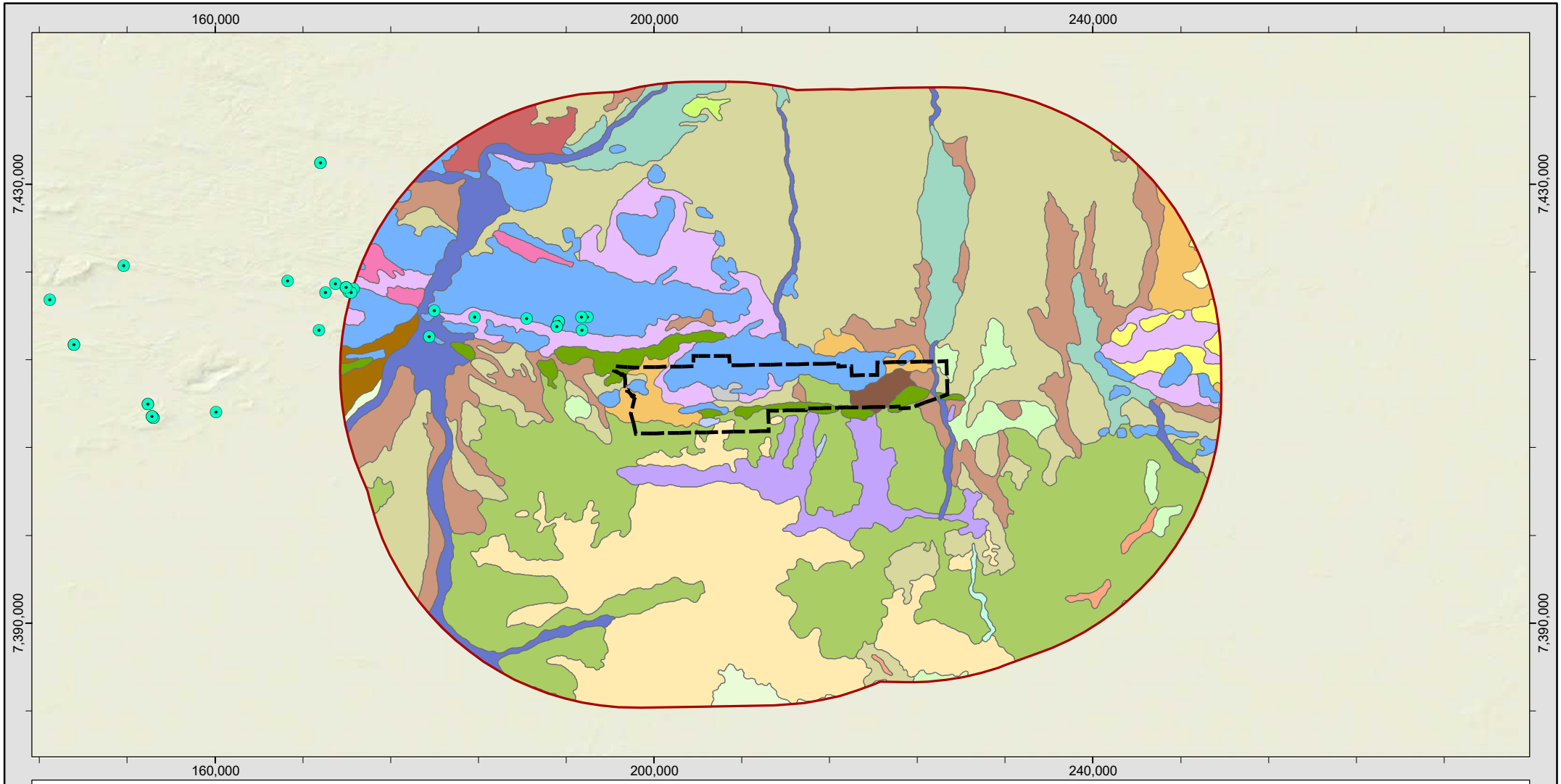
The Pilbara Olive Python is known from a number of sites throughout the Pilbara and is associated with drainage systems, including areas with localised drainage and semi-permanent watercourses (DotE, 2016). In the Hamersley IBRA subregion, the Pilbara olive python is most often encountered in the vicinity of permanent waterholes in rocky ranges or among riverine vegetation (DotE, 2016).

The Rangeland land systems within 25 km of the activity area are detailed in Table 4.2 and Figure 4.15. Of these land systems, the Newman land system provide a significant quantity (35,260 ha) of preferred Pilbara Olive Python habitat to the northwest of the activity area. The Newman land area located to the northwest of the activity area is not currently subject to extensive mining or mining exploration, which makes this a long term habitat for the Pilbara Olive Python.

Trugallenden Pool is located 18 km west, on the edge of the Fortescue River, however is outside of the influence of the activity. Jinerabar Pool, an intermittent pool, is located on Jimblebar Creek (on Ethel Creek Station) (Pinder et al., 2017) approximately 45 km downstream of the northern boundary of the proposed activity area (Figure 4.14). It is located 1.5 km upstream of the confluence between Jimblebar and Caramulla creeks and the Fortescue River, on the alluvial Fortescue Land System where flow merges during large floods. Jinerabar Pool is filled by surface runoff. There is evidence of heavy grazing of riparian vegetation (Pinder et al., 2017). No records of the Pilbara Olive Python have been identified at Trugallenden or Jinerabar Pools. Surface water feature within and adjacent to the activity area are shown on Figure 1.3.

Minor intermittent rock pools have been identified to the north west (3 km) of the activity area, in locations where Pilbara Olive Python have been recorded (Figure 4.12). These rock pools are located in Pilbara Olive Python preferred gorge and gully habitat. The closest record of a Pilbara Olive Python within this area is 5km.

Figure 4.14: Jinerabar Pool



Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTMISATION PROJECT
Pilbara Olive Python Regional Land Systems

Scale @ A4: 1:500,000	Prepared: J.VIS	Project No: A949/98 REV A
Date: 16/12/2019	Checked:	Figure : 4.15
Revision: REV A	Reviewed: ENVIRO. A&I	

Pilbara Olive Python records
Activity Area
Activity Area Buffer

Land System

- Adrian
- Balfour
- Boolgeeda
- Cadgie
- Charley
- Disturbed Land
- Divide
- Elimunna
- Fan
- Fortescue
- Jamindie
- Laterite
- McKay
- Newman
- Prairie
- River
- Robertson
- Rocklea
- Spearhole
- Sylvania
- Table
- Talga
- Washplain
- Zebra

N

0 2 4 6
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_098_E_VN_PilbaraOlivePython_RangelandsLandSystems_RevA.mxd

4.5.4 Local Habitat

Gorge and gully are the primary form of habitat for the Pilbara Olive Python, of which 4.5 ha is within the activity area (Figure 4.16). Additionally there is 210 ha of major drainage line habitat within the activity area. While there is potential habitat for this species in the activity area and surrounding areas, there are relatively few records from this region of the Hamersley Range (Figure 4.17). Table 4.13 details the habitat assessment.

Innawally Pool is located within the activity area in Jimblebar Creek. Innawally Pool is not included in the PMO as the approved activities qualify for the exemptions described in Section 2.3 of the Program.

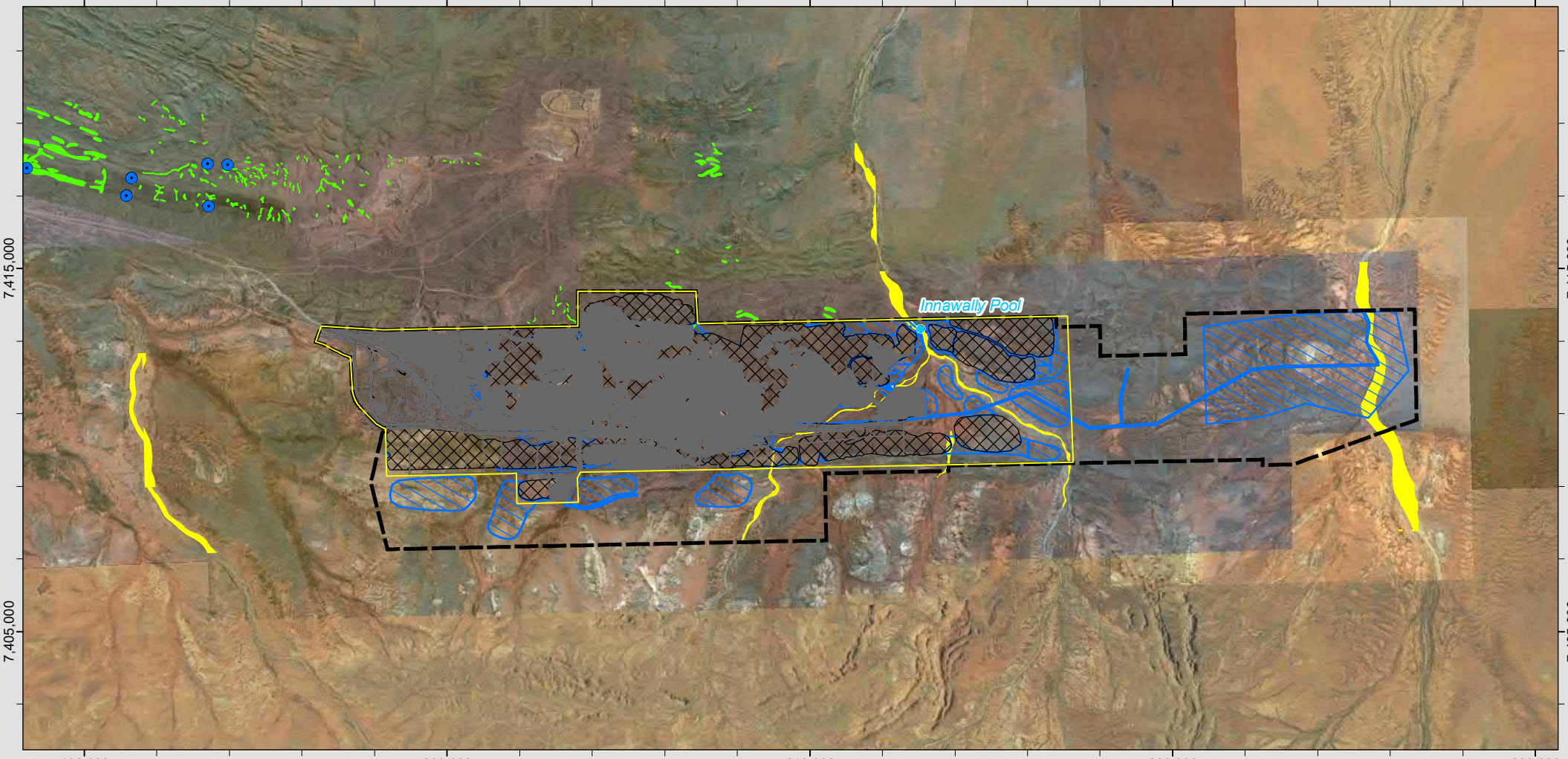
Table 4.13: Pilbara Olive Python Habitat Assessment

Modelled Habitat Assessment (ha)					Survey Habitat Assessment (ha)		
Habitat Description	Modelled Habitat Area Pilbara bioregion	Modelled Habitat in Strategic Assessment Area	Modelled Habitat within the Full Development Scenario	Modelled within the Activity Area^	Habitat Description	Within the Activity Area	Within disturbance footprint of the Activity^
H4	1,126,500	473,336	1,344	14	Gorge and Gully	4.5	1
H3	2,948,403	1,060,548	23,897	444			
H2	3,100,368	1,161,035	35,155	860	Pools	1	0
H1	10,609,870	3,263,373	60,394	4,940	Major drainage line	210	33

^ excluding the Jimblebar existing operations

4.5.5 Pilbara Olive Python Records

There is no evidence of Pilbara Olive Python individuals with the activity area, despite extensive baseline and targeted surveys in the area, since 2004. The nearest Pilbara Olive Python record is 5 km northwest of the activity area. Figure 4.17 details the survey areas within and surrounding the activity area.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Pilbara Olive Python Habitat and Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/76 REV B
Date: 2/12/2019	Checked:	Figure : 4.16
Revision: REV B	Reviewed: ENVIRO. A&I	

- Innawally Pool
- BHPIO Pilbara Olive Python Species Recording
- Existing Project Boundary
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Disturbance Footprint

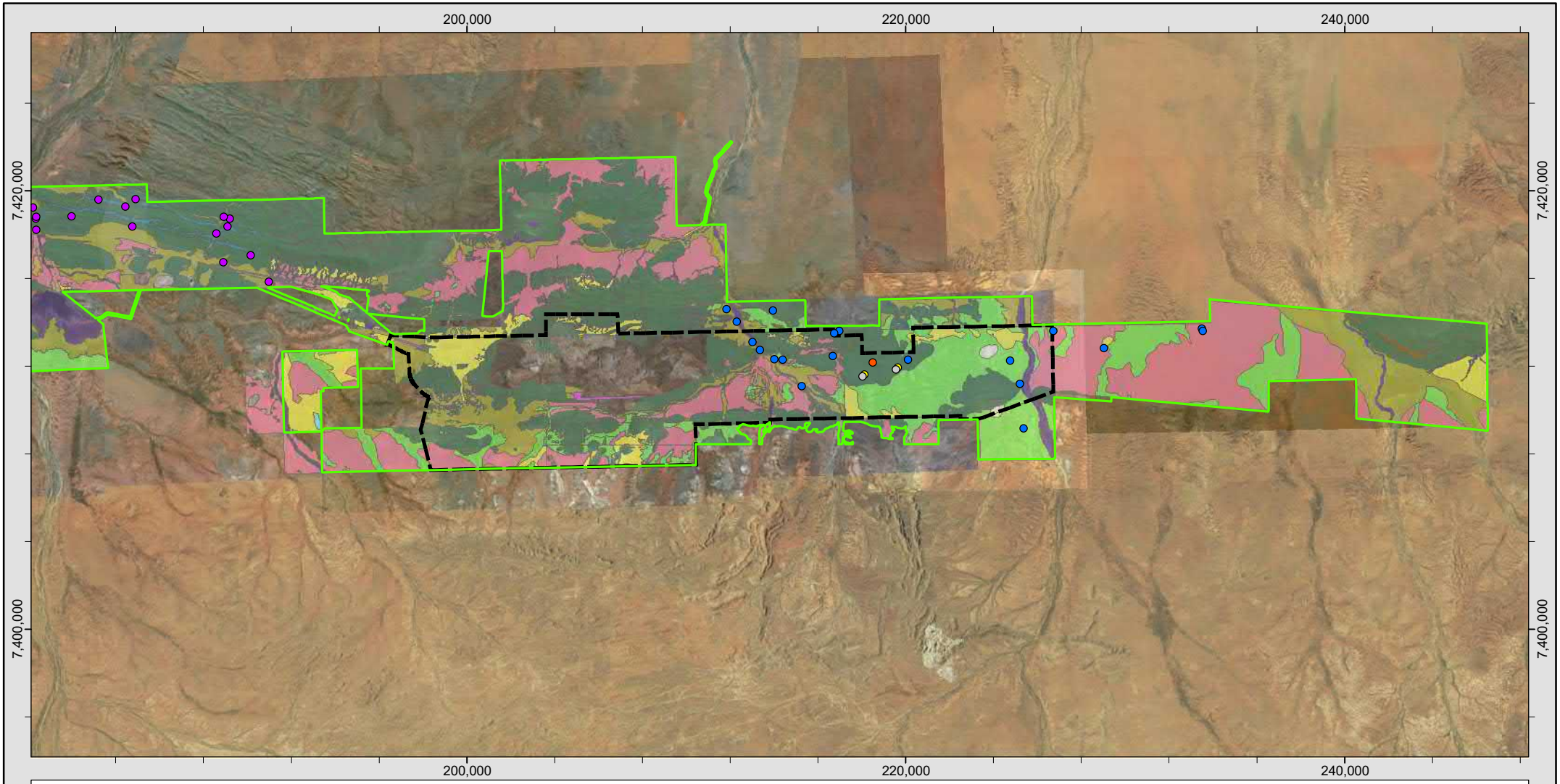
Habitat Type
- Gorge/ Gully
- Major Drainage Line

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_076_E_VN_OlivePythonHabitat_Records_RevB.mxd



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROPOSAL
Pilbara Olive Python Survey Coverage

Scale @ A4: 1:250,000	Prepared: J. VIS	Project No: A949/103 REV B
Date: 21/02/2020	Checked:	Figure : 4.17
Revision: REV B	Reviewed: ENVIRO. A&I	

Pilbara Olive Python Sample Site
- 2005
- 2006
- 2008
- 2013
- 2019
- Pilbara Olive Python Survey Coverage
- Activity Area

Habitat Type
- Artificial Wetlands
- Breakaway/ Cliff
- Calcrete Plain
- Claypan
- Drainage Area/ Floodplain
- Gorge/ Gully
- Hardpan Plain
- Hillcrest/ Hillslope
- Major Drainage Line
- Medium Drainage Line
- Minor Drainage Line
- Mulga Woodland
- Sand Plain
- Stony Plain

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_103_E_VN_PilbaraOlivePython_SurveyCoverage_RevB.mxd

4.5.6 Impact Assessment

Habitat Loss

The key direct impact to the Pilbara Olive Python arising from implementation of the activity is loss of habitat. Approximately 1 ha of gorge and gully habitat and 33 ha of major drainage line habitat will be disturbed by the activity. These habitats are contiguous with surrounding areas and are not considered to be uncommon in this part of the Hamersley Range.

Potential habitats that support semi-permanent water exist within the region. These include Innawally Pool (within the activity area), Trugallenden Pool (18 km west) and Jinerabar Pool (45 km north). Innawally Pool is exempt from this Validation Notice and Trugallenden Pool and Jinerabar Pool are located outside of the activity area.

Groundwater Changes

Potential impacts to groundwater through mining activities may affect the Pilbara Olive Python via indirect impacts to the species' habitat. MAR will increase the groundwater levels at Caramulla, where Major Drainage Line habitat is present. Caramulla MAR will be managed with a view to limiting mounding to a maximum of 25m below the ground surface (bgs). Given the root zone depth of vegetation species within the Major Drainage Line habitat (*Eucalyptus victrix* and *Eucalyptus camaldulensis* - up to 15 m below ground level), the groundwater mounding from the Caramulla MAR (up to 25 mbgs) will limit any impacts to vegetation and therefore any indirect impact to potential Pilbara Olive Python habitat. As there are no groundwater-fed surface water features within the activity area the MAR is unlikely to change the hydrogeological features (e.g. extent or duration of water present) of the pools.

