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Mining Area C

Life of Project Environmental Management Plan Revision 6

Part A – Site Environmental Management Plan

Part B – Environmental Impact Assessment Summary

October 2015

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Revision History

Revision	Year	Summary
Initial Draft	1997	Included as Appendix B of the Public Environmental Review (PER) for the mining of C Deposit and the Brockman Detrital Deposit and development of associated infrastructure.
1	2003	Initial Draft updated prior to the commencement of mining in 2003 to satisfy Proponent Commitment No.1 within the PER.
2	2007	Mining of E Deposit and the development of associated infrastructure.
3	2008	Mining of F Deposit and the development of associated infrastructure.
4	2009	Mining of A, D, P1 and P3 deposits and the development of associated infrastructure.
5	2012	Mining of B and P4 deposits and the development of associated infrastructure.
5a	2014	Minor update to the *Life of Project Environmental Management Plan Revision 5, Section 4.5* following an amendment to Ministerial Statement 491 under Section 46C of the *Environmental Protection Act 1986.* Condition No.5 was updated to describe an outcome-based approach to the management of potential impacts on hydrological processes. Section 4.5 of the Life of Project EMP was updated to align with the revised Condition 5.
6	2015	Mining of P2, P5, P6 and R deposits and the development of associated infrastructure. Management of all approved elements of Mining Area C. This version supersedes previous revisions of the Mining Area C *Life of Project Environmental Management Plan*.

EXECUTIVE SUMMARY

This revision of the Mining Area C Life of Project Environmental Management Plan (EMP) Revision 6 has been developed to satisfy the requirements of Ministerial Statement 491, in particular Condition 7 and Proponent Commitments 1, 2 and 3. Ministerial Statement 491 provides an on-going mechanism for the development of the Mining Area C deposits, subject to the EMP being reviewed and updated as deposits are developed. The content of this EMP has also been updated to reflect changes in environmental management practices that have occurred since the previous revision.

Part A of this EMP defines environmental factors and objectives for the environmental management of Mining Area C operations, and how these will be achieved through monitoring, management, contingency actions, and reporting. The key environmental factors identified for Mining Area C operations include:

- flora and vegetation;
- landforms;
- subterranean fauna;
- terrestrial fauna;
- hydrological processes; and
- rehabilitation and decommissioning (integrating factor).

Other relevant factors that have been considered as part of the EMP Revision 6 include:

- terrestrial environmental quality;
- inland waters environmental quality;
- air quality and atmospheric gases;
- amenity;
- heritage; and
- human health.

Part B summarises the findings of the environmental impact assessments to support this EMP revision process. A life of asset planning and assessment approach has been undertaken and includes the remaining P2, P5, P6 and R deposits. The P1, P3, P4, A, B, C, D, E, F and Brockman Detrital deposits at Mining Area C have been assessed under previous revisions of the EMP. Assessment of all 14 deposits at Mining Area C has been completed in accordance with the requirements of the Ministerial Statement.

Part A – Site Environmental Management Plan

1 INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL MANAGEMENT PLAN

This Life of Project Environmental Management Plan (EMP) (Revision 6) defines environmental based objectives for the environmental management of Mining Area C operations, and how these will be achieved through monitoring, management, contingency actions and reporting.

The intent of this EMP is to improve efficiency and effectiveness by adopting an outcome-based approach that links practically to the on-ground environmental management. The content of the EMP Revision 6 has been updated to reflect changes in environmental management practices that have occurred since the previous revision. These changes have largely been associated with:

- stakeholder consultation and changes to public, internal and regulator expectations, including simplification of the document to reflect Environmental Protection Authority guidelines;
- an outcome-based approach to the management of potential impacts due to BHP Billiton Iron Ore's operations; and
- updates and improvements to the BHP Billiton Iron Ore (WA) Environmental Management System and associated procedures.

The EMP Revision 6 satisfies the relevant conditions and commitments within Ministerial Statement 491, as outlined below in Table 1.1. This EMP is for managing operational impacts, whilst rehabilitation and closure activities are still guided by the current *Mine Closure Plan* (formerly referred to as the *Decommissioning and Rehabilitation Plan*) in accordance with the Department of Mines and Petroleum (DMP) guidelines.

Table 1.1 EMP Compliance to Relevant MS491 Conditions and Commitments

Relevant Ministerial Condition or Proponent Commitment	Environmental Management Plan/ Programme Required	Status
Condition 3	Environmental Management System.	BHP Billiton Iron Ore has developed and implemented an Environmental Management Framework for its operations that is certified to Australian/New Zealand Standard ISO 14001.
Condition 7	Life of Project Environmental Management Plan.	BHP Billiton Iron Ore has updated the Life of Project EMP prior to the commencement of mining deposits in accordance with proponent commitments 1, 2 and 3.
Commitments 1, 2 and 3	Undertake additional surveys to assess potential environmental impacts prior to updating the Life of Project Environmental Management Plan Reviews.	BHP Billiton Iron Ore has completed the required surveys and environmental impact assessments to inform EMP Revision 6.
Commitment 6	The proponent will manage any potentially reactive pyritic shales as part of the EMP within overburden storage areas and/or in-pit to prevent acid generation processes occurring.	BHP Billiton Iron Ore has updated the Mine Closure Plan for Mining Area C to support the proposed development as described in EMP Revision 6.

1.2 OTHER RELEVANT ENVIRONMENTAL APPROVALS

The key existing approval under Part V of the *Environmental Protection Act 1986* (EP Act) is the Mining Area C Operating Licence (currently L7851/2002/6).

Groundwater abstraction at Mining Area C is conducted in accordance with the Licence to Take Water (currently GWL110044(9)) issued by the Department of Water under section 5C of the *Rights in Water Irrigation Act 1914* (RIWI Act) and the Groundwater Licence Operating Strategy for the Mining Area C wellfield.

BHP Billiton Iron Ore will obtain other relevant environmental approvals (licences/permits) where necessary. These may include, but are not limited to, licensing under the RIWI Act and Works Approvals and licences under Part V of the EP Act.

1.3 PROJECT DESCRIPTION

Mining Area C is located approximately 100 km north-west of the town of Newman in the Pilbara region of Western Australia (Figure 1.1). The mine is situated within Mining Lease ML281SA and is operated by BHP Billiton Iron Ore in accordance with the *Iron Ore (Mount Goldsworthy) Agreement Act 1964*.

BHP Billiton Iron Ore was granted approval under Part IV of the *Environmental Protection Act 1986* (EP Act) for the mining of 14 iron ore deposits (A, B, C, D, E, F, R, P1, P2, P3, P4, P5, P6 and the Brockman Detrital deposits) in the Northern Flank area of Mining Area C in 1998, under Ministerial Statement 491.

Mining Area C has been an operational mine since 2003. Ministerial Statement 491 provides an on-going mechanism for the development of the Mining Area C deposits, subject to the Life of Project EMP being reviewed and updated as deposits are developed (as per condition 7 and proponent commitments 1 - 3 in Ministerial Statement 491).

Figure 1.2 shows the indicative general arrangement of the mining operation including supporting infrastructure and indicative resource areas within the 14 deposits as approved under Ministerial Statement 491.

1.3.1 Mining Method

Mining Area C operations will continue to campaign mine iron ore and overburden through conventional open cut mining methods. Campaign mining involves drilling, blasting, and categorisation of blasted material into iron ore or waste rock.

1.3.2 Ore Processing, Loading and Transport

Fixed and/or mobile crushing facilities are used for ore extracted from the operation. The indicative locations of ore processing and stockpiling areas are presented in Figure 1.2. Crushed ore is loaded onto trains after being reclaimed from the crushed ore stockpiles. The use of primary and mobile crushers will be regulated as per the Mining Area C operating licence.

1.3.3 Overburden Management

Overburden generated at the operation is hauled to out-of-pit overburden storage areas (OSAs) or is used to backfill mined-out voids in accordance with the mine plan. The indicative locations of ore processing and stockpiling areas are presented in Figure 1.2. Closure objectives for OSAs are discussed in the Mining Area C Mine Closure Plan (BHP Billiton Iron Ore 2015a).

1.3.4 Mine Dewatering and Disposal of Surplus Water

Groundwater abstraction (i.e. dewatering volumes and monitoring) is regulated by the Department of Water (DoW) 5C licensing process and various groundwater operating strategies under the *Rights in Water and Irrigation Act 1914* (the RIWI Act).

Mining Area C will continue dewatering of nominated pits in accordance with the mine plan to facilitate dry mining conditions. A Managed Aquifer Recharge (MAR) trial is currently in operation to reinject surplus water back into the aquifer. This activity is managed under the Mining Area C operating licence. Some of the excess water generated from mine dewatering is also re-used by operations on site (for example, dust suppression and ore processing requirements).

1.3.5 Infrastructure

Ancillary infrastructure including but not limited to access roads, accommodation camps, administration offices, workshops, fuel storage facilities, refuelling stations and wash down facilities,

bulk ammonium nitrate and explosive storage facilities at Mining Area C will be located within the Licence Boundary and in accordance with the mine plan requirements.

1.4 EXPLORATION

Exploration activities are ongoing at Mining Area C. The maximum disturbance boundary for exploration activities is the Licence Boundary (Figure 1.2).

The environmental aspects and their potential impacts described within this EMP are deemed relevant to the ongoing exploration activities at Mining Area C. All BHP Billiton Iron Ore exploration drilling in the Pilbara region is managed under the *WA Iron Ore Exploration Environmental Management Plan* (BHP Billiton Iron Ore 2015b).

1.5 COMMUNITY

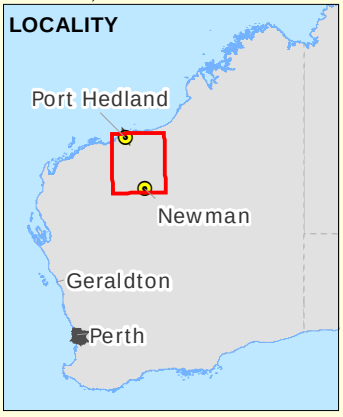
The nearest township is Newman (Figure 1.1) and there is no public access to the site. While the operations have no direct community impact, regular engagement and communication continues to be undertaken by BHP Billiton Iron Ore to update the community on its operations and future projects in the region. Mining Area C is within the Banjima Native Title Claimant and BHP Billiton Iron Ore regularly meets with the Banjima to discuss heritage matters.

A summary of all stakeholder consultation undertaken to date for the EMP Revision 6 is provided in Part B – Table 3.1.

LEGEND

- BHP Billiton Operation
- Highway
- Rail

LOCALITY



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Health Safety and Environment
BHP BILLITON IRON ORE

WESTERN AUSTRALIAN OPERATIONS
BHP BILLITON IRON ORE

Not to scale	Prepared:	P. Gant	Project No: A762/001
Date: 5/10/2015	Checked:	E. Drain	1-1
Datum: GDA 94, Projection: MGA Zone 50	Revision:	Final	

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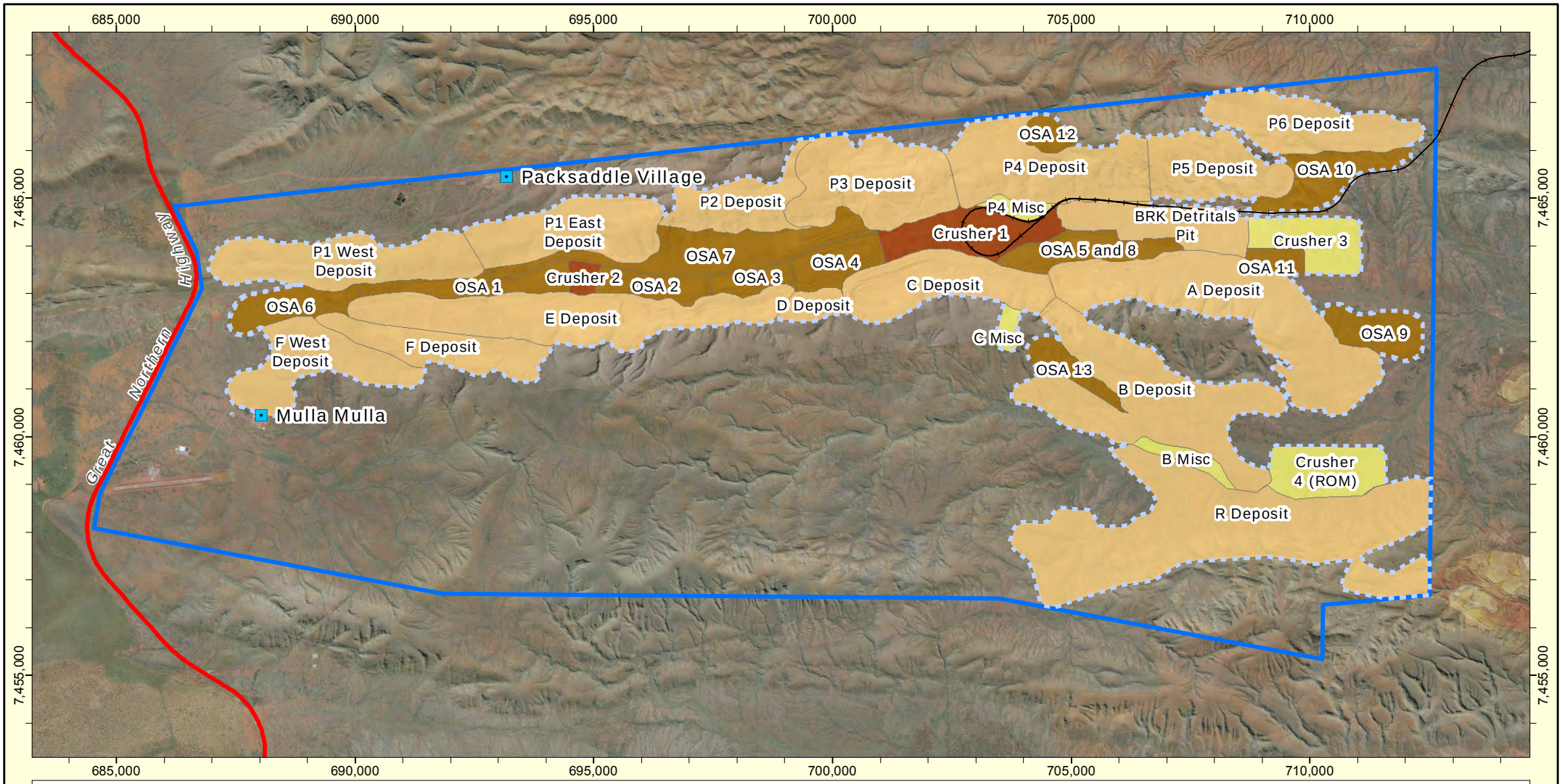

Health, Safety and Environment
BHP BILLITON IRON ORE

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MINING AREA C
Proposed Indicative General Arrangement

Scale @ A4: 1:115,000	Prepared: P. Gant	Project No: A762/02
Date: 5/10/2015	Checked: E. Drain	Figure: 1-2
	Revision: Final	

LEGEND

- BHP Billiton Iron Ore Camp
- Proposed EMP Rev 6 Boundary
- Area C Licence Boundary

Proposed Indicative General Arrangement (Rev 6)

Category

- Indicative OSA Area
- Indicative Pit Area
- Indicative Infrastructure
- Existing Infrastructure

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2 ENVIRONMENTAL MANAGEMENT FRAMEWORK

Site specific Environmental Management Plans (EMPs) form part of BHP Billiton Iron Ore's Environmental Governance Hierarchy (Figure 2.1). The Environmental Governance Hierarchy enables the business to meet its environmental objectives and legal compliance requirements, and provides for continual improvement in environmental performance.

BHP Billiton Iron Ore's Environmental Governance Hierarchy is comprised of three tiers – Group/Corporate level, Asset level and Operation (site) level. At the Group/Corporate level, the BHP Billiton Charter identifies the values that underpin business activities. Measureable, minimum performance standards are defined in Group Level Documents (GLD). These standards apply to all assets and support the development and implementation of environmental management systems. BHP Billiton's GLD.009 (Environment) is the key guidance document for environmental management across all operations.

At the asset level, BHP Billiton Iron Ore's Environmental Management System and procedures describe the environmental outcomes for the Pilbara region and the mechanisms that will be used to meet these outcomes.

Operation-specific management, monitoring and reporting is undertaken via site-based EMPs. BHP Billiton Iron Ore publicly reports its environmental compliance performance in accordance with its approval conditions. BHP Billiton reports its Group-wide sustainability performance in the BHP Billiton Annual Sustainability Report.

Figure 2.1 BHP Billiton Iron Ore's Environmental Management Framework

2.1 ENVIRONMENTAL RISK MANAGEMENT PROCESS

The BHP Billiton Iron Ore risk management process (GLD.017) provides tools to identify hazards and manage risks associated with all environmental risks / impacts.

The risk management process used for environmental risks is summarised below:

1. Establish Context:

   a. Defines the parameters within which risks must be managed and sets the scope for the risk management process.
2. Risk Assessment:
   a. Risk identification (comprehensive list of environment risks).
   b. Risk analysis (determine cause and existing preventative and mitigating controls).
3. Risk Control:
   a. Risk evaluation (select, implement and monitor the effectiveness of specific risk controls).
   b. Risk treatment (assign, implement and monitor action plans for further mitigation of environment risks to as low as reasonably practicable).
4. Risk Monitoring and Review:
   a. Monitor, review and update (review progress and developments, check actions effectiveness, identify new risks).
5. Risk Communication and Reporting.
   a. Reviews of Operation / Project Environment Risk Registers are communicated to any applicable Risk Owner(s).

BHP Billiton Iron Ore assesses environmental risks at the Mining Area C operation against environmental factors and identifies practicable environmental management measures to control and/or manage identified risks to an acceptable level.

Mining Area C environmental risks are aligned with the environmental factors listed in Section 3.

2.2 PROJECT ENVIRONMENTAL AND ABORIGINAL HERITAGE REVIEW

BHP Billiton Iron Ore has a Project Environmental Aboriginal Heritage Review (PEAHR) process to manage the implementation of its environmental, Aboriginal heritage, land tenure and legal obligations prior to and during land disturbance activities. Additionally, the PEAHR procedure provides a mechanism whereby technical and professional advice can be provided to the business regarding environmental issues, land access and Aboriginal heritage planning and management issues. The PEAHR system is accessible to all employees and consists of an electronic workflow process linked to a geographical information system. The objectives of the PEAHR process are to:

- identify the significant environmental, Aboriginal heritage and legal aspects of proposed activities;
- ensure that, through appropriate environmental Aboriginal heritage and land access planning and management, BHP Billiton Iron Ore activities comply with all legal and other obligations;
- avoid, minimise and mitigate the number and nature of environmental, Aboriginal heritage and land tenure events and ensure the environmental performance of BHP Billiton Iron Ore operations; and
- provide a mechanism for continuous improvement.

3 ENVIRONMENTAL MANAGEMENT MEASURES

A summary of environmental factors relevant to Mining Area C and as described in *Environmental Assessment Guideline 8 for Environmental Principles, Factors and Objectives* (EPA 2015) is provided in Table 3.1.

The management components of the key environmental factors are outlined in Table 3.2, including the below (as applicable):

- management actions to minimise or avoid potential impacts;
- monitoring details;
- formulation of indicators and/or trigger criteria;
- potential contingency actions; and
- reporting requirements.

