OB29/30/35

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Mine Closure Plan

(draft)

September 2013

BHP Billiton Iron Ore

OREBODY 29/30/35 MINE

Mine Closure Plan

ML244SA, G52/258 and M52/906

DRAFT

September 2013

SUBMISSION DETAILS

Company Name:	BHP Billiton Iron Ore
Title of Project	Orebody 29/30/35 Mine
Document Title	Orebody 29/30/35 Mine Closure Plan
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Mineral Tenements:	ML244SA, G52/258 and M52/906
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Checklist

Mine Closure Plan checklist		Y/N	Page	Comments
1	Has the Checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of Checklist.)	Y	Page iv	
2	How many copies were submitted to DMP?	Hard copies = 2 Electronic = 1		
	Cover Page, Table of Contents			
3	Does the cover page include; • Project Title. • Company Name. • Contact Details (including telephone numbers and email addresses). • Document ID and version number. • Date of submission (needs to match the date of this checklist).	Y	NA	
4	Has a Table of Contents been provided?	Y	Page v	
	Scope and Project Summary			
5	State why the MCP being submitted (as part of a Mining Proposal or a reviewed MCP or to fulfil other legal requirements).	Y	Section 1.2	
6	Does the project summary include; • Land ownership details. • Location of the project. • Comprehensive site plan(s). • Background information on the history and status of the project.	Y	Section 1.1 and Section 2	
	Legal Obligations and Commitments			
7	Has a consolidated summary of register of closure obligations and commitments been included?	Y	Section 3	
	Data Collection and Analysis			
8	Has information relevant to mine closure been collected from each domain or feature (including pre-mining baseline studies, environmental and other data)?	Y	Section 4	
9	Has a gap analysis been conducted to determine if further information is required in relation to closure of each domain or feature?	Y	Section 7.5	
	Stakeholder Consultation			

Mine Closure Plan checklist		Y/N	Page	Comments
10	Have all stakeholders involved in closure been identified?	Y	Section 5.2	
11	Has a summary or register of stakeholder consultation been provided, with details as to who has been consulted and the outcomes?	Y	Section 5.3	
	Final land use(s) and Closure Objectives			
12	Does the MCP include proposed end land use(s) and closure objectives?	Y	Section 6	
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post closure plan use (including contaminated sites)?	N		No specific restrictions
	Identification of Management of Closure Issues			
14	Does the MCP identify all key issues impacting the mine closure objectives and outcomes?	Y	Section 7	
15	Does the MCP include proposed management or mitigation options to deal with these issues?	Y	Section 7.4	
16	Have the process, methodology, and rationale been provided to justify identification and management of all the issues?	Y	Section 7	
	Closure Criteria			
17	Does the MCP include an appropriate set of specific closure criteria and/ closure performance indicators?	Y	Section 8	
	Closure Financial Provisioning			
18	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	Section 9	Provision not included
19	Does the MCP include a process for regular review of the financial provision?	Y	Section 9	
	Closure Implementation			
20	Does the reviewed MCP include a summary of the closure implementation strategies and activities for the proposed operations or for the whole site?	Y	Section 10	
21	Does the MCP include a closure work program for each domain or feature?	Y	Section 10.4	
22	Have site layout plans been provided to clearly show each type of disturbance?	Y	Appended figures	
23	Does the MCP contain a schedule of research and trail activities?	Y	Section 7.1.1	Specific dates not provided
24	Does the MCP contain a schedule of progressive rehabilitation activities?	Y	Section 10.3	Specific dates not provided

Mine Closure Plan checklist		Y/N	Page	Comments
25	Does the MCP include details of how unexpected closure and care and maintenance will be handled?	Y	Section 10.5	
26	Does the MCP contain a schedule of decommissioning activities?	Y	Section 10.2.3 and Section 10.4	High-level only
27	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?	Y	Section 11	Specific dates have not been developed
	Closure Monitoring and Maintenance			
28	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	Section 11	
	Closure Information and Data Management			
29	Does the mine closure plan contain a description of management strategies including systems, and processes for the retention of mine records?	Y	Section 12	
30	Confidentiality			

Corporate Endorsement:

"I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Director General of Mines."