Surface Water Changes

Changes to surface water flows may cause changes to fauna habitat values, particularly in riparian zones. Alteration of fauna habitat may occur due to increased temporal availability of surface water from discharge of surplus water. The presence of water from the discharge may temporarily alter the fauna habitat, particularly in major drainage lines, and increase fauna visitation to the area. The nearest record of Pilbara Olive Python is 32 km west and the nearest Gorge Gully habitat is 15km west of Caramulla Creek. Caramulla Creek area is located within the Fortescue, Divide and Washplain land systems, which do not contain preferred Pilbara Olive Python habitat. Therefore the presence of surface water within Caramulla Creek is unlikely to result in the presence of the Pilbara Olive Python given the absence of preferred habitat and records in the area.

Alterations to landforms and construction of infrastructure can lead to increased erosion and deposition of sediments in waterways. Only a minor drainage line diversion is required and the estimated cumulative decrease in runoff volume is less than 3%, which is within the natural variation of seasonal runoff. Therefore, the disruption to natural surface flows and reduction in the availability of surface water downstream will be minimal. The changes to surface water regimes from the construction of infrastructure are not considered to be significant.

Overall, given the existing management practices in place, the magnitude of the impact to the Pilbara Olive Python from changes in surface water within the activity area is expected to be minor. BHP standard practices for surface water management will be implemented to minimise water quality impacts to downstream receptors.

4.5.7 Mitigation Hierarchy

Avoid

In early 2018, BHP identified a need for additional disturbance for OSAs south of the Jimblebar South pits due to:

- a lack of available area to allow expansion of OSAs, specifically adjacent to South Jimblebar, with the northern area constrained by existing infrastructure and the southern area constrained by the existing approved project area;
- a higher waste to ore ratio at South Jimblebar;
- backfill options being limited by pit stage sequencing requirements (a partial backfill schedule was developed to reduce the size of the OSAs required); and

- long-term impracticality of hauling waste material to backfill the depleted pit WH4 at the Wheelarra Hill deposit area.

Initial overall project disturbance requirements was estimated to be 3,000 ha. The initial mine plan was developed to maximise pit availability during the life of mine, therefore backfilling of mine pits was restricted. From this point, the mine plan was optimised to maximise the backfilling of pits. This involved scheduling the early completion of pits so they can be immediately backfilled. This optimisation of backfilling reduces the disturbance required to construct OSAs to 2,000 ha. The majority of the major drainage line habitat, associated with Jimblebar Creek, will be retained.

Minimise

The primary potential impact to the Pilbara Olive Python from the activity is loss of suitable habitat. The management measures proposed to minimise this impact include:

- avoiding direct impacts where practicable through planning and implementing the PEAHR internal process prior to land disturbance;
- restrict groundwater mounding from MAR injection to 25 mbgl.
- minimise clearing of native vegetation, by utilising existing infrastructure, facilities and cleared areas, and maximising the disposal of waste rock within mine pits, where practicable; and
- diverting surface water around the mining activity to the extent practicable to minimise the loss of surface water flow in the natural drainage systems.

Rehabilitate

Given the absence of a population of the Pilbara Olive Python within the activity area and the minor quantity of preferred habitat, any future rehabilitation of disturbed areas are unlikely to encourage the establishment of Pilbara Olive Python populations within the activity area. Rehabilitation activities within the activity area will be undertaken, in accordance with standard BHP rehabilitation procedures.

4.5.8 Residual Impact

The indicative disturbance footprint requiring direct disturbance of gorge and gully and major drainage line habitats consists of MAR borefield infrastructure (23 ha), other infrastructure (roads, laydown area etc.) (1 ha) and mine pits (10 ha) (see Table 4.14). Successful rehabilitation of the major drainage line habitat disturbed by MAR borefield infrastructure will allow its re-use by the Pilbara Olive Python. This results in a residual impact to Pilbara Olive Python habitat, from mine pits, of approximately 11 ha.

Table 4.14: Indicative Disturbance Footprint by Habitat and Activity

Habitat Description	Mine Pits (ha)	OSAs (ha)	MAR Borefield Infrastructure (ha)	Other Infrastructure (ha)	Indicative Disturbance (ha)	Residual Impact (ha)	Habitat Retained within Activity Area (ha)
Gorge and Gully (H3)	0	0	0	1	1	1	3.5
Major Drainage Line (H1)	10	0	23	0	33	10	200
Total	10	0	23	1	34	11	203.5

The significance of the 11 ha was assessed against the Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act (CoA 2013) and is presented in Table 4.15. Based on the available information the activity will not result in significant residual impact to the Pilbara Olive Python. Application of the mitigation hierarchy has predicted that the residual impact to Pilbara Olive Python is not significant at a species or a population level.

Table 4.15: Significance of Residual Impact (Pilbara Olive Python)

Aspect	Significant Impact Criteria+	Assessment#	Significance (L/M/H*)
Comparison of loss to regional representation of habitat	The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	1 ha of residual impact to gorge/gully habitat, with only 4.5 ha of suitable habitat within the activity area. Total of 10 ha residual impact to major drainage line habitat, from 210 ha within the activity area. Regionally there is 35,260 ha of the Newman Range land system. See section 4.5.3 and section 4.5.4.	L
Pre-existing condition of habitat impacted	The availability or quality of habitat to the extent that the species is likely to decline	Major drainage lines are generally in 'poor to good condition, with the overall quality of the remainder of the activity area being in 'good to excellent condition'.	L
Fragmentation of surrounding habitat	Fragment an existing important population^ into two or more populations	Surrounding habitat areas exist to the north of the activity area. Retaining the major drainage lines will ensure connectivity and limit habitat fragmentation.	L
Presence of records in the habitat impacted	Reduce the area of occupancy of an important population^	No individuals have been identified within the impacted habitat area. See section 4.5.5.	L
Presence of breeding individuals in the habitat impacted	Disrupt the breeding cycle of an important population^	No individuals have been identified within the impacted habitat area. The area does not support an important population. See section 4.5.3, 4.5.4 and 4.5.5.	L
Value as a breeding or foraging area	Disrupt the breeding cycle of an important population^ The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	1 ha of residual impact to gorge/gully habitat, with only 4.5 ha of suitable habitat within the activity area. Total of 10 ha residual impact to major drainage line habitat, from 210 ha within the activity area. Regionally there is 35,260 ha of the Newman Range land system. No suitable breeding areas have been recorded within the activity area. See section 4.5.4	L
Avoid the introduction of disease and invasive species	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat Introduce disease that may cause the species to decline	Major drainage lines are generally in 'poor to good condition' (due to grazing). Due to the area currently being subject to mining and pastoral activities the minor quantity of suitable habitat within the area, no new diseases or invasive species are likely to be	L

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
		introduced that could cause a decline in the species.	
Long term viability of the species	Interfere substantially with the recovery of the species.	No individuals have been identified within the impacted habitat area. No suitable breeding areas have been recorded within the activity area. Regionally there is sufficient habitat to allow recovery of the species.	L

[+] Significant impact guidelines 1.1 (DoE, 2013)

[#] Biologic 2018, 2019 and GHD 2019

* L/M/H – low/moderate/high

^ 'a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range. '

4.5.9 Review of Program Matter Outcomes

Following the impact assessment (section 4.5.6 and 4.5.8) and application of the mitigation hierarchy (section 4.5.7) a review of the activity against the PMO was undertaken. Table 4.16 details a review and identifies which PMO outcomes are relevant for the activity and considers further management.

Table 4.16: Review of Program Matter Outcomes (Pilbara Olive Python)

Program Matter Outcome	Applicable Triggers	Assessment
No loss of Pilbara Olive Python population/s as a result of Program activities.	None applicable	No Pilbara Olive Python populations have been identified within the activity area, therefore no loss of Pilbara Olive Python populations will result from the activities.
Program activities do not physically disturb, or result in adverse changes to the hydrological regimes and/or water quality of the following waterholes: Weeli Wolli Spring, Coondiner Pool, Ben's Oasis, Koodaideri Spring, and Punda Spring.	None applicable	No named waterholes will be disturbed as a result of the proposed activity.
Loss of Pilbara Olive Python habitat is offset by measures that maintain or enhance the distribution and conservation status of the Pilbara Olive Python.	Presence of Pilbara Olive Python habitat within or adjacent to the activity;	Minimal disturbance of Pilbara Olive Python habitat is proposed by the activity which will maintain the distribution and conservation status.

4.5.10 Monitor

Due to the absence of the Pilbara Olive Python within and adjacent to the activity area, the distance to the nearest Pilbara Olive Python record (5 km northwest) and the small existing preferred habitat (gorge and gully) within and adjacent to the activity area, no monitoring of the species is considered to be required.

4.5.11 Summary

BHP considers the activity will meet the PMO for Pilbara Olive Python population, as no individuals have been identified within or adjacent to the activity area to indicate the presence of a population.

BHP considers the activity will meet the PMO for Pilbara Olive Python habitat loss. The mitigation hierarchy has limited the loss of habitat to 11 ha in the activity area. Given the suitable habitat surrounding the activity area this residual impact is not considered significant. Therefore, there is no requirement to offset habitat loss as per Section 3.2 of the Program.

4.6 Pilbara Leaf-Nosed Bat

4.6.1 General Species Information

The Pilbara Leaf-Nosed Bat occurs over an approximate area of 120 million hectares (Eco Logical 2014b) and is restricted to the Pilbara bioregion of Western Australia. Armstrong (2001) suggests that there may be three discrete subpopulations – George Range, Hamersley Range and Upper Gascoyne – separated by extensive flat areas restricting gene flow. Individual colonies vary in size from 10 individuals to 20,000 individuals, although the latter is exceptional (Armstrong 2001; Ecologia Environment 2005, 2006a, 2006b). The total number of Pilbara Leaf-Nosed Bats is currently unknown due to difficulties in counting individuals (Eco Logical 2014b). An assessment of data by Bullen (2013) indicates 24 maternal or day roosts occur across the Pilbara. Figure 4.18 details the regional records and distribution of Pilbara Leaf-Nosed Bat.

4.6.2 Regional Habitat and Baseline Modelling Data

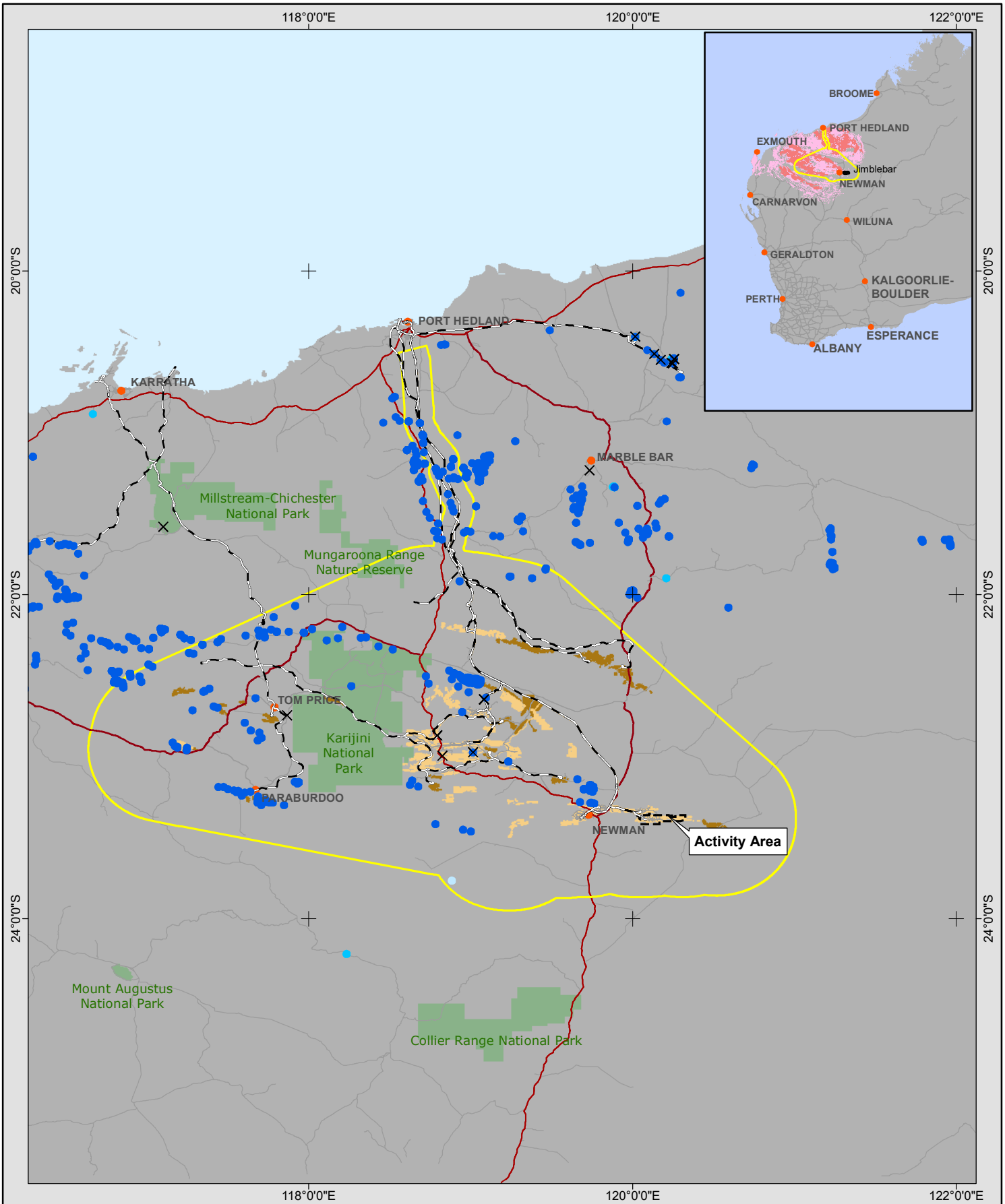
In the Impact Assessment Report, Eco Logical (2015) modelled the habitat preference for the Pilbara Leaf-Nosed Bat using 137 species records from publicly available and BHP data. The model indicated that preferred habitat (H4) occurs in the central-east of the Pilbara bioregion.

The cumulative impact assessment model predicted a potential decrease of 6,275 ha to H4 for the Pilbara Leaf-Nosed Bat as a result of the Full Conceptual Development Scenario (Table 4.17). This area of potential impact from the Program represents less than 1% of the area modelled as H4 within the Pilbara bioregion. BHP recognises that, although the modelled potential impact is considered relatively minor at a regional scale, the Pilbara Leaf-Nosed Bat has specific habitat requirements that may not have been captured at a regional scale, and thus management at a local scale is important.

In addition to the regional modelling approach, BHP also conducted an impact assessment based on Pilbara Leaf-Nosed Bat species records. The records data were obtained from the State DPaW and Western Australian Museum in December 2015 and January 2016 respectively. Based on the species records data, 7.7% of the known records within the Strategic Assessment Area were predicted to be cumulatively impacted by iron ore mining in the Pilbara. The data show that the potential impact is from both BHP and reasonably foreseeable third party mines.

Based on surveys to date, there have been no significant roosts for this species identified in BHP tenure; therefore this species was considered to be at low risk from the Full Conceptual Development Scenario. Figure 4.19 shows the Pilbara Leaf-Nosed Bat modelled habitat and regional records within the activity area.

The Rangeland land systems within 25 km of the activity area are detailed in Table 4.2 and Figure 4.20. Of these land systems, the River, Fortescue and Newman land systems provide a significant quantity (63,261 ha) of preferred Pilbara Leaf-Nosed Bat foraging and roosting habitat adjacent to the activity area. The River, Fortescue and Newman land systems located to the north, west and south of the activity area are not currently subject to mining or mining exploration, which makes this a potential long-term habitat for the Pilbara Leaf-Nosed Bat.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Pilbara Leaf-nosed Bat regional records and distribution

Scale @ A4: 1:3,500,000	Prepared: J.VIS	Project No: A949/095 Rev A	
Date: 2/12/2019	Checked:	Figure: 4.18	
Revision: REV A	Reviewed: ENVIRO. A&I		

Pilbara Leaf-nosed Bat records
- Records After 2005
- Records between 1980 - 2004
- Records Prior 1979
- Records Missing Date
- Town
- Species or species habitat likely to occur
- Species or species habitat may occur

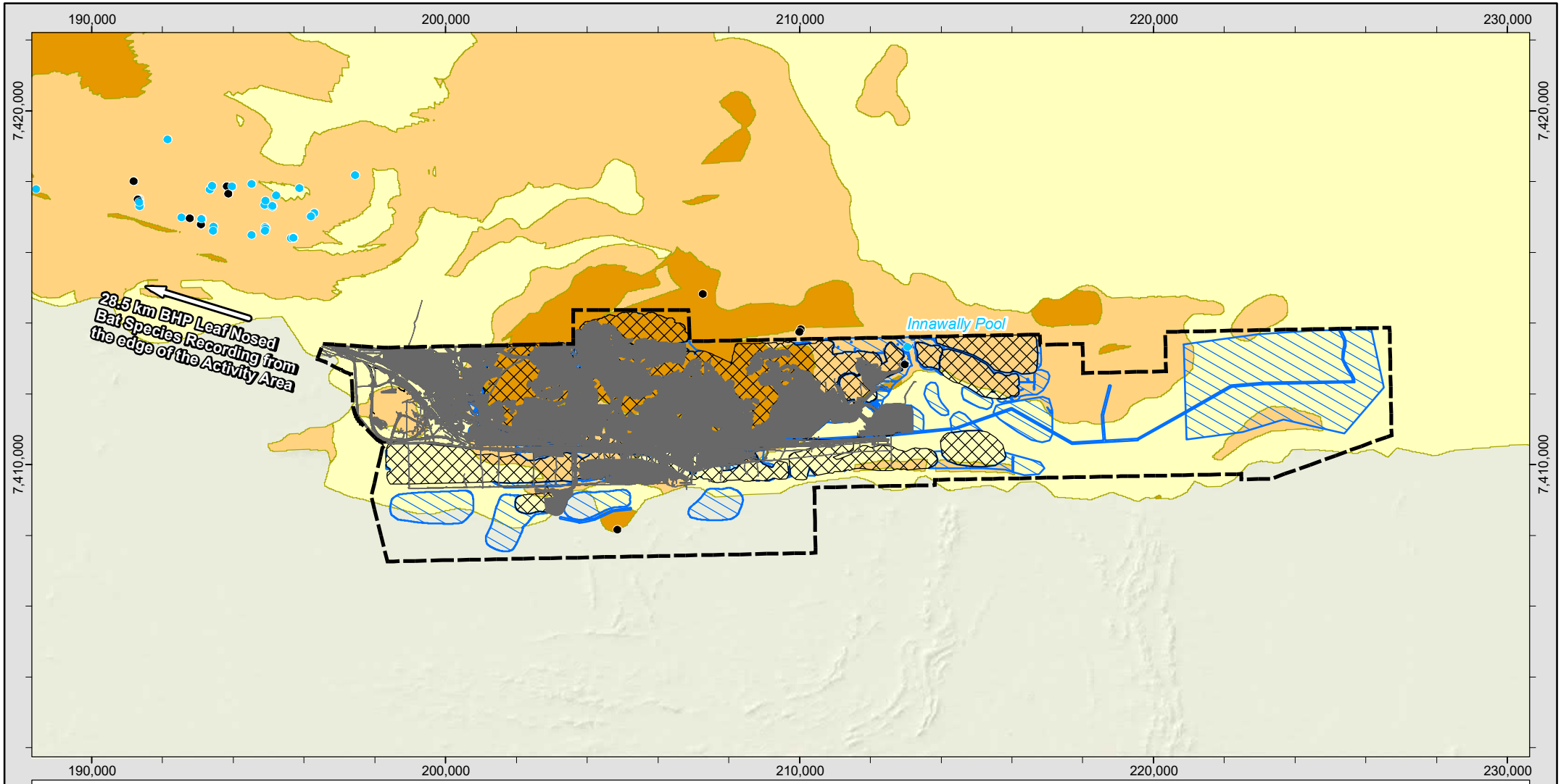
- Major Road
- Minor/Regional Road
- Rail Centreline
- Strategic Assessment Area
- BHP LOA Mine Plan disturbance footprint
- Third Party disturbance footprint
- Activity Area