Table 3.1 Environmental Factors Summary

EPA Environmental Factor	Environmental Objective	EPA Key Factor – Yes / No	Impacts/Comment	Managed by Regulatory Processes
Flora and vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.	Yes Relevant Aspect: • Clearing • Spread of weeds • Groundwater drawdown • Surface hydrology alterations • Fire • Dust	• Eight Priority flora species have been recorded within the Licence Boundary, six of which are within the EMP Revision 6 boundary. All species are known from records outside of the Licence Boundary. • No Threatened flora listed under the WC Act or the EPBC Act have been recorded. • Twenty one weeds have been recorded within the Licence Boundary. • It is unlikely that alterations to natural surface water flows will impact on downstream Mulga. • No groundwater dependent vegetation has been recorded within the Licence Boundary. • Three areas surrounding the Licence Boundary identified as supporting groundwater dependent vegetation: - Coondewanna Flats (1 km south-west); - Weeli Wolli Spring (10 km east); and - Ben's Oasis (12.5 km south-east) No significant impact from Mining Area C alone; however, cumulative impacts with Hope Downs may result in decline of vegetation at Weeli Wolli and Ben's Oasis.	• Ministerial Statement
Landforms	To maintain the variety, integrity, ecological functions and environmental values of landforms.	Yes Relevant Aspect: • Modification • Integrity and stability of built landforms	• Mine pits and overburden storage areas will be progressively developed as part of the site operations of Mining Area C. • Final landform design is considered in the Mine Closure Plan.	• Ministerial Statement

EPA Environmental Factor	Environmental Objective	EPA Key Factor – Yes / No	Impacts/Comment	Managed by Regulatory Processes
Subterranean fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Yes <u>Relevant Aspect:</u> • Groundwater drawdown • Pit excavation	Stygofauna • Three species (nr *Epactophanes* sp. B01, *Dussartcyclops* sp. B10 and nr *Notobathynella* sp. S01) are known only from the area of proposed groundwater change greater than 2 m (assessment area). The ranges of nr *Epactophanes* sp. B01 and *Dussartcyclops* sp. B10 are unclear and the potential threat to these species is uncertain because of their occurrence as single animals. nr *Notobathynella* sp. S01 occurs only 77 m from the edge of the assessment area and the proximity of this record to areas of minimal groundwater drawdown means its range almost certainly extends into areas that are classified as undisturbed. Consequently, the level of threat to nr *Notobathynella* sp. S01 is likely to be low. Troglofauna • Twenty species are known only from the proposed pit areas within the EMP Revision 6 boundary. • Based on a detailed habitat assessment, the inferred ranges of 17 of the 20 species are considered to extend beyond the proposed pit areas. • The status of the three remaining species (*Hanseniella* sp. B08, *Symphyella* sp. B03, and Parajapygidae sp. S03) is uncertain because there is currently little information on which to infer likely ranges of the species.	• Ministerial Statement
Terrestrial environmental quality	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.	No	• Potential impacts from contamination and AMD are considered low. • Existing waste disposal procedures and practices are considered effective.	• Part V licence • Mine Closure Plan (in relation to AMD)

EPA Environmental Factor	Environmental Objective	EPA Key Factor – Yes / No	Impacts/Comment	Managed by Regulatory Processes
Terrestrial fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Yes <u>Relevant Aspect:</u> • Clearing • Introduced fauna and flora species • Noise and vibration • Dust • Light • Barriers to movement (e.g. infrastructure) • Vehicle movements • Human interaction • Groundwater drawdown • Fire	• Thirteen species of conservation significant vertebrate fauna have been recorded within the Licence Boundary. Six of these are identified as key receptors for the proposed EMP Revision 6 development. • The Ghost Bat (Priority 4) was identified as the only key receptor where impacts could result in loss of individuals or reduce breeding success in the locality. • Three short-range endemic invertebrate fauna species (*Antichiropus* `DIP006`, *Chenistonia* `MYG088` and *Karaops banyjima)* have only been recorded within the EMP Revision 6 boundary. • Suitable habitat for *Karaops banyjima* is known to occur in large continuous extents throughout the Licence Boundary. Some potential habitat for *Antichiropus* `DIP006` and *Chenistonia* `MYG088` has been identified outside of the EMP Revision 6 boundary; however, it is not continuous.	• Ministerial Statement
Hydrological processes	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.	Yes <u>Relevant Aspect:</u> • groundwater dewatering and re-injection • sediment run-off <u>Not Relevant Aspect:</u> • surface water diversion / discharge	• Ongoing practices of mine dewatering and reinjection of surplus water is proposed at Mining Area C. • Effects of groundwater drawdown on groundwater dependent ecology. • Potential for adverse impacts on groundwater or surface water quality as a result of potential contamination by hydrocarbons, chemicals or mine wastes (i.e. PAF overburden). • Existing management practices for sediment run-off control are considered effective.	• Ministerial Statement • 5C licence and associated Groundwater Operating Strategy • Part V licence
Inland waters environmental quality	To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.	No	• Risk assessment concluded that the potential for AMD is low due to the predominantly oxidised nature of the ore. • Existing management practices for sediment run-off control and surface water management are considered effective.	• Part V licence • Ministerial Statement (Commitment 6 in relation to management of pyritic shales) • Mine Closure Plan (in relation to AMD)

EPA Environmental Factor	Environmental Objective	EPA Key Factor – Yes / No	Impacts/Comment	Managed by Regulatory Processes
Air quality and atmospheric gases	To maintain air quality for the protection of the environment and human health and amenity, and to minimise the emission of greenhouse and other atmospheric gases through the application of best practice.	No	• Nearest sensitive receptor is the site mine camp, Packsaddle Village, located approximately 5 km from operations at Mining Area C and the Great Northern Highway along the western border of the Licence Boundary.	• Part V licence
Amenity	To ensure that impacts to amenity are reduced as low as reasonably practicable.	No	• Nearest sensitive receptor is the site mine camp, Packsaddle Village, located approximately 5 km from operations at Mining Area C and the Great Northern Highway along the western border of the Licence Boundary.	• Ministerial Statement
Heritage	To ensure that historical and cultural associations, and natural heritage, are not adversely affected.	No	• No heritage sites are expected to be impacted by operations. If any site cannot be avoided, BHP Billiton Iron Ore will apply for consent to use the land under Section 18 of the *Aboriginal Heritage Act 1972*.	• Section 18 approval
Human health	To ensure that human health is not adversely affected.	No	• Nearest sensitive receptor is the site mine camp, Packsaddle Village, located approximately 5 km from operations at Mining Area C and the Great Northern Highway along the western border of the Licence Boundary.	• Part V licence • Environmental Protection (Noise) Regulations 1997
Rehabilitation and decommissioning (Integrating factor)	To ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.	Yes <u>Relevant Aspect:</u> • landforms • pit lake formation	• The Mining Area C Mine Closure Plan describes management of the site post-operations phase.	• Ministerial Statement • DMP and EPA Guidelines for the Preparation of Mine Closure Plans

Table 3.2 Environmental Management Components

EPA Environmental Factor	EMP Management Objective	Management Action	Monitoring Requirements	Indicators and/or Trigger Criteria	Contingency Actions	Reporting Requirements
Flora and vegetation	• no unauthorised disturbance	• PEAHR must be in place prior to land disturbance	• PEAHR inspections to verify no unauthorised clearing	• clearing outside the PEAHR boundary or constraints as specified in the key characteristics table	• assess level of impact to determine appropriate actions	• notification to the regulatory authority and relevant parties, upon confirmation of unauthorised clearing • land disturbance reported annually
	• no increase in weed distribution attributable to BHP Billiton Iron Ore activities	• weed hygiene inspections of ground-engaging equipment prior to arriving at site • weed surveys	• weed inspections	• an increase in weed distribution and new weed species identified within the EMP Revision 6 boundary	• weed control programme implemented as required	• notification to regulatory authority upon identification of a new weed species on site
	• maintain diversity and distribution of significant flora species and vegetation communities	• PEAHR must be in place prior to land disturbance	• 5-yearly review of baseline biodiversity surveys to determine if further surveys are required • capture of data on significant species/community cleared	• new conservation significant flora species or vegetation community identified within the EMP Revision 6 boundary • elevation of conservation status of a flora species or vegetation community with potential to occur within the EMP Revision 6 boundary	• assess level of impact to determine appropriate management actions	• notification to the regulatory authority upon identification of new significant species or vegetation community
Landforms	• minimise impact from development of mining operations on surrounding landform	• long-term mine planning sign-off process (Master Area Request for OSA design) • PEAHR must be in place prior to land disturbance • compliance to the Mine Closure Plan	• compliance assessment against approved landform design	• non-conformance to specified closure criteria in Mine Closure Plan	• review of the Mine Closure Plan in consultation with regulatory authority	• reporting as per the Mine Closure Plan requirements
	• long term stability to prevent erosion	• compliance to the Mine	• compliance assessment against	• significant erosion of built landforms	• assess level of impact to	• reporting as per the Mine Closure Plan

EPA Environmental Factor	EMP Management Objective	Management Action	Monitoring Requirements	Indicators and/or Trigger Criteria	Contingency Actions	Reporting Requirements
	from wind and rain	Closure Plan	approved landform design • inspection of drainage bunds and OSAs after rainfall event		determine appropriate actions and re-engineer landform if required	requirements
Subterranean fauna	• no unauthorised disturbance	• PEAHR must be in place prior to land disturbance	• PEAHR inspections to verify no unauthorised clearing	• clearing outside the proposed maximum pit extent (within the EMP Revision 6 boundary) or constraints as specified in the key characteristics table	• assess level of impact to determine appropriate actions	• notification to the regulatory authority and relevant parties, upon confirmation of unauthorised clearing • land disturbance reported annually
	• maintain abundance and diversity of significant subterranean fauna and communities	• long-term mine planning sign-off process (Master Area Request for mine infrastructure design) • PEAHR must be in place prior to land disturbance	• 5- yearly review of baseline biodiversity surveys to determine if further surveys are required • capture of data on significant species/habitat cleared	• new species identified occurring only within the EMP Revision 6 boundary • elevation of conservation status of a species or community with potential to occur within the EMP Revision 6 boundary	• assess level of impact to determine appropriate actions	• notification to the regulatory authority upon identification of new species or habitat on site
Terrestrial fauna	• no unauthorised disturbance	• PEAHR must be in place prior to land disturbance	• PEAHR inspections to verify no unauthorised clearing	• clearing outside maximum disturbance boundary	• assess level of impact to determine appropriate actions	• notification to the regulatory authority and relevant parties, upon confirmation of unauthorised clearing • land disturbance reported annually
	• no new invasive species introduced attributable to BHP Billiton Iron Ore activities • no increase in invasive species abundance and diversity attributable to BHP	• PEAHR must be in place prior to land disturbance	• inspections for invasive species	• new invasive species identified on site • increase in distribution of invasive species on site	• control programme implemented as required	• notification to regulatory authority upon identification of a new invasive species on site

EPA Environmental Factor	EMP Management Objective	Management Action	Monitoring Requirements	Indicators and/or Trigger Criteria	Contingency Actions	Reporting Requirements
	Billiton Iron Ore activities					
	• maintain abundance and diversity of significant fauna and communities	• long-term mine planning sign-off process (Master Area Request for mine infrastructure design) • PEAHR must be in place prior to land disturbance	• 5- yearly review of baseline biodiversity surveys to determine if further surveys are required • capture of data on significant species/community cleared	• new conservation significant fauna species identified within the EMP Revision 6 boundary • elevation of conservation status of a fauna species or community with potential to occur within the EMP Revision 6 boundary	• assess level of impact to determine appropriate actions	• notification to the regulatory authority upon identification of new priority species or habitat on site
Hydrological processes	• minimise the short and long-term impacts on groundwater resources and groundwater dependent ecology caused by mining operations and groundwater use • prevent any significant impact on Weeli Wolli Spring (including Ben's Oasis) or Coondewanna Flats (including Lake Robinson) as a result of BHP Billiton Iron Ore operations • ensure the Groundwater Licence volume allocations are not exceeded; • minimise impact on groundwater levels and quality and to minimise	• management in accordance with 5C licence, Part V licence requirements and the Central Pilbara Water Resources Management Plan and the site Groundwater Operating Strategy • compliance to the Mine Closure Plan	• monitoring in accordance with the 5C licence and Part V licence requirements • compliance against approved landform design (surface water regime and below water table mine voids)	Further hydrological work is required to formulate a practical and meaningful threshold for Weeli Wolli Spring to demonstrate the efficiency of management actions and the achievement of the environmental objective. BHP Billiton Iron Ore will review the requirement for triggers at Weeli Wolli Spring: • At notification of pre-closure of Rio Tinto Iron Ore's Hope Downs mining operation; • If other BHP Billiton Iron Ore below water table operations are approved in the catchment; • If changes are identified via the annual or triennial aquifer review process; and • As required by BHP Billiton Iron Ore. In relation to potential impacts at Coondewanna Flats (including Lake Robinson) there are two corresponding thresholds: • An investigation trigger of 663.75 mRL (at GWB0039M). This trigger will initiate further assessment to identify an appropriate management response. The trigger provides a timeframe of at least 5 years for adaptive management to be reviewed, and if need be, implemented and become effective, based on an	In the event that the thresholds are exceeded BHP Billiton Iron Ore will: • Investigate and verify threshold exceedance. • Investigate feasible adaptive management options. • Engage with the OEPA and the DoW on the findings and the proposed approach. • Implement and monitor effectiveness of adaptive management via monitoring. • Draw from suite of options available for mitigation.	• monitoring data, groundwater abstraction, water management and associated aquifer sustainability reported as part of the Annual and Triennial Aquifer Review monitoring reports • Part V licence requirements reported in the Annual Environmental Report

EPA Environmental Factor	EMP Management Objective	Management Action	Monitoring Requirements	Indicators and/or Trigger Criteria	Contingency Actions	Reporting Requirements
	potential impacts on the surrounding environment; and • minimise impacts on groundwater dependent ecosystems, communities and/or species.			annual recession of approximately 0.05 m per year (for an average rainfall year). • A rate-of-change trigger of greater than 0.5 m per year. Should the net annual water level change be greater than 0.5 m per year reduction then an assessment will be carried out to identify the appropriate management response. The trigger manages the risk of dewatering effects occurring sooner than predicted.		
Rehabilitation and decommissioning (Integrating factor)	• create a safe, stable and non-polluting landscape consistent with surrounding environmental values	• PEAHR must be in place prior to land disturbance • compliance to the Mine Closure Plan	• compliance assessment against approved landform design	• non-conformance to specified criteria in the Mine Closure Plan	• review of rehabilitation and the Mine Closure Plan in consultation with the regulatory authority • assess level of impact to determine appropriate actions	• reporting as per the Mine Closure Plan requirements

4 REVIEWING AND REPORTING

4.1 REVIEW OF THE ENVIRONMENTAL MANAGEMENT PLAN

The EMP will be reviewed and revised in accordance with Condition 7 of the Ministerial Statement and/or as a consequence of amendment to the Ministerial Statement and/or change to status of a key environmental factor during operation of Mining Area C.

The EMP review cycle will take into consideration if the plan requires an update under the adaptive management and continual improvement process. Any changes or modifications deemed significantly different to previous standard management measures will be reviewed and updated in accordance with the Ministerial Statement.

4.1.1 Government Reporting Requirements

Reporting requirements are summarised within Table 3.2 for each environmental factor. Ministerial Statement 491 reporting requirements for the Mining Area C operation are outlined in Table 4.1.

Table 4.1 Ministerial Statement 491 Reporting Requirements

No.	Details of condition or commitment	Reporting requirement
8	**Performance Review**	
8-1	Each six years following the commencement of construction, the proponent shall submit a Performance Review to the Department of Environmental Protection: • to document the outcomes, beneficial or otherwise; • to review the success of goals, objectives and targets; and • to evaluate the environmental performance over the six years; relevant to the following: 1. environmental objectives reported on in Environmental Protection Authority Bulletin 913; 2. proponent's consolidated environmental management commitments documented in Schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement; 3. environmental management system environmental management targets; 4. environmental management programs and plans; and/or 5. environmental performance indicators; to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection. Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review.	The Performance Review was submitted to the OEPA in September 2015 as part of the Annual Environmental Report (AER).
8-2	Notwithstanding the requirements of condition 8-1, in the event that the timing requirements of that condition are not compatible with the timing requirements of the triennial reporting required under the *Iron Ore (Mount Goldsworthy) Agreement Act 1964*, then the timing of the latter shall prevail.	Reporting requirements under the *Iron Ore (Mount Goldsworthy) Agreement Act 1964* are included within the AER.

No.	Details of condition or commitment	Reporting requirement
11	**Compliance Auditing**	
11-1	The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.	The AER is prepared and submitted annually by BHP Billiton Iron Ore. The report summarises environmental performance and compliance. The AER will include a statement of compliance, and an audit table as required, as per the Environmental Protection Authority guidelines and advice.

4.1.2 Event reporting

BHP Billiton Iron Ore has a formal system in place at all sites for reporting environmental events. The following event reporting mechanisms are implemented via the event reporting procedure:

- all employees and contractors are required to report environmental events and hazards via their Supervisor for recording, investigation and remediation where necessary;
- non-compliance or emergency events are reported to regulatory authorities as per the requirements of relevant licences, approvals and legislation; and
- significant events and event trends are analysed and communicated within BHP Billiton Iron Ore to facilitate continuous improvement and prevent recurrence.

All personnel receive training for event and hazard reporting.

5 REFERENCES

BHP Billiton Iron Ore (2015a). *Mining Area C Mine Closure Plan.*

BHP Billiton Iron Ore (2015b). *WA Iron Ore Exploration Environmental Management Plan.*

Environmental Protection Authority (2015). *Environmental Assessment Guideline No. 8 for Environmental Principles, Factors and Objectives.*

PART B – Environmental Impact Assessment

1 INTRODUCTION

1.1 BACKGROUND

BHP Billiton Iron Ore was granted approval under Part IV of the *Environmental Protection Act 1986* (EP Act) for the mining of 14 iron ore deposits (A, B, C, D, E, F, R, P1, P2, P3, P4, P5, P6 and the Brockman Detrital deposits) in the Northern Flank area of Mining Area C in 1998, under Ministerial Statement 491.

Mining Area C has been operational since 2003 and is located within Mining Lease ML281SA, approximately 100 km north-west of the town of Newman in the Pilbara region of Western Australia (Figure 1.1).

Mining Area C is operated by BHP Billiton Iron Ore who acts as the manager for the Mount Goldsworthy Mining Associates Joint Venture. The Joint Venture partners and their respective share of Mining Area C ownership include:

- BHP Billiton Minerals Pty Ltd - 85%;
- Itochu Minerals and Energy of Australia Pty Ltd - 8%; and
- Mitsui Iron Ore Corporation Pty Ltd - 7%.

The Joint Venture operates in relation to the rights and benefits granted under the *Iron Ore (Mount Goldsworthy) Agreement Act 1964*.

1.2 ENVIRONMENTAL MANAGEMENT PLAN HISTORY AND STATUS

BHP Billiton Iron Ore prepared an initial draft Environmental Management Plan (EMP) which was appended to the Public Environmental Review (PER) (Woodward-Clyde 1997). The initial draft EMP was prepared in accordance with PER Proponent Commitment 1 and provided details of the management requirements during construction and operation of the C and Brockman Detrital deposits, the Mining Area C ore handling facilities, rail loading facility and associated mine services and infrastructure. The EMP was finalised in 2003 prior to the commencement of operations at Mining Area C.

In addition to the specific assessment of C Deposit and the Brockman Detrital Deposit, the PER and Ministerial Statement 491 provided an on-going mechanism for the development of the remaining 12 deposits. Development of the remaining deposits is made subject to additional environmental surveys being undertaken (Proponent Commitment 2) and the EMP being reviewed and updated as the other deposits come on line (Proponent Commitment 3), including the commitment to incorporate public comments received to the requirements of the EPA (Condition 7). A list of previous revisions of the Life of Project EMP, including a summary of each scope, is included in the *Revision History*, Part A – page i.

1.3 PURPOSE OF THE ENVIRONMENTAL MANAGEMENT PLAN

BHP Billiton Iron Ore has updated the Mining Area C Life of Project EMP (Revision 6) in order to access the remaining four deposits (P2, P5, P6 and R), modify boundaries of existing deposits and overburden storage areas (OSAs) where required, enable below water table mining of all deposits and develop associated infrastructure to support mining operations within the Mining Area C Licence Boundary (Figure 1.2).

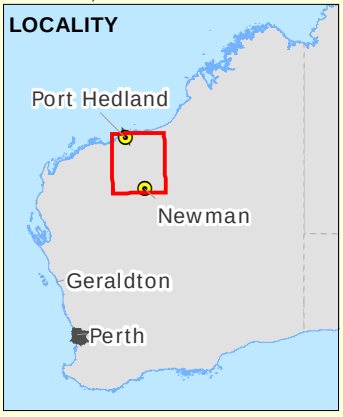
The Proponent Commitments relevant to this EMP from Ministerial Statement 491 (i.e. commitments. 1, 2, and 3) are set out in Table 1.1. Where appropriate, the corresponding sections in this Life of Project EMP that address each component of the commitments are cross-referenced. An environmental impact assessment has been undertaken in accordance with these commitments.

No change to the original proposal as approved under Ministerial Statement 491 is proposed under this Life of Project EMP. BHP Billiton Iron Ore will submit a Part IV approval if a change to the proposal is required under the EP Act or a Part V approval for any activity which may trigger a prescribed premises requirement under Schedule 1 of the Environmental Protection Regulations 1987.