Name: _____ **Signed:** _____

Position: _____ **Date:** _____

NB: The corporate endorsement section must be given by tenement holder(s) or a senior representative authorised by the tenement holder(s), such as a Registered Manager or Company Director.

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1. Scope and purpose

1.1 Project background

The Orebody 29/30/35 mining operations (OB29/30/35) are located approximately two kilometres (km) to the south of the BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) Mount Whaleback mining operations. Mount Whaleback is situated between 7 and 10 km west of the Newman Township, in the eastern Pilbara region of Western Australia (WA) (**Figure 1**).

The OB29/30/35 above the water table mining operations were approved under and are subject to the *Iron Ore (Mount Newman) Agreement Act 1964*. Orebody 29 (OB29) above water table mining operation commenced in 1974 with further development of OB29 approved under a State Agreement Act Development Proposal in 1988 (Iron Ore BHP-Utah Minerals International 1988). The Orebody 30 (OB30) and Orebody 35 (OB35) above water table mining operations were approved under a State Agreement Act Project Proposal in 1999 (BHPIO 1999). OB35 above water table mining operations was referred to the Western Australian (WA) Environmental Protection Authority (EPA) in 2011, with the EPA decision being "Not Assessed – Public Advice Given". Mining is conducted in accordance with the *Iron Ore (Mount Newman) Agreement Act* 1964 and various environmental approvals under the EP Act.

BHP Billiton Iron Ore is currently seeking approval to mine below the water table at OB29/30/35. The proposed below the water table mining operations require the submission of a referral to the Environmental Protection Authority (EPA) under the *Environmental Protection Act* 1986 (EP Act). This Mine Closure Plan (MCP) has been developed to support this referral.

Mining of the OB29/30/35 deposits supports the Mount Whaleback mining operations, these deposits are the main source of Marra Mamba iron ore feed. The mining operations and associated closure area boundaries are situated within Mineral Lease 244SA (ML244SA), General Purpose Lease G52/257 and Mining Lease M52/906 (**Table 1** and **Figure 2**). Exploration Licence E52/2008 overlaps part of G52/257.

Table 1: Tenements underlying the Orebody 29/30/35 mining operations

Lease	Description	Grant Date	Expiry Date
Mineral Lease 244SA (ML244SA) State Agreement Mineral Lease	Mount Whaleback Mine and Orebody 29/30/35 Mine	07/04/1967	06/04/2030
G52/257 General Purpose Lease	Orebody 35	23/05/2006	22/05/2027
M52/906 Mining Lease	Orebody 35	04/12/2012	03/12/2033
E52/2008 Exploration Lease	Orebody 35	27/03/2013	26/03/2016

The mining operations comprise three orebodies:

- OB29 (**Figure 3**);
- OB30 (**Figure 4**); and
- OB35 (**Figure 5**).

The OB 29/30/35 deposits contain approximately 220 million tonnes (Mt) of iron ore, which is to be campaign mined to supply Marra Mamba ore to blend with the Brockman ore from the Mount Whaleback operations.

The current life-of-mine (LoM) planning approach indicates the projected date for closure of the majority of OB29/30/35 mining infrastructure is approximately 2038. BHP Billiton Iron Ore undertakes regular reviews of the LoM Planning based on business priorities, resource availability and market demand.

1.2 Purpose of plan

This MCP provides a description of the closure activities for the OB29/30/35 mining operations, and provides an overview of how the operations will be rehabilitated and closed in accordance with the Department of Mines and Petroleum (DMP)/EPA Guidelines for Preparing Mine Closure Plans 2011 (DMP/EPA Guidelines) and in a manner that satisfies BHP Billiton Iron Ore's legal and other obligations.

This MCP will be used by BHP Billiton Iron Ore and its contractors in the implementation of appropriate rehabilitation and mine closure strategies at OB29/30/35. Where there is any conflict between the provisions of this MCP and a contractor's obligation under the relevant contract – including the various statutory requirements (i.e. licences, permits, consent conditions and relevant laws) – the contract and statutory requirements are to take precedence. In the case of any real or perceived ambiguity between elements of this MCP and the above statutory requirements, the contractor shall first request clarification from BHP Billiton Iron Ore prior to implementing that element of this MCP over which the ambiguity is identified.