N

0 25 50 75
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_095_E_VN_SEA_Species_Leaf_Nosed_Bat_RevA.mxd



BHP

Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Pilbara Leaf-nosed Bat Modelled Habitat and Regional Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/28 REV C
Date: 2/12/2019	Checked:	Figure : 4.19
Revision: REV C	Reviewed: ENVIRO. A&I	

- Cave
- Waterhole
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Disturbance Footprint

Leaf Nosed Bat Potential Habitat Modelling

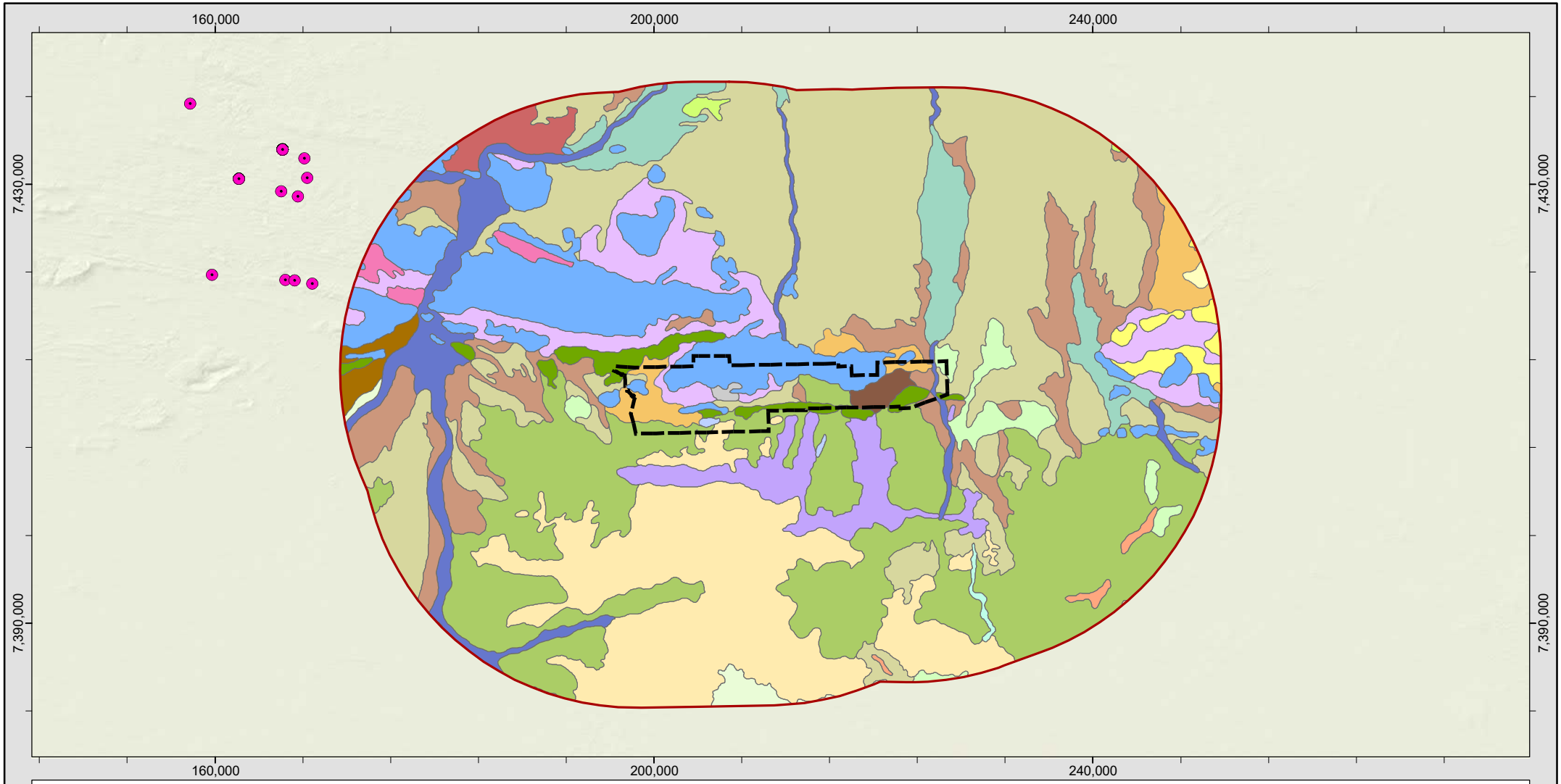
- 1 - Lowest Potential
- 2
- 3

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_028_E_JDP_VN_LeafNosedBatModelled_RevC.mxd



BHP

Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTMISATION PROJECT
Pilbara Leaf-nosed Bat Regional Land Systems

Scale @ A4: 1:500,000	Prepared: J.VIS	Project No: A949/99 REV A
Date: 2/12/2019	Checked:	Figure : 4.20
Revision: REV A	Reviewed: ENVIRO. A&I	

Pilbara Leaf-nosed Bat records
Activity Area
Activity Area Buffer 25km

Land System

- Adrian
- Balfour
- Boolgeeda
- Cadgie
- Charley
- Disturbed Land
- Divide
- Elimunna
- Fan
- Fortescue
- Jamindie
- Laterite
- McKay
- Newman
- Prairie
- River
- Robertson
- Rocklea
- Spearhole
- Sylvania
- Table
- Talga
- Washplain
- Zebra

N

0 2 4 6
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_099_E_VN_PilbaraLeafNosedBat_RangelandsLandSystems_RevA.mxd

4.6.3 Local Habitat

Gorge and gully are the primary form of habitat for the Pilbara Leaf-Nosed Bat, of which 4.5 ha is within the activity area (Figure 4.21). No suitable Pilbara Leaf-Nosed Bat diurnal roosting features were recorded within the activity area (Biologic 2018 and 2019). Additionally there is 210 ha of major drainage line habitat within the activity area, which may be utilised as foraging habitat. Biologic 2018 and 2019 and GHD 2019 identified that while potential foraging was present in the area, the Pilbara Leaf-Nosed Bat is unlikely to occur within the activity area due to an absence of suitable caves for roosting and foraging distances from known confirmed records of the species. The nearest confirmed record of the species is approximately 29 km to the west. This distance is beyond the typical foraging distance of the species (Biologic 2019). Table 4.17 details the habitat assessment.

Table 4.17: Pilbara Leaf-Nosed Bat Habitat Assessment

Modelled Habitat Assessment (ha)					Survey Habitat Assessment (ha)		
Habitat Description	Modelled Habitat Area Pilbara bioregion	Modelled Habitat in Strategic Assessment Area	Modelled Habitat within the Full Development Scenario	Modelled within Activity Area^	Habitat Description	Within the Activity Area	Within disturbance footprint of the Activity Area^
H4	1,623,283	437,819	6,275	0	Gorge and Gully	4.5	1
H3	4,233,754	1,956,461	59,048	216			
H2	6,569,572	1,388,978	15,271	1,431	Pools	1	0
H1	5,372,377	2,174,864	80,595	4,619	Major drainage line	210	33

^ excluding the Jimblebar existing operations

With the only records from the extensive bat survey effort previously completed in the activity area and surrounding locality being 29 km to the west of the activity area, the data strongly suggest there are no critical habitat roost sites within or adjacent to the area (Priority 1 to 3 - Table 4.18 and Figure 4.21).

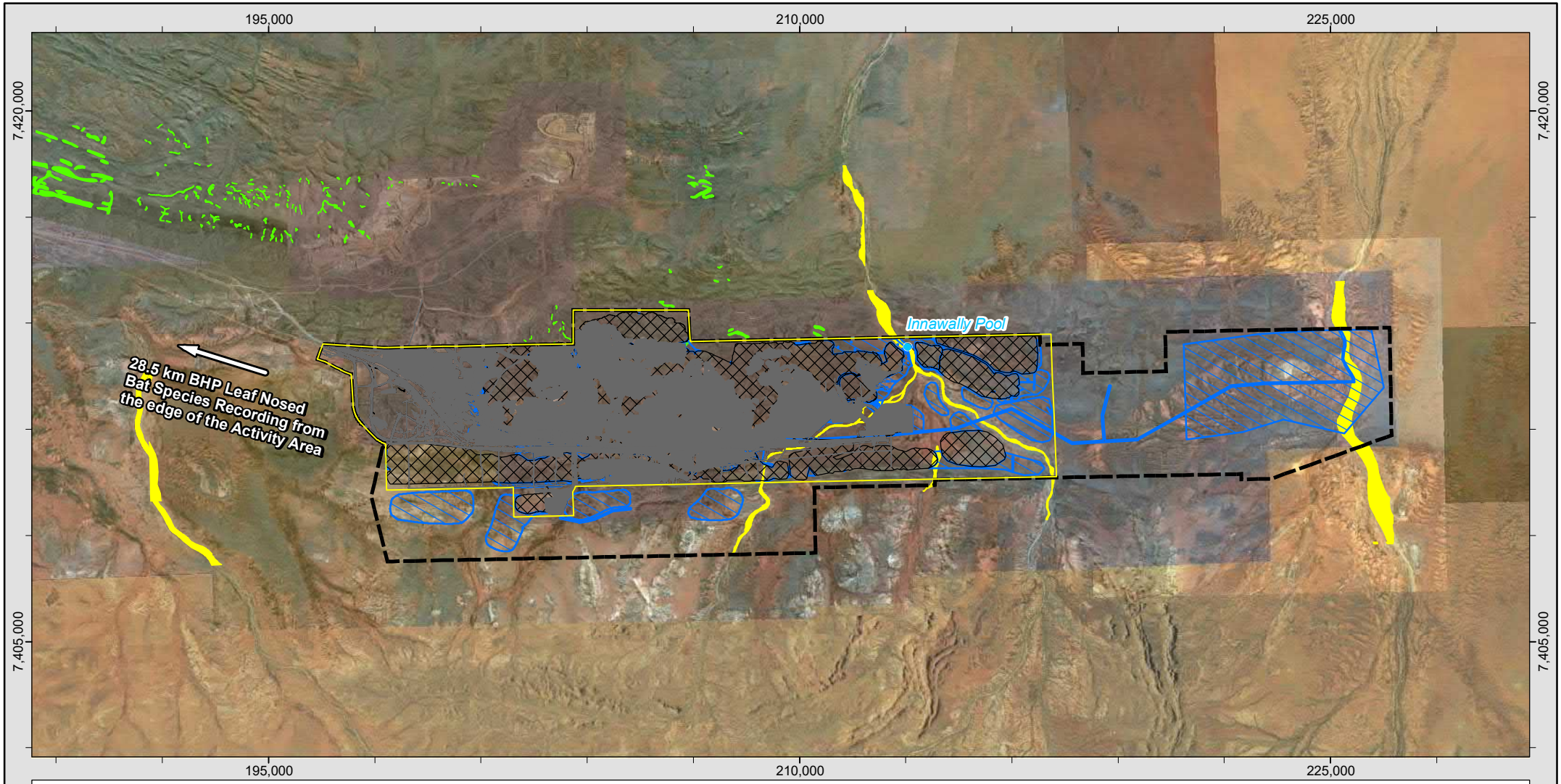
Table 4.18: Critical Roosting and Foraging habitat for the Pilbara Leaf-Nosed Bat (TSSC 2016)

Priority	Roost Description	Habitat Description
1	**Permanent Diurnal Roosts** Occupied year-round and likely the focus for some part of the 9-month breeding cycle; Critical habitat that is essential for the daily survival of the Pilbara Leaf-Nosed Bat.	**Gorges with pools** Watercourses through upland areas bounded by sheer rock walls for parts of their length, often containing pools that remain for weeks or months, sites of relatively large biomass production, sometimes containing caves.
2	**Non-permanent breeding roosts** Evidence of usage during some part of the 9-month breeding cycle (July–March), but not occupied year-round; Critical habitat that is essential for both the daily and long-term survival of the Pilbara Leaf-Nosed Bat.	**Gullies** Primary drainage with limited riparian development in upland rocky habitats, sometimes containing small pools that may last for weeks, with less biomass production than Priority 1 gorge habitat.

Priority	Roost Description	Habitat Description
3	**Transitory diurnal roosts** Occupied for part of the year only, outside the breeding season (i.e. April–June), and which could facilitate long distance dispersal in the region; Critical habitat that is essential for both the daily and long-term survival of the Pilbara Leaf-Nosed Bat.	**Rocky outcrop** Areas of exposed rock at the top of rocky outcrop and mesa hills that contain caves and overhangs, and boulder piles in the granite terrains.
4	**Nocturnal refuge** Occupied or entered at night for resting, feeding or other purposes, with perching not a requirement. Excludes overhangs. Not considered critical habitat, but are important for persistence in a local area.	**Major watercourses** Riparian vegetation on flat land plus the main gravelly or sandy channel of the river bed, sometimes containing pools that persist for weeks or months, and generally supporting higher productivity of biomass than the surrounding habitats.
5		**Open grassland and woodland** Dominated by Triodia, on lowland plains, colluvial slopes and hilltops.

4.6.4 Pilbara Leaf Nosed Bat Records

There are no records of Pilbara Leaf-Nosed Bat in the activity area, despite extensive baseline and targeted surveys for bats in the area, since 2004. Records within the region are from calls recorded from a cave 29 km to the west of the activity area. Figure 4.22 details the survey areas within and surrounding the activity area.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Pilbara Leaf-nosed Bat Habitat and Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/77 REV B
Date: 2/12/2019	Checked:	Figure : 4.21
Revision: REV B	Reviewed: ENVIRO. A&I	

- Innawally Pool
- Existing Project Boundary
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Disturbance Footprint

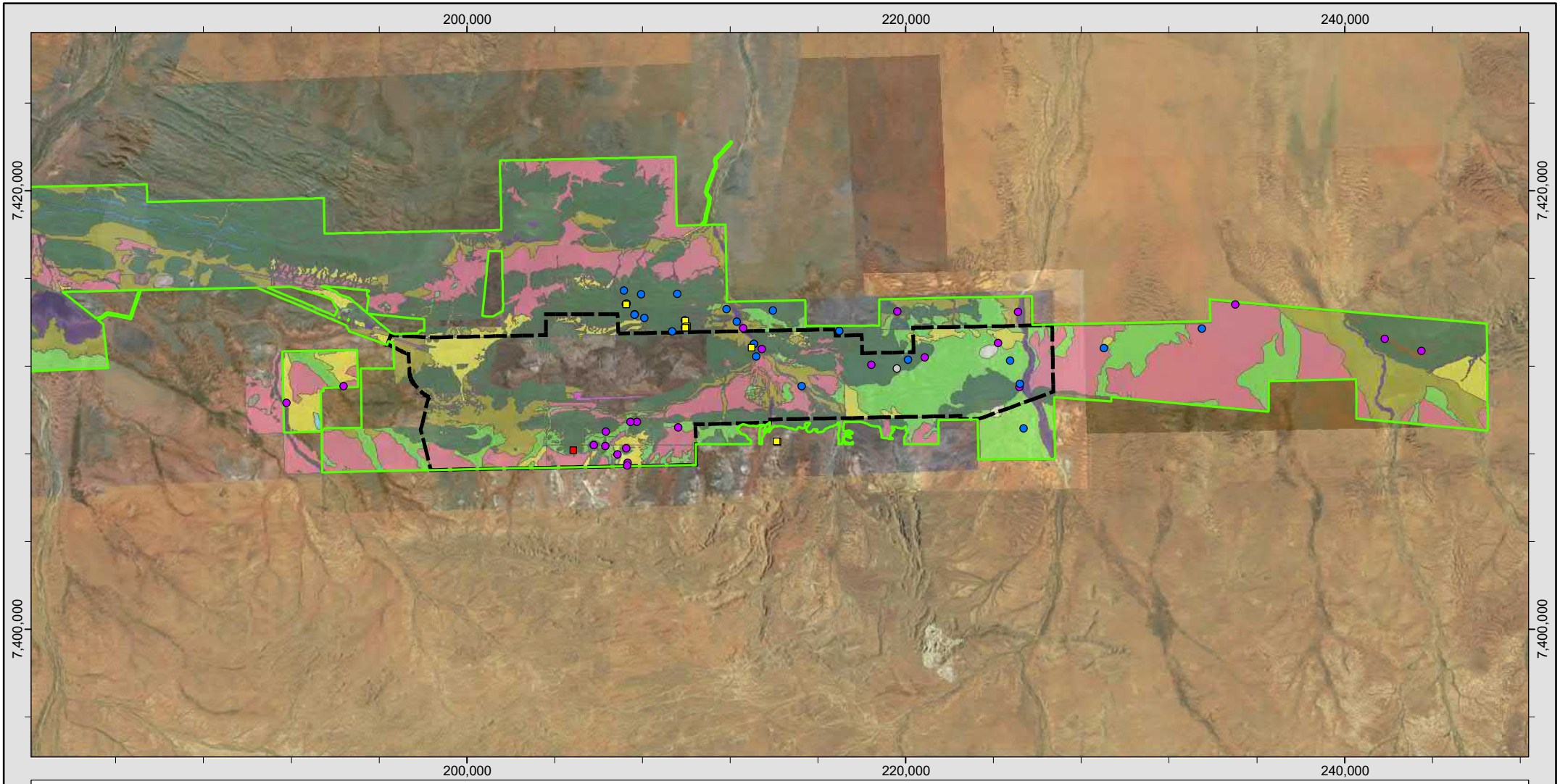
Habitat Types
- Gorge/ Gully
- Major Drainage Line

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_077_E_VN_LeafNosedBatHabitat_Records_RevB.mxd



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROPOSAL
Pilbara Leaf-nosed Bat Survey Area

Scale @ A4: 1:250,000	Prepared: J. VIS	Project No: A949/104 REV B
Date: 21/02/2020	Checked:	Figure : 4.22
Revision: REV B	Reviewed: ENVIRO. A&I	

Targeted Bat Cave Site
- 2018
- 2019

Bat Sample Site
- 2006
- 2018
- 2019

Pilbara Leaf-nosed Bat Survey Coverage

Activity Area

Habitat Type
- Artificial Wetlands
- Breakaway/ Cliff
- Calcrete Plain
- Claypan
- Drainage Area/ Floodplain
- Gorge/ Gully
- Hardpan Plain
- Hillcrest/ Hillslope
- Major Drainage Line
- Medium Drainage Line
- Minor Drainage Line
- Mulga Woodland
- Sand Plain
- Stony Plain

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_104_E_VN_PilbaraLeafNosedBat_SurveyCoverage_RevB.mxd

4.6.5 Impact Assessment

Habitat Loss

The primary direct impact to the Pilbara Leaf-Nosed Bat is the loss of potential roost sites associated with mining activities. The Pilbara Leaf-Nosed Bat has a very limited ability to conserve heat and water and requires very hot (28 to 32ºC) and humid (96% to 100%) roost sites in caves or abandoned mines (Armstrong 2001). Such caves are relatively uncommon in the Pilbara (Armstrong and Anstee 2000; Armstrong 2001), which limits the availability of diurnal roosts for this species. Loss of roosting habitat can occur in many ways, such as collapse or flooding of disused mines, as well as mining activities, such as open cutting of underground mines, exploration drilling and blasting.