LEGEND

- BHP Billiton Operation
- Highway
- Rail

LOCALITY



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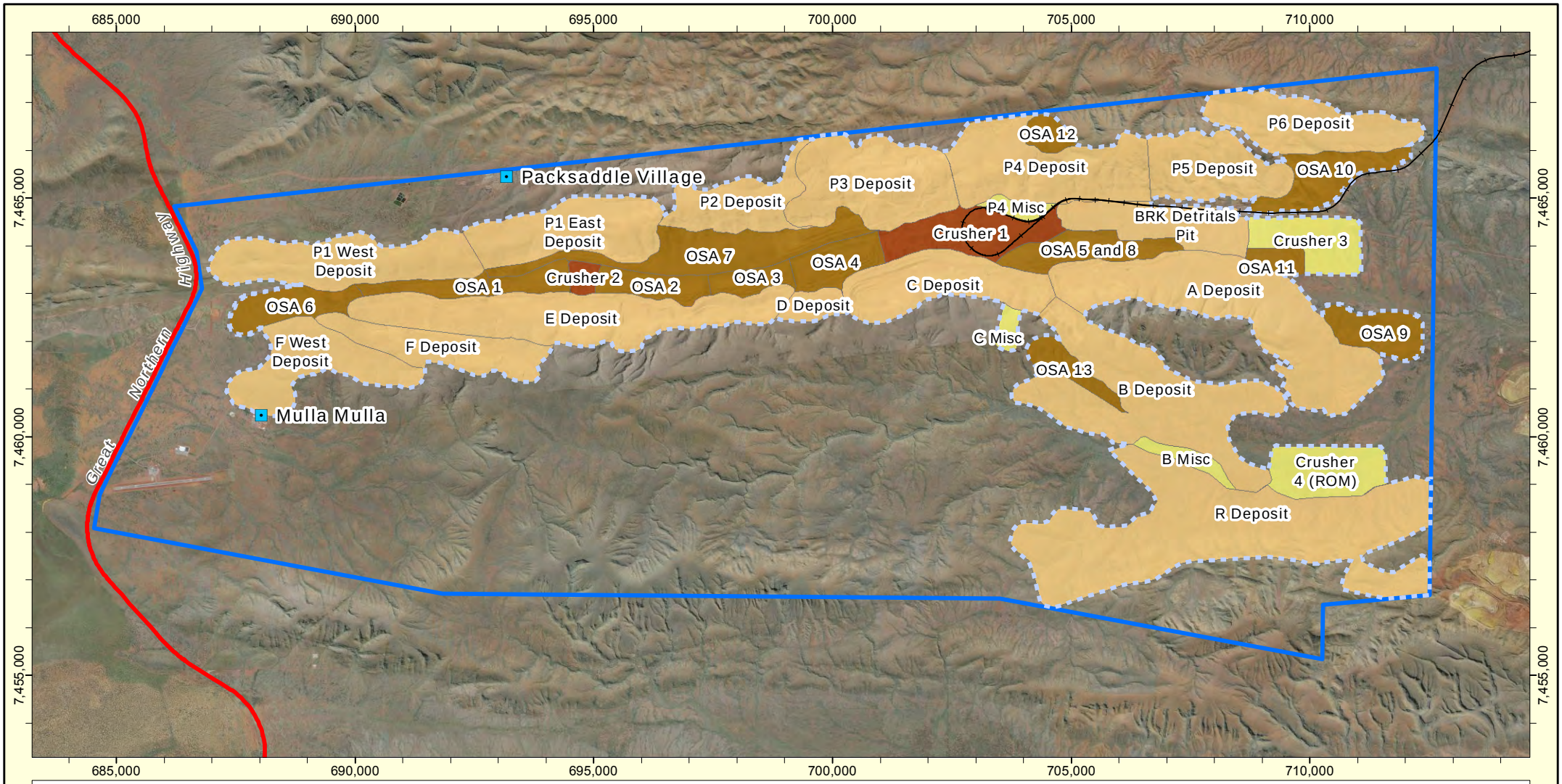
Health Safety and Environment
BHP BILLITON IRON ORE

WESTERN AUSTRALIAN OPERATIONS
BHP BILLITON IRON ORE

Not to scale	Prepared:	P. Gant	Project No: A762/001
Date: 5/10/2015	Checked:	E. Drain	1-1
Datum: GDA 94, Projection: MGA Zone 50	Revision:	Final	

Document Path: Y:\Jobs\A501_A1000\A762\3Project\A762_001_STMAC_025EIA_RevB.mxd



Health, Safety and Environment
BHP BILLITON IRON ORE

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MINING AREA C
Proposed Indicative General Arrangement

Scale @ A4: 1:115,000	Prepared: P. Gant	Project No: A762/02
Date: 5/10/2015	Checked: E. Drain	Figure: 1-2
	Revision: Final	

LEGEND

- BHP Billiton Iron Ore Camp
- Proposed EMP Rev 6 Boundary
- Area C Licence Boundary

Proposed Indicative General Arrangement (Rev 6)

Category

- Indicative OSA Area
- Indicative Pit Area
- Indicative Infrastructure
- Existing Infrastructure

N

0 2.5 5
Kilometres

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Table 1.1 Proponent Commitments relevant to this EMP

	PER Proponent Commitment	Evidence
1	The proponent will prepare and implement a 'Life of Project' Environmental Management Plan (EMP) for mining operations within the Northern Flank of Mining Area C. The proponent will address and manage the following environmental factors: 1. Surrounding environment 2. Vegetation and topsoil 3. Overburden storage 4. Surface water 5. Groundwater 6. Flora 7. Fauna 8. Aboriginal heritage 9. Noise 10. Dust 11. Waste and hazardous materials 12. Rehabilitation 13. Decommissioning 14. Contracting, and 15. Continuous improvement.	The EMP Revision 6 has been developed in accordance with Condition 7 and Proponent Commitments 1, 2 and 3. All factors are addressed in Part B – Section 5 and 6. This includes a summary of the existing environment, impact assessment findings and the outcome of the assessment of each factor against the relevant EPA objectives. The environmental factor terminology has been updated throughout this EMP to reflect the EPA *Environmental Assessment Guideline 8 for Environmental Principles, Factors and Objectives* (2015). For example, *Groundwater* is now referred to as *Hydrological Processes.* Refer to Part B – Table 1.2 for a list of the environmental factors as assessed for the EMP Revision 6. Management of the key environmental factors, including monitoring requirements, trigger criteria, reporting requirements and contingency actions are also summarised in Part A – Table 3.2 for implementation on site.
2	The proponent will undertake additional surveys on areas other than the Deposit C and Brockman Detrital Deposit to assess potential environmental impacts. Those surveys will include: 1. Surrounding environment 2. Vegetation and topsoil 3. Overburden storage 4. Surface water 5. Groundwater 6. Flora 7. Fauna 8. Aboriginal heritage 9. Noise 10. Dust 11. Waste and hazardous materials 12. Rehabilitation 13. Decommissioning 14. Contracting, and 15. Continuous improvement.	Additional surveys have been undertaken at Mining Area C to satisfy this commitment. A summary of the work undertaken to support the EMP Revision 6 is included in Part B – Section 4. All factors are addressed in Part B – Section 5 and 6. The environmental impact assessment reports for key factors are also included as appendices (Appendix A – F). The integrating factor *Rehabilitation* and *Decommissioning* is also addressed in more detail within the *Mining Area C Mine Closure Plan* (Appendix G).
3	The proponent will review and update the 'Life of Project' Environmental Management Plan for the development of deposits other than Deposit C and Brockman Detrital Deposit in the Northern Flank to reflect site specific characteristics and the results of any additional surveys as detailed in Commitment 2, and implement.	BHP Billiton Iron Ore has updated the 'Life of Project' EMP as required for deposits other than C and Brockman Detrital. The EMP Revision 6 scope includes assessment of the P2, P5, P6 and R deposits. Impact assessments for all 14 deposits have now been completed (see Part A – page v for *Revision History*).

	PER Proponent Commitment	Evidence
	The EMP will be reviewed and updated, and will include provision for public review to meet the requirements of the EPA.	Part A – Section 4 outlines the review and reporting requirements for the EMP in accordance with Ministerial Statement 491. Part B – Table 3.1 summarises stakeholder and public consultation undertaken to date as part of the EMP review and update process.

As noted in Table 1.1, the environmental factor terminology has been updated throughout this document to reflect the *Environmental Assessment Guideline 8 for Environmental Principles, Factors and Objectives* (EPA 2015). Table 1.2 provides a list of the environmental factors as assessed for the EMP Revision 6 and supersedes the EPA factor terminology within Ministerial Statement 491.

Table 1.2 Environmental Factor Alignment

EPA Factor within MS491 (1998)	Corresponding EPA Factor EAG 8 (2015)
1. Surrounding environment	This is included within the regional context and existing environment section for all factors and is therefore no longer considered as a separate environmental factor
2. Vegetation and topsoil	Flora and vegetation Landforms (considers topsoil)
3. Overburden storage	Landforms Amenity
4. Surface water	Hydrological processes Inland waters environmental quality
5. Groundwater	Hydrological processes Inland waters environmental quality
6. Flora	Flora and vegetation
7. Fauna	Terrestrial fauna (including short-range endemics) Subterranean fauna
8. Aboriginal heritage	Heritage
9. Noise	Human health
10. Dust	Air quality and atmospheric gases
11. Waste and hazardous materials	Terrestrial environmental quality
12. Rehabilitation	Rehabilitation and decommissioning (integrating factor)
13. Decommissioning	Rehabilitation and decommissioning (integrating factor)
14. Contracting	Mining Area C is no longer operated by a contractor and 'contracting' is not considered to be an environmental factor
15. Continual improvement	Included within BHP Billiton Iron Ore's EMS management framework and 'continual improvement' is not considered to be an environmental factor

2 PROJECT DESCRIPTION

2.1 OVERVIEW

2.1.1 Mining Method

Mining Area C operations will continue to campaign mine iron ore and overburden through conventional open cut mining methods. Campaign mining involves drilling, blasting, and categorisation of blasted material into iron ore or waste rock.

2.1.2 Ore Processing, Loading and Transport

Fixed and/or mobile crushing facilities are used for ore extracted from the operation. The indicative locations of ore processing and stockpiling areas are presented in Figure 1.2. Crushed ore is loaded onto trains after being reclaimed from the crushed ore stockpiles. The use of primary and mobile crushers will be regulated as per the Mining Area C operating licence under Part V of the EP Act.

2.1.3 Overburden Management

Overburden generated at the operation is hauled to out-of-pit overburden storage areas (OSAs) or is used to backfill mined-out voids in accordance with the mine plan. The indicative locations of ore processing and stockpiling areas are presented in Figure 1.2.

2.1.4 Mine Dewatering and Disposal of Surplus Water

Groundwater abstraction (i.e. dewatering volumes and monitoring) is regulated by the Department of Water 5C licensing process and various groundwater operating strategies under the *Rights in Water and Irrigation Act 1914* (the RIWI Act).

Mining Area C will continue dewatering of nominated pits in accordance with the mine plan to facilitate dry mining conditions. A Managed Aquifer Recharge (MAR) trial is currently in operation to reinject surplus water back into the aquifer. This activity is managed under the Mining Area C operating licence. Some of the excess water generated from mine dewatering is also re-used by operations on site (for example, dust suppression and ore processing requirements).

2.1.5 Infrastructure

Ancillary infrastructure including but not limited to access roads, accommodation camps, administration offices, workshops, fuel storage facilities, refuelling stations and wash down facilities, bulk ammonium nitrate and explosive storage facilities at Mining Area C will be located within the Licence Boundary and in accordance with the mine plan requirements.

2.2 PROPOSED DEVELOPMENT

BHP Billiton Iron Ore is seeking access to the remaining deposits at Mining Area C with the update of the Life of Project EMP Revision 6. The project scope includes:

- development of the P2, P5, P6 and R deposits;
- current and planned pit boundaries and OSA boundaries (including modifications to boundaries approved under previous revisions of the Life of Project EMP);
- below water table mining of all deposits (where required) to access the orebody;
- placement of overburden in mined out voids and out-of-pit OSAs;
- continued groundwater abstraction and usage of this water to meet operational demands;
- out-of-pit topsoil, Run-of-Mine and low grade ore stockpiles;
- additional crushers and ore handling facilities;
- construction and use of haul and access roads;
- additional ancillary infrastructure required to support the future mine plan up to 70 Million tonnes per annum (Mtpa); and

- closure and progressive rehabilitation.

The additional deposits and modifications to existing pit boundaries will provide flexibility for Mining Area C to continue operations and meet market demand for iron ore. No changes to the existing rail infrastructure are proposed to support the indicative 70 Mtpa mine plan.

2.3 EXISTING AND PROPOSED PROJECT DISTURBANCE

The proposed EMP Revision 6 indicative general arrangement is provided in Figure 1.2. Approximate areas of disturbance approved under previous revisions of the Life of Project EMP are summarised in Table 2.1.

Table 2.1 Indicative Current Project Disturbance

Mine Component	Area (ha)
Current Deposits (Brockman Detrital, A, B, C, D, E, F, P1, P3 and P4)	2,790*
Current OSAs (1 - 9)	1,420*
Current Infrastructure (Crusher 1 and 2)	320
Approximate Total	**4,530**

* Indicative disturbance hectares for access and haul roads have been included within these totals

Note that the Brockman Detrital Deposit and beneficiation plant have not been developed to date.

Proposed indicative disturbance requirements for Mining Area C operations for the EMP Revision 6 are summarised in Table 2.2.

Table 2.2 Indicative Proposed Project Disturbance

Mine Component	Area (ha)
Proposed Deposits (P2, P5, P6, R deposits and existing pit boundary modifications)	3,370
Proposed OSAs (10 - 13 and existing OSA boundary modifications)	215
Proposed Infrastructure (Crusher 3 and 4)	460
Proposed Infrastructure (including haul roads and ancillary)	1,465
Approximate Total	**5,510**

Ministerial Statement 491 covers an approximate area of 25,815 ha (the Licence Boundary) for exploration and mining purposes. Mining Area C is currently approved for up to 5,000 ha disturbance (for 14 deposits) under the Key Characteristics Table within Ministerial Statement 491. Previous revisions of the Life of Project EMP have described approximately 4,530 ha of disturbance for 10 of the 14 deposits (Table 2.1).

The total area assessed for the proposed Life of Project EMP (Figure 1.2) is approximately 11,377 ha (Revision 6 boundary). Of this area, BHP Billiton Iron Ore proposes an indicative additional disturbance requirement of up to 5,510 ha for the life of mine (Table 2.2). A larger development area has been assessed in order to provide flexibility for the location of mine components (i.e. pits, OSAs and infrastructure) and the designs to be modified (within the proposed EMP Revision 6 boundary) if required. This indicative disturbance requirement may potentially be reduced over time with further exploration and resource definition within the EMP Revision 6 boundary.

To date, the total disturbance at Mining Area C as reported in the Annual Environmental Report (AER) is 3,970 ha (BHP Billiton Iron Ore 2015a). Based on current rate of disturbance calculations for Mining Area C operations, the approved 5,000 ha project disturbance (for 14 deposits) will meet site requirements up to end of Financial Year 2018. Current estimates indicate a potential requirement of up to 10,040 ha for the life of mine. BHP Billiton Iron Ore, in consultation with the EPA, will seek a Part IV approval under the EP Act if a change to the original proposal is required in future.

2.4 PLANNING PROCESS

The Life-of-Mine planning and Master Area Request sign-off processes are supported at the operational level by the use of BHP Billiton Iron Ore's Project Environmental and Aboriginal Heritage Review (PEAHR) process (as described in Part A – Section 2.2).

The Life-of-Mine planning process provides flexibility in the final siting of mine components as long as they are located within the defined by the nominated maximum disturbance boundary for operations (i.e. Revision 6 boundary), avoid significant sites and environmental aspects and allow for progressive rehabilitation in accordance with the mine plan. The Master Area Request sign-off process is a planning step to ensure relevant subject matter experts confirm the preliminary designs are suitable and within the approved project area. The PEAHR process is a final step in the process to ensure compliance with the mine plan and that environmental objectives can be met.

2.5 EXPLORATION

Exploration activities are ongoing at Mining Area C. The maximum disturbance boundary for exploration activities is the Licence Boundary (Figure 1.2).

The environmental aspects and their potential impacts described within this EMP are deemed relevant to the ongoing exploration activities at Mining Area C and surrounds. All BHP Billiton Iron Ore exploration drilling in the Pilbara region is managed under the *WA Iron Ore Exploration Environmental Management Plan* (BHP Billiton Iron Ore 2015b).

3 STAKEHOLDER CONSULTATION

3.1 CONSULTATION OBJECTIVES

BHP Billiton Iron Ore has conducted a consultation programme as part of the revision of the Life of Project EMP. The main objectives of the consultation programme were to:

- Provide information and the opportunity to comment to relevant government agencies, local authorities and to other groups or individuals who may potentially be interested in Mining Area C; and
- Where possible, discuss and allow stakeholder comments on operational and mine closure issues relating to Mining Area C to be incorporated into this EMP.

3.2 CONSULTATION PROGRAMME SUMMARY

Changes as a result of consultation have been incorporated within this document. Table 3.1 provides a summary of consultation undertaken to date for the EMP Revision 6.

Table 3.1 Stakeholder Consultation Summary

Stakeholder	Date	Topic/issue raised	Proponent response/outcome
Office of the Environmental Protection Authority (OEPA)	26 February 2015 Meeting held at the OEPA, Perth	Regular monthly meeting with the OEPA included BHP Billiton Iron Ore's intention to update the Life of Project EMP during 2015. Revision 6 of the document is in preparation in accordance with Ministerial Statement 491 in order to access the remaining four deposits at Mining Area C.	No concerns.
	24 June 2015 Meeting held at the OEPA, Perth	Presentation of the EMP Revision 6 proposed scope, document format, key environmental factors and indicative timeframes were discussed.	BHP Billiton Iron Ore communicated the intention to submit the EMP in September and anticipate endorsement by December 2015. OEPA advised a four month period may be required to process the EMP submission.
	9 September 2015 Meeting held at BHP Billiton, Perth	Early consultation with the OEPA (including the Terrestrial Ecosystems Branch) regarding BHP Billiton Iron Ore's assessment of troglofauna at Mining Area C. Discussion on the OEPA's expectations in regards to the application of *Environmental Assessment Guideline 12* with regard to the use of habitat as a surrogate in troglofauna impact assessment. The Troglofauna Environmental Impact Assessment report was provided for information. The OEPA requested that the Troglofauna Habitat Assessment report be made available as supporting information for their assessment.	Consultation session and engagement with the OEPA was undertaken on the advice of DPaW at the 15 July 2015 session. BHP Billiton Iron Ore will consider providing a copy of the Troglofauna Habitat Assessment (Commercial-in-Confidence) report as supporting documentation to the OEPA.
Department of Parks and Wildlife (DPaW)	13 March 2015 Meeting held at the DPaW office, Kensington	Presentation of BHP Billiton Iron Ore's habitat assessment approach and the methodology for assessing potential impacts to troglofauna.	No concerns.
	15 July 2015 Meeting held at the DPaW office, Kensington	Presentation of the EMP Revision 6 proposed scope and impact assessments undertaken for relevant environmental factors including; Subterranean Fauna (troglofauna and stygofauna), Terrestrial Fauna (particularly the Ghost Bat, short-range endemic invertebrate species and suitable fauna habitat), and Flora and Vegetation (including Weeli Wolli Spring and Coondewanna Flats Priority Ecological Communities (PECs)).	A consultation session with the OEPA (including the Terrestrial Ecosystems Branch) was undertaken on 9 September 2015 following DPaW's recommendation. BHP Billiton Iron Ore presented the Troglofauna Habitat Assessment methodology and the application of EAG 12 for the impact assessment.

Stakeholder	Date	Topic/issue raised	Proponent response/outcome
		Consultation with the OEPA Terrestrial Ecosystems Branch was recommended by DPaW specifically in relation to Subterranean Fauna and the troglofauna habitat assessment methodology.	
	31 July 2015 Meeting held at BHP Billiton, Perth	Regular meeting with Dr Stephen van Leeuwen included discussions on studies and research BHP Billiton Iron Ore is undertaken to increase our knowledge of the Ghost Bat and their habitat use in the vicinity of Mining Area C. DPaW advised the Ghost Bat had been recommended for consideration by the Threatened Species Scientific Committee of the Commonwealth Department of the Environment for inclusion on the National Threatened Species List. Ghost Bats are on the Priority Assessment List commencing 1 October 2015. DPaW also advised a number of species were currently before the WA Minister for the Environment for reclassification or inclusion in the State Schedules as administered under the *Wildlife Conservation Act 1950*. Dr van Leeuwen indicated built structures could not meet the geological timescale of 25,000 years that caves had been, and would continue to be present (i.e. without impact from mining developments). Any built structures should try and meet this criterion.	BHP Billiton Iron Ore will continue to monitor the progress of the potential Ghost Bat listing and any recommendations from the Department of the Environment. BHP Billiton Iron Ore noted comments regarding the criterion for built structures and the difficulty of guaranteeing engineering standards for a 25,000 year timescale. Ghost bat research and surveys are ongoing within the vicinity of Mining Area C, with the intent to further our knowledge of the species.
	16 September 2015 Site visit, Mining Area C	Overall site familiarisation with DPaW and an overview of the EMP Revision 6. Visited the Coondewanna Flats area to discuss the ongoing eco-hydrological investigations and the Packsaddle Range to discuss the targeted troglofauna survey work and the Ghost Bat survey work. The proposed Ghost Bat habitat creation was also discussed.	No concerns.
WA Museum	September 2015 Telephone conversations	In order to review the adequacy of the habitat assessment approach (in relation to assessment of potential impacts to troglofauna associated with mine pits), BHP Billiton Iron Ore has held discussions with Dr Mark Harvey from the WA Museum regarding the opportunity to present the methodology approach and seek any suggestions that may improve our methods for this and future assessments.	A meeting with Dr Harvey and Dr Humphreys on the habitat characterisation and assessment approach will be scheduled for late October 2015, pending availability.

Stakeholder	Date	Topic/issue raised	Proponent response/outcome
		Dr Harvey indicated he would be able to provide advice on the habitat assessment methodology BHP Billiton Iron Ore have used, but would require some notice. Suggestion to also include Dr Bill Humphreys from the WA Museum that his perspective and experience would be valuable.	
Department of Mines and Petroleum	27 August 2015 Meeting held at the DMP office, Perth	Presentation of the EMP Revision 6 proposed scope and the supporting impact assessments undertaken for relevant environmental factors. Noted the upcoming submission of the Mine Closure Plan and request for two week review period. No position stated either way on ability to meet this timeframe. The DMP assessing officer was not available for this presentation and another briefing session prior to submission was suggested.	BHP Billiton Iron Ore has scheduled a follow up session with the DMP assessing officer late October 2015 to present the Mine Closure Plan which supports the EMP Revision 6 scope.
Department of Water	16 September 2015 Meeting held at BHP Billiton, Perth	Presentation of the proposed scope of the EMP Revision 6 and the supporting Mine Closure Plan. The groundwater model and impact assessment were also discussed. Suggestion to arrange a combined presentation to relevant stakeholders on the eco-hydrological investigations undertaken for the Coondewanna Flats area.	BHP Billiton will coordinate a combined session with the Department of Water, OEPA and DPaW to present the Coondewanna eco-hydrological investigations undertaken to date and key findings.
Banjima Traditional Owners	18 August 2015 Letter correspondence	An overview of the proposed EMP Revision 6 scope was provided in the spirit of cooperation and in accordance with the current heritage agreement and the proposed Comprehensive Agreement.	No concerns.

4 ENVIRONMENTAL STUDIES AND SURVEY EFFORT

A number of environmental studies, investigations and surveys have been undertaken to inform the Life of Project EMP Revision 6 in accordance with Proponent Commitments 1 to 3 of Ministerial Statement 491. Table 4.1 details the studies, investigations and surveys undertaken to date, the study area covered, the guidelines referred to and any limitations of the study. Environmental impact assessment reports are included in Appendix A – F as supporting information for the key environmental factors. Information relevant to key and other environmental factors is summarised in Section 5 and 6.