The MCP will be revised at intervals of not more than three years. This revision timeline is consistent with the DMP/EPA Guidelines, and with WA Iron Ore's (WAIO) strategic approach to closure planning across its Pilbara assets.

1.3 BHP Billiton Iron Ore Business Guidance

BHP Billiton is committed to environmental stewardship. The Charter is the overarching document that articulates the corporate vision and values and what BHP Billiton stands for. The first value in the Company Charter is:

> *Sustainability: putting health and safety first, being environmentally responsible and supporting our communities.*

This commitment provides the starting point from where the mine closure and rehabilitation policy and procedures begin. The remaining values are integrity, respect, performance, simplicity and accountability.

A series of Group Level Documents (GLDs) that underpin the Charter have been developed, which describe the performance requirements and accountabilities for definitive business obligations, processes, functions and activities. Compliance with the GLDs ensures reputations are managed and minimum standards are met for all BHP Billiton operations.

The GLDs are the foundation for developing and implementing management systems. The GLDs considered relevant to this Mine Closure Plan include:

- Environment GLD.009 - establishes the performance requirements for the management of land, biodiversity, water, air, greenhouse gases, hydrocarbons and wastes; the latter including waste rock and tailings (BHP Billiton Limited 2012a);

- Risk Management GLD.017 - establishes the performance requirements for the assessment, control, monitoring and reporting of material risks that could impact the purpose and business plans. It includes risk rankings for both environmental and community aspects (BHP Billiton Limited 2013b);
- Corporation Alignment Planning GLD.034 - represents an annual cycle of key activities designed to focus the organisation on achieving '*Our Purpose and Our Strategy'* by facilitating robust debate, informed decision-making and the disciplined delivery of quality planning outcomes. Mine closure planning is specifically addressed in the annual cycle ensuring closure liabilities, risks and requirements are appropriately managed (BHP Billiton Limited 2013c); and
- Major Capital Projects (Minerals) GLD.031 - defines the performance requirements for the initiation, development, execution, close out and transition to operations phases of minerals (including iron ore) major capital projects. It sets out the minimum study requirements for each of these phases including studies specifically related to closure and rehabilitation planning (BHP Billiton Limited 2012a).

From the Charter and GLDs flow various business level documents and procedures that provide a framework for the application of the corporate vision and values with respect to mine closure planning and rehabilitation. These include:

- WAIO Rehabilitation Standard 0001074 Version 1.0 (BHP Billiton 2011a);
- WAIO Closure Planning - Business Planning Procedure 0005144 Version 1.0 (BHPBIO 2012a);
- WAIO Acid and Metalliferous Drainage Management Standard 0096370 Version 1.0 (BHPBIO 2013a);
- BHP Billiton Iron Ore Environment, Land and Biodiversity Management 0044650 Version 1.0, (BHPBIO 2012b); and
- BHP Billiton Iron Ore Environment Monitoring, Data Management and Reporting Procedures 0045364 Version 1.0 (BHPBIO 2012c)

2. Project summary

2.1 Ownership

The majority of the OB29/30/35 mine is situated within ML244SA, with the south-western portion of OB 35 located on M52/906 and G52/257, (which overlays E52/2008) (**Figure 2**). These operations are conducted by BHP Billiton Iron Ore who acts as Joint Venture manager on behalf of the Mount Newman Joint Venture. The Mount Newman Joint Venture (NJV) partners and their respective interests are as follows:

- BHP Billiton Minerals Pty Ltd (85%);
- Mitsui - Itochu Iron Pty Ltd (10%); and
- Itochu Minerals and Energy of Australia Pty Ltd (5%).

ML244SA and G52/257 are held by the Newman Joint Venture partner while M52/906 and E52/2008 are held by BHP Iron Ore (Jimblebar) Pty Ltd.