Potential habitats that support semi-permanent water exist within the region. These include Innawally Pool (within the activity area), Trugallenden Pool (18 km west) and Jinerabar Pool (45 km north) (Figure 1.3). Innawally Pool is exempt from this Validation Notice and Trugallenden Pool and Jinerabar Pool are located outside of the activity area (Figure 1.3).

No roosts will be directly impacted by the activity. There are no important breeding or roosting populations, or critical habitat for the Pilbara Leaf-Nosed Bat within the proposed activity area. Surveys have identified, gorge and gully habitats in the activity area (Table 4.17) of which approximately 0.8 ha of this habitat will be removed. This habitat is contiguous with surrounding areas outside of the activity area and is not considered to be uncommon in this part of the Hamersley Range. BHP considers that the activity will not have a significant impact on this species at a local or regional scale.

Noise and Vibration

Noise and vibration are indirect impacts which may potentially impact the Pilbara Leaf-Nosed Bat. Responses to noise and vibration vary among vertebrate fauna species and individuals according to a number of factors (Busnel and Fletcher 1978). These include:

- the characteristics of the noise and its duration;
- life history characteristics of the species;
- habitat type;
- season;
- activity at the time of exposure;
- sex and age of the individual;
- level of previous exposure; and
- whether other stresses are present at the time of exposure.

Given the absence of caves within and adjacent to the activity area, potential impacts to Pilbara Leaf-Nosed Bat from increased noise are considered to be minor.

Light

Artificial light may indirectly impact fauna through disrupting navigation, causing a barrier to movement, impacting foraging activity, potentially restricting the use of roosts and nests and exposing animals to nocturnal predators (Rich and Longcore 2006). Lighting for the MAR and OSAs will be established to allow for safe working areas. With the absence of suitable caves and records of the species impacts to the Pilbara Leaf Nosed Bat are considered negligible.

Groundwater Change

Potential impacts to groundwater through mining activities may affect the Pilbara Leaf Nosed Bat via indirect impacts to the species' habitat. MAR will increase the groundwater levels at Caramulla, where Major Drainage Line habitat is present. Caramulla MAR will be managed with a view to limiting mounding to a maximum of 25m below the ground surface (bgs). Given the root zone depth of vegetation species within the Major Drainage Line habitat (*Eucalyptus*

victrix and *Eucalyptus camaldulensis* - up to 15 m below ground level), the groundwater mounding from the Caramulla MAR (up to 25 mbgs) will limit any impacts to vegetation and therefore any indirect impact to potential Pilbara Leaf Nosed Bat habitat. As there are no groundwater-fed surface water features within the activity area the MAR is unlikely to change the hydrogeological features (e.g. extent or duration of water present) of the pools.

Surface Water Changes

Changes to surface water flows may cause changes to fauna habitat values, particularly in riparian zones. Alteration of fauna habitat may occur due to increased temporal availability of surface water from discharge of surplus water. The presence of water from the discharge may temporarily alter the fauna habitat, particularly in major drainage lines, and increase fauna visitation to the area.

Alterations to landforms and construction of infrastructure can lead to increased erosion and deposition of sediments in waterways. Only a minor drainage line diversion is required and the estimated cumulative decrease in runoff volume is less than 3%, which is within the natural variation of seasonal runoff. Therefore, the disruption to natural surface flows and reduction in the availability of surface water downstream will be minimal. The changes to surface water regimes from the construction of infrastructure are not considered to be significant.

Overall, the impact to the Pilbara Leaf-Nosed Bat from changes in surface water within the activity area is expected to be minor. BHP standard practices for surface water management will be implemented to minimise water quality impacts to downstream receptors.

4.6.6 Mitigation Hierarchy

Avoid

In early 2018, BHP identified a need for additional disturbance for OSAs south of the Jimblebar South pits due to:

- a lack of available area to allow expansion of OSAs, specifically adjacent to South Jimblebar, with the northern area constrained by existing infrastructure and the southern area constrained by the existing approved project area;
- a higher waste to ore ratio at South Jimblebar;
- backfill options being limited by pit stage sequencing requirements (a partial backfill schedule was developed to reduce the size of the OSAs required); and
- long-term impracticality of hauling waste material to backfill the depleted pit WH4 at the Wheelarra Hill deposit area.

Initial overall project disturbance requirements was estimated to be 3,000 ha. The initial mine plan was developed to maximise pit availability during the life of mine, therefore backfilling of mine pits was restricted. From this point, the mine plan was optimised to maximise the backfilling of pits. This involved scheduling the early completion of pits so they can be immediately backfilled. This optimisation of backfilling reduces the disturbance required to construct OSAs to 2,000 ha. The majority of the major drainage line habitat, associated with Jimblebar Creek, will be retained.

Minimise

The primary potential impact to the Pilbara Leaf-Nosed Bat from the activity is loss of potentially suitable habitat. The management measures proposed to minimise this impact include:

- avoiding direct impacts to potentially suitable habitat, where practicable through planning and implementing the PEAHR internal process prior to land disturbance; and
- minimise clearing of native vegetation, by utilising existing infrastructure, facilities and cleared areas, and maximising the disposal of waste rock within mine pits, where practicable.

Rehabilitate

Given the absence of a population of the Pilbara Leaf-Nosed Bat within the activity area and the minor quantity of preferred habitat, any future rehabilitation of disturbed areas are unlikely to encourage the establishment of Pilbara

Leaf-Nosed Bat populations within the activity area. Rehabilitation activities within the activity area will still be undertaken, in accordance with standard BHP rehabilitation procedures.

4.6.7 Residual Impact

The indicative disturbance footprint requiring direct disturbance of gorge/gully and major drainage line habitats consists of MAR borefield infrastructure (23 ha), other infrastructure (roads, laydown area etc.) (1 ha) and mine pits (10 ha) (see Table 4.19). Successful rehabilitation of the MAR borefield infrastructure areas will return the foraging habitat for potential use by the Pilbara Leaf-Nosed Bat. This results in an estimated residual impact to Pilbara Leaf-Nosed Bat habitat, from mine pits, of approximately 11 ha.

Table 4.19: Indicative Disturbance Footprint by Habitat and Activity

Habitat Description	Mine Pits (ha)	OSAs (ha)	MAR Borefield Infrastructure (ha)	Other Infrastructure (ha)	Indicative Disturbance (ha)	Residual Impact (ha)	Habitat Retained within Activity Area (ha)
Gorge and Gully (H3)	0	0	0	1	1	1	1.5
Major Drainage Line (H1)	10	0	23	0	33	10	200
Total	10	0	23	1	34	11	201.5

The significance of the 11 ha was assessed against the Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act (CoA 2013) and is presented in Table 4.20. Based on the available information the activity will not result in significant residual impact to the Pilbara Leaf-Nose Bat.

Table 4.20: Significance of Residual Impact (Pilbara Leaf-Nosed Bat)

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
Comparison of loss to regional representation of habitat	The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	1 ha of residual impact to gorge/gully habitat, with only 4.5 ha of suitable habitat within the activity area. Total of 10 ha residual impact to major drainage line habitat, from 210 ha within the activity area. Regionally there is 63,261 ha of suitable foraging habitat within the River, Fortescue and Newman Range land systems.	L
Pre-existing condition of habitat impacted	The availability or quality of habitat to the extent that the species is likely to decline	Major drainage lines are generally in 'poor to good condition, with the overall quality of the remainder of the activity area being in 'good to excellent condition'.	L

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
Fragmentation of surrounding habitat	Fragment an existing important population^ into two or more populations	Surrounding habitat areas exist to the north of the activity area.	L
Presence of records in the habitat impacted	Reduce the area of occupancy of an important population^	No individuals have been identified within the impacted habitat area. Biologic 2018 and 2019 and GHD 2019 identified that while potential foraging was present in the area, the Pilbara Leaf-Nosed Bat is unlikely to occur within the activity area due to an absence of suitable caves for roosting and foraging distances from known confirmed records of the species.	L
Presence of breeding individuals in the habitat impacted	Disrupt the breeding cycle of an important population^	No individuals have been identified within the impacted habitat area. No suitable breeding areas have been recorded within the activity area.	L
Value as a breeding or foraging area	Disrupt the breeding cycle of an important population^ The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	1 ha of residual impact to gorge/gully habitat, with only 4.5 ha of suitable habitat within the activity area. Total of 10 ha residual impact to major drainage line habitat, from 210 ha within the activity area. Regionally there is 63,261 ha of suitable foraging habitat within the River, Fortescue and Newman Range land systems. No suitable breeding areas have been recorded within the activity area.	L
Avoid the introduction of disease and invasive species	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat Introduce disease that may cause the species to decline	Major drainage lines are generally in 'poor to good condition' (due to grazing). Due to the area currently being subject to mining and pastoral activities the minor quantity of suitable habitat within the area, no new diseases or invasive species are likely to be introduced that could cause a decline in the species.	L
Long term viability of the species	Interfere substantially with the recovery of the species.	No individuals have been identified within the impacted habitat area. No suitable breeding areas have been recorded within the activity area. Regionally there is sufficient habitat to allow recovery of the species.	L

[+] Significant impact guidelines 1.1 (DoE, 2013)

[#] Biologic 2018, 2019 and GHD 2019

* L/M/H – low/moderate/high

^ 'a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range. '

4.6.8 Review of Program Matter Outcomes

Following the impact assessment (section 4.6.5 and 4.6.7) and application of the mitigation hierarchy (section 4.6.6) a review of the activity against the PMO was undertaken. Table 4.21 details a review and identifies which PMO are relevant for the activity and considers further management.

Table 4.21: Review of Program Matter Outcomes (Pilbara Leaf-Nosed Bat)

Program Matter Outcome	Applicable Triggers	Assessment
No loss of Pilbara Leaf-Nosed Bat population/s as a result of Program activities.	None applicable	No Pilbara Leaf-Nosed Bat individuals or populations have been identified within the activity area, therefore no loss of Pilbara Leaf-Nosed Bat populations will result from the activities.
Loss of Pilbara Leaf-Nosed Bat habitat is offset by measures that maintain or enhance the distribution and conservation status of the Pilbara Leaf-Nose Bat.	Presence of Pilbara Leaf-Nosed Bat roosting or foraging habitat within or adjacent to the activity.	Minimal disturbance of Pilbara Leaf-Nosed Bat foraging habitat is proposed by the activity which will maintain the distribution and conservation status.

4.6.9 Monitor

Due to the absence of Pilbara Leaf-Nosed Bat records within and adjacent to the activity area, the distance to the nearest Pilbara Leaf-Nosed Bat record (29 km west) and the small existing preferred habitat (gorge and gully - 4.5 ha) within the activity area, no monitoring of the species is considered required.

4.6.10 Summary

BHP considers the activity will meet the PMO for Pilbara Leaf-Nosed Bat population, as no individuals have been identified within or adjacent to the activity area to indicate the presence of a population.

BHP considers the activity will meet the PMO for Pilbara Leaf-Nosed Bat habitat loss. The mitigation hierarchy has limited the loss of habitat to 11 ha in the activity area. Given the suitable habitat surrounding the activity area, this residual impact is not considered significant. Therefore, there is no requirement to offset habitat loss as per Section 3.2 of the Program.

4.7 Northern Quoll

4.7.1 General Species Information

The Northern Quoll is the smallest and most arboreal of the four Australian quoll species (van Dyck & Strahan 2008) and has undergone a dramatic range contraction since European settlement, including a 75% reduction in distribution during the 20th century. In the Pilbara, Northern Quoll distribution is bounded in the north, east and south by the Great Sandy Desert, Gibson Desert and Little Sandy Desert (DotE 2014a). Northern Quolls mostly favour rocky habitats (e.g. escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines and treed creek lines) as denning or shelter habitat, and foraging occurs in the vegetated areas surrounding their dens (Commonwealth of Australia 2016). Figure 4.23 details the regional records and distribution of Northern Quoll.

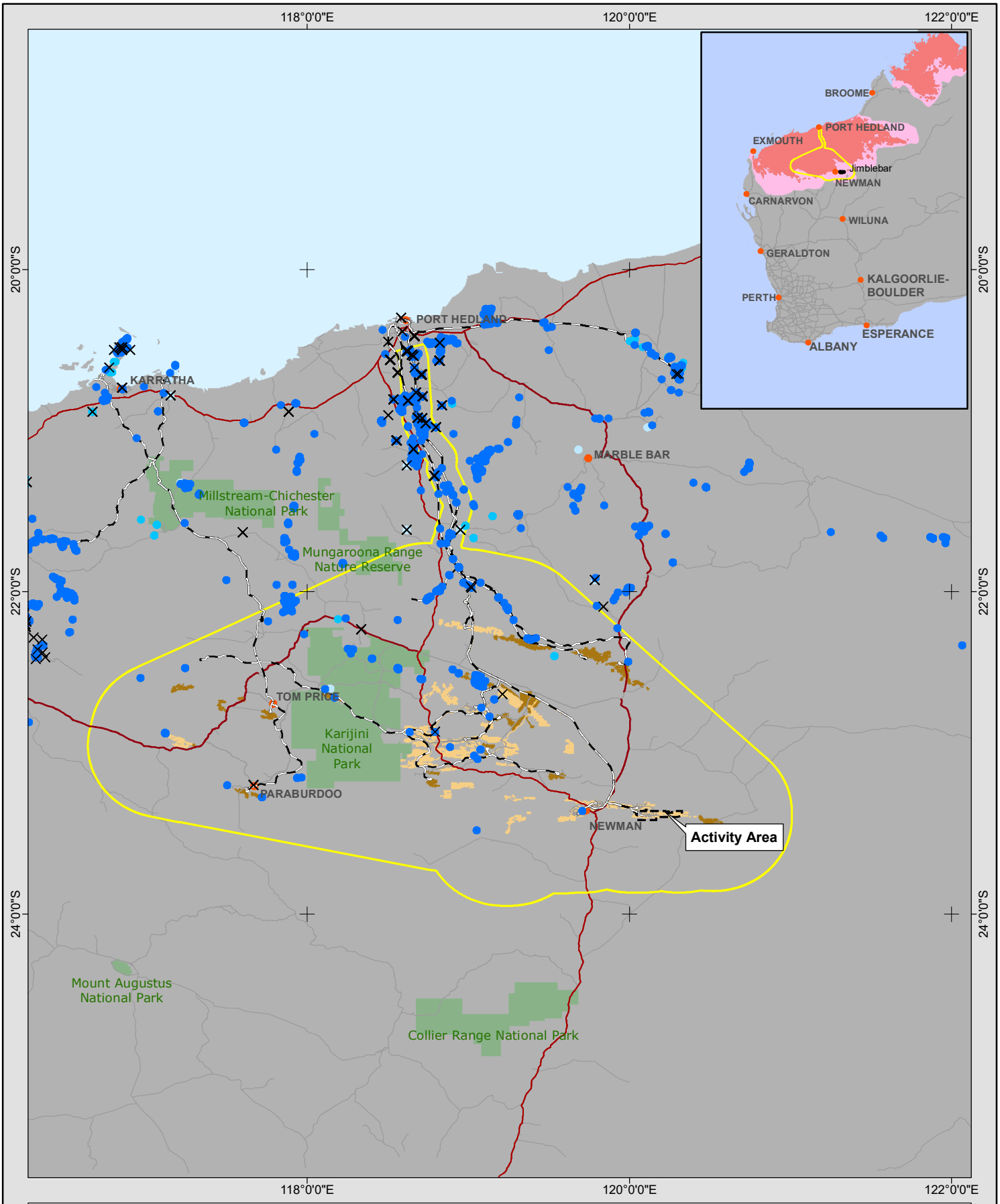
The ecology of Northern Quolls is complex as they use habitats in a variety of ways for denning and foraging, and an individual can use multiple den sites. Northern Quolls will den during the day and leave den sites to forage during the night. They are generally considered to be solitary, with females having mutually exclusive denning areas, but can have overlapping foraging areas. Populations fluctuate annually, which is likely to be related to the abundance, dispersion and renewability of food (Oakwood 2002). Both sexes usually change dens every night, with females each using up to 55 dens (Oakwood 2008).

4.7.2 Regional Habitat and Baseline Modelling Data

The Impact Assessment Report, Eco Logical (2015) modelled the habitat preference for the Northern Quoll using 518 species records from publicly available and BHP data. The model indicated that preferred habitat (H4) was strongly associated with rugged hills, ranges and outcrops in the north and northeast of the Pilbara bioregion, as opposed to areas in the central and southern areas of the Pilbara bioregion. It was acknowledged, however, that the model may have potentially under predicted in the higher elevation ranges in the southern part of the Strategic Assessment Area (Eco Logical 2014a).

The cumulative impact assessment model predicts a potential impact of 504 ha to H4 for the Northern Quoll as a result of the Full Conceptual Development Scenario (Table 4.22). In addition to the regional modelling approach, BHP also conducted an impact assessment based on Northern Quoll species records. The records data were obtained from the State DBCA and Western Australian Museum in December 2015 and January 2016 respectively. Based on the species records data, 4% of the known records within the SAA are predicted to be impacted cumulatively by iron ore mining in the Pilbara, with the majority of the impact from BHP. There are few records within the Full Conceptual Development Scenario footprint; indicating the species was at low risk from the Program. Figure 4.24 details the Northern Quoll modelled habitat and regional records within the activity area for this Notice.