Table 4.1 Environmental Studies and Surveys

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
Flora and vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.	*Mining Area C – Flora and Vegetation Environmental Impact Assessment* (Onshore Environmental 2015). (Appendix A)	This environmental impact assessment study was carried out to review the proposed development against a range of baseline survey data captured in an extensive range of reports dating back to 1996. The information from baseline reports which overlap all or parts of the Licence Boundary were consolidated as part of the *Mining Area C – Review of Flora and Vegetation Baseline Information* report (Onshore 2014a).	EPA Guidance Statement 51. *Terrestrial Flora and Vegetation Surveys for Environmental Impact in Western Australia* (EPA 2004a). EPA Guidance Statement 2. Environmental Protection of Native Vegetation in Western Australia: Clearing of native vegetation with particular reference to agricultural areas (EPA 2000). Consultation with DPaW and OEPA as per details provided in Table 3.1.
		Mining Area C - Review of Flora and Vegetation Baseline Information (Onshore Environmental 2014a).	This report was compiled in 2014 and covered the proposed EMP Revision 6 boundary, wider Licence Boundary and the surrounding Mining Area C vicinity. The report consolidated the findings of all previous baseline survey results and reports.	As above.
		Consolidation of Regional Vegetation Mapping - BHP Billiton Iron Ore Pilbara Tenure (Onshore Environmental 2014b).	Confidential Report prepared for BHP Billiton Iron Ore which includes vegetation mapping for BHP Billiton tenure in the Pilbara region.	As above.
		Coondewanna Flats Ecohydrological Study: Ecological Water Requirements of Vegetation Report (Astron Environmental 2014).	This study was undertaken to determine the ecological water requirement of vegetation as part of BHP Billiton Iron Ore's eco-hydrogeological investigation of the Coondewanna Flats (the Flats), located southwest of Mining Area C. The purpose of this work was to determine the eco-hydrological function of priority ecological communities (PECs) in order to inform ongoing management and monitoring of the Flats. The aim of management is to ensure the long term persistence of PECs at the Flats in response to changes in surface water and groundwater regimes associated with surrounding mining activities.	*Environmental Water Provisions Policy for Western Australia*, Statewide Policy No 5 (Waters and Rivers Commission 2000). *Priority Ecological Communities for Western Australia, Species and Communities Branch, Department of Environment and Conservation* (DEC 2011).

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
Landforms	To maintain the variety, integrity, ecological functions and environmental values of landforms.	*Area C EMP Revision 6 Landscape and Visual Impact Assessment* (Urbis 2015).	This study was completed in January 2015. The study included data captured from pre-determined vantage points in the vicinity of Mining Area C. It also utilised modelling to assess the impact (during operations and post closure) on viewsheds and landscape character types in the Pilbara region.	*Visual Landscape Planning in Western Australia* (Western Australian Planning Commission [WAPC] 2007). *EPA Guidance Statement 6. Rehabilitation of Terrestrial Ecosystems* (EPA 2006). *Guidelines for Preparing Mine Closure Plans* (DMP and EPA 2015). *EPA Guidance Statement 33. Environmental Guidance for Planning and Development* (EPA 2008).
Subterranean fauna	To maintain the representation, diversity, viability and ecological function at the species, population and assemblage level.	*Mining Area C, Life of Project: Stygofauna Assessment* (Bennelongia 2015a). (Appendix B)	This study was completed in 2015. This was a desktop environmental impact (during operations and post closure) assessment review of potential impacts to stygofauna identified for the proposed Mining Area C operations. In this report, the additional area experiencing groundwater drawdown of ≥2 m as a result of the EMP Revision 6 was referred to as the Groundwater Assessment Area. It reflected the maximum spatial extent of modelled groundwater drawdown ≥2 m during the proposed life of mine operations.	*EPA Environmental Assessment Guideline 12. Consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA 2013b). *EPA Guidance Statement 54a. Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (EPA 2007). Consultation with DPaW, OEPA Terrestrial Branch and the WA Museum as per details provided in Table 3.1.
		Mining Area C, Life of Project: Troglofauna Assessment (Bennelongia 2015b). (Appendix C)	This study was undertaken in 2014 and revised in 2015 to include additional survey findings and available habitat assessment information. This was a desktop environmental impact assessment review of potential impacts to troglofauna within the indicative mine pit areas.	As above.
		Packsaddle East Subterranean Fauna Baseline Report (Bennelongia 2015c).	One round of subterranean fauna sampling during March 2015, with traps collected in May 2015. This survey utilised drilling holes from exploration programmes that were not within the indicative resources at Mining Area C.	As above.
		Coondewanna Flats and Packsaddle West	Two rounds of subterranean fauna sampling during September 2014 (Round 1) and February	As above.

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
		Subterranean Fauna Baseline Report (Bennelongia 2015d).	2015 (Round 2), with traps collected in November 2014 and April 2015 respectively. This survey utilised drilling holes from exploration programmes that were not within the indicative resources at Mining Area C, and drill holes from within the Coondewanna Flats area associated within the eco-hydrological study.	
		Mining Area C Troglofauna Report (Bennelongia 2015e).	One round of troglofauna fauna sampling during March 2015, with traps collected in May 2015. Out-of-pit survey at Mining Area C which utilised drilling holes from exploration programmes that were not within the indicative resources. This programme was targeted based on the results of the preliminary troglofauna environmental impact assessment and the habitat assessment.	As above.
		Mining Area C Troglofauna Habitat Assessment (BHP Billiton Iron Ore 2015c).	This confidential report was a desktop study completed during 2015 using available geological information from Mining Area C drill logs to describe the subterranean fauna habitat present. The report was provided to Bennelongia to further inform the troglofauna impact assessment.	As above. Limitations: Data availability and limited information in the literature as to what geological characteristics make a stratigraphic unit suitable as troglofauna habitat. Indicative pit boundaries are current as of May 2015 and changes may either extend or retract these pit boundaries and the uncertainty surrounding these changes should be given due consideration.
		Mining Area C: Baseline Subterranean Fauna Report (Bennelongia 2014).	This report was compiled in 2014 and covered the proposed EMP Revision 6 boundary, wider Licence Boundary and the surrounding Mining Area C vicinity. The report consolidated the findings of all previous baseline survey results and reports. Findings were used to inform the troglofauna and stygofauna impact assessments.	*EPA Environmental Assessment Guideline 12. Consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA 2013b). *EPA Guidance Statement 54a. Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (EPA 2007).
Terrestrial environmental quality	To maintain the quality of land and soils so that the environment values, both ecological and	*Mining Area C Preliminary Acid and Metalliferous Drainage Risk Assessment* (Klohn Crippen Berger	This study was completed in 2014. This study reviewed the potential impacts to key environmental receptors from potentially acid-forming materials within the Mining Area C deposits during operations and post closure.	Commonwealth Department of Industry, Tourism and Resources [DITR] (2007) *Leading Practice Sustainable Development Program for the Mining Industry - Managing Acid and Metalliferous Drainage.*

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
	social, are protected.	2014).		International Network for Acid Prevention (2012) *Global Acid Rock Drainage Guide* (GARD Guide). Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000), *Australian Water Guidelines for Fresh and Marine Waters* (and its updates). Consultation with DMP as per details provided in Table 3.1.
Terrestrial fauna (including short-range endemics)	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	*Mining Area C Vertebrate Fauna Environmental Impact Assessment* (Biota 2015). (Appendix D)	This study was completed in 2015. This study was an environmental impact assessment review of potential impacts to terrestrial vertebrate fauna within the indicative EMP Revision 6 boundary.	*EPA Position Statement 3. Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002). *EPA Guidance Statement 56. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b). Consultation with DPaW as per details provided in Table 3.1.
		Central Pilbara Ghost Bat Population and Roost Assessment: 2014 (Biologic 2015a).	The survey was undertaken in 2014 and results compiled in 2015. The survey focused on the Packsaddle Range within the Mining Area C Licence Boundary. Findings have been incorporated in the *Mining Area C Vertebrate Fauna Environmental Impact Assessment* (Biota 2015).	As above.
		Mining Area C Desktop Review of Baseline Information on Vertebrate Fauna (Biologic 2014a).	This report was compiled in 2014 and covered the proposed EMP Revision 6 boundary and wider Licence Boundary. A review of all databases and reports containing information on the vertebrate fauna of the Licence Boundary and relevant reports from the surrounding region was conducted. The report consolidated the findings of all previous baseline survey results and reports for the area.	As above.
		Mining Area C – Life of Project EMP Revision 6 Environmental Impact Assessment of Short-	This study was completed in 2015. This study was an environmental impact assessment review of potential impacts to terrestrial invertebrate fauna within the indicative	*EPA Position Statement 3. Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002). *EPA Guidance Statement 56. Terrestrial Fauna*

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
		range Endemic Fauna (Biologic 2015b). (Appendix E)	EMP Revision 6 boundary.	*Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b). *EPA Guidance Statement 20. Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA 2009).
		Mining Area C Short-range Endemic Fauna Habitat Assessment (Biologic 2015b).	A habitat assessment across the Licence Boundary was completed in 2014 to cover gaps in existing information. The results were incorporated within the Environmental Impact Assessment report (see above).	As above.
		Mining Area C Short-range Endemic Invertebrate Desktop Review (Biologic 2014b).	This report was compiled in 2014. The study area covered the wider Licence Boundary, including the indicative EMP Revision 6 boundary. A review of all databases and reports containing information on the short-range invertebrate fauna of the Licence Boundary and relevant reports from the surrounding region was conducted. The report consolidated the findings of all previous baseline survey results and reports for the area and was used to inform the environmental impact assessment report.	As above.

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
Hydrological processes	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected,	*Mining Area C Environmental Management Plan Revision 6 Surface Water Assessment* (RPS Aquaterra 2015).	This study was undertaken in 2014 and finalised in 2015. The study included an environmental impact assessment review of potential impacts to surface water (during operations and post closure) from the proposed EMP Revision 6 development at Mining Area C.	*Operational Policy No.1.02 Policy on water conservation/efficiency plans* (DoW 2009). *Pilbara Regional Water Plan 2010-2030* (DoW 2010). *Operational Policy No. 5.08 Use of operating Strategies in the water licensing process* (DoW 2011). *Western Australia Water in Mining Guideline* (DoW 2013a). *Pilbara Groundwater Allocation Plan,* (DoW 2013b). *Pilbara Regional Water Supply Strategy: a long-term outlook of water demand and supply* (DoW 2013c). *Use of mine dewatering surplus* (DoW 2013d).
		Hydrogeological Assessment for Mining Area C (RPS Aquaterra 2014).	This groundwater modelling and assessment was completed in 2014. The assessment area encompassed the three identified environmental receptors in the area: Coondewanna Flats, Weeli Wolli Spring and Ben's Oasis and also included cumulative impact predictions and closure.	As above. Limitations associated with the model include: • Assumptions in the 2014 mine plan (i.e. rate, sequence, timing and depth of pushbacks). • Assumptions in closure settings (particularly backfill properties and evaporation rates). Consultation with DoW as per details provided in Table 3.1.
		Mining Area C Hydrological Impact Assessment and Water Management Summary (BHP Billiton Iron Ore 2015d). (Appendix F)	This report summarises the outcomes of the modelling and impact assessment (during operations and post closure) undertaken by RPS Aquaterra in 2014.	Consultation with DoW as per details provided in Table 3.1.
		Coondewanna Flats Phase III Water	The scope of this study was developed in consultation with Astron Environmental (2014).	*Priority Ecological Communities for Western Australia, Species and Communities Branch,*

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
		Assessment (URS 2014).	This report presents the results and preliminary interpretations of hydrogeological data collected during site investigations conducted in April and May 2014. The aim of this investigation was to increase the level of knowledge of the surface, groundwater and subsequently soil moisture in the Coondewanna Flats area.	*Department of Environment and Conservation* (DEC 2011).
		Coondewanna Flats Eco-Hydrological Review and Conceptual Model (AQ2 2015)	This report combines the assessment findings of the Astron (2014) and URS (2014) studies for the Coondewanna Flats area to develop an integrated eco-hydrological model.	As above.
Inland waters environmental quality	To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.	*Mining Area C Environmental Management Plan Revision 6 Surface Water Assessment* (RPS Aquaterra 2015).	This study was completed in 2014. This was a desktop environmental impact assessment review of potential impacts to surface water (during operations and post closure) from the proposed EMP Revision 6 development at Mining Area C.	Water Quality Protection Guidelines – Mining and Mineral processing. Limitation: This report was carried out based on the mine plan at the time the report was commissioned. As the mine plan evolves, surface water infrastructure will be revised and updated as required.
		Hydrogeological Assessment for Mining Area C (RPS Aquaterra 2014).	This groundwater modelling and assessment was completed in 2014. The assessment area encompassed the three identified environmental receptors in the area: Coondewanna Flats, Weeli Wolli Spring and Ben's Oasis and also included cumulative impact predictions and closure.	Limitations associated with the model include: • Assumptions in the 2014 mine plan (i.e. rate, sequence, timing and depth of pits). • Assumptions in closure settings (particularly backfill properties and evaporation rates).
		Mining Area C Hydrological Impact Assessment and Water Management Summary (BHP Billiton Iron Ore 2015d). (Appendix F)	This report summarises the outcomes of the modelling and impact assessment (during operations and post closure) undertaken by RPS Aquaterra in 2014.	Consultation with DoW as per details provided in Table 3.1.
Air quality and atmospheric	To maintain air quality for the protection of the	*Air Quality Assessment for Mining Area C* (Pacific Environment	The modelling and impact assessment was completed in 2015.	*Air Quality Modelling Guidance Notes, Department of Environment,* Government of Western Australia,

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
gases	environment and human health and amenity, and to minimise the emission of greenhouse and other atmospheric gases through the application of best practice.	Limited 2015).	This study utilised modelling to assess air quality based on current and planned dust controls at selected sensitive receptors within the regional area.	March 2006. *National Greenhouse Accounts (NGA) Factors* (Commonwealth Department of Climate Change and Energy Efficiency 2010). Limitations: The modelling was carried out based on the mine plan at the time the report was commissioned. The Financial Year 2027 scenario was used as a high case for assessing potential impacts.
Amenity	To ensure that impacts to amenity are reduced to as low as reasonably practicable.	*Area C EMP Revision 6 Landscape and Visual Impact Assessment* (Urbis 2015).	This study was completed in 2015. It included data captured from pre-determined vantage points in the vicinity of the proposed EMP Revision 6 development. The study also utilised modelling to assess the impact on viewsheds and landscape character types (during operations and post closure).	*EPA Guidance Statement 33. Environmental Guidance for Planning and Development* (EPA 2008). *Visual Landscape Planning in Western Australia*: A Manual for Evaluation, Assessment, Siting and Design (DPI 2007).
Heritage	To ensure that historical and cultural associations, and natural heritage, are not adversely affected.	*A number of archaeological and ethnographical surveys have been carried out.*	Surveys have covered the indicative Revision 6 boundary and the wider Licence Boundary area.	*EPA Guidance Statement 41. Assessment of Aboriginal Heritage* (EPA 2004c). Consultation with the Traditional Owners (*Banjima*) as per details provided in Table 3.1.
Human health (noise)	To ensure that human health is not adversely affected.	*Environmental Noise Assessment: Mining Area C* (SVT 2014).	This study was completed in 2014. This study utilised modelling to assess a range of potential development scenarios and determine noise levels at selected sensitive receptors within the regional area.	*Environmental Assessment Guideline 13 for the Consideration of Environmental Impacts from Noise* (EPA 2014a). Limitations: The modelling was carried out based on the mine plan at the time the report was commissioned. The Financial Year 2027 scenario was used as a high case for assessing potential impacts.
Rehabilitation and decommissioning (integrating factor)	To ensure that premises are decommissioned and rehabilitated in an ecologically sustainable	*Mining Area C Acid and Metalliferous Drainage Risk Assessment* (Klohn Crippen Berger 2014).	This study was completed in 2014 and reviewed the potential impacts to key environmental receptors from potentially acid-forming materials (during operations and post closure) within the Mining Area C deposits. The results have been incorporated within the *Mining Area C Mine*	*EPA Guidance Statement 6. Rehabilitation of Terrestrial Ecosystems* (EPA 2006). *Guidelines for Preparing Mine Closure Plans* (DMP and EPA 2015).

Factor	EPA Objective	Survey/investigation	Study area, type and timing	Study standard/guidance and limitations
	manner.		*Closure Plan* (Appendix G).	*Leading Practice Sustainable Development Program for the Mining Industry - Managing Acid and Metalliferous Drainage* (DITR 2007).
		Mining Area C Baseline Soil and Landform Survey and Impact Assessment (MWH Australia (formerly Outback Ecology) 2015).	This baseline survey was undertaken in 2014. The report incorporates the results of the 2011 survey (Outback Ecology 2012).	The soil survey was conducted in accordance with the Western Australia (WA) Department of Mines and Petroleum (DMP), formerly the WA Department of Industry and Resources (DoIR), *Guidelines for Mining Proposals in Western Australia* (DoIR 2006).
		Mining Area C Assessment Study Area Soil and Landform Assessment (Outback Ecology 2012).	This baseline survey was completed in 2011 and covered part of the proposed EMP Revision 6 development area.	As above.

5 ASSESSMENT OF KEY ENVIRONMENTAL FACTORS

Key environmental factors were identified for Mining Area C during the PER assessment process and outlined within Bulletin 913 (EPA 1998). BHP Billiton Iron Ore has completed environmental impact studies to quantify the potential environmental impacts and determine the significance of the environmental factors identified for Mining Area C against the EPA Significance Framework (EPA 2013a). The environmental factors within Bulletin 913 were reviewed following the completion of the studies and impact assessment for the EMP Revision 6 boundary and the potential key environmental factors, as defined in *Environmental Assessment Guideline 8* (EPA 2015) were determined. The list of key environmental factors includes:

- flora and vegetation;
- landforms;
- subterranean fauna;
- terrestrial fauna;
- hydrological processes; and
- rehabilitation and decommissioning (integrating factor).

With regards to flora and vegetation, it has been considered a key environmental factor for this assessment as a result of a proposed larger disturbance area and future approval requirement to modify the Key Characteristics Table within Ministerial Statement 491.

For each key environmental factor, a sub-section with the following information is provided:

- context, including a concise description of the relevant environmental values;
- the potential impacts resulting from the proposed development;
- environmental aspects that may cause significant impacts;
- a description of ongoing mitigation for each significant impact;
- the regulation process required to make sure adequate mitigation occurs; and
- a statement of the outcome and justification to demonstrate that the EPA's objective would be achieved.

BHP Billiton Iron Ore has considered the mitigation hierarchy in the recently published *Western Australian Government's Offsets Policy* (WA Government 2011) and the EPA's bulletin *Environmental Protection Bulletin No.1 Environmental Offsets* (EPA 2014b) which clarifies how the EPA will consider offsets through the environmental impact assessment process. The mitigation hierarchy steps include:

- avoid;
- minimise;
- rehabilitate; and
- offset.

Environmental management components including management actions, monitoring requirements, indicators and/or trigger criteria, contingency actions and reporting requirements for each key environmental factor are also summarised in Part A – Table 3.2 for their implementation by Mining Area C operations.

5.1 FLORA AND VEGETATION

5.1.1 Existing Environment

5.1.1.1 Significant Flora

None of the plant taxa recorded from the Mining Area C Licence Boundary are gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the *Wildlife Conservation Act 1950* or listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

There were eight Priority flora taxa distributed across a wide extent of the Licence Boundary (Figure 5.1), six of which were recorded within the EMP Revision 6 boundary:

- *Aristida jerichoensis* var. *subspinulifera* (Priority 3);
- *Aristida lazaridis* (Priority 2);
- *Eremophila magnifica* subsp. *magnifica* (Priority 4);
- *Nicotiana umbratica* (Priority 3);
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) (Priority 3); and
- *Rostellularia adscendens* var. *latifolia* (Priority 3).

5.1.1.2 Introduced Flora

There were 21 introduced (weed) species recorded predominantly from plains and drainage lines throughout the Mining Area C Licence Boundary, and less prominent in areas of higher relief. None of the weeds were listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (Onshore Environmental 2015).

5.1.1.3 Significant Vegetation

There were 28 vegetation associations described and mapped from within the Licence Boundary (Figure 5.2). None of these were affiliated with any know Federal or State listed Threatened Ecological Communities (TECs) or State listed Priority Ecological Communities (PECs).

Two sub-types of the Coolibah-lignum Flats PEC are associated with the Coondewanna Flats area (including Lake Robinson), situated less than 1 km south-west of the Licence Boundary (Figure 5.3). Field assessments confirmed that none of the vegetation associations within the Licence Boundary were found to have affiliations with any of the known PECs.

Locally significant vegetation

Six of the 28 vegetation associations mapped from the Licence Boundary were determined to be locally significant, of which three occur within the EMP Revision 6 boundary. The three vegetation associations occur on plains scattered throughout the Licence Boundary, floodplains within the north-west sector of the Licence Boundary, and stony plains within the west, south and east sectors of the Licence Boundary.

Groundwater dependent vegetation

No groundwater dependent vegetation has been identified within the Licence Boundary.