The contact details for BHP Billiton Iron Ore are:

BHP Billiton Iron Ore Pty Ltd

City Square

125 St Georges Terrace

PERTH WA 6000

Phone: 6321 6000

2.2 Overview of operations

BHP Billiton Iron Ore plan to use existing open pit mining techniques, ore processing methods, and supporting mine infrastructure (with allowance for ongoing maintenance and replacement of worn-out components) over the life of the mining operations; with the exception of mine dewatering which will require new infrastructure. Development of above the water table mining commenced at OB29 in 1974 and OB30 in 1999.

The main components of the Operations, are as follows:

- mining of ore from OB29, OB30 and OB35 using conventional, progressive, open pit mining methods;
- hauling of ore to the existing Mount Whaleback processing facility for processing, blending and dispatch;
- mine dewatering in order to access ore located below the water table. The abstracted water will be used as a preference to supplement Mount Whaleback mining operations water requirements, with surplus water transported via current NJV water infrastructure (an existing pipeline) and disposed at licensed discharge points into the Ophthalmia Dam artificial recharge system, located approximately 12 km east of the mining operations via existing pipeline infrastructure;
- disposal of overburden from the open pits in adjacent out-of-pit overburden storage areas (OSAs); and
- use of existing workshops, consumable storage areas, offices, and other service facilities and infrastructure, located at Mount Whaleback.

To facilitate effective mine closure planning, the OB29/30/35 mining operations have been divided into a number of physically distinct domains and features (**Table 2**). The domains are comprised of features that have similar rehabilitation and closure requirements (**Figure 3, Figure 4** and **Figure 5**).

Table 2: Domains and features of the Operations

Domain	Feature
Overburden Storage Areas	OB29 Overburden Storage Areas
	OB35 Overburden Storage Area
	Topsoil Stockpiles
Infrastructure	OB29 Crib Room and Emergency Services Training Facility
	OB30 Flood Protection Bunding and Rock Armoured Creek Bank
	OB35 General Disturbance
	Water Tank and Standpipe
	Dewatering Bores and Associated Pipelines
	Monitoring Bores
Mine Voids	OB29 Open Pit
	OB30 Open Pit
	OB35 Open Pit
Roads	OB29/30/35 Haul Roads
	Roads and Access Tracks

The following sub-sections provide an overview of the key components of the OB29/30/25 mining operations.

2.3 Mining method

Overburden and ore will be selectively mined using conventional open pit mining methods. Following drilling and blasting, mined ore is categorised and then loaded by hydraulic excavators and/or front end loaders into off-highway rear dump haul trucks for transport to the processing facility located at Mount Whaleback.

There are areas within the existing OB29/30/35 open pits where ore reserves have been identified as existing below the water table and therefore require dewatering to enable mining. The indicative open pit designs for mining below the water table at the OB29/30/35 are depicted in **Figure 3**, **Figure 4** and **Figure 5**.

The current mining operations at OB29 have been developed to a depth of 520 meters Reduced Level (mRL); BHP Billiton Iron Ore anticipates that mining below the water table will occur to a depth of approximately 435 mRL (BHPBIO 2008).

The existing OB30 open pit has been developed to a depth of 526 mRL (BHPBIO 2010a). BHP Billiton Iron Ore anticipates that mining will occur below the water table to a depth of approximately 465 mRL.

Above water table mining at Orebody 35 is due to commence in late 2013. BHP Billiton Iron Ore anticipates that mining below the water table will occur to a depth of approximately 455 mRL (BHP Billiton Iron Ore 2010b).

2.4 Overburden management

Overburden generated during mining operations at the OB29/30 open pits is currently placed in out-of-pit OSAs. The OB29 OSAs will be permanent landforms designed to accommodate waste generated from mining the OB29 open pit. Waste generated from the OB30 open pit will be placed within the W13 OSA, which is located within the Mount Whaleback Operations; hence it is not

captured within this MCP. Waste generated from mining the Orebody 35 open pit, will be placed within the OB35 OSAs.

The opportunities to minimise the size of the OSAs by increasing the amount of overburden material used to infill final voids (as void areas become available and/or as resources are mined out) will continue to be explored as part of ongoing operational planning.