The Rangeland land systems within 25 km of the activity area are detailed in Table 4.2 and Figure 4.25. Of these land systems, the Newman land system provide a significant quantity (35,260 ha) of preferred Northern Quoll habitat to the northwest of the activity area. The Newman land area located to the northwest of the activity area is not currently subject to mining or mining exploration, which makes this a long term habitat for the Northern Quoll.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Northern Quoll regional records and distribution

Scale @ A4: 1:3,500,000	Prepared: J.VIS	Project No: A949/096 Rev A	
Date: 2/12/2019	Checked:	Figure: 4.23	
Revision: REV A	Reviewed: ENVIRO. A&I		

Northern Quoll records
- Records After 2005
- Records between 1980 - 2004
- Records Prior 1979
- Records Missing Date
- Town
- Species or species habitat likely to occur
- Species or species habitat may occur

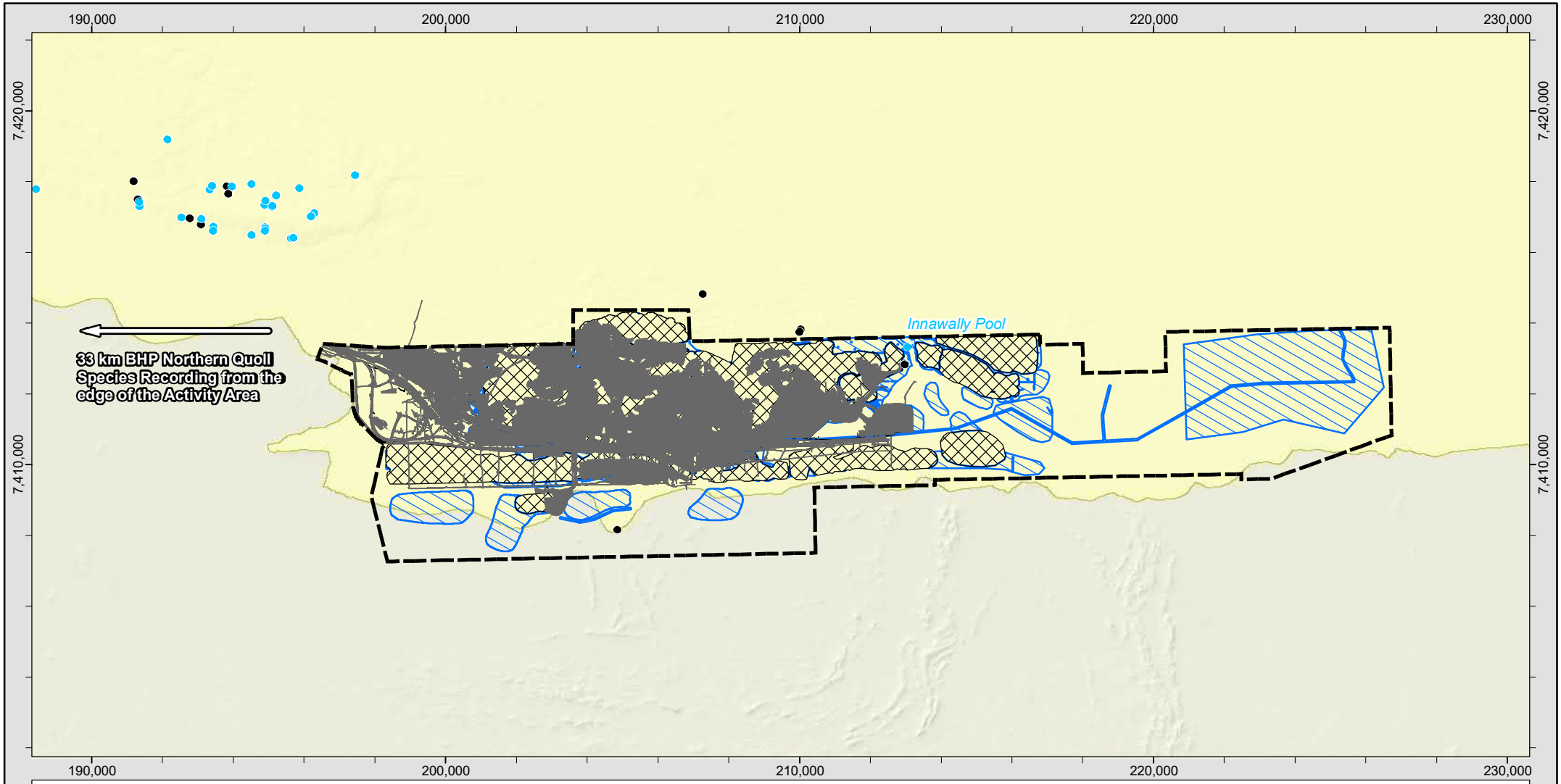
- Major Road
- Minor/Regional Road
- Rail Centreline
- Strategic Assessment Area
- BHP LOA Mine Plan disturbance footprint
- Third Party disturbance footprint
- Activity Area

N

0 25 50 75
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_096_E_VN_SEA_Species_Northern_Quoll_RevA.mxd



BHP

Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Northern Quoll Modelled Habitat and Regional Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/26 REV C
Date: 2/12/2019	Checked:	Figure : 4.24
Revision: REV C	Reviewed: ENVIRO. A&I	

- Cave
- Waterhole
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Disturbance Footprint

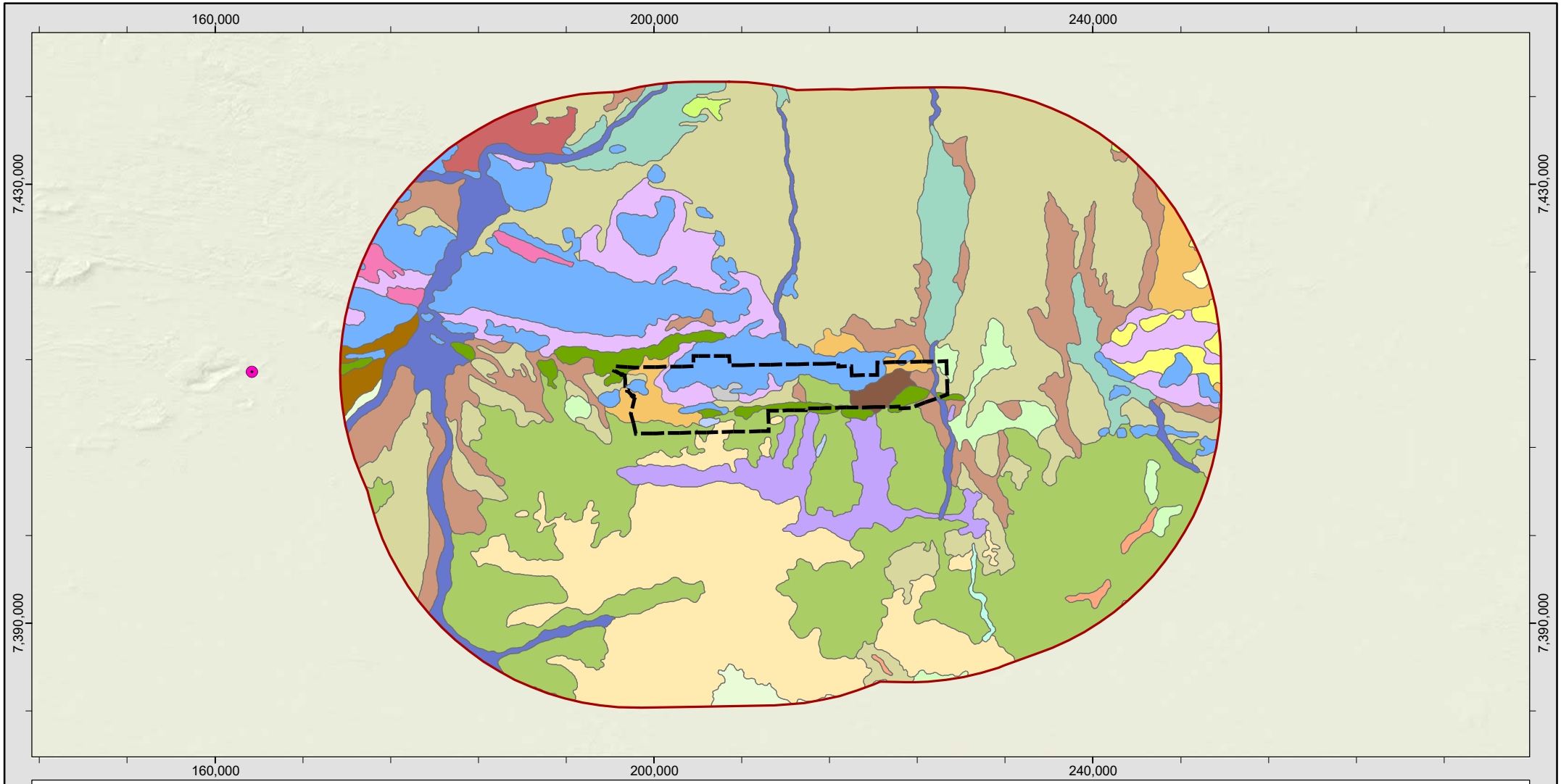
Northern Quoll Potential Habitat Modelling
- 1 - Lowest Potential
- 2

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_026_E_JDP_VN_QuollModelled_RevC.mxd



Spatial Data - Studies Planning & Access
BHP BILLITON IRON ORE

JIMBLEBAR OPTMISATION PROJECT
Northern Quoll Regional Land Systems

Scale @ A4: 1:500,000	Prepared: J.VIS	Project No: A949/100 REV A
Date: 2/12/2019	Checked:	Figure : 4.25
Revision: REV A	Reviewed: ENVIRO. A&I	

Northern Quoll records
Activity Area
Activity Area Buffer 25km

Land System

- Adrian
- Balfour
- Boolgeeda
- Cadgie
- Charley
- Disturbed Land
- Divide
- Elimunna
- Fan
- Fortescue
- Jamindie
- Laterite
- McKay
- Newman
- Prairie
- River
- Robertson
- Rocklea
- Spearhole
- Sylvania
- Table
- Talga
- Washplain
- Zebra

N

0 2 4 6
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_100_E_VN_NorthernQuoll_RangelandsLandSystems_RevA.mxd

4.7.3 Local Habitat

Regional likelihood mapping undertaken by Biota (2012) considered the activity area to occur in an area unlikely to support Northern Quolls, although suitable habitat for the species (comprising gorge and gully and major drainage line habitats) does occur. While potential habitat does occur within the activity area, in the form of hillcrest/hillslope and major drainage lines, these habitats do not form part of the species core habitat type, which is typically rocky breakaways and major gorges and gullies (DoE, 2016). Minor areas of breakaways are located within the north western area of the activity area, however this area is isolated and out of scope of this Validation Notice, due to being within the existing approved project area. Due to the lack of core habitat and the lack of recent records within the vicinity of the activity area, it is unlikely that this species occurs within the activity area (Biologic 2019 and GHD 2019). Approximately 4.5 ha of suitable gorge and gully habitat and 210 ha of major drainage line habitat for the Northern Quoll occurs within the activity area (Figure 4.26). Table 4.22 details the habitat assessment.

Table 4.22: Northern Quoll Habitat Assessment

Modelled Habitat Assessment (ha)					Survey Habitat Assessment (ha)		
Habitat Description	Modelled Habitat Area Pilbara bioregion	Modelled Habitat in Strategic Assessment Area	Modelled Habitat within the Full Development Scenario	Modelled within Activity Area^	Habitat Description	Within the Activity Area	Within the disturbance footprint Activity^
H4	1,552,321	64,228	504		Gorge and Gully	4.5	0.8
H3	4,497,928	221,103	3,104				
H2	3,822,101	678,966	3,104		Major drainage line	210	33
H1	7,920,267	4,993,780	273	6,268			

^ excluding the Jimblebar existing operations

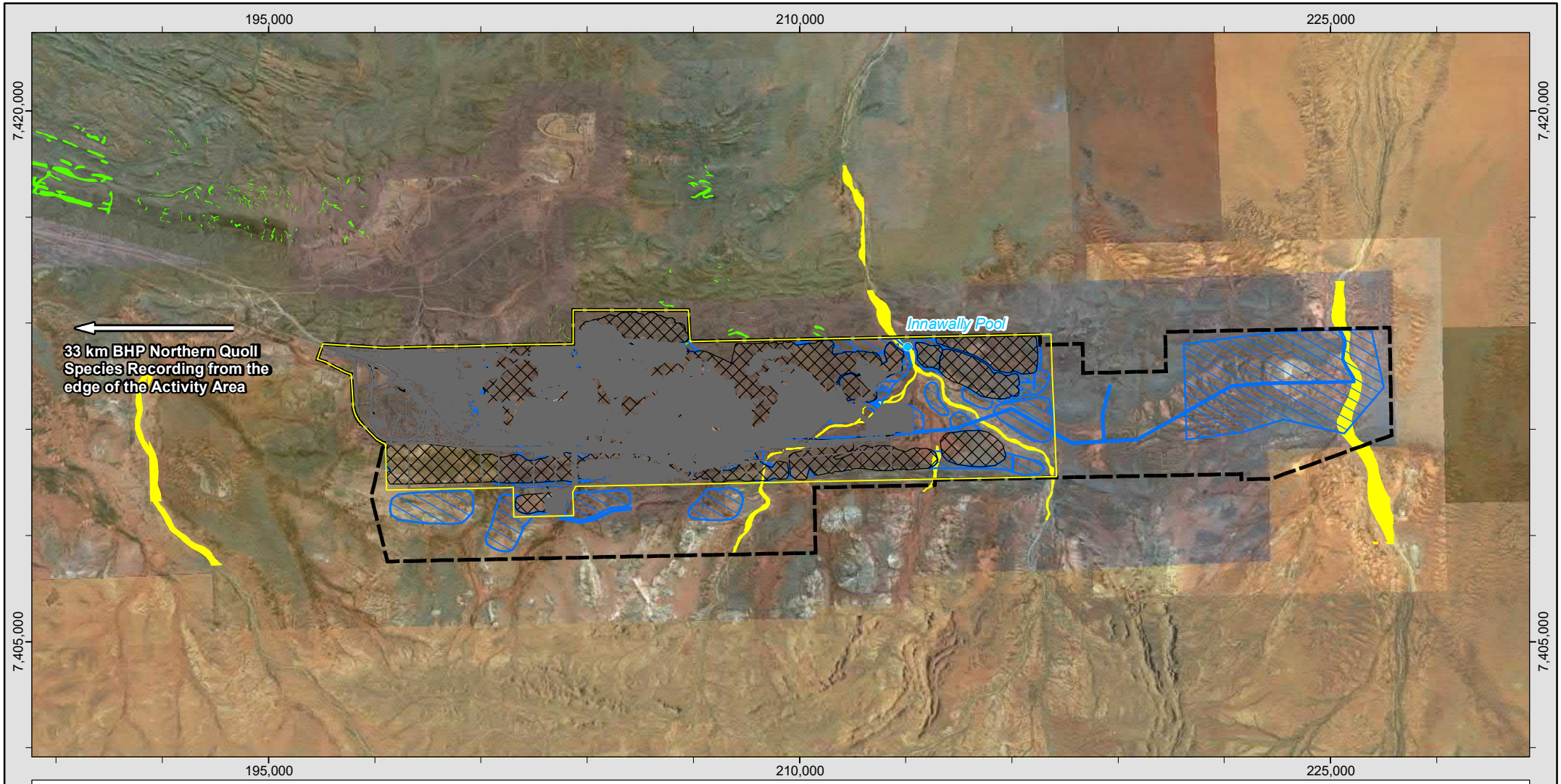
4.7.4 Northern Quoll Records

At present, Northern Quolls are relatively common in the northern Pilbara region (generally within 150 km of the coast) but are much less common in southern and south-eastern parts of the region (Cramer et al., 2016). There is a recognised paucity of record within the south eastern Hamersley Range which is an area considered to be beyond the south-eastern limit of the species range based on historical records (GHD 2019). There are no records of northern quolls within the activity area, despite extensive baseline and targeted surveys for quolls in the area, since 2004. The nearest record of a Northern Quoll is 33 km west of the activity area. The Northern Quoll is not known to occur locally, with area beyond the south-eastern limit of current geographic range (GHD 2019).

The activity area does not support an important population for the long-term survival of the Northern Quoll as defined by DoE (2016):

- high density quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present;
- occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water; and
- subject to ongoing conservation or research actions i.e. populations being monitored by government agencies or universities or subject to reintroductions or translocation.

Figure 4.27 details the survey areas within and surrounding the activity area.