Three areas surrounding the Mining Area C Licence Boundary support vegetation that has been identified as groundwater dependent (Weeli Wolli Spring and Ben's Oasis) (Figure 5.3) or potentially groundwater dependent under extended drought conditions (Lake Robinson and Coondewanna Flats), and occurring within areas where in situ groundwater levels could facilitate groundwater utilisation. These areas are:

- Lake Robinson and areas of the surrounding Coondewanna Flats that support *Eucalyptus victrix*, situated less than 1 km south-west of the Licence Boundary. Large *Eucalyptus victrix* trees within Lake Robinson and Coondewanna Flats may be susceptible to groundwater drawdown during extended drought conditions;
- Weeli Wolli Spring and the adjoining channel of Weeli Wolli Creek extending upstream and downstream of the spring, situated approximately 10 km east of the Licence Boundary. This area supports the true phreatophyte *Melaleuca argentea* which is highly sensitive to groundwater drawdown; and
- Ben's Oasis, situated approximately 12.5 km south-east of the Licence Boundary, also supports the true phreatophyte *Melaleuca argentea*.

Mulga vegetation

Within the Licence Boundary, Mulga vegetation occurring on floodplains was mapped and described as four associations. Mulga vegetation is predominately situated along the western fringe of the

Licence Boundary, with smaller localised areas situated east of R, A and B Pits (Onshore Environmental 2015).

5.1.1.4 Vegetation Condition

Vegetation condition within the Licence Boundary ranged from 'Completely Degraded' to 'Pristine'. A majority of the vegetation within the EMP Revision 6 boundary was rated between 'Good' and 'Excellent', with the remainder rated as 'Degraded' or 'Completely Degraded' (Onshore Environmental 2015).

Vegetation in areas of higher relief, with restricted access, and supporting less palatable plant species retained higher condition scores. Vegetation condition was reduced on floodplains in the south-west, north-west and eastern sectors of the Licence Boundary, as well the east-west central sector supporting mining infrastructure and areas of Packsaddle Range supporting intensive exploration and mining. However, the major disturbance contributing to lower vegetation condition was grazing by domestic stock and associated surface erosion and introduction of weeds, recorded across lowland habitats such as stony plains, floodplains, sandy drainage zones and drainage lines.

5.1.2 Potential Impacts

Relevant potential impacts include:

- clearing of significant flora species;
- introduction or spread of introduced flora species (weeds);
- clearing of locally significant vegetation communities;
- impacts to groundwater dependent vegetation from mine dewatering;
- impacts to Mulga vegetation from surface water alterations; and
- clearing of vegetation in 'Good' to 'Excellent' condition.

5.1.2.1 Significant Flora

The six Priority Flora species recorded from the EMP Revision 6 boundary are also known to occur outside of the Licence Boundary.

The impact on *Rhagodia* sp. Hamersley (M. Trudgen 17794), *Eremophila magnifica* subsp. *magnifica*, *Aristida jerichoensis* var. *subspinulifera* and *Aristida lazaridis* is considered to be low, with the majority of records for these four taxa occurring outside the proposed EMP Revision 6 boundary and also present at surrounding locations outside the Licence Boundary (Onshore Environmental 2015).

The impact of the proposed disturbance on *Rostellularia adscendens* var. *latifolia* and *Nicotiana umbratica* is considered to be low to moderate. *Nicotiana umbratica* has been recorded from a single location within the south-west corner of the proposed R Pit area, noting that it has also been collected from several other locations within the Pilbara. The majority of recorded locations for *Rostellularia adscendens* var. *latifolia* occur within the proposed A Pit area, but the population does extend further east along medium drainage lines outside the EMP Revision 6 boundary (Onshore Environmental 2015).

5.1.2.2 Introduced Flora

Domestic stocks such as cattle are significant vectors for weed species within the Licence Boundary. Another important factor influencing weed establishment is increased vehicular access combined with disturbance such as clearing for roads and other infrastructure.

Existing operations at Mining Area C have various strategies associated with prevention (quarantine) and control (targeted spray programs and progressive rehabilitation) of weeds. The impacts from introduced flora are not expected to significantly increase as a result of the proposed EMP Revision 6 development.

5.1.2.3 Significant Vegetation

Locally significant vegetation

The three locally significant vegetation associations identified within the EMP Revision 6 boundary are well represented outside the Licence Boundary as confirmed by the recent consolidated mapping of Pilbara tenements by BHP Billiton Iron Ore (Onshore Environmental 2014b). For each of the locally significant vegetation associations, less than 2% of the total consolidated mapping area occurring on BHP Billiton Ore tenements occurs within the proposed EMP Revision 6 boundary. Impacts to these vegetation associations are therefore considered to be low (Onshore Environmental 2015).

Groundwater dependent vegetation

Consideration of groundwater dependent vegetation and in situ groundwater levels at January 2000 confirms there are no areas within either the proposed EMP Revision 6 boundary or the wider Licence Boundary that are at risk from groundwater drawdown by proposed mining activities. Existing groundwater levels within the Licence Boundary occur at a depth that is not accessible to overlying vegetation.

At Coondewanna Flats and Lake Robinson, the maximum predicted groundwater drawdown from proposed mining activities at Mining Area C is between 6 m and 9.5 m, with no increase recorded for the cumulative groundwater drawdown (from Mining Area C and Hope Downs operations). A recent study on the ecological water requirement of vegetation at Coondewanna Flats by Astron Environmental (2014) was inconclusive regarding the overall groundwater dependence of *Eucalyptus victrix* at Coondewanna Flats, although it highlighted that the larger trees of this species are likely to have an increased reliance on groundwater during extended periods of drought.

A subsequent (and ongoing) eco-hydrological investigation by AQ2 (2015) suggests that the vegetation communities at Coondewanna Flats do not appear to be groundwater dependent and instead rely on plant-available water in the unsaturated soil profile, which is estimated to be sufficient to sustain the vegetation community for a drought period of approximately 10 years. Whilst these investigations are ongoing, a precautionary approach will be taken in the management of groundwater and for the purpose of this assessment, the vegetation will be assumed to be partly dependent upon groundwater resources. Therefore, under the current groundwater model, large *Eucalyptus victrix* trees at this location may be at increased risk from groundwater drawdown resulting from mining activities at Mining Area C during extended drought conditions.

The predicted groundwater drawdown at both Weeli Wolli Spring and Ben's Oasis from proposed Mining Area C activities is less than 1 m. This impact alone is unlikely to result in any decline in vegetation at either location. However, the maximum predicted cumulative groundwater drawdown (from Mining Area C and Hope Downs operations) is between 4 m and 6 m for Weeli Wolli Spring and 2 m to 5 m for Ben's Oasis. This cumulative impact would result in decline of groundwater dependent vegetation at both sites (Onshore Environmental 2015).

Mulga vegetation

The alteration of existing surface water regimes have the potential to impact on susceptible downstream vegetation, most notably Mulga dominated vegetation associations situated on floodplains. Proposed changes to surface hydrology are not likely to result in any significant alteration to the composition or structure of existing vegetation associations. While downstream vegetation is likely to be at highest risk from impacts associated with reduced surface water flows, increased sediment loading and contamination, the potential impacts are determined to be not significant because vegetation associations are not regarded to support high risk species and are well represented locally and regionally (Onshore Environmental 2015).

5.1.3 Mitigation Actions

BHP Billiton Iron Ore is continually modifying the clearing requirements as more resource definition occurs. Various scenarios for reducing the extent of clearing will continue to be investigated and considered throughout the Life of Project. Where possible, the use of existing infrastructure and facilities at Mining Area C will be considered to reduce the proposed clearing requirement where practicable.

Details of the management actions to minimise or avoid potential impacts, monitoring details, formulation of indicators and/or trigger criteria, reporting requirements and potential contingency actions are included in Part A – Table 3.2 for implementation on site.

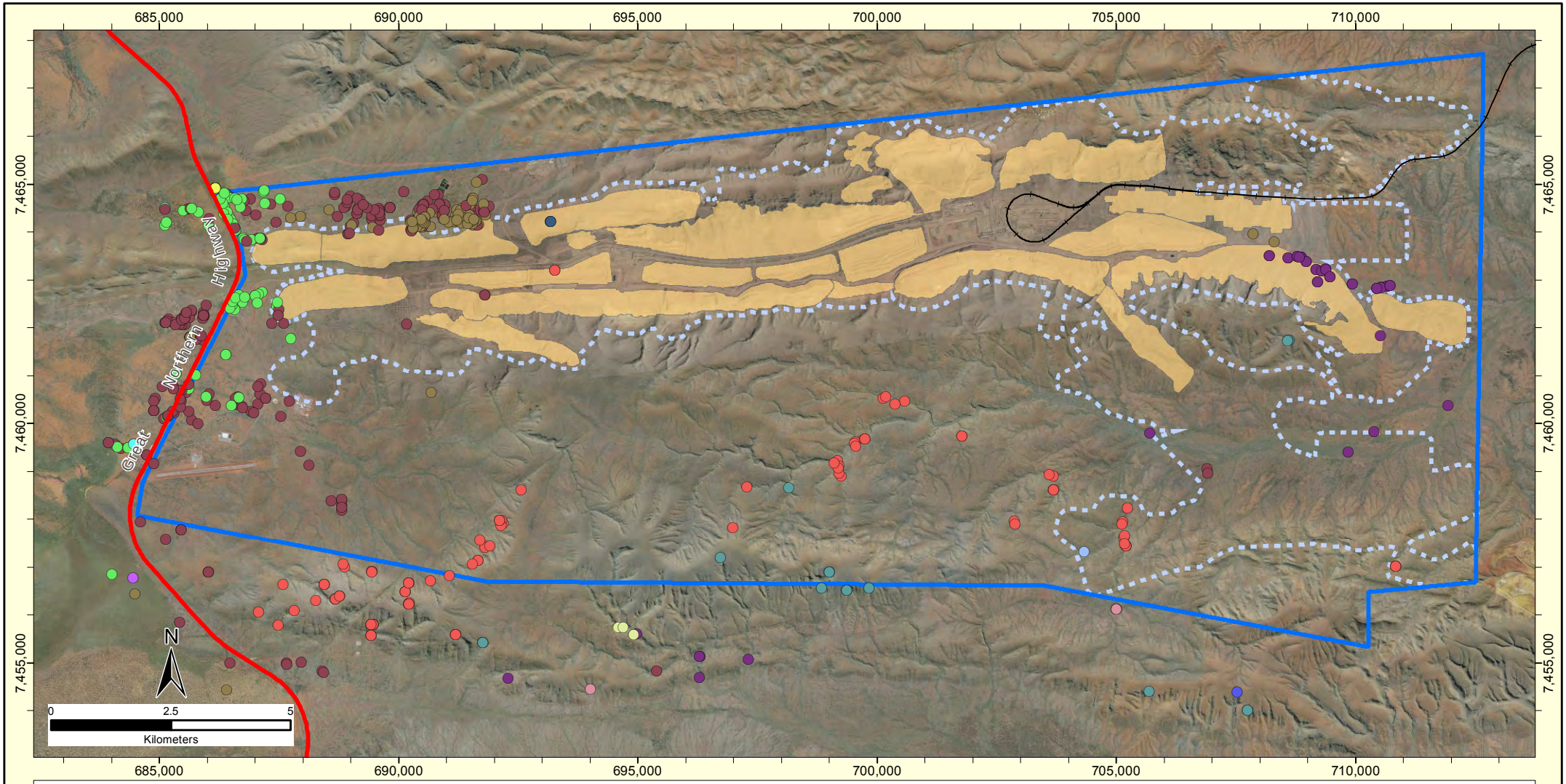
BHP Billiton Iron Ore will consider offsets to address residual impacts for each hectare of 'Good' to 'Excellent' vegetation cleared for the development that exceeds the current 5,000 ha (under Ministerial Statement 491) as part of future applications to increase disturbance requirements at Mining Area C.

5.1.4 Regulatory Mechanism

Flora and vegetation is managed by the Ministerial Statement. BHP Billiton Iron Ore will manage this factor as part of its standard Pilbara-wide Health, Safety and Environment Management System.

5.1.5 Outcome

BHP Billiton Iron Ore proposes flora and vegetation representation, diversity, viability and ecological function at the species, population and community level can be maintained.



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resourcing the future

MINING AREA C
Conservation Significant Flora Species

Scale @ A4: 1:115,000	Prepared: P. Gant	Project No: A762/004
Date: 6/10/2015	Checked: E. Drain	Figure: 5-1
	Revision: Final	

LEGEND

- Approved Indicative Deposits and OSAs
- Area C Licence Boundary
- Proposed EMP Rev 6 Boundary

Significant Flora Recorded

- Acacia bromilowiana (Priority 4)
- Aristida jerichoensis var. subspinulifera (Priority 1)
- Aristida lazaridis (Priority 2)
- Brachyscome sp. Wanna Munna Flats (S. van Leeuwen 4662) (Priority 1)
- Eremophila magnifica subsp. magnifica (Priority 4)
- Euphorbia inappendiculata var. inappendiculata (Priority 2)
- Goodenia lyrata (Priority 3)
- Goodenia nuda (Priority 4)
- Grevillea sp. Turee (J. Bull & G. Hopkinson ONS JJ 01.01), Priority 1
- Nicotiana umbratica (Priority 3)
- Rhagodia sp. Hamersley (M. Trudgen 17794) (Priority 3)
- Rostellularia adscendens var. latifolia (Priority 3)
- Sida sp. Barlee Range (S. van Leeuwen 1642) (Priority 3)
- Spartothamnella puberula (Priority 2)
- Themeda sp. Hamersley Station (M.E. Trudgen 11431) (Priority 3)
- Triodia sp. Mt Ella (M.E. Trudgen 12739) (Priority 3)
- Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684) (Priority 1)

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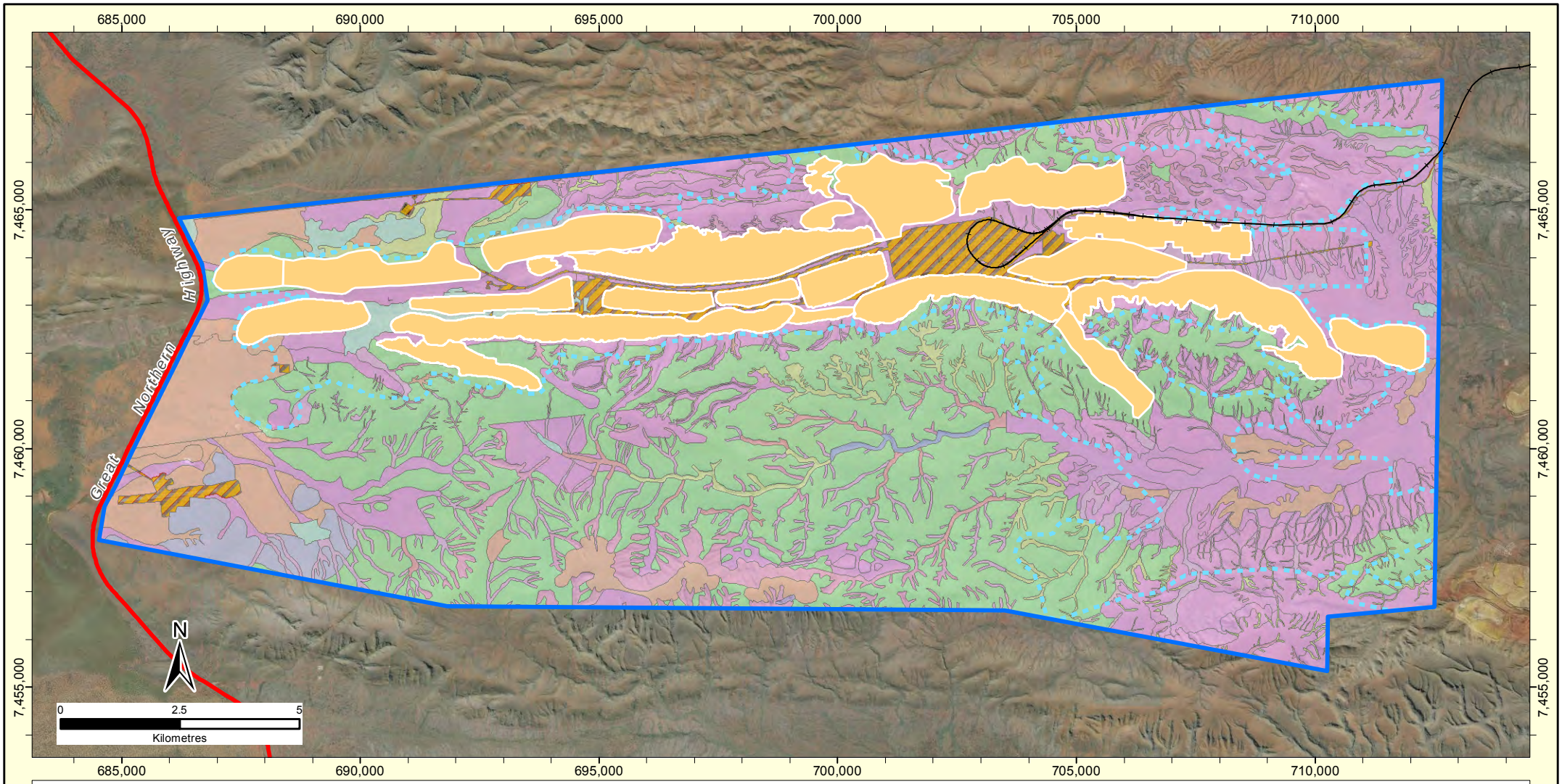

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MINING AREA C
Vegetation Associations

Scale @ A4: 1:115,000	Prepared: P. Gant	Project No: A762/003
Date: 6/10/2015	Checked: E. Drain	Figure: 5-2
	Revision: Final	

LEGEND

- Approved Indicative Deposits and OSAs
- Area C Licence Boundary
- Proposed EMP Rev 6 Boundary

Mapped Vegetation Associations (Onshore Environmental, 2014)

- Disturbed
- Acacia High Shrubland
- Acacia Low Open Forest
- Acacia Low Open Woodland
- Acacia Low Woodland
- Acacia Open Scrub
- Callitris Low Open Forest
- Corymbia Low Woodland
- Eucalyptus Low Woodland
- Petalostylis Shrubland
- Themeda Open Tussock Grassland
- Themeda Tussock Grassland
- Triodia Hummock Grassland
- Triodia Hummock Grassland
- Triodia Open Hummock Grassland

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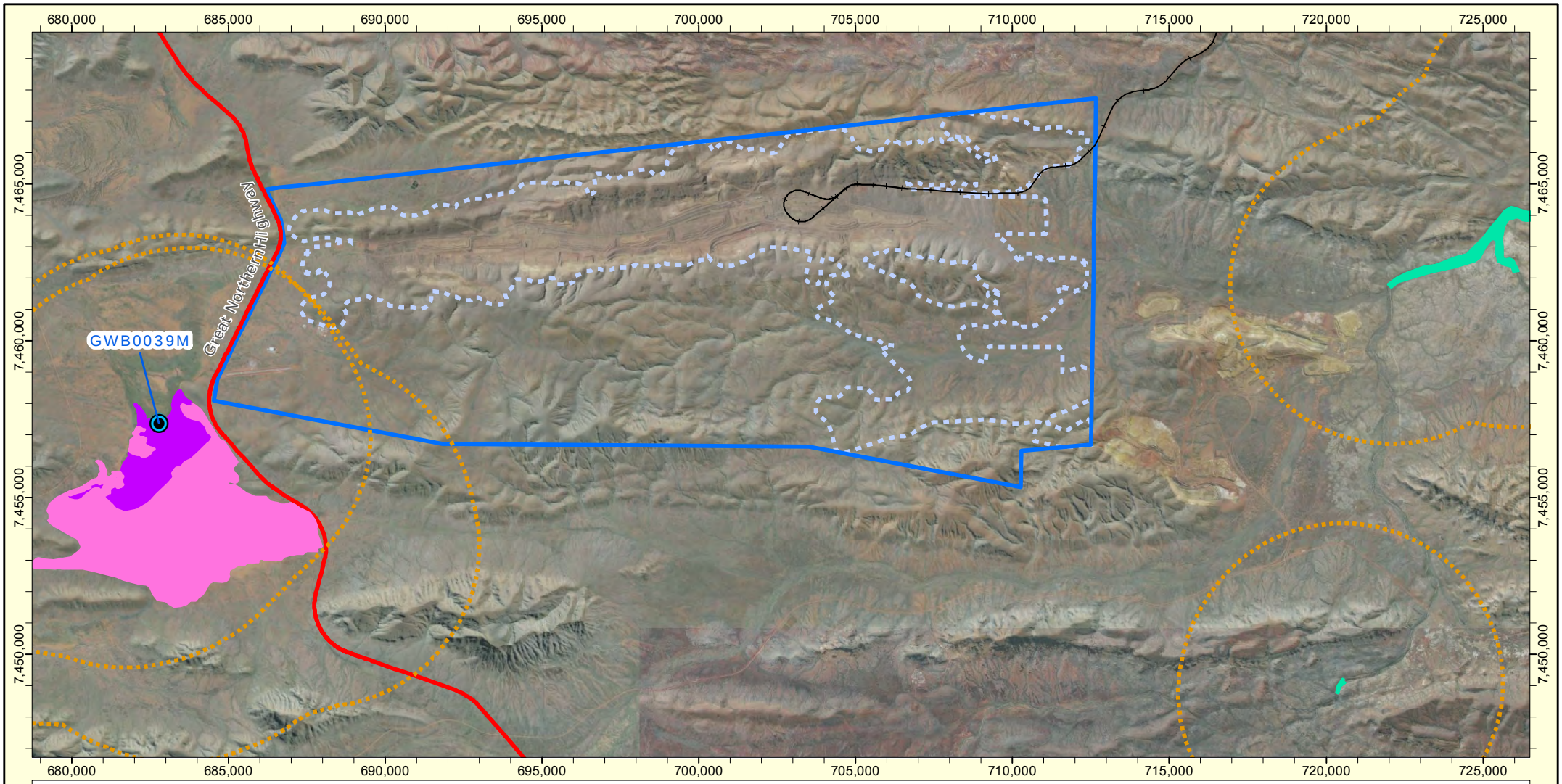

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MINING AREA C
Priority Ecological Communities and Groundwater Monitoring Bore

Scale @ A4: 1:175,000	Prepared: P. Gant	Project No: A762/008
Date: 5/10/2015	Checked: E. Drain	Figure: 5-3
	Revision: Final	

LEGEND

- Monitoring Bore

Boundaries - Priority Ecological Communities

- Coolibah - Lignum Flats: sub type 1: Coolibah and mulga woodland over lignum and tussock grasses on clay plains (Coondewanna and Wanamunna flats)
- Coolibah - Lignum Flats: sub type 2: Coolibah woodlands over lignum (Muehlenbeckia florulenta) over swamp wanderrie (Lake Robinson)
- Weeli Wolli Spring Community
- Priority Ecological Communities - Exclusion Area
- Area C Licence Boundary
- Proposed EMP Rev 6 Boundary

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5.2 LANDFORMS

5.2.1 Existing Environment

Mining Area C lies in the central eastern part of the Hamersley sub-region, which forms the southern section of the Pilbara Craton (Kendrick 2001). This sub-region is characterised by mountainous areas of Proterozoic sedimentary (ironstone) ranges and plateaux dissected by gullies and gorges.