BHP Billiton Iron Ore do not expect to encounter significant quantities of low grade material, however, any material that is classified as low grade will be treated as waste and placed adjacent to the OSAs, (if required this can easily be incorporated into the final OSA design at closure).

The OSAs are designed and constructed to be stable and the maximum height is not greater than natural adjacent ridgelines. It is intended that the final rehabilitated profile will be similar to the surrounding naturally occurring landforms. The final slopes will have topsoil applied, be contour ripped and seeded with local provenance species.

2.5 Processing and transportation of ore

Ore from the OB29/30/35 mine will be hauled to the run-of-mine pad at the Mount Whaleback mine site. Crushing and screening occurs 24 hours per day, seven days per week. The crushers produce lump ore of less than 100 millimetres (mm) in diameter. In order to minimise dust generation, dust curtains, collectors and sprays have been installed in high dust generation areas. Process infrastructure is managed in accordance with BHP Billiton Iron Ore's Licence to Operate (L4503/1975/13) issued by the Department of Environment and Conservation (now the Department of Environment Regulation).

The ore will be processed and blended with other ore products and then transported to Port Hedland via the Newman to Port Hedland rail line.

2.6 Waste materials

The following wastes will be generated as part of mining operations at OB29/30/35:

- mine waste (overburden);
- washdown water;
- non-metal scrap (e.g. uncontaminated piping, plastic, fibreglass or wood);
- general refuse;
- office and administrative wastes (e.g. paper, cardboard, etc.);
- domestic putrescible wastes;
- tyres;
- explosives and chemical packaging and wastes;
- batteries; and
- hydrocarbon waste.

Controlled wastes, as defined by the *Environmental Protection (Controlled Waste) Regulations 2004*, will be removed from site by licensed waste removal contractors. Non-controlled wastes will be removed offsite or be disposed of in the existing on-site landfill area.

2.7 Workforce, infrastructure and transport

Overall management of the mine, including environmental obligations will continue to be the responsibility of BHP Billiton Iron Ore.

Administration offices and light and heavy vehicle workshops operations are currently associated with the Mount Whaleback operations and are therefore not captured within this MCP.

3. Closure obligations and commitments

3.1 Legislative requirements

The management measures contained within this MCP have been developed with reference to State government rehabilitation requirements, policies and guidance statements, which are summarised below. It should be noted that the information presented is intended only to provide a summary of the subject matter covered and does not purport to be comprehensive or to render legal advice.

3.1.1 Environmental Protection Act 1986

- The EP Act provides for the establishment of the Office of the Environmental Protection Authority (OEPA) to support the EPA and has the objective of overseeing the prevention, control and abatement of pollution and environmental harm, and the conservation, preservation, protection, enhancement and management of the environment. The OEPA has developed policies to assist with achieving its objective. These include policies and guidance notes on the use of the precautionary principle, consideration of intergenerational equity, the conservation of biological diversity and ecological integrity, and waste minimisation.
- EPA guidance notes and position statements relevant to mine closure include:
    - DMP/ EPA Guidelines for Preparing Mine Closure Plans (2011).
    - EPA Guidance Statement Number 6: Rehabilitation of Terrestrial Ecosystems (2006).
    - EPA Guidance Statement Number 33: Environmental Guidance for Planning and Development (2008).
    - EPA Position Statement Number 2: Environmental Protection of Native Vegetation in Western Australia (2000).
    - EPA Position Statement Number 5: Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia (2004a).
    - EPA Position Statement Number 7: Principles of Environmental Protection (2004b).
    - EPA Position Statement Number 8: Environmental Protection in Natural Resource Management (2005).

Part IV of the EP Act establishes provisions for the OEPA to carry out formal Environmental Impact Assessments of proposals which may have a significant impact on the environment and allows for the setting of statutory conditions by the Minister for the Environment.

The development of OB35 above the water table was formally referred to the EPA in 2011; the EPA assigned a level of assessment for this application as ‘Not Assessed – Public Advice Given’.

Appendix A provides a summary of the commitments associated with the above water table approvals and native vegetation clearing permits that are of particular importance to this MCP.

3.1.2 Permits