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROJECT
Northern Quoll Habitat and Records

Scale @ A4: 1:155,000	Prepared: J.VIS	Project No: A949/78 REV B
Date: 2/12/2019	Checked:	Figure : 4.26
Revision: REV B	Reviewed: ENVIRO. A&I	

- Innawally Pool
- Existing Project Boundary
- Activity Area
- Indicative Cleared Area as at FY2019 (Out of Scope)
- Indicative Previously Assessed Area (Out of Scope)
- Indicative Disturbance Footprint

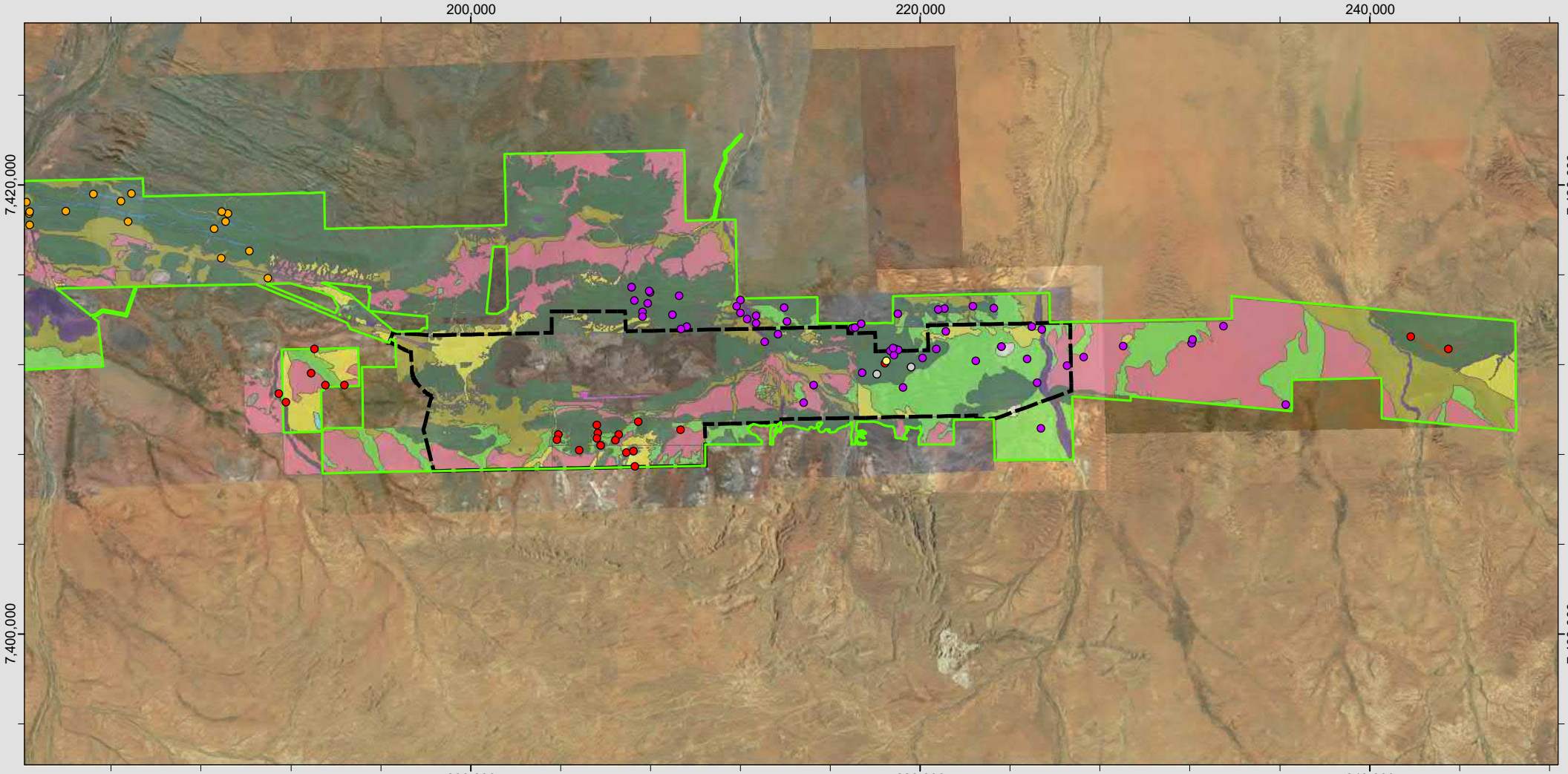
Habitat Types
- Gorge/ Gully
- Major Drainage Line

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_078_E_VN_NorthernQuollHabitat_Records_RevB.mxd



BHP

Spatial Data - Studies Planning & Access
BHP IRON ORE

JIMBLEBAR OPTIMISATION PROPOSAL
Northern Quoll Survey Coverage

Scale @ A4: 1:250,000	Prepared: J. VIS	Project No: A949/102 REV B
Date: 21/02/2020	Checked:	Figure : 4.27
Revision: REV B	Reviewed: ENVIRO. A&I	

Northern Quoll Sample Site
- 2005
- 2006
- 2008
- 2013
- 2018
- 2019
- Northern Quoll Survey Coverage
- Activity Area

Habitat Type
- Artificial Wetlands
- Breakaway/ Cliff
- Calcrete Plain
- Claypan
- Drainage Area/ Floodplain
- Gorge/ Gully
- Hardpan Plain
- Hillcrest/ Hillslope
- Major Drainage Line
- Medium Drainage Line
- Minor Drainage Line
- Mulga Woodland
- Sand Plain
- Stony Plain

N

0 1 2 3
Kilometres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Document Path: Y:\Jobs\A501_A1000\A949\3Project\A949_102_E_VN_NorthernQuoll_SurveyCoverage_RevB.mxd

4.7.5 Impact Assessment

Habitat Loss

The removal of Northern Quoll habitat from the activity area may result in the loss of denning and foraging habitat for the Northern Quoll, consequently causing a reduction in its distribution in the Pilbara bioregion. Suitable habitat for Northern Quoll within the activity area is the gorge and gully habitat. The surveys identified the gorge/gully habitat throughout the activity area with 4.5 ha of the habitat mapped. Although there is a presence of apparently suitable habitat within the activity area, this habitat is considered marginal (Biologic 2019 and GHD 2019). There is a lack of species records despite the extent of survey work undertaken for this species within the activity area and surrounds.

Habitat fragmentation could isolate Northern Quoll populations, reduce genetic connectivity across affected areas and increase the risk in reduction of local populations. All of the suitable habitats found within the activity area are contiguous with surrounding areas and are not considered uncommon in this part of the Hamersley Range.

Biologic (2018, 2019) and GHD (2019) conclude that while apparent suitable habitat was present, the lack of records of the species from the area and the known historical distribution of the Northern Quoll suggests that the species is unlikely to inhabit the area. As a result, the risk of habitat fragmentation to the Northern Quoll from the activity is considered to be low.

Feral Predators

Feral predators may compete with the Northern Quoll for food or may prey on it. The activity may attract feral predators to the area, with the establishment of water sources.

The season, frequency, extent and severity of fires are all likely to be key factors influencing Northern Quoll populations. The greatest threat posed by fire, however, is probably the increased risk of predation on Northern Quolls after removal of cover. When fire has removed the ground cover, Northern Quolls are more vulnerable to predators, such as dingoes, cats and raptors (Oakwood 2004). Evidence of cats was recorded during the 2018 and 2019 fauna surveys. With the lack of records of the Northern Quoll and known historical distribution of the species the impacts to the species are considered low.

The Northern Quoll is vulnerable to lethal toxic ingestion of cane toad toxin, and this is considered the main threat to Northern Quoll populations outside the Pilbara (Oakwood 2004; Hill & Ward 2010). The future predicted spread of the cane toad into the Pilbara bioregion may have comparable negative impacts to the Northern Quoll as observed in other areas of northern Australia. Some models predict that the cane toad's distribution will spread to include the Pilbara via the narrow coastal strip but that this spread will be dependent on artificial water bodies in this narrow strip (Tingley et al. 2013). It is acknowledged that introduction via vehicles or equipment can occur (Government of Western Australia, 2015).

4.7.6 Mitigation Hierarchy

Avoid

In early 2018, BHP identified a need for additional disturbance for OSAs south of the Jimblebar South pits due to:

- a lack of available area to allow expansion of OSAs, specifically adjacent to South Jimblebar, with the northern area constrained by existing infrastructure and the southern area constrained by the existing approved project area;
- a higher waste to ore ratio at South Jimblebar;
- backfill options being limited by pit stage sequencing requirements (a partial backfill schedule was developed to reduce the size of the OSAs required); and
- long-term impracticality of hauling waste material to backfill the depleted pit WH4 at the Wheelarra Hill deposit area.

Initial overall project disturbance requirements was estimated to be 3,000 ha. The initial mine plan was developed to maximise pit availability during the life of mine, therefore backfilling of mine pits was restricted. From this point, the

mine plan was optimised to maximise the backfilling of pits. This involved scheduling the early completion of pits so they can be immediately backfilled. This optimisation of backfilling reduces the disturbance required to construct OSAs to 2,000 ha. The majority of the major drainage line habitat, associated with Jimblebar Creek, will be retained.

Minimise

The primary potential impact to the Northern Quoll from the activity is loss of suitable habitat. The management measures proposed to minimise this impact include:

- avoiding direct impacts to suitable habitat, where practicable through planning and implementing the PEAHR internal process prior to land disturbance;
- limit the use of barbed wire fencing within and surrounding the activity area; and
- minimise clearing of native vegetation, by utilising existing infrastructure, facilities and cleared areas, and maximising the disposal of waste rock within mine pits, where practicable.

Rehabilitate

Given the absence of a population of the Northern Quoll within the activity area and the minor quantity of preferred habitat, any future rehabilitation of disturbed areas are unlikely to encourage the establishment of Northern Quoll populations within the activity area. Rehabilitation activities within the activity area will still be undertaken, in accordance with standard BHP rehabilitation procedures.

4.7.7 Residual Impact

The indicative disturbance footprint requiring direct disturbance of gorge/gully and major drainage line habitats consists of MAR borefield infrastructure (23 ha), other infrastructure (roads, laydown area etc.) (1 ha) and mine pits (10 ha) (see Table 4.23). Successful rehabilitation of the MAR borefield infrastructure areas will return the foraging habitat for potential use by the Northern Quoll. This results in an estimated residual impact to Northern Quoll habitat, from mine pits, of approximately 11 ha.

Table 4.23: Indicative Disturbance Footprint by Habitat and Activity

Habitat Description	Mine Pits (ha)	OSAs (ha)	MAR Borefield Infrastructure (ha)	Other Infrastructure (ha)	Indicative Disturbance (ha)	Residual Impact (ha)	Habitat Retained within Activity Area (ha)
Gorge and Gully (H3)	0	0	0	1	1	1	3.5
Major Drainage Line (H1)	10	0	23	0	33	10	200
Total	10	0	23	1	34	11	203.5

The significance of the 11 ha was assessed against the Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act (CoA 2013) and is presented in Table 4.24. Based on the available information the activity will not result in significant residual impact to the Northern Quoll.

Table 4.24: Significance of Residual Impact (Northern Quoll)

Aspect	Significant Impact Criteria[+]	Assessment[#]	Significance (L/M/H*)
Comparison of loss to regional representation of habitat	The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	1 ha of residual impact to gorge/gully habitat, with only 4.5 ha of suitable habitat within the activity area. Total of 10 ha residual impact to major drainage line habitat, from 210 ha within the activity area. Regionally there is 35,260 ha of the Newman Range land system.	L
Pre-existing condition of habitat impacted	The availability or quality of habitat to the extent that the species is likely to decline	The proposed habitat to be impacted is generally in 'good to excellent condition'.	L
Fragmentation of surrounding habitat	Fragment an existing important population^ into two or more populations	Surrounding habitat areas exist to the north of the activity area.	L
Presence of records in the habitat impacted	Reduce the area of occupancy of an important population^	No individuals have been identified within the impacted habitat area.	L
Presence of breeding individuals in the habitat impacted	Disrupt the breeding cycle of an important population^	No individuals have been identified within the impacted habitat area. No suitable breeding areas have been recorded within the activity area.	L
Value as a breeding or foraging area	Disrupt the breeding cycle of an important population^ The availability or quality of habitat to the extent that the species is likely to decline Adversely affect habitat critical to the survival of a species	1 ha of residual impact to gorge/gully habitat, with only 4.5 ha of suitable habitat within the activity area. No suitable breeding areas have been recorded within the activity area.	L
Avoid the introduction of disease and invasive species	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat Introduce disease that may cause the species to decline	Major drainage lines are generally in 'poor to good condition' (due to grazing). Due to the area currently being subject to mining and pastoral activities and the minor quantity of suitable habitat within the area, no new diseases or invasive species are likely to be introduced that could cause a decline in the species.	L
Long term viability of the species	Interfere substantially with the recovery of the species.	No individuals have been identified within the impacted habitat area. No suitable breeding areas have been recorded within the activity area. Regionally there is sufficient habitat to allow recovery of the species.	L

[+] Significant impact guidelines 1.1 (DoE, 2013)

[#] Biologic 2018, 2019 and GHD 2019

* L/M/H – low/moderate/high

^ 'a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range. '

4.7.8 Review of Program Matter Outcomes

Following the impact assessment (section 4.7.5 and 4.7.7) and application of the mitigation hierarchy (section 4.7.6) a review of the activity against the PMO was undertaken. Table 4.25 details a review and identifies which PMO are relevant for the activity and considers further management.

Table 4.25: Review of Program Matter Outcomes (Northern Quoll)

Program Matter Outcome	Applicable Triggers	Assessment
No loss of Northern Quoll population/s as a result of Program activities.	None applicable	No Northern Quoll populations have been identified within the activity area, therefore no loss of Northern Quoll populations will result from the activities.
No loss of Northern Quoll habitat that supports a high density population as a result of Program activities.	Presence of Northern Quoll habitat within or adjacent to the activity	No high density populations of Northern Quolls have been identified within the activity area.
Loss of Northern Quoll habitat is offset by measures that maintain or enhance the distribution and conservation status of the Northern Quoll.	Presence of Northern Quoll habitat within or adjacent to the activity	Minimal disturbance of Northern Quoll habitat is proposed by the activity which will maintain the distribution and conservation status.

4.7.9 Monitor

Due to the absence of Northern Quoll population within and adjacent to the activity area, the distance to the nearest Northern Quoll record (33 km west) and the small existing preferred habitat (gorge/gully) within and surrounding the activity area, no monitoring of the species is considered to be required.

4.7.10 Summary

BHP considers the activity will meet the PMO for Northern Quoll population, as no individuals have been identified within or adjacent to the activity area to indicate the presence of a population.

BHP considers the activity will meet the PMO for Northern Quoll habitat loss. The mitigation hierarchy has limited the loss of habitat to 11 ha in the activity area. Given the suitable habitat surrounding the activity area this residual impact is not considered significant. Therefore, there is no requirement to offset habitat loss as per Section 3.2 of the Program.

5 Offsets

The Jimblebar Optimisation Project Validation Notice has determined that the activity will not result in significant residual impacts to the Program Matters (Greater Bilby, Ghost Bat, Pilbara Olive Python, Pilbara Leaf-nosed Bat and Northern Quoll) as demonstrated through the mitigation hierarchy and will meet the PMOs for species and habitat. As described in Sections 3.2 and 7.2 of the Program, the Program does not require offsets where the residual impact is not significant.

BHP will provide financial contributions to the Pilbara Environmental Offsets Fund (PEOF) for the clearing of native vegetation in 'Good' to 'Excellent' condition, that contains foraging habitat for the Ghost Bat as per Ministerial Statement 1126 and EPA Report (1663, January 2020). This contribution and supporting assessment are summarised in Section 5.1. Additional offsets under the EPBC Act for loss of habitat would be a duplication of the State offsets for the project, which address clearing for the entire project footprint and includes habitat. The EPBC Act Environmental Offsets Policy states that 'A state or territory offset will count toward an offset under the EPBC Act to the extent that it compensates for the residual impact to the protected matter identified under the EPBC Act'. The loss of habitat was not considered an additional significant residual impact and in any case the State offset compensates for any residual impacts to which EPBC Act offsets would be directed.

5.1 State Offset Contribution to the PEOF

The Jimblebar Optimisation Project was referred to the WA EPA under section 38 of the EP Act as a Revised Proposal and the subsequent EPA Report (1663, January 2020) considered the following regarding the residual impact of the project and the subsequent offsets.

5.1.1 Terrestrial Fauna

"A recent targeted survey focussed on determining the presence of the ghost bat (Macroderma gigas) and the greater bilby (Macrotis lagotis) due to historical records of these conservation significant species in or near the development envelope.

There is a historical recording of the greater bilby east of the development envelope, with the presence of a burrow recorded. The targeted surveys did not record any new or recent evidence of this species. A sand goanna was recorded on camera near the historical burrow, with signs the goanna was utilising the burrow. The EPA considers that the greater bilby is unlikely to be found within the development envelope and further assessment of the impacts on this species is not required" EPA Report 1663, Page 22.

"The EPA also considers that given there are no significant roosts or roosting habitat within the development envelope, and there are large areas of foraging habitat available outside the development envelope that, the local loss of foraging habitat within the development is not necessary to maintain the species and does not constitute an additional significant residual impact at a local scale" EPA Report 1633 Page 23.

5.1.2 Offsets

Environmental offsets are actions that provide environmental benefits which counterbalance the significant residual impacts of a proposal. The EPA may apply environmental offsets where it determines that the residual impacts of a proposal are significant, after avoidance, minimisation and rehabilitation have been pursued. In applying the residual impact significance model (Government of Western Australia 2014), the EPA considers that the proposal (Jimblebar Optimisation Project) would have a significant residual impact from the following:

- clearing of native vegetation in 'Good' to 'Excellent' condition, that contains foraging habitat for the ghost bat.

In its advice on the cumulative impacts in the Pilbara (EPA 2014), the EPA considered that without intervention, the increasing cumulative impacts of development and land use in the Pilbara region will significantly impact on biodiversity and environmental values. The EPA considers that the clearing of native vegetation and impacts on other

associated environmental values in the Pilbara Interim Biogeographic Regionalisation for Australia (IBRA) bioregion is significant where the cumulative impact may reach critical levels if not managed.

The proposal is located within the Fortescue and Hamersley IBRA subregions. Only 0.55% of the Fortescue subregion and 13% of the Hamersley subregion are currently reserved for conservation.

Consistent with the Residual Impact Significance Model in the WA Environmental Offsets Guidelines, where the cumulative impact may reach critical levels if not managed, the clearing of up to 2,000 ha of native vegetation in 'Good' to 'Excellent' condition within the Fortescue and Hamersley IBRA subregions, that contains foraging habitat for the ghost bat and no significant roosts, requires an offset to counterbalance the significant residual impact of the clearing." EPA Report 1633 Page 24 and 25.

The EPA has recommended conditions requiring BHP to contribute funds to the Pilbara Environmental Offsets Fund to counterbalance residual impacts to vegetation in 'Good' to 'Excellent' condition, including foraging habitat for the ghost bat. The conditions proposed are detailed below:

9-1 In view of the significant residual impacts and risks as a result of the implementation of the proposal, the proponent shall contribute funds to the Pilbara Environmental Offset Fund calculated pursuant to condition 9-2, subject to any reduction approved by the CEO under condition 9-9.

9-2 The proponent's contribution to the Pilbara Environmental Offset Fund shall be paid biennially, with the amount to be contributed calculated based on the clearing undertaken in each year of the biennial reporting period in accordance with the rates in condition 9-3. The first biennial reporting period shall commence from vegetation clearing activities for the environmental values identified in condition 9-3.

9-3 Calculated on the 2018-2019 financial year, the contribution rates are:

(1) $816 AUD (excluding GST) per hectare of 'Good' to 'Excellent' condition native vegetation, including foraging habitat for ghost bat, cleared within the development envelope within the Hamersley IBRA subregion.

(2) $1,632 AUD (excluding GST) per hectare of 'Good' to 'Excellent' condition native vegetation, including foraging habitat for ghost bat, cleared within the development envelope within the Fortescue IBRA subregion.

6 Reporting

BHP will produce an Annual Environmental Report for all of its environmental obligations for each notifiable action under the Strategic Assessment Approval. As a minimum, the Annual Environmental Report will contain:

- Notifiable Actions identified under the Program;
- Details of activities within the scope of the Program which were commenced but were determined not notifiable;
- Status of implementation (planned start date, action commenced and planned completion date; and action completed) of all Notifiable Actions;
- Assets divested through the process described in Section 2.1 of the Program;
- Offsets implemented for each Notifiable Action;
- Where applicable, accumulated disturbance against Program Matter Outcome;
- Disturbance areas associated with all actions, whether material or non-material, implemented since the Approval. Both the annual disturbance and the total disturbance (since the Approval) will be included.
- Summary of any exceedances of the PMO relevant to each Notifiable Action, and corrective actions taken; and
- deviations from the Program or from information contained in a Validation Notice for a Notifiable Action.

7 References

Abbott, I (2001). 'The bilby *Macrotis lagotis* (Marsupialia: *Peramelidae*) in south-western Australia: original range limits, subsequent decline, and presumed regional extinction', Records of the Western Australian Museum, vol. 20, pp. 271-305.

Armstrong K. (2001). 'The distribution and roost habitat of the orange leaf-nosed bat, *Rhinonicteris aurantius*, in the Pilbara region of Western Australia', Wildlife Research, vol. 28, pp. 95-104.