The Land Systems within Mining Area C were mapped as part of the Technical Bulletin No. 92 (Van Vreeswyk et al. 2004). A Land System includes a number of land-units and is classified by the recurring pattern of topography, soils and vegetation. These recurring patterns can be seen using aerial photography or other remotely sensed imagery and are typically ground-truthed with field surveys. The Mining Area C Licence Boundary encompasses four Land Systems including Newman (>60%), Boolgeeda (~25%), Platform and Wannamunna (both 1 to 5%).

The surface soil profiles within the Licence Boundary exhibited some variation in terms of morphological characteristics, based on their occurrence within different landscape positions on naturally occurring landform features. Within the Revision 6 boundary, three soil management units (SMUs) were identified, namely: 'undulating stony plains and hills', 'ridgeline/scree slope' and 'drainage'.

The Revision 6 boundary area is dominated by ridgelines and undulating stony plains and hills. Consequently, the surface soils were morphologically variable, sometimes shallow and often dominated by a high composition of coarse fragments.

5.2.2 Potential Impacts

Alteration of the landform will occur through the creation of pits, OSAs and overland infrastructure. The integrity and stability of built landforms is a relevant aspect for the proposed EMP Revision 6 development.

Project machinery and equipment that disturbs and transports soil has the potential to cause a range of impacts including:

- repeated handling of soil by excavation, grading, loading, transporting and dumping can lead to the breakdown of soil structure, increasing susceptibility to erosion and reducing capacity to support vegetation. Surface soil materials contained a relatively high percentage of coarse material, but were slightly dispersive and are therefore considered prone to structural decline and erosion;
- handling of surface soil materials when wet, could lead to a decline in structural stability and an increase in impacts associated with clay dispersion;
- compaction by trafficking of heavy machinery and equipment reduces the soil material's capacity to capture and store water, and support vegetation, particularly if close to the final surface of a landform; and
- interruption of local surface drainage patterns by stockpiles may cause accelerated erosion of the material within the stockpiles, downstream sedimentation and/or the dehydration of the soil profile in other areas.

Soil and landform assessment

A baseline soil and landform survey and impact assessment was undertaken by MWH Australia Pty Ltd (MWH, formerly Outback Ecology) in 2011 and 2014. The aim of the assessment was to characterise the physical and chemical properties of the surface soils located within the future mining activities at Mining Area C, to facilitate the development of a topsoil inventory, to identify potential impacts to soils and landforms, identify preliminary rehabilitation and landform design requirements, and to provide recommendations for earthworks and mine closure activities.

Results of the 2011 and 2014 surveys were combined into one report (MWH 2015). The sampling regime included 115 samples from 43 sites (2012) and 33 samples from 10 sites (2014).

The majority of the topsoils were aggregated with little variation of shape and size of the aggregates between SMUs. Weathered, fractured rock hardcaps were common, particularly at sampling sites located comparatively higher in the landscape.

The topsoils (0 to 0.1 m) from all SMUs are typical of Pilbara soils and are considered a valuable source of rehabilitation material. The topsoils generally have a moderately high coarse rock fragment content, moderate hydraulic conductivity, are non-hardsetting, non-saline and are non-sodic, indicating a low inherent erodibility.

The topsoils are, however, prone to minor clay dispersion upon severe disturbance. Care should be taken to minimise the handling of these soils where possible, particularly when wet. Despite this, the topsoil from within the Impact Assessment Area is considered suitable for use as a surface rehabilitation material on constructed landforms.

On average, the subsoils (0.1 to 1.5 m) from all three SMUs contain moderately high amount of coarse rock fragments, have moderate hydraulic conductivity, are non-hardsetting, pH neutral, predominately non-saline and are non-sodic, indicating a low inherent erodibility. Similar to the topsoil, the subsoils are prone to minor clay dispersion upon severe disturbance.

5.2.3 Mitigation Actions

Similar to the *Rehabilitation and Decommissioning Factor* (Section 5.6), the preferred option is to backfill depleted pits at Mining Area C where the mine plan schedule allows. Where this is not possible, any required OSAs will be designed to blend with the natural landforms to reduce the impact of OSAs on existing landforms.

Details of the management actions to minimise or avoid potential impacts, monitoring details, formulation of indicators and/or trigger criteria, reporting requirements and potential contingency actions are included in Part A – Table 3.2 for implementation on site.

5.2.4 Regulatory Mechanism

BHP Billiton Iron Ore will manage this factor as part of its standard Pilbara-wide Health, Safety and Environment Management System.

A revised Mine Closure Plan has also been developed to support the proposed Life of Project EMP Revision 6 scope.

5.2.5 Outcome

BHP Billiton Iron Ore proposes that this factor can be managed under existing approvals as well as being supported by the existing management measures (refer Part A – Table 3.2).

Based on the results of the assessment, it is apparent that the majority of the surface soil materials assessed, once stripped and placed in stockpiles, will have physical and chemical characteristics which are relatively inert and, due primarily to their high coarse fragment content, relatively resistant to erosion.

5.3 SUBTERRANEAN FAUNA

5.3.1 Existing Environment

5.3.1.1 Stygofauna

Stygofauna surveys have been undertaken at and surrounding Mining Area C since 2007. More recently, surveys have been undertaken at Mining Area C and nearby locations in the Weeli Wolli and Coondewanna catchments. These surveys have resulted in 386 stygofauna samples collected from within the Groundwater Assessment Area (the maximum spatial extent of modelled groundwater drawdown ≥2 m during the proposed life of mine operations). A further 393 stygofauna samples were collected from the Reference Area (the surrounding catchment areas). Fifty-one stygofauna species were collected from these samples, of which, 37 species were found in the Groundwater Assessment Area. Three of these species (nr *Epactophanes* sp. B01, *Dussartcyclops* sp. B10, and nr *Notobathynella* sp. S01) are considered to be known only from the Groundwater Assessment Area (Bennelongia 2015a).

Weeli Wolli Spring Priority Ecological Community

The Weeli Wolli Spring PEC comprises Weeli Wolli Spring and Ben's Oasis. The two areas are considered to support a unique community of animals and plants, including endemic species of stygofauna (van Leeuwen 2009 as cited in Bennelongia 2015a). The richness of stygofauna species in the PEC is attributed to the large-scale calcrete and alluvial aquifer system associated with the two

areas (van Leeuwen 2009; DPaW 2014 as cited in Bennelongia 2015a). Two species of stygofauna are considered by DPaW to be endemic to Weeli Wolli Spring itself: the water mite *Arrenurus* sp. nov. 1 (PSS) and the oligochaete *Ainudrilus* sp. WA26 (PSS) (van Leeuwen 2009 as cited in Bennelongia 2015a).

Coolibah-lignum Flats Priority Ecological Community

The other PEC occurring within the Groundwater Assessment Area is the Coolibah-lignum Flats PEC (occurring at Coondewanna Flats and Lake Robinson) in the Coondewanna Catchment. These flats are characterised by *Eucalyptus victrix* growing over *Duma florulenta* (lignum) on red clays in run-on zones. Extensive areas of sub-surface calcrete are known to occur in the Coondewanna Catchment, including within the Coolibah-lignum Flats PEC, and these areas of calcrete may support stygofauna communities. This PEC has been found to support a depauperate stygofauna community, with only eight species collected from the PEC. All eight species are known to be more widespread in the Coondewanna Catchment (Bennelongia 2015a).

5.3.1.2 Troglofauna

Extensive troglofauna surveys have been undertaken within the Licence Boundary and the local vicinity. These surveys resulted in the collection of 82 troglofauna species from the proposed EMP Revision 6 boundary and surrounding reference area. Twenty of these species are known only from the proposed indicative mine pits and/or from previously approved mine pits. These 20 localised species were recorded from a small number of records, with 13 species recorded as singletons.

The status of three of the 20 species (*Hanseniella* sp. B08, *Symphyella* sp. B03, and Parajapygidae sp. S03) is uncertain because there is currently little information on which to infer the likely ranges for each of these species.

5.3.2 Potential Impacts

Relevant potential impacts include:

- loss of stygofauna habitat through groundwater drawdown and pit excavation; and /or
- removal of troglofauna habitat through pit excavation.

5.3.2.1 Stygofauna

The impact assessment determined that of the 37 species recorded from the Groundwater Assessment Area, the copepods nr *Epactophanes* sp. B01 and *Dussartcyclops* sp. B10, and the syncarid nr *Notobathynella* sp. S01, have ranges that make them potentially vulnerable to groundwater drawdown within the Groundwater Assessment Area.

In assessing whether groundwater drawdown is likely to threaten the conservation status of the three species, it should be recognised that the ranges of the species are likely to have been underestimated because of the low numbers of records of each species. While habitat connectivity appears to be high, the ranges of nr *Epactophanes* sp. B01 and *Dussartcyclops* sp. B10 are unclear because of their occurrence as a singleton or from a single location respectively, therefore the potential threat to these species is uncertain. nr *Notobathynella* sp. S01 occurs only 77 m from the edge of the Groundwater Assessment Area and its range almost certainly extends into areas that are classified as undisturbed. Consequently, the level of threat to nr *Notobathynella* sp. S01 is assessed as low (Bennelongia 2015a).

Weeli Wolli Spring Priority Ecological Community

The modelled drawdown from Mining Area C and Hope Downs is predicted to reduce the area of undisturbed calcrete within the Weeli Wolli Spring PEC and its buffer from 38 to 34 km^2 and will reduce the area of undisturbed calcrete immediately upstream from 6.2 to 2.8 km^2. However, it is considered unlikely that stygofauna conservation values will be threatened because of the abundant stygofauna habitat downstream of Weeli Wolli Spring (Bennelongia 2015a).

Based on sampling, Ben's Oasis does not appear to have high conservation values for stygofauna. All species collected in the vicinity of Ben's Oasis occur more widely in the Weeli Wolli Creek Catchment and beyond. The impacts of the proposed groundwater drawdown on stygofauna conservation values at the Weeli Wolli Spring PEC, including Ben's Oasis, are expected to be low (Bennelongia 2015a).

Coolibah-lignum Flats Priority Ecological Community

Only eight species have been collected from the Coolibah-lignum Flats PEC, all of which are known to be more widespread in the Coondewanna Catchment. Therefore, the impacts of the proposed groundwater drawdown on stygofauna at the Coolibah-lignum Flats PEC are likely to be negligible (Bennelongia 2015a).

5.3.2.2 Troglofauna

The only impact likely to threaten the persistence of troglofauna species is the direct loss of habitat resulting from mine pit excavation (Bennelongia 2015b).

Detailed habitat characterisation undertaken for Mining Area C suggested there is little difference in the structure of the rock between commercial grade iron ore (i.e. the mine pits) and surrounding areas. Originally, 29 species were identified only from within the proposed indicative mine pits. Targeted sampling programs (Bennelongia 2015c; 2015d; 2015e) based on information from the detailed habitat characterisation was undertaken. This sampling program located nine of the restricted species outside of the proposed mine pits and within predicted prospective habitats. These results verified the conclusions of the habitat characterisation.

More detailed habitat characterisation was undertaken for each of the remaining 20 restricted species (BHP Billiton Iron Ore 2015c). Based on this detailed species specific habitat characterisation, 17 of the 20 species are considered unlikely to be restricted to the proposed indicative mine pits and/or previously approved mine pits. The proposed development is therefore considered to present only a low level of threat to these 17 species (Bennelongia 2015b).

The status of remaining three species (*Hanseniella* sp. B08, *Symphyella* sp. B03, and Parajapygidae sp. S03) is uncertain because there is currently little information on which to infer likely ranges of the species.

Hanseniella sp. B08 was recorded from four drill holes on the margin between P3 Deposit and P2 Deposit with a liner range of 0.9 km (Figure 5.4). All four of the drill holes contain unmineralised BIF (Brockman Formation) with hardcap that becomes semi-hardcap with depth. Mapping suggests that surface expression of Brockman Formation (Joffre) extends continuously to the north and east of the P2 Deposit proposed pit. Given the relatively well connected geology in which this species occurs, it is unlikely that the species has as small a range as current records suggest. However, many species of the symphylan genus *Hanseniella* have known linear ranges of <5 km and due to the occurrence of a number of records (six specimens) in a small area, the potential range of this species remains uncertain.

Symphyella sp. B03 is known from a single record within the R Deposit pit (Figure 5.4). It occurs within the Marra Mamba Formation where hardcap has been identified from 0 to 10 m depth (BHP Billiton Iron Ore 2015c). Suitable habitat exists in the hardcapped MacLeod Member, which extends to the south of R Deposit. The hardcapped detritals to the north may also provide suitable habitat for this species. There is limited information on the ranges of *Symphyella* species, but it is expected they are similar to the ranges of species in the symphylan genus *Hanseniella* (typically <5 km). *Symphyella* sp. B03 probably occurs outside the proposed R Deposit pit but the limited data for this species (and genus) mean there is uncertainty about the range of the species.

Parajapygidae sp. S03 is known from a single record within P6 Deposit (Figure 5.4). The geology of the drill hole consists of mineralised detritals (TD3) and Dales Gorge Member with hardcap occurring from 0 to 27 m (BHP Billiton Iron Ore 2015c). Hardcap is known to extend outside of the mine pit, but understanding of the remainder of the geology is not well developed (BHP Billiton Iron Ore 2015c). Parajapygidae sp. S03 probably occurs outside P6 Deposit pit, but the limited data for this species (and family) and the limited available information on the geology extending beyond the proposed P6 Deposit pit, means there is uncertainty about the likely range of this species.

5.3.3 Mitigation Actions

Implementation of Condition 5 of Ministerial Statement 491, which outlines the requirement to manage groundwater abstraction and dewatering activities to ensure minimal adverse impacts on groundwater dependent ecology at Weeli Wolli Spring and Coondewanna Flats.

BHP Billiton Iron Ore is continually modifying the proposed mine pit extent as more resource definition occurs. Various scenarios for reducing the extent of direct impact will continue to be investigated and considered throughout the Life of Project.

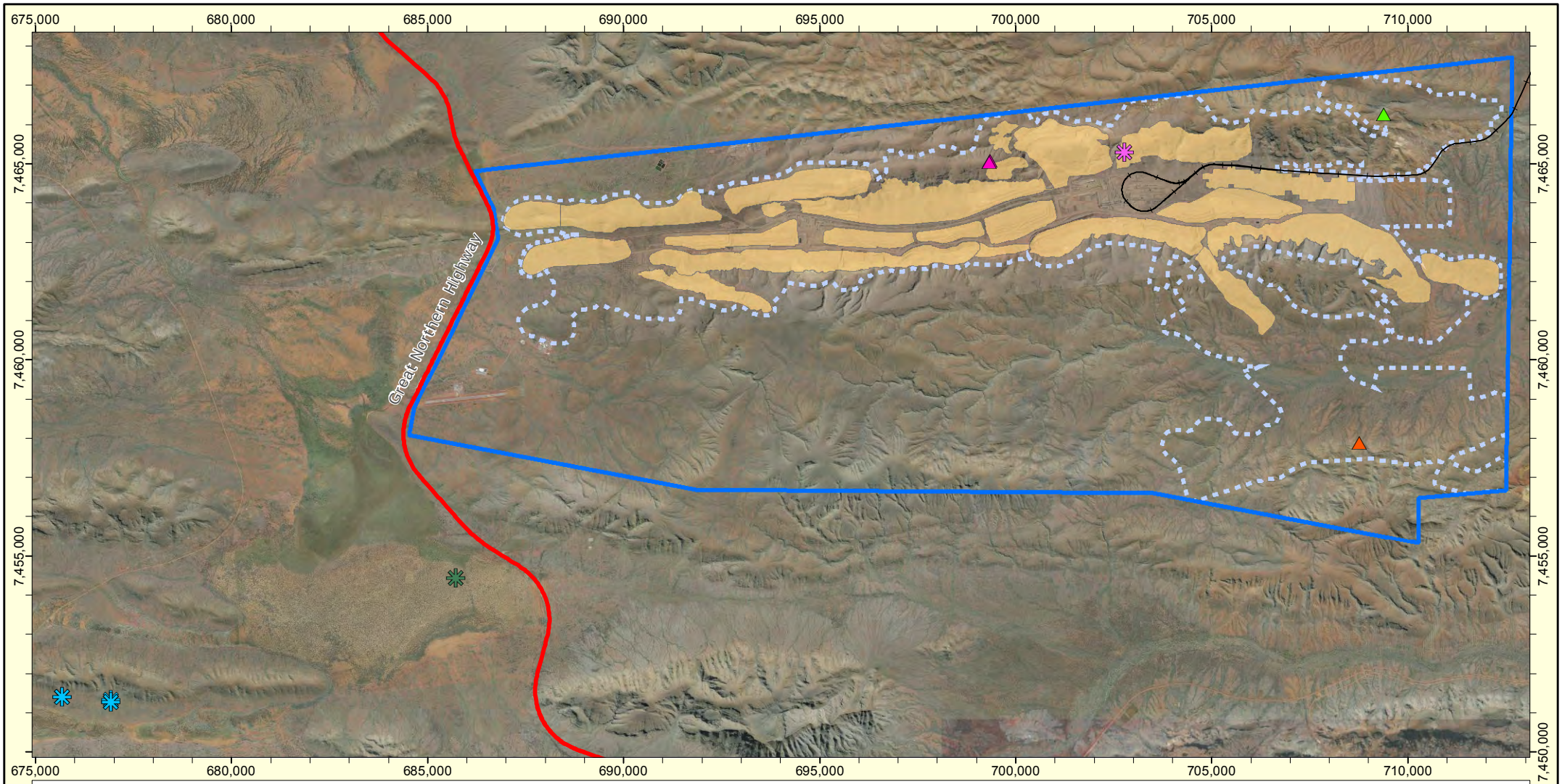
Details of the management actions to minimise or avoid potential impacts, monitoring details, formulation of indicators and/or trigger criteria, reporting requirements and potential contingency actions are included in Part A – Table 3.2 for implementation on site.

5.3.4 Regulatory Mechanism

Subterranean fauna is managed by the Ministerial Statement. BHP Billiton Iron Ore will manage this factor as part of its standard Pilbara-wide Health, Safety and Environment Management System.

5.3.5 Outcome

BHP Billiton Iron Ore proposes subterranean fauna (with the exception of the three troglofauna species with uncertain ranges) representation, diversity, viability and ecological function at the species and population level can be maintained.



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MINING AREA C
Subterranean Fauna Species

Scale @ A4: 1:140,000	Prepared: P. Gant	Project No: A762/005
Date: 6/10/2015	Checked: E. Drain	Figure: 5-4
	Revision: Final	

LEGEND

Restricted Troglofauna
- Hanseniella sp. B08
- Parajapygidae sp. S03
- Symphyella sp. B03

Restricted Stygofauna
- Dussartcyclops sp. B10
- nr Epactophanes sp. B01
- nr Notobathynella sp. S01

- Approved Indicative Deposits and OSAs
- Area C Licence Boundary
- Proposed EMP Rev 6 Boundary

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5.4 TERRESTRIAL FAUNA

5.4.1 Existing Environment

5.4.1.1 Vertebrate Fauna

Numerous surveys have been conducted at Mining Area C and surrounds, from which 17 species of conservation significance were identified as potentially occurring within the Licence Boundary.

Of these 17 species, six were identified as the key receptors for the proposed EMP Revision 6. These species include:

- Northern Quoll *Dasyurus hallucatus* (Schedule 1; Endangered);
- Pilbara Olive Python *Liasis olivaceus barroni* (Schedule 1; Vulnerable);
- Grey Falcon *Falco hypoleucos* (Schedule 1);
- Pilbara Flat-headed Blind Snake *Anilios ganei* (Priority 1);
- Pilbara Barking Gecko *Underwoodisaurus seorsus* (Priority 2); and
- Ghost Bat *Macroderma gigas* (Priority 4).

Eight fauna habitats were mapped within the Licence Boundary of which two were identified (Gorge/gully and Mulga) as key receptor habitats for the proposed EMP Revision 6.

5.4.1.2 Invertebrate Short-range Endemic Fauna

Database searches and previous surveys reported 11 SRE species from within the Licence Boundary, of which the majority have also been recorded outside of the Licence Boundary. Three SRE species have only been recorded within the EMP Revision 6 boundary, the millipede *Antichiropus* `DIP006`, the mygalomorph spider *Chenistonia* `MYG088`, and the selenopid spider *Karaops banyjima*.

Nine habitat zones were identified from within the EMP Revision 6 boundary, four of which were considered to be highly suitable or moderately-highly suitable habitat zones for SRE species. These comprised of:

- south-facing Major gorge/ gully systems (highly suitable);
- River gorges (highly suitable);
- north-facing Major gorge/ gully systems (moderately-highly suitable); and
- Ridges/open gullies (moderately-highly suitable).

5.4.2 Potential Impacts

Relevant potential impacts include:

- clearing or alteration of fauna habitat;
- impacts from noise and vibration;
- habitat fragmentation and barriers to fauna species movement; and/or
- introduction of feral species.

5.4.2.1 Vertebrate Fauna Species

The Northern Quoll, Pilbara Olive Python and Grey Falcon have only been recorded as either a single or double record within the Licence Boundary, despite multiple surveys (Figure 5.5). Considering the extent of effort that has been invested and that the species are typically detectable when present, it appears unlikely that any of the species occur within the EMP Revision 6 boundary at either regionally or locally significant densities. Based on available information, the habitats within the EMP Revision 6 boundary are not considered important to any of these three species. Potential impacts for the Northern Quoll, Pilbara Olive Python and Grey Falcon were therefore assessed as minor to negligible (Biota 2015).

The Pilbara Flat-headed Blind Snake and Pilbara Barking Gecko (Figure 5.5) have relatively poorly known distributions and abundance. The impact assessment was therefore based on proportionate habitat loss and regional distribution of records. Habitat loss at both the local and regional scale for both species was determined to be minor. The wide distribution of records of the Pilbara Flat-headed Blind Snake suggests it is probably under-estimated in overall abundance; therefore impacts on this species were assessed as negligible. Habitat loss was similarly not significant for the Pilbara Barking Gecko. The overall impact on the species was considered minor, considering the data indicated it is a more geographically restricted species. The overall range of both species, as currently known, would not be reduced by the proposed development (Biota 2015).

The Ghost Bat (Figure 5.5) is the key receptor with the greatest exposure to potential impacts from EMP Revision 6, the most significant of which is that eight feeding and four day roost sites would be directly affected by the proposed development. No maternity roosts would be affected and a range of other feeding and day roosts would remain intact at 25 spatially distributed locations in the immediate area (Biota 2015). Regional data shows 195 other caves with evidence of Ghost Bat use in the wider locality, and this is likely to be an under-estimate as a result of survey effort being restricted to particular areas throughout the region (Biota 2015). Whilst the overall area of occupancy of the species is not expected to be reduced, there may be some direct loss of a number of individuals within the EMP Revision 6 boundary. However, the species will continue to persist as a component of the local bat assemblage (Biota 2015).

5.4.2.2 Vertebrate Fauna Habitat

Two key habitats were identified as key receptors for vertebrate fauna, Gorge/Gully and Mulga. The proposed EMP Revision 6 development would remove 23% and 30% of the extent of these habitats within the Licence Boundary, respectively. This represents a very conservative analysis constrained to the habitats mapped within the Licence Boundary. Equivalent habitat types occur widely in the locality and Pilbara region (Biota 2015). These habitats within the EMP Revision 6 boundary are not at the limits of their distributions and the proposed ground disturbance would not reduce their overall range of occurrence in the region, therefore the impacts were assessed as minor (Biota 2015).

5.4.2.3 Invertebrate Short-range Endemic Fauna Species

The selenopid spider *Karaops banyjima* is known only from one record within the EMP Revision 6 boundary at the proposed P6 pit area (Figure 5.6). *Karaops* spiders are known to inhabit rock cracks and crevices within a wide variety of rocky habitat types. As this habitat occurs more widely throughout the Licence Boundary, and possibly beyond, the *K. banyjima* is unlikely to be restricted to the EMP Revision 6 boundary and potential impacts on this species are therefore considered moderate (Biologic 2015b).

The polydesmid millipede *Antichiropus* `DIP006` and the mygalomorph spider *Chenistonia* `MYG088`, are currently only known from within the south-facing Major gorge/ gully systems habitat zone in the proposed OSA 12 and the adjacent P4 pit area (Figure 5.6). It remains possible that *Antichiropus* `DIP006` and *Chenistonia* `MYG088` could occur more widely than recorded, however current ecological information suggests that these species tend to be restricted to highly sheltered, complex, isolated habitats such as the Major gorge/ gully systems within which they were found. The majority of this habitat zone occurs along the south face of the Packsaddle Range, almost entirely within the EMP Revision 6 boundary. Therefore the potential impacts to *Antichiropus* `DIP006` and *Chenistonia* `MYG088` are considered high (Biologic 2015b).

5.4.2.4 Invertebrate Short-range Endemic Fauna Habitat

The four habitat zones identified as being highly suitable or moderately-highly suitable, occupy only 5.1% of the total Licence Boundary area, most of which (71.4%) occurs outside of the EMP Revision 6 boundary. However, approximately 90.9% of the extent of the south-facing Major gorge/ gully systems (highly suitable for SRE species) occurs inside the proposed EMP Revision 6 boundary, therefore this habitat zone will be highly impacted by the proposed development.

The remaining three suitable habitat zones; River gorges, north-facing Major gorge/ gully systems, and Ridges/open gullies, have been mapped as occurring more broadly outside of the proposed EMP Revision 6 boundary, with 86.5%, 60.3% and 87% mapped within the Licence Boundary respectively.

5.4.3 Mitigation Actions

BHP Billiton Iron Ore is continually modifying the clearing requirements as more resource definition occurs. Various scenarios for reducing the extent of clearing will continue to be investigated and considered throughout the Life of Project. Where possible, the use of existing infrastructure and facilities at Mining Area C will be considered to reduce the proposed clearing requirement where practicable.

Details of the management actions to minimise or avoid potential impacts, monitoring details, formulation of indicators and/or trigger criteria, reporting requirements and potential contingency actions are included in Part A – Table 3.2 for implementation on site.

The Ghost Bat has been identified as key receptor and as such, BHP Billiton Iron Ore will continue to undertake research and surveys for this species within the vicinity of Mining Area C, with the intent to further our knowledge of the species.

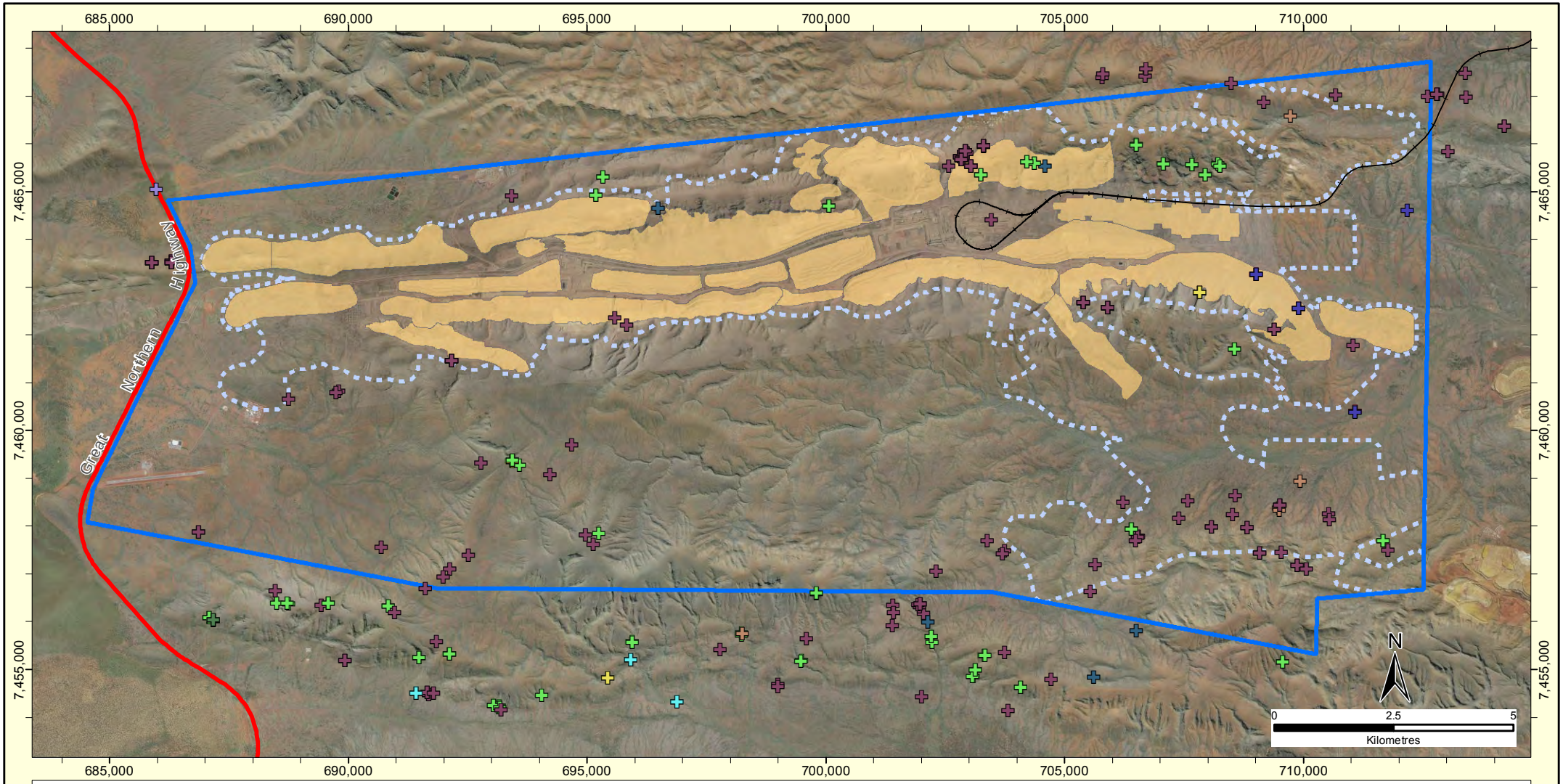
As a specific mitigation action for the short-range endemic invertebrate fauna species *Antichiropus* `DIP006` and *Chenistonia* `MYG088`, the proposed OSA 12 and associated access road have been designed to avoid the known location of these species and as much of their mapped habitat zone as practicable.

5.4.4 Regulatory Mechanism

Terrestrial fauna is managed by the Ministerial Statement. BHP Billiton Iron Ore will manage this factor as part of its standard Pilbara-wide Health, Safety and Environment Management System.

5.4.5 Outcome

BHP Billiton Iron Ore proposes terrestrial fauna representation, diversity, viability and ecological function at the species, population and assemblage level can be maintained.



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MINING AREA C
Vertebrate Fauna Species

Scale @ A4: 1:115,000	Prepared: P. Gant	Project No: A762/006
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	Revision: Final	

LEGEND

- Approved Indicative Deposits and OSAs
- Area C Licence Boundary
- Proposed EMP Rev 6 Boundary

Vertebrate Fauna Species Recorded

- Pilbara Flat-headed Blind Snake (Anilios ganei) (P1)
- Fork-tailed Swift (Apus pacificus) (EPBC Act M; WC Act S3)
- Ghost Bat (Macroderma gigas) (P4)
- Grey Falcon (Falco hypoleucos) (WC Act S1)
- Northern Quoll (Dasyurus hallucatus) (EPBC Act E; WC Act S1)
- Pilbara Barking Gecko (Underwoodisaurus seorsus) (P1)
- Pilbara Leaf-nosed Bat (Rhinonicteris aurantia) (EPBC Act V; WC Act S1)
- Pilbara Olive Python (Liasis olivaceus subsp. barroni) (EPBC Act V; WC Act S1)
- Rainbow Bee-eater (Merops ornatus) (EPBC Act M; WC Act S3)
- Western Pebble-mound Mouse (Pseudomys chapmani) (P4)
- Wood Sandpiper (Tringa glareola) (EPBC Act M; WC Act S3)

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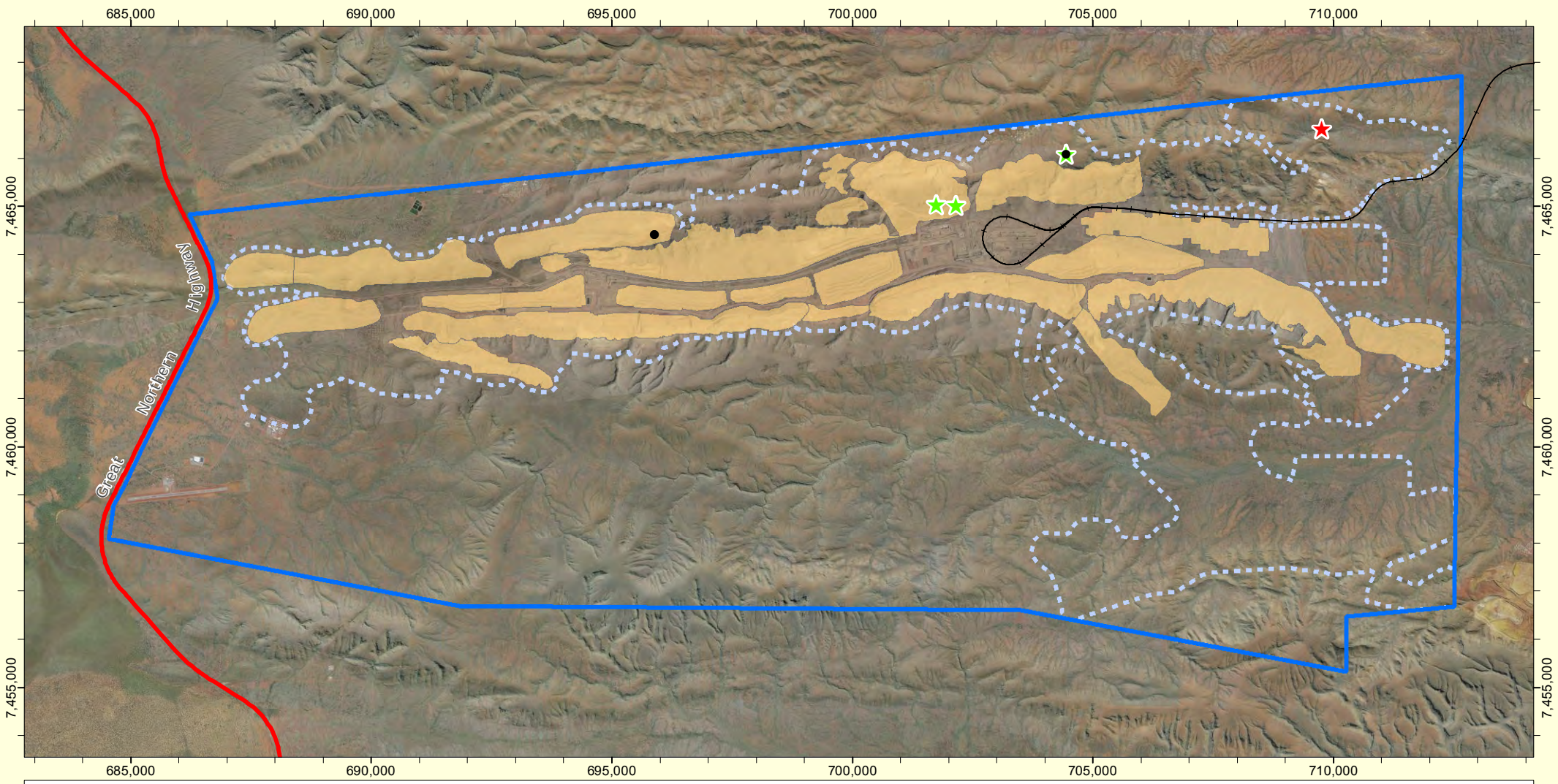

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MINING AREA C
Short-Range Endemic Invertebrate Fauna Species

Scale @ A4: 1:115,000	Prepared: P. Gant	Project No: A762/007
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	Revision: Final	

LEGEND

- Approved Indicative Deposits and OSAs
- Area C Licence Boundary
- Proposed EMP Rev 6 Boundary

Short-Range Endemic Invertebrate Fauna Species

- Antichiropus spDIP006
- Karaops banyjima
- Chenistonia spMYG088

N

0 2.5 5
Kilometres

Document Path: Y:\Jobs\A501_A1000\A762\3Project\A762_007_STMAC_025EIA_RevB.mxd

5.5 HYDROLOGICAL PROCESSES

5.5.1 Existing Environment

Regional groundwater flow occurs predominantly in the regional aquifers of the Wittenoom Dolomite (particularly the karstic Paraburdoo member) and overlaying Tertiary detritals. As such, regional groundwater flow is concentrated in the valleys and intervening alluvial plains of Mining Area C.

Prior to mining related activities in the catchment, groundwater flows were from west to east (from Coondewanna Flats to Weeli Wolli Spring). Water levels ranged from ~660 mAHD to ~560 mAHD over this area.

Water supply abstraction for Mining Area C commenced in 2001 from C Deposit (the local Marra Mamba aquifer) and the western end of the North Flank Valley (regional aquifer), with additional temporary abstractions used during construction of the railway line and Coondewanna airstrip. Dewatering commenced from C Deposit and E Deposit in mid-2010 and early 2011 respectively.

Rio Tinto Iron Ore's Hope Downs Mining operations are located within the Northern Flank Valley (North and South Deposits). Dewatering commenced in January 2007 and is proposed to continue until the end of 2025 (i.e. until the end of mining and infilling). This is predicted to have a significant impact on flows at Weeli Wolli Spring and Rio Tinto Iron Ore are artificially supporting the system until the natural flow returns to within 10% of pre-mining rates, potentially up to 20 years after decommissioning (HDMS 2000).

5.5.2 Potential Impacts

BHP Billiton Iron Ore commissioned RPS Aquaterra to undertake a hydrogeological assessment for Mining Area C. Pit designs and development rates for all deposits associated with EMP Revision 6 Base and High Cases (derived from the 2014 mine plan) were included in model predictions.

The model was used to test the significance of both the hydrogeological system and the EMP Revision 6 Base and High Cases on the response of the groundwater system to mining at Mining Area C. The model was run numerous times, with the following variables:

- Mining Area C (EMP Revision 6) mine plan Base Case and High Case;
- with and without Hope Downs mine related water management and mitigation measures;
- with Hope Downs but without historical or future Mining Area C related water management activities;
- open voids and infilled voids at A and E Deposits; and
- injection of water to mitigate the propagation of drawdown from Mining Area C towards Coondewanna Flats.

The Mining Area C regional model has been updated and calibrated to a significant amount of data. In places, this data spans many years and is representative of different aspects of the groundwater system (flows, spring baseflow and a regional water balance). The model has been used to simulate the effect on the groundwater system of cumulative water management activities, mitigation and closure options at Mining Area C and Hope Downs mines.

The modelling has shown that for the proposed mining below the water table at Mining Area C for EMP Revision 6 Base and High Cases (based on the 2014 mine plan):

- The water management associated with both the Base Case and High Cases have a very similar effect on the groundwater system.
- The maximum dewatering rate may be up to 42,000 kL/d (15.3 GL/a).
- The maximum cumulative groundwater drawdown at:
    - Coondewanna is predicted to be between 6 m and 9.5 m. With mitigation this can be reduced and maintained at less than 1 m;
    - Ben's Oasis is likely to be less than about 2 m; and

  - o Weeli Wolli Spring is likely to be less than 1 m (after the period of proposed mitigation by Rio Tinto Iron Ore).
- Post-closure, the recovery of the groundwater system is likely to take hundreds of years at Coondewanna Flats and Ben's Oasis, but tens of years at the Weeli Wolli Spring.
- The scenario of leaving open voids at A and E Deposits post-closure is predicted to have a significant reduction in the final recovery groundwater levels, particularly at Coondewanna Flats.

5.5.3 Mitigation Actions

In accordance with Condition 5 of Ministerial Statement 491, BHP Billiton Iron Ore will continue to manage groundwater abstraction and dewatering activities to ensure minimal adverse impacts on groundwater dependent ecology at Weeli Wolli Spring and Coondewanna Flats. The Monitoring Bore GWB0039M (Figure 5.3) will continue to be utilised in relation to monitoring the two corresponding thresholds (refer Part A – Table 3.2) for potential impacts at Coondewanna Flats (including Lake Robinson).

The management options include the following:

- re-use of surplus water onsite in mining operations;
- reinjection of surplus water back into the aquifer via a Managed Aquifer Recharge (MAR) programme; and/or
- back-filling of pit voids in accordance with the mine plan to above water table.

Details of the management actions to minimise or avoid potential impacts, monitoring details, formulation of indicators and/or trigger criteria, reporting requirements and potential contingency actions are included in Part A – Table 3.2 for implementation on site.

5.5.4 Regulatory Mechanism

Hydrological processes are managed by the following regulatory processes:

- Ministerial Statement;
- 5C licence and associated Groundwater Operating Strategy;
- Part V licence; and
- Department of Mines and Petroleum Mine and EPA's Guidelines for the Preparation of Mine Closure Plans.

5.5.5 Outcome

BHP Billiton Iron Ore proposes that this factor can be managed under existing approvals under the RIWI Act as well as being supported by the existing management measures as required under Condition 5 of Ministerial Statement 491 (refer Part A – Table 3.2).

A revised Mine Closure Plan has also been developed to support the proposed Life of Project EMP Revision 6 scope.

5.6 REHABILITATION AND DECOMMISSIONING

5.6.1 Existing Environment

Mining Area C commenced operations in 2003. In accordance with Ministerial Statement 491, the 'Life of Project' for mine production is for more than 50 years of continual operation.

Studies completed for the EMP Revision 6 have considered the closure and rehabilitation of Mining Area C (e.g. surface water, groundwater hydrology, landscape and visual impact and stygofauna studies). In addition the following specific closure and rehabilitation studies have been undertaken:

- a Landforms and Soil Impact Assessment (MWH 2015) has been carried out to inform the topsoil volumes and rehabilitation requirements.
- an AMD Risk Assessment has also been completed (Klohn Crippen Berger 2014) for all 14 deposits currently identified at Mining Area C.

These assessments have been used to develop the closure strategy for the Mine Closure Plan to support the EMP Revision 6 scope, and is based on the current mine plan schedule.

5.6.2 Potential Impacts

A key aspect is the alteration of the landform that will occur for Mining Area C through the creation of pits, OSAs and overland infrastructure. The integrity and stability of built landforms is a relevant aspect for the proposed development for operational, closure and post-closure phases of the project.

The potential risk for AMD and impacts on groundwater, surface water and soil quality are considered a low. Further discussion of the aspects and potential impacts is provided in the Mine Closure Plan.

5.6.3 Mitigation Actions

BHP Billiton Iron Ore will continue backfilling depleted pits with waste material in accordance with the mine plan and where practicable in order to minimise legacy issues associated with empty pits post mining and impact on final landforms.

Legacy issues and potential impacts associated with empty pits post-mining will be minimised through adaptive management (refer Part A – Table 3.2).

The adaptive management approach aims to reduce impacts by embedding a cycle of monitoring, reporting and implementing change where required. It allows an evaluation of the mitigation controls so that they are progressively improved and refined, or alternative solutions adopted, to achieve the desired environmental outcomes. BHP Billiton Iron Ore's approach is underpinned by its corporate commitments, which collectively articulate and mandate the Company's core values and minimum performance standards for environmental management and sustainability.

The adaptive management approach is required in evolving political, social and natural environments. It provides the necessary flexibility to respond to conservation significance changes (e.g. listing of new species); the development of new technologies; and as the understanding of assets, values, species, threatening processes and impacts (e.g. climate change) improves.

Further discussion of the mitigation actions for each relevant factor is provided in the Mine Closure Plan.

5.6.4 Regulatory Mechanism

The rehabilitation and decommissioning factor is managed by the following regulatory processes:

- Ministerial Statement;
- *Iron Ore (Mount Goldsworthy) Agreement Act 1964*; and
- Department of Mines and Petroleum Mine and EPA's Guidelines for the Preparation of Mine Closure Plans.

5.6.5 Outcome

BHP Billiton Iron Ore is obliged under its the tenure requirements of the Mining Lease, issued under the *Iron Ore (Mount Goldsworthy) Agreement Act 1964* to ensure that premises are closed, decommissioned and rehabilitated in an manner consistent with current government standards and without unacceptable liability to the State. To support this, a Mine Closure Plan has been developed.

BHP Billiton Iron Ore proposes that this factor can be managed under existing approvals and supported by the implementation of the Mine Closure Plan.

6 OTHER ENVIRONMENTAL FACTORS

An assessment of the environmental factors not considered to be key environmental factors is provided in this section. Other relevant factors for Mining Area C include:

- terrestrial environmental quality;
- inland waters environmental quality;
- air quality and atmospheric gases;
- amenity;
- heritage; and
- human health.

The sub-section for each of these environmental factors provides the following information:

- a description of the activity and potential impact;
- relevant aspect of the proposed development;
- mitigation actions to address residual impacts; and
- proposed mechanism for mitigation.

6.1 TERRESTRIAL ENVIRONMENTAL QUALITY

6.1.1 Existing Environment

An AMD risk assessment has been completed (Klohn Crippen Berger 2014) for all 14 deposits currently identified at Mining Area C. This assessment has been used to develop the closure strategy for the Mine Closure Plan to support the proposed EMP Revision 6 scope, and is based on the current mine plan schedule.

6.1.2 Potential Impacts

Potential aspects include mining of potentially acid forming (PAF) material during operations, generation of waste materials and storage and handling of dangerous goods.

Potential sources of AMD during operations are:

- mine waste and by association OSAs; and
- pits (pit wall, wall rock).

Mining Area C as a whole is a low sulfur system, with material classified as PAF characterised by a low net acid production potential (NAPP) of an average <5-6 kg H_2SO_4/t, and thus not likely to generate elevated acidity.

When, and if, deposits R, P2, P5 and P6 and Brockman Detrital are developed, PAF volumes are predicted to increase. Extensions beyond the current pit shells may intercept lithologies more sulfur-rich than those encountered so far, which may increase the acid generating capacity of mine waste, depending of the proportion of high sulfur lithologies comprising mine waste.

Initial interpretation of the exposure of PAF blocks on the pit wall using *MicroMine* software suggested that there might be locations where PAF materials are exposed on the pit walls. However, these exposures are situated above the water table, and most often located in the upper portions of the pit wall. To date, approximately 115,000m^2 of exposed PAF material has been identified across all EMP Revision 5 pits. These exposures could represent a small source of AMD, most likely associated with leaching of sparingly soluble acid sulfates (i.e. jarosite and alunite) and contribute to solute loads in runoff should they remain exposed.

Potential transport pathways during operation

Potential transport pathways for AMD during mine operation are:

- groundwater; and

- surface water.

Regional groundwater flow is towards the east towards Weeli Wolli Spring. During operation, it is expected that as a result of dewatering activities, local groundwater flow directions will be modified and groundwater will flow towards the dewatered pits.

To the west of Deposit E, a natural hydrological divide is located within the Northern Flank Valley, with surface water draining towards the west. Westward draining surface water from the Northern Flank Valley flows towards the internal draining, low-lying Coondewanna Flats (including Lake Robinson). Surface water flow into this internally draining basin infiltrates into the groundwater system or evaporates. Eastward draining surface water flows towards Weeli Wolli Spring.

6.1.3 Mitigation Actions

Potential impacts from contamination are considered low for Mining Area C operations. Existing waste disposal procedures and practices are considered effective.

Further discussion of the mitigation actions for each relevant factor is provided in the Mine Closure Plan.

6.1.4 Outcome

The proposed development meets the EPA's objective for this factor and is therefore not considered a key environmental factor. BHP Billiton Iron Ore considers that this factor can be addressed under Part V of the *Environmental Protection Act 1986*.

6.2 INLAND WATERS ENVIRONMENTAL QUALITY

6.2.1 Existing Environment

The existing mining infrastructure at Mining Area C is located in the main Northern Flank Valley. This main valley is relatively linear, being contained by the ridgelines lying along the north and south sides of the valley. The existing mining developments straddle the catchment divide between the Coondewanna Catchment to the west and the Weeli Wolli Creek Catchment to the east.

Mining Area C also contains a second main valley, located south from the main North Flank Valley, and draining into the main North Flank Valley just downstream (east) from the mine development areas. This second main valley (referred to as the Southern Sub-catchment) is wider and has a larger catchment area than the main North Flank Valley.

Following a rainfall event, runoff from the ridgelines is relatively concentrated and rapid. Upon entering the natural valley floor, these discharges tend to spread out over a wider flow zone and slow, thus reducing their flow peak and sediment carrying capacity. Where runoff from the steeper valley sides enters the valley floor, sediment deposits have accumulated and in the more confined main North Flank Valley these deposits can influence the valley floor drainage patterns.

Two main tributary creeks enter the main North Flank Valley from the north side. The catchments of these tributaries (referred to as the Northwest and North Central Sub-catchments) are significant sources of runoff and sediment to the valley floor. Sediments contained in the outflow from the North Central Sub-catchment, although causing a small delta on the valley floor, appear to have been predominantly washed downstream and dispersed by the upstream discharges.

Discharges from the Northwest Sub-catchment (with an area around 9 km^2) enter the main valley through a break in the north side ridgeline. Based on the valley floor contours, discharges from this sub-catchment currently flow eastwards into the Weeli Wolli Creek drainage system, however it is likely that historically these discharges would have oscillated between flowing east and west depending on the shape of the accumulated sediment delta. During flood events, discharges from this sub-catchment would be relatively concentrated when passing through the ridgeline, then spread out over a wider flow zone and slow upon entering the valley floor.

The indicative existing pit boundaries for the A, B, C, D, E and F deposits are located along the southern valley side and for the P1 West, P1 East, P3 and P4 Deposits along the northern valley side. The out-of-pit OSAs are spread along the main valley floor and extend onto the northern valley side between the P1 East and P3 Pits. The railway loop, Ore Handling Plant (OHP) 1 plant site and OHP2 plant site are also located on the valley floor.

A natural catchment divide is located in the main North Flank Valley. West of this catchment divide, natural drainage discharges westwards across the Great Northern Highway to the Coondewanna Flats, whereas east of this divide natural drainage discharges eastwards into the Weeli Wolli Creek system (upstream from Weeli Wolli Spring). Drainage systems developed to accommodate the valley floor infrastructure have been designed to generally follow these natural drainage routes.

6.2.2 Potential Impacts

Proposed pit and OSA developments for the P2, P5, P6 and R deposits and modifications to the existing indicative deposit and OSA boundaries have the potential to impact surface water resources by changing local surface water flow patterns, by affecting surface water runoff volumes and quality, by increasing the risk of erosion and sedimentation or by contamination from chemicals/hydrocarbons.

Potential impacts on natural surface water quality are negligible. The risk assessment concluded that the potential for AMD is low due to the oxidised nature of the ore. Existing management practices for sediment run-off control are considered effective.

6.2.3 Mitigation Actions

BHP Billiton Iron Ore considers that this factor can be addressed under Part V of the *Environmental Protection Act 1986*.

6.2.4 Outcome

The proposed development meets the EPA's objective for this factor and is therefore not considered a key environmental factor. BHP Billiton Iron Ore considers that this factor can be addressed under Part V of the *Environmental Protection Act 1986*.

6.3 AIR QUALITY AND ATMOSPHERIC GASES

6.3.1 Existing Environment

The semi-arid landscape of the Pilbara is a naturally dusty environment with wind-blown dust a significant contributor to ambient dust levels within the region. This was highlighted by the aggregated emission study that was conducted by Sinclair Knight Merz in 2000. This study found that the Pilbara region emitted around 170,000 tonnes of windblown particulate matter in the Financial Year (FY) 1999. In order to determine the existing background concentration of PM_{10} to be included in the model, it is necessary to review the ambient air quality data in the region (PEL 2015).

As part of the environmental management regime, BHP Billiton Iron Ore has an ambient air quality monitoring network in place in the vicinity of the inland Pilbara operations. The current network consists of six ambient air monitoring and two meteorological stations in the region. Siting of the stations was originally planned or intended to measure background dust concentrations (or regional dust concentrations) and to measure the potential impact of the operations at indicative sensitive receptor locations (PEL 2015).

6.3.2 Potential Impacts

6.3.2.1 Air Quality

The predominant emissions from an iron ore mine and material handling facility are particulates (PM_{10}). Emissions from combustion processes, such as the operation of machinery and power generation will also be created, but are considered insignificant in terms of impacts on sensitive receptors when compared to particulate emissions. As such, emissions from combustion processes have not been modelled.

An emissions inventory for the operations was developed for PM_{10}. The following emission sources for the assessment were identified:

- bulldozing;
- loading/unloading ore and waste;
- wheel generated dust from haul roads;
- wind erosion from stockpiles and open areas;

- blasting and drilling;
- crushing and screening;
- stacking and reclaiming; and
- transfer stations.

The air quality assessment has been based on the early designs of the mine, and therefore the findings must be interpreted in the context that design, layout and management strategies will be subject to refinement and change.

In summary, the predicted ground level PM_{10} concentration, indicate that there are potential areas of higher risk from particulate impacts (accommodation camps and Great Northern Highway). BHP Billiton has a range of mitigating controls that may be implemented to reduce the potential impacts of particulate emissions. The assessment undertaken indicates that implementation of dust controls, results in the 24-hour PM_{10} concentration meeting the Taskforce and the NEPM criteria at the Mulla Mulla Camp and one of the three receptors on the Great Northern Highway. However, the early assessment indicated that the PM_{10} concentration may not be met at the Packsaddle Village and two of the three receptors on Great Northern Highway. These results indicated that without further engineering or administrative controls, visible dust may still be seen leaving the premises, and may be considered unacceptable in relation to the Operating Licence conditions. More detailed assessment of predicted impacts and mitigation controls to be implemented will be undertaken as mine plans mature and as part of the Part V licencing process.

6.3.2.2 Greenhouse Gases

Greenhouse gas (GHG) emissions from Mining Area C operations result from the use of electricity and diesel consumption.

GHG emissions were estimated for the proposed development using the standard National Greenhouse and Energy Reporting Guidelines.

GHG emissions, as carbon dioxide emissions (CO_2-e) equivalent range between 167,000 tonnes and 319,000 tonnes for the indicative mine plan from FY 2016 to FY 2030. For consistency, a comparison was made to Western Australian and Australian emissions for the same mine plan year as that utilised for dust and noise modelling (FY 2027). For this production year, it is estimated that operations at Mining Area C will emit 178,531 tonnes of CO_2-e. This represents an intensity of 0.0025 tonnes CO_2-e per tonne of iron ore, representing 0.21% of the total Western Australian emissions (as reported for 2013) and 0.032% of Australian emissions (as reported for 2013).

6.3.3 Mitigation Actions

BHP Billiton Iron Ore will continue to manage Mining Area C operations to protect the environment and human health and amenity from impacts resulting from associated activities with the operations.

Compared to existing dust controls, the planned additional controls can reduce the potential impact of high PM_{10} concentrations at the selected sensitive receptors under certain meteorological conditions. The current mine plan may need to be refined to manage the potential impact along the Great Northern Highway, reducing the potential for impact to an acceptable level.

Based on CO_2-e calculations and estimations, it is concluded that GHG emissions from Mining Area C are not significant and can be minimised through the application of best practice.

6.3.4 Outcome

The proposed development meets the EPA's objective for this factor and is therefore not considered a key environmental factor.

BHP Billiton Iron Ore proposes air quality can be maintained for the protection of the environment, human health and amenity of the local Mining Area C vicinity.

6.4 AMENITY

6.4.1 Existing Environment

The existing operations at Mining Area C, like the broader Pilbara region, have been the focus of Australia's iron ore mining activities for many years. The proposed development will be undertaken

within the Licence Boundary adjacent to existing deposits and associated infrastructure. In the broader regional context, the mine is located in the same region as Rio Tinto's Hope Downs mine development, approximately 4 km to the east and Rio Tinto's West Angelas mine, approximately 30 km to the south-west of Mining Area C. BHP Billiton Iron Ore's Yandi mine is located approximately 20 km to the north.

Urbis (2015) conducted a desktop assessment to identify sensitive viewpoints in the vicinity of the Licence Boundary and assess potential visual impacts associated with the proposed development.

6.4.2 Potential Impacts

Nine viewpoints, located within the local, sub-regional and regional settings, were chosen for detailed assessment based on their higher levels of viewer sensitivity:

- Mt Meharry Lookout – 25 km to the west.
- Mt Robinson - summit – 9.6 km to the south-west.
- Mt Robinson - car park – 9.8 km to the south-west.
- Great Northern Highway (South) – 15.2 km to the south.
- Packsaddle Village – 3.8 km to the north-west.
- Hope Downs Secondary Accommodation Village – 1.1 km to the east.
- Hope Downs Accommodation Village – 7.5 km to the east.
- Weeli Wolli Spring – 14 km to the east.
- Great Northern Highway (West) – 900 m to the west.

The only surrounding viewpoint assessed to be impacted significantly by the proposed development is the Great Northern Highway to the west of Mining Area C where the visual impact is assessed as high. This is consistent with current Mining Area C operations.

The Hope Downs Mine Secondary Accommodation Village and the Packsaddle Village are assessed as low to moderate potential visual impact.

All remaining viewpoints are assessed as potentially experiencing a very low to low visual impact.

Urbis considered the proposed development and associated mine components in the context of the existing mine operations. The consolidation of components which are visually similar reduces the visual modification level and potential visual impact for surrounding viewpoints. The proposed development increases the visible area by 21% over the activity at the existing approved Mining Area C operations. The increase in area is considered to be relatively small and most of this area is not sensitive land use and would result in a minimal impact to visual amenity. Consolidation of mine operations in this area is a positive measure as it confines the area of visual disturbance.

6.4.3 Mitigation Actions

The existing Mining Area C management measures are considered appropriate for application to the proposed development so that impacts to amenity are reduced to as low as reasonably practicable.

6.4.4 Outcome

The proposed development meets the EPA's objective for this factor and is therefore not considered a key environmental factor.

6.5 HERITAGE

6.5.1 Existing Environment

Mining Area C falls within the lands of the Banjima People. BHP Billiton Iron Ore is in the process of negotiating a comprehensive Native Title Agreement with the traditional owners of the land.

Comprehensive archaeological and ethnographic surveys have been undertaken throughout the Mining Area C Licence Boundary which encompasses the proposed development. As a result of the surveys, heritage sites have been recorded at various locations. Out of respect for the wishes of the traditional owners, the locations and details of these heritage sites are not represented in this EMP.

6.5.2 Potential Impacts

The proposed development will require the clearing of native vegetation and will involve land disturbance which may directly impact Aboriginal heritage sites.

6.5.3 Mitigation Actions

All archaeological and ethnographical surveys have been conducted and where required, approvals have been sought to impact heritage sites. Identified heritage sites are avoided where practicable through design, planning and engineering solutions.

For sites which cannot be avoided, a ministerial consent under Section 18 of the *Aboriginal Heritage Act 1972* will be submitted prior to impacting selected heritage sites within the proposed development for the purpose of mining. Should any previously unknown/unrecorded heritage sites be discovered within the Licence Boundary, BHP Billiton Iron Ore will promptly report this to the Banjima.

6.5.4 Outcome

The proposed development meets the EPA's objective for this factor and is therefore not considered a key environmental factor.

6.6 HUMAN HEALTH

6.6.1 Existing Environment

Previous noise modelling and monitoring at Mining Area C has included the recent development of the P1 (East) deposit in Financial Year 2013. The P1 (East) study resulted in the successful identification and mitigation of environmental noise impacts in the Packsaddle Village to achieve noise levels compliant with Australian Standard AS2107 (SVT 2013). The noise controls for the accommodation camp were determined by following a well-defined process which required modelling, as low as reasonably practicable (ALARP) demonstration, noise control selection and a pilot study before noise controls were implemented throughout the camp. This noise control implementation was supported by a noise monitor located at the Packsaddle Village, which measured ambient noise levels during the P1 (East) study.

BHP Billiton Iron Ore commissioned SVT (2014) to undertake an environmental noise impact assessment of the proposed mining operations at Mining Area C, based on a 70 Mtpa case as modelled for the Financial Year 2027.

6.6.2 Potential Impacts

Noise emissions which may have the potential to impact human health (hearing) can be from various sources and may include:

- mobile plant equipment such as excavators, graders, haul trucks and drill rigs;
- fixed plant such as conveyors and ore processing facilities; and
- blasting noise.

Based on the noise modelling results (SVT 2014) for the 70 Mtpa indicative mining configuration (Financial Year 2027), the following has been concluded:

- Received noise levels at the Packsaddle Village are predicted to range from 33.6 dB(A) to 35.8 dB(A). Of the four point receiver locations modelled at Packsaddle Village, the noise model predicts the highest received noise levels at the south-west edge of camp, which are slightly (0.8 dB(A)) above the noise target of 35 dB(A) and are predicted to be caused by heavy mobile equipment activities on the P1 (West) overburden storage area (OSA 6).
- Received noise levels at the Mulla Mulla Camp and Rio Tinto's Hope Downs Camp are predicted to be below the 35 dB(A) noise target.
- Received noise levels at the Packsaddle Village for the 70 Mtpa mining configuration are expected to be significantly lower (6-10 dB) than current mining noise impacts for 60 Mtpa, which includes mining of the P1 (East) deposit. This is owing to the pits planned for the 70 Mtpa mining configuration are further from the Packsaddle Village than the current 60 Mtpa configuration.

- Blasting noise and vibration levels are not expected to impact any of the camps at levels above the Environmental Protection (Noise) Regulations 1997 or Vibration Australian Standard AS2187.2.

6.6.3 Mitigation Actions

Received noise levels are predicted to be below assigned noise levels. BHP Billiton Iron Ore will continue to manage Mining Area C operations to protect the amenity of occupants at the camps from noise and vibration impacts resulting from activities associated with the operations.

6.6.4 Outcome

The proposed development meets the EPA's objective for this factor and is therefore not considered a key environmental factor. BHP Billiton Iron Ore proposes that this factor can continue to be managed under Part V of the *Environmental Protection Act 1984* to meet statutory requirements and so that human health is not adversely affected.

Any anticipated noise impacts will be managed under the Environmental Protection (Noise) Regulations 1997. BHP Billiton Iron Ore will also manage this factor as part of its standard Pilbara-wide Health, Safety and Environment Management System.

7 CONCLUSION

Mining Area C has been operating in the Pilbara region since 2003. BHP Billiton Iron Ore has undertaken the required studies and impact assessments to support the Revision 6 scope of the Life of Project EMP.

Part A of this document provides a framework summary for Mining Area C operations to implement environmental management components including management actions, monitoring requirements, indicators and/or trigger criteria, contingency actions and reporting requirements for each key environmental factor.

Part B of the Life of Project EMP provides the supporting information for environmental factors in order to assess impacts associated with the proposed development at the existing Mining Area C operations.

BHP Billiton Iron Ore proposes that the environmental factors can be adequately managed to meet the EPA's objectives for each factor, provided the proposed management measures continue to be implemented at Mining Area C.

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APPENDICES

Appendix A – Flora and Vegetation Environmental Impact Assessment

Appendix B – Stygofauna Environmental Impact Assessment

Appendix C – Troglofauna Environmental Impact Assessment

Appendix D – Vertebrate Fauna Environmental Impact Assessment

Appendix E – Short-range Endemic Invertebrate Fauna Environmental Impact Assessment

Appendix F – Hydrological Impact Assessment and Water Management Summary

Appendix G – Mining Area C Mine Closure Plan