Armstrong N.K. and Anstee D.S. (2000). The Ghost Bat in the Pilbara: 100 years on. Australian Mammalogy. vol.22 pp. 83-101

BHP (2016a). Code of Business Conduct. Available at: http://www.bhp.com/aboutus/ourcompany/codeofbusconduct.

BHP (2016b). Our Requirements Community. Available at: http://www.bhp.com/~/media/bhp/documents/aboutus/ourcompany/governance/160404_gld_community.pdf?la=en.

BHP (2016c). Our Requirements Environment and Climate Change. Available at: http://www.bhp.com/~/media/bhp/documents/aboutus/ourcompany/governance/160411_gld_environmentclimatechange.pdf?la=en.

BHP (2016). BHP Pilbara Strategic Assessment Impact Assessment Report. BHP Pty Ltd. Perth, Western Australia.

Biologic Environmental Survey (Biologic) & Bat Call WA (2014). Pilbara regional Ghost Bat review. Report prepared for BHP by Biologic and Bat Call WA. Western Australia, North Perth

Biologic Environmental Survey Pty Ltd (Biologic) (2013) *South West Jimblebar Vertebrate Fauna Survey*. Report prepared for BHP Billiton Iron Ore Pty Ltd, 2013, Western Australia.

Biologic Environmental Survey Pty Ltd (Biologic) (2014) *Consolidation of Regional Fauna Habitat Mapping: BHP Billiton Iron Ore Pilbara Tenure*. Report prepared for BHP Billiton Iron Ore Pty Ltd, 2014, Western Australia.

Biologic Environmental Survey Pty Ltd (Biologic) (2018) *Caramulla Level 1 Vertebrate Fauna Assessment*. Report prepared for BHP Billiton Iron Ore Pty Ltd, September 2018, Western Australia.

Biologic Environmental Survey Pty Ltd (Biologic) (2019) *Shearer's West Targeted Vertebrate Fauna and Short-range Endemic Invertebrate Fauna Assessment*. Report prepared for BHP Billiton Iron Ore Pty Ltd, January 2019, Western Australia.

Biologic Environmental Survey Pty Ltd (Biologic) (in prep) *East Jimblebar and Caramulla Flora and Vegetation Survey*. Report being prepared for BHP Billiton Iron Ore Pty Ltd, Western Australia.

Bullen B. (2013). Pilbara Leaf-Nosed Bat (PLN) *Rhinonicteris aurantia*: Summary of current data on distribution, energetics, threats, Microsoft PowerPoint presentation prepared by Bob Bullen. Viewed 10 October 2014. Available at: www.sustainable.net.au/pilbara-leaf-nosed-bat/.

Bullen, R. and Creese, S. (2014). A note on the impact on Pilbara leaf-nosed and Ghost Bat activity from cave sound and vibration levels during drilling operations. *The Western Australian Naturalist* 29: 145-154.

Bush B. and Maryan B. (2011). Field Guide to Snakes of the Pilbara, Western Australia. Western Australian Museum. Western Australia, Perth.

Busnel, R.G. and Fletcher, J.L. (Eds.) (1978). *Effects of Noise on Wildlife*. Academic Press, New York.

Commonwealth of Australia (2010). Survey guidelines for Australia's threatened bats. Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/system/files/resources/2f420bf1-d9e4-44ec-a69c-07316cb81086/files/survey-guidelines-bats.pdf

Commonwealth of Australia (2011) Survey guidelines for Australia's threatened mammals; Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/system/files/resources/b1c6b237-12d9-4071-a26e-ee816caa2b39/files/survey-guidelines-mammals.pdf

Commonwealth of Australia (2011) Survey guidelines for Australia's threatened reptiles. Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/system/files/resources/eba674a5-b220-4ef1-9f3a-b9ff3f08a959/files/survey-guidelines-reptiles.pdf

Commonwealth of Australia (2011). Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads. Department of the Environment, Canberra. Available from: http://www.environment.gov.au/resource/threat-abatement-plan-biological-effects-including-lethal-toxic-ingestion-caused-cane-toads

Commonwealth of Australia (2013) Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act

Commonwealth of Australia (2016) EPBC Act referral guideline for the endangered northern quoll. . Department of the Environment, Canberra

DBCA (2017) Guidelines for surveys to detect the presence of bilbies and assess the importance of habitat in Western Australia. DBCA

DotE (2014a), Species Profile and Threats Database - Northern Quoll. Prepared by the Commonwealth Department of the Environment (DotE). Canberra, ACT. Viewed: 16 March 2014. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

DotE (2014b), Species Profile and Threats Database - The Greater Bilby. Prepared by the Commonwealth Department of the Environment (DotE). Canberra, ACT.

DotE (2014c), Species Profile and Threats Database - Olive Python (Pilbara subspecies).Prepared by the Commonwealth Department of the Environment (DotE). Canberra, ACT. Viewed: 16 March 2014. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

DotE (2016a), Species Profile and Threats Database – Ghost Bat. Prepared by the Commonwealth Department of the Environment (DotE). Canberra, ACT. Viewed: 1 July 2016. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

Doughty, P, Rolfe, J, Burbidge, A, Pearson, D and Kendrick, P (2011). 'Herpetological assemblages of the Pilbara biogeographic region, Western Australia: ecological associations, biogeographic patterns and conservation', Records of the Western Australian Museum- Supplement 78, pp. 315–341, viewed 10 June 2014, http://museum.wa.gov.au/sites/default/files/WAM_Supp78(B)_DOUGHTYetal.pdf

Ecologia Environment (Ecologia) (2005). Pilbara Leaf-Nosed Bat, (*Rhinonicteris aurantius*) and Ghost Bat, (*Macroderma gigas*) monitoring survey at Nimingarra and Cattle Gorge 2005. Unpublished report prepared for BHP, Western Australia, Perth.

Ecologia Environment (Ecologia) (2006a). Goldsworthy bat monitoring, February 2006. Unpublished report prepared for BHP, Western Australia, Perth.

Ecologia Environment (Ecologia) (2006b). Hashimoto terrestrial fauna survey. Unpublished report prepared for BHP, Western Australia, Perth

Eco Logical Australia (Eco Logical) (2014a). BHP Proposal: Cumulative Impact Assessment, Species Synopsis – Northern Quoll. Unpublished report prepared for BHP, Western Australia, Perth.

Eco Logical Australia (Eco Logical) (2014b). BHP Proposal: Cumulative Impact Assessment, Species Synopsis – Pilbara Leaf-Nosed Bat. Unpublished report prepared for BHP, Western Australia, Perth.

Eco Logical Australia (Eco Logical) (2015). Predictive Species Habitat Modelling: Pilbara IBRA. Unpublished report prepared for BHP, Western Australia, Perth.

GHD (2019) Jimblebar East and Caramulla Fauna Survey. Report prepared for BHP Billiton Iron Ore, August 2019.

Government of Western Australia (2014) Cumulative environmental impacts of development in the Pilbara region.

Greatwich B. 2013. Bilby records from Fortescue's Mainline monitoring (2013-ongoing), Microsoft PowerPoint presentation prepared by Bruce Greatwich, Ecologia Environment. Viewed: 10 October 2014. Available at: http://www.sustainable.net.au/bilby/.

Grierson, P. (2015) Dust suppression and likelihood of adverse impact on *Acacia sp.* East Fortescue at Orebdoy 31. Confidential report for BHP Billiton Iron Ore, University of Western Australia.

Johnson, K.A (2008). Bilby, *Macrotis lagotis*. In ' The Mannals of Australia.' (pp. 191-193) Third edition.)

Hill, B. & S. Ward (2010). National Recovery Plan For the Northern Quoll *Dasyurus hallucatus*. Department of Natural Resources, Environment, The Arts and Sport, Northern Territory. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/northern-quoll.html.

McKenzie, N.L. and Bullen, R.D. (2009). The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats. Records of the Western Australian Museum, Supplement 78: 123–155.

Pavey C. (2006a). National Recovery Plan for the Greater Bilby *Macrotis lagotis*, Northern Territory Department of Natural Resources, Environment and the Arts, Viewed: 10 June 2014. Available at: http://www.environment.gov.au/system/files/resources/37646d5b-a355-45d6-9c78-604833626a37/files/m-lagotis.pdf.

Pavey C. (2006b). Threatened species of the Northern Territory, Greater Bilby *Macrotis lagotis*. Department of Natural Resources Environment and the Arts, Parks and Wildlife Commission Northern Territory.

Pearson D. (2003). Giant Pythons of the Pilbara, Landscope, vol. 19, pp. 32-39.

Oakwood M. (2002). Spatial and social organization of a carnivorous marsupial *Dasyurus hallucatus* (Marsupialia: Dasyuridae). *Journal of Zoology London* 257: 237-248.

Oakwood M. (2004). The effect of cane toads on a marsupial carnivore, the northern quoll, *Dasyurus hallucatus*. Report to Parks Australia.

Oakwood, M. (2008). Northern Quoll *Dasyurus hallucatus*. *The Mammals of Australia*. (Ed: R. Strahan). Sydney, Reed New Holland.

Rich, C. and Longcore, T. (2006) Ecological Consequences of Artificial Night Lighting, Island Press, Washington, DC.

SKM (2012). Browse Bilby Review – Consolidated Information Relating to the Occurrence of Bilby (*Macrotis lagotis*). Report prepared by Sinclair Knight Mertz (SKM), Western Australia, Perth

Southgate R. (1990). Habitats and diet of the Greater Bilby *Macrotis lagotis* Reid (Marsupialia: Peramelidae), in Seebeck, J, Brown, P, Wallis, R and Kemper, C (eds), Bandicoots and Bilbies, pp. 303-309, Surrey Beatty and Sons: Chipping Norton, NSW.\

Southgate R., Paltridge R., Masters R. and Carthew S. (2007). Bilby distribution and fire: a test of alternative models of habitat suitability in the Tanami Desert, Australia, Ecography, vol. 30, pp.759-776.

Southgate, R., Dziminski, M., Partridge, R., Schubert, A., and Gaikhorst, G. 2018. Verifying bilby presence and the systematic sampling of wild populations using sign-based protocols – with notes on aerial and ground based techniques and asserting absence. Australian Mammalogy.

SRK Consulting. (2016). Jimblebar Preliminary Acid and Metalliferous Drainage Source Assessment.

Threatened Species Scientific Committee (TSSC) (2005). Commonwealth Listing Advice on Northern Quoll (*Dasyurus hallucatus*). Available from: http://www.environment.gov.au/biodiversity/threatened/species/dasyurus-hallucatus.html.

Tidemann, C.R, Priddel, D.M., Nelson, J.E. & Pettigrew, J.D (1985). Foraging behaviour of the Australian Ghost Bat, *Macroderma gigas* (Microchiroptera: Megadermatidae), Australian Journal of Zoology 33, 705-713.

Tingley, R., Phillips, B. L., Letnic, M., Brown, G. P., Shine, R., and Baird, S. J. (2013). Identifying optimal barriers to halt the invasion of cane toads Rhinella marina in arid Australia. Journal of Applied Ecology 50, 129–137.

TSSC (2008). Approved Conservation Advice for *Liasis olivaceus barroni* (Olive Python – Pilbara subspecies), Conservation Advice approved by the Minister/Delegate of the Minister on 3 July 2008. Viewed: 03 July 2013. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66699-conservation-advice.pdf.

TSSC (2016a). Approved Conservation Advice for *Macrotis lagotis* (Greater Bilby). Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/282-conservation-advice-15072016.pdf.

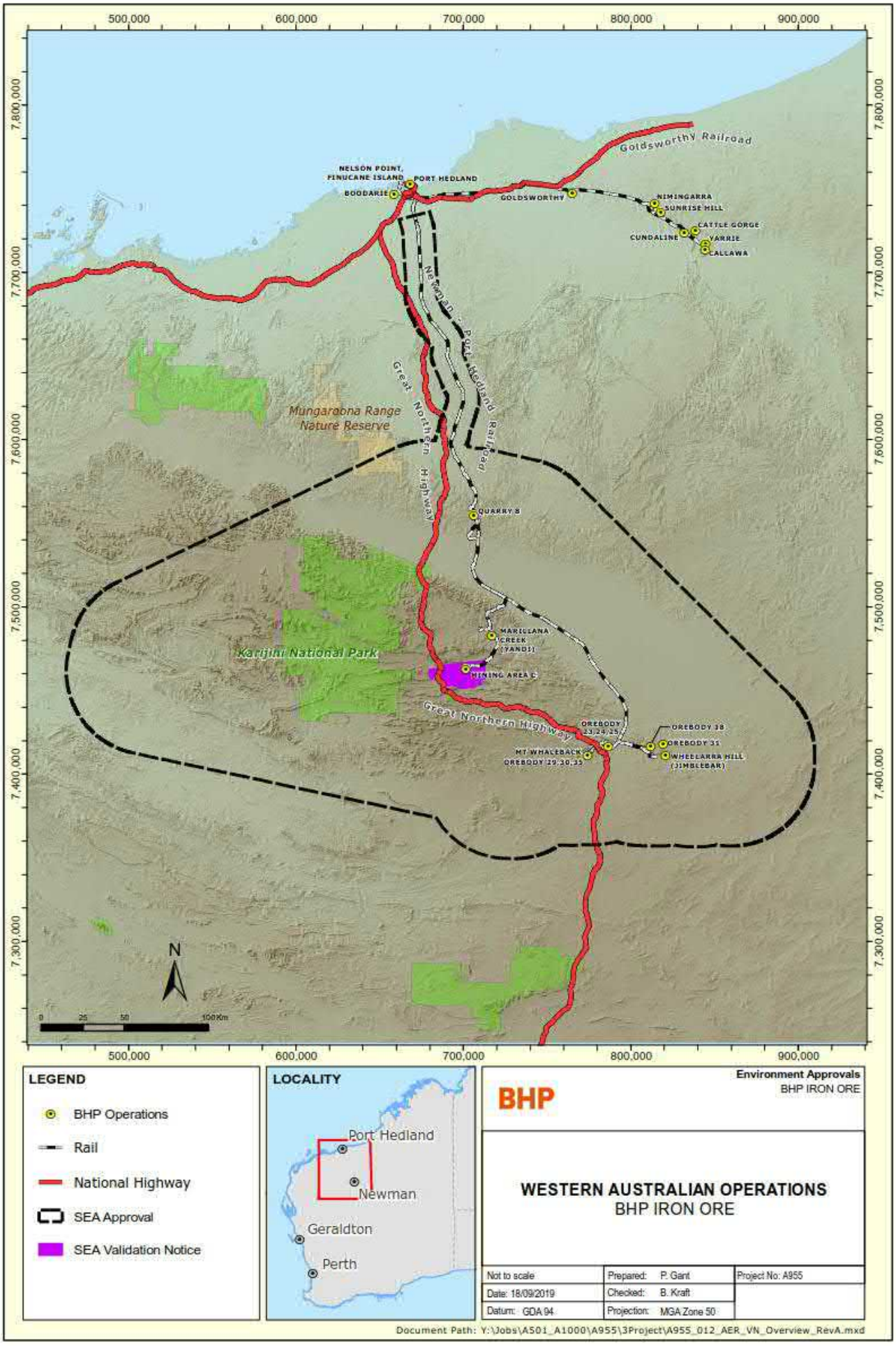
TSSC (2016b). Approved Conservation Advice for *Rhinonicteris aurantia* (Pilbara form) (Pilbara Leaf-Nosed Bat). Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/82790-conservation-advice-10032016.pdf.

TSSC (2016c). Approved Conservation Advice for *Macroderma gigas* (Ghost Bat). Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/174-conservation-advice-05052016.pdf

van Dyck S. and Strahan R. (2008). The Mammals of Australia, ed. 3, Reed New Holland, Sydney.

8 Appendices

Appendix 1: Strategic Environmental Assessment Approval Area


500,000
600,000
700,000
800,000
900,000
7,800,000
7,700,000
7,600,000
7,500,000
7,400,000
7,300,000
Goldsworthy Railroad
NELSON POINT, PINUCANE ISLAND
PORT HEDLAND
BOODARIE
GOLDSWORTHY
NIMINGARRA
SUNRISE HILL
CATTLE GORGE
CUNDALINE
YARRIE
CALLAWA
Newman - Port Hedland Railroad
Great Northern Highway
Mungaroona Range Nature Reserve
QUARRY 8
MARILLANA CREEK (YANDI)
Karijini National Park
MINING AREA C
Great Northern Highway
OREBODY 23,24,25
OREBODY 38
OREBODY 35
MT WHALEBACK OREBODY 29,30,35
WHEELARRA HILL (JIMBLEBAR)
N
0 25 50 100Km
LEGEND
BHP Operations
Rail
National Highway
SEA Approval
SEA Validation Notice
LOCALITY
Port Hedland
Newman
Geraldton
Perth
BHP
Environment Approvals
BHP IRON ORE
WESTERN AUSTRALIAN OPERATIONS
BHP IRON ORE
Not to scale
Prepared: P. Gant
Project No: A955
Date: 18/09/2019
Checked: B. Kraft
Datum: GDA 94
Projection: MGA Zone 50
Document Path: Y:\Jobs\A501_A1000\A955\3Project\A955_012_AER_VN_Overview_RevA.mxd

Appendix 2: Department of Agriculture, Water and the Environment – Jimblebar Validation Notice and Offset Proposal Analysis

Jimblebar Optimisation Project - Validation Notice

DAWE Comments	BHP Comments
1. Discussion of avoidance and mitigation measures would benefit from greater clarity in relation to the mine planning process. The approximation of impacted area and demonstration of how the pre-avoidance area of 3000 ha was firstly determined and then reduced to 2000 ha including avoiding clearance of 500 ha of bilby habitat could be more clearly explained.	Section 4.3.7, 4.4.6, 4.5.7, 4.6.6 and 4.7.6 of the Validation Notice have been updated.
2. Noting the identification of direct disturbance or clearing of protected matter habitat as a result of the action, the Department does not necessarily consider it reasonable to conclude that there is no significant residual impact and therefore no offset required. The Department does not necessarily support the finding of impacts as 'minor' and therefore not requiring an offset just because there is a large amount of surrounding habitat not presently at risk of mining or exploration. Clarifying the residual impact methodology and conversion to offset would streamline review of future validation notices.	The significance of the total residual impact was assessed against each criteria of the Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act (CoA 2013) for each species within the Validation Notice. Tables 4.5, 4.9, 4.15, 4.20 and 4.24 withint the Validaiton Notice provide a detailed assessment of the significance of the total residual impact. Sections 4.3.5, 4.4.4, 4.5.5, 4.6.4 and 4.7.4 of the Validation Notice detail the species species records within the region of the activity area. Based on this assessment the Validation Notice determined that the activities meet the PMOs for species and habitat and therefore there are no requirements to offsets habitat loss. The EPA assessment did not consider impact to Ghost Bat or Greater Bilby habitat as significant. However, given the significant residual impacts resulting from the clearing of vegetation within the Pilbara region, the EPA required offsets to counterbalance the residual impacts of the vegetation clearing. Any additional offsets considered by DAWE would be a duplication of the State offsets for the project. Section 5 has been added to the Validation Notice to include an offsets review.
3. The Department is keen to work with BHP to ensure the Residual Impact methodology is clarified and agreed as part of a revised Assurance Plan and Offsets	BHP is currently undertaking a review of the Assurance Plan to clarify residual impact methodology and will consult with the Department during this review process.
4. The Department is concerned to ensure that both direct and indirect impacts are appropriately accounted for.	
i. The MAR borefield is an area impacted, however it appears that only the direct impacts from bore sites and access tracks/associated infrastructure are being counted as impacts. Indirect impact should also be assessed/counted where applicable.	Sections 4.3.6, 4.4.5, 4.5.6, 4.6.5 and 4.7.5 of the Validation Notice have been updated.
ii. There will be significant flows up to 75ML/day into Caramulla Creek extending 34km downstream. This is a new permanent discharge in a normally ephemeral environment. Flows are not temporary and could be expected to create a physical barrier to movement, an aggregator of predators and a change in floral and faunal assemblage. Downstream areas also form potential Pilbara Olive Python (POP) habitat. The direct and indirect impacts of these changes under all flow conditions should be considered.	Sections 4.3.6 and 4.5.6 of the Validation Notice have been updated.
iii. The notice indicates 3.5 ha of impact to Ghost Bat and other species. Based upon information provided about the role of major drainage lines, the Department queries if in fact the potential impact to foraging habitat will be larger.	The 3.5ha of disturbance to major drainage line within the 2km forging range of the Ghost Bat. Sections 4.4.4 and 4.4.7 of the Validation Notice has been updated to include the addtional disturbance outside the 2km foraging range, as per the assessment for the Pilbara Olive Python.
5. The Project Environmental and Aboriginal Heritage Review (PEAHR) process is identified for numerous matters to mitigate impacts. The PEAHR was not endorsed as part of the Assurance Plan process and is not understood by the Department. BHP's response to the Department's comments of 7 June 2019 suggest the Jimblebar Draft VN will outline the PEAHR process. This information should ideally be provided as	Section 4.3.7 of the Validation Notice have been updated.
6. The derivation of the 25km buffer ascribed around the Activity Area (per Figure 4.3 and others) needs to be further explained to demonstrate and ensure alignment of this approach with the current approved Assurance and Offsets Plans.	The assurance plan indicates that 'adjacent activity' is anywhere up to 10km or the extend of the groundwater drawdown. Given these distances, the use of 25km aligns with the Assurance Plan.
7. The notice would be improved with greater clarity about survey outcomes and justification of survey efforts and locations against requirements set out under the endorsed program, in particular to ensure the validation notice and decision-making is based on 'contemporary information'.	See sections 4.1, 4.2 , 4.3.3 and 4.4.3 and Figures 4.4, 4.9, 4.17, 4.22 and 4.27 within the Validation Notice.

Jimblebar Optimisation Project - Validation Notice

DAWE Comments (8 April 2020)	BHP Comments
1. Discussion of avoidance and mitigation measures would benefit from greater clarity in relation to the mine planning process. The approximation of impacted area and demonstration of how the pre-avoidance area of 3000 ha was firstly determined and then reduced to 2000 ha including avoiding clearance of 500 ha of bilby habitat could be more clearly explained.	Section 4.3.7, 4.4.6, 4.5.7, 4.6.6 and 4.7.6 of the draft Validation Notice were amended.
2.Given that the Jimblebar project has triggered the need for a validation notice as a notifiable action, and in light of the identification of direct disturbance or clearing of protected matter habitat as a result of the action, the Department does not consider it reasonable to conclude that there is no significant residual impact and therefore no offset required. The Department does not necessarily support the finding of impacts as 'minor' and therefore not requiring an offset just because there is a large amount of surrounding habitat not presently at risk of mining or exploration. Clarifying the residual impact methodology and conversion to offset would streamline review of this project and future notifiable actions and validation notices. The Department welcomes the opportunity to discuss this matter further and is keen to work with BHP to ensure the Residual Impact methodology is clarified and agreed as part of a revised Assurance Plan and Offsets Plan. The Department also welcomes the opportunity to discuss the details of the offsets to be provided for the Jimblebar project to satisfy State requirements and whether they meet requirements of the endorsed Program.	The significance of the total residual impact was assessed against each criteria of the Matters of National Environmental Significance Significant Impact Guidelines 1.1 EPBC Act (CoA 2013) for each species within the Validation Notice. Tables 4.5, 4.9, 4.15, 4.20 and 4.24 within the Validaiton Notice provide a detailed assessment of the significance of the total residual impact. Sections 4.3.5, 4.4.4, 4.5.5, 4.6.4 and 4.7.4 of the Validation Notice detail the species records within the region of the activity area. Based on this assessment the Validation Notice determined that the activities meet the PMOs for species and habitat and therefore there are no requirements to provide additional offsets for habitat loss. Offsets will be provided as part of the State assessment of the Jimblebar Optimisation Project. Details of the offset were provided in the draft Validation Notice. The EPA assessment did not consider impact to Ghost Bat or Greater Bilby habitat as significant. However, given the significant residual impacts resulting from the clearing of vegetation within the Pilbara region, the EPA required offsets to counterbalance the residual impacts of the vegetation clearing. Any additional offsets considered by DAWE would be a duplication of the State offsets for the project. Section 5 was added to the Validation Notice to include an offsets review, which includes the State offset contribution into the Pilbara Environmental Offset Fund (PEOF).
3. The Department is concerned to ensure that both direct and indirect impacts are appropriately accounted for.	
i. The MAR borefield is an area impacted, however it appears that only the direct impacts from bore sites and access tracks/associated infrastructure are being counted as impacts. Indirect impact should also be assessed/counted where applicable. The document would also benefit from clearer technical details eg the depth and nature of bores in the borefield, or the possible pathways for surface expression of injected groundwaters.	Sections 4.3.6, 4.4.5, 4.5.6, 4.6.5 and 4.7.5 of the draft Validation Notice were amended.
ii. There will be significant flows up to 75ML/day into Caramulla Creek extending 34km downstream. This is a new permanent discharge in a normally ephemeral environment. Flows are not temporary and could be expected to create a physical barrier to movement, an aggregator of predators and a change in floral and faunal assemblage. Downstream areas also form potential Pilbara Olive Python (POP) habitat. The direct and indirect impacts of these changes under all flow conditions should be considered.	Sections 4.3.6 and 4.5.6 of the draft Validation Notice were amended.
iii. The notice indicates 3.5 ha of impact to Ghost Bat and other species. Based upon information provided about the role of major drainage lines, the Department queries if in fact the potential impact to foraging habitat will be larger.	The 3.5ha of disturbance to major drainage line is within the 2km forging range of the Ghost Bat. Sections 4.4.4 and 4.4.7 of the draft Validation Notice were amended to include the addtional disturbance outside the 2km foraging range, as per the assessment for the Pilbara Olive Python.
iv. While there may by adjacent or contiguous habitat for some species, this is difficult to determine due to the scale of maps provided. The provision of shape files would aid such assessment	BHP can provide DAWE with higher resolution maps.
v. The Conservation Advice and the PMO for Ghost Bat identify a 5km radius from a diurnal roost site. This would increase the potential impacted area and potential offset requirement for this species.	The Assurance Plan defines the term "adjacent" for the notifiable action trigger for each species. For the Ghost Bat adjacent is determined as the area within a 5km radius from the activity area. As stated in the recent fauna survey completed for the east Jimblebar area (GHD 2019), studies that have been undertaken on Ghost Bat foraging found that the species will move up to 2 km from a roost cave, utilising large trees as vantage points to hunt (Churchill 1998). Based on the information presented, a buffer of 2 km (radius from roost) was used to determine the potential impacts on the Ghost Bat foraging habitats, on the roosts with evidence of Ghost Bat use (i.e. scats) occurring outside the Activity Envelope. BHP notes that the Conservation Advice does not refer to a definitive distance, and refers to 1.9 km (Tidemann et al. 1985) and Bullen pers. Comm., 2015 '[for Ghost Bats] to persist in an area, colonies require a group of caves and a gully/gorge system that opens onto a plain or riparian line for foraging, typically less than 5km from the diurnal roost site'. Therefore, BHP considers that the 2 km distance is appropriate for the foraging range and more scientifically robust, as it is based on a scientific study, rather than the 5 km distance which is a personal communication. The Validation Notice takes a conservative approach with Table 4.7 (in section 4.4.4) detailing the total indicative disturbance area of preferred Ghost Bat habitiat within the activity area, not only those within the 2km radius forging range. The assessment of the residual impact within Section 4.4.7 considers the total indicative disturbance area, not just within the 2km radius. Therefore, increasing the radius to 5km would not increase the potentially impacted area or the residual impact area.
vi. The Department queries the assumption that successful rehabilitation has occurred when calculating a potential residual impact. A residual impact, and corresponding offset, is typically calculated once all avoidance and mitigation measures that can be taken before disturbance occurs have been implemented.	As detailed in Sections 4.3.7 and 4.3.8, only the disturbance of infrastructure areas, which have been successfully rehabilitated in the Pilbara, have been not been considered residual impact. There are numerous examples in the Pilbara region, where infrastructure areas have been successfully rehabilitated due to the relatively minor distubance within large habitiat areas that allows the reintegration of the disturbed areas back into the larger habitiat areas.
4. The Project Environmental and Aboriginal Heritage Review (PEAHR) process is identified for numerous matters to mitigate impacts. The PEAHR was not endorsed as part of the Assurance Plan process and is not understood by the Department. BHP's response to the Department's comments of 7 June 2019 suggest the Jimblebar Draft VN will outline the PEAHR process. This information should ideally be provided as indicated.	Section 4.3.7 of the draft Validation Notice was amended.
5. The derivation of the 25km buffer ascribed around the Activity Area (per Figure 4.3 and others) needs to be further explained and substantiated with appropriate technical studies where appropriate, to demonstrate and ensure alignment of this approach with the current approved Assurance and Offsets Plans. Given the size of the project area, provision of shape files would further aid the assessment of the notice.	The assurance plan indicates that 'adjacent activity' is anywhere up to 10km of the activity area or the extend of the groundwater drawdown. Species located within 10km of the activity are considered adjacent and have to potential to move at least 10km further away from the activty. Therfore, land systems within 25km of the activity area are considered within the potential range of species adjacent to the activity area.
6. The notice would be improved with greater clarity about survey outcomes and stronger justification of survey efforts and locations against requirements set out under the endorsed program, in particular to ensure the validation notice and decision-making is based on 'contemporary information'.	See sections 4.1, 4.2 , 4.3.3 and 4.4.3 and Figures 4.4, 4.9, 4.17, 4.22 and 4.27 within the Validation Notice.

Appendix 3: Terrestrial Fauna Surveys

Terrestrial Fauna Surveys

Survey	Jimblebar Mine Site Biological Survey	South-West Jimblebar Vertebrate Fauna Survey	Caramulla Level 1 Vertebrate Fauna Assessment	Shearer's West targeted Vertebrate and Short-range Endemic Invertebrate Fauna Assessment	Jimblebar-Wheelarra Hill 3 Flora and Fauna Assessment	Jimblebar Iron Ore Project Pebble-mound Mouse *Pseudomys chapmani* site survey	Jimblebar-Wheelarra Hill Biological Survey (Survey ID 494)	East Jimblebar Exploration Project Biological Survey (Survey ID 460)	BHPBIO Hashimoto Terrestrial Vertebrate Fauna Assessment	Jimblebar Marra Mamba Exploration Biological Survey	West Jimblebar Lease Fauna Assessment	Wheelarra Hill North Fauna Assessment	Carramulla Exploration Area Flora and Vegetation Survey and Fauna Assessment	Jimblebar East and Caramulla Fauna Survey	Jimblebar Iron Ore Project Terrestrial Vertebrate Fauna Assessment	Wheelarra Hill Iron Ore Modification Flora and Fauna Assessment	Total Survey Effort
Consultant	BHP (1994)	Biologic (2013a)	Biologic (2018a)	Biologic (2019)	Biota (2004)	ecologia (1996)	Ecologia (2004a)	ecologia (2005)	ecologia (2006a)	ecologia (2006b)	ENV (2007b)	ENV (2012)	GHD (2009)	GHD (2019)	Outback Ecology Services (2009a)	Outback Ecology Services (2009c)	NA
Type	Level 2 Fauna Survey	Level 2 Fauna Survey	Level 1 Fauna Survey	Level 2 Fauna Survey	Level 1 Fauna Survey	Targeted	Level 2 Fauna Survey	Level 1 Fauna Survey	Level 2 Fauna Survey	Level 1 Fauna Survey	Level 2 Fauna Survey	Level 2 Fauna Survey	Level 1 Fauna Survey	Level 2 Fauna Survey	Level 2 Fauna Survey	Level 2 Fauna Survey	10 Level 2 5 Level 1 1 Targets
Survey dates	11 - 22 June 1994	4 -17 March 2013	17 - 21 Feb 2018	29 April - 4 May 2018	28th and 29th August 2003	7-18 Dec 1995	9 Feb – 13 Mar 2004	8 Feb – 14 Feb 2005	26 Aug – 16 Sep 2005 6 – 15 Feb 2006	22 – 28 May 2006	14-21 May 2007	7-18 April and 4-13 October 2011	1 - 8 Dec 2008	29 April - 10 May 2019	4 -15 June and 27 Sept - 3 Oct 2008	4 to 15 June 2008, and 25 Sept to 2 Oct 2008	NA
No. of trapping sites	18	4	0	5	0	0	5	0	6	0	10	7	0	8	9	5	77
Trapping site configuration	Pit and Elliott traps	Two lines of 5 pitfall traps, 10 funnel traps,10 Elliott traps and 1 cage trap	N/A	10 Elliott traps/site	N/A	N/A	Two trap lines of 20 Elliott,10 pitfall, 4 funnel	N/A	Trap lines of 20 Elliott,10 pitfall, 2 funnel, 2 cage traps	N/A	10 Elliott and 10 funnel traps (Trap lines also opened at Coodiner)	10 Elliott traps, 2 cage traps and 10 trapping grids each consisting of 2 funnel and 1 pitfall trap	N/A	10 Elliot traps, 2 cage traps, 10 buckets traps and 20 funnel traps	Two drift fences/site. Alternating bucket/PVC. Elliot/cage either side	Two drift fences/site. Alternating bucket/PVC. Elliot/cage either side	NA
Nights trapped	10	7	N/A	3-5	N/A	N/A	Not specified	N/A	Not specified	N/A	Not specified	14	N/A	9	Not specified	7	52
Cage nights	0	56	N/A	0	N/A	N/A	0	N/A	360	N/A	245	316	N/A	9	126	52	1,164
Elliott nights	675	560	N/A	190	N/A	N/A	620	N/A	2640	N/A	275	176	N/A	9	1330	320	6,795
Funnel nights	0	560	N/A	0	N/A	N/A	260	N/A	1320	N/A	520	1960	N/A	9	322	216	5,167
Bucket nights	175	280	N/A	0	N/A	N/A	307	N/A	1220	N/A	245	980	N/A	9	125	130	3,471
PVC Pipe nights	0	0	N/A	0	N/A	N/A	0	N/A	0	N/A	0	0	N/A	N/NA	125	130	255
Pot traps[21]	0	0	N/A	0	N/A	N/A	0	N/A	0	N/A	490	0	N/A	N/A	0	0	490
Total Trap nights	850	1456	0	190	0	0	1187	0	5540	0	1775	3432	0	2520	2028	1048	20,026
Diurnal search (hrs)	18	73	9	5	Not stated	Not stated	15	246	59	42	35	60	Not stated	Not stated	22 searching and 38.5 opportunistic	12	634
Nocturnal search (hrs)	0	24	0	0	0	0	Not specified	48	19	19	12	19	Not stated	510	18.75	5.5	675
Bird surveys (hrs)	9	5.5	96 hours recordings	84 hours recordings	Not stated	0	12.3	15.5	45	0	34	49	Not stated	820	19	7.67	1,197
Bird survey method	Not stated	20 minute census	Acoustic (Night parrot) and census	Acoustic (Night parrot) and census	Not stated	0	20 minute census	20 minute census	20 minute census	N/A	Opportunistic	15 minute census	Opportunistic	Opportunistic	20 min census	Fixed min census	NA
Bat recording (nights)	0	15	12	9	0	0	25	2	30	15	3	2	0	28	0	1	142

[21] Small 500 ml 'pots' employed as a means of potentially trapping small sub-fossorial taxa.

Survey	Jimblebar Mine Site Biological Survey	South-West Jimblebar Vertebrate Fauna Survey	Caramulla Level 1 Vertebrate Fauna Assessment	Shearer's West targeted Vertebrate and Short-range Endemic Invertebrate Fauna Assessment	Jimblebar-Wheelarra Hill 3 Flora and Fauna Assessment	Jimblebar Iron Ore Project Pebble-mound Mouse *Pseudomys chapmani* site survey	Jimblebar-Wheelarra Hill Biological Survey (Survey ID 494)	East Jimblebar Exploration Project Biological Survey (Survey ID 460)	BHPBIO Hashimoto Terrestrial Vertebrate Fauna Assessment	Jimblebar Marra Mamba Exploration Biological Survey	West Jimblebar Lease Fauna Assessment	Wheelarra Hill North Fauna Assessment	Carramulla Exploration Area Flora and Vegetation Survey and Fauna Assessment	Jimblebar East and Caramulla Fauna Survey	Jimblebar Iron Ore Project Terrestrial Vertebrate Fauna Assessment	Wheelarra Hill Iron Ore Modification Flora and Fauna Assessment	Total Survey Effort
Bat recording (hrs)	0	180	144	108	0	0	Not specified	4	Not specified	180	4	60-120	0	Not specified	0	6	686
No. Caves Assessed	0	0	0	1	0	0	0	0	1*	0**	2	0	0	2	0	1	6
Bat survey method	N/A	SM2BAT	SM4	SM4	N/A		Anabat	Anabat	Anabat	Anabat	Anabat	Anabat	N/A	Anabat	N/A	Anabat	NA
Limitations	None	None	None stated	None stated	Much of the W3 area was difficult or impossible to access by vehicle.	None stated	Weather limited opportunity for opportunistic searching and adequate reptile sampling as illustrated by species accumulation curve	Only 48% of predicted fauna recorded, however this compared well with other surveys in the region with a similar scope.	Weather resulted in reduced reptile activity during summer survey. Only 58% of predicted fauna recorded, however this compared well with other surveys in the region with a similar scope.	Only 32% of predicted fauna recorded. Reptile fauna could have been sampled over a longer duration and (along with mammals and frogs) surveyed using pit-trapping methods. Additional bird censuses could be done.	Technical difficulties with the Anabat II acoustic recorders resulted in less than the desired quantity of bat recording time	None stated	None stated	None stated	None	None	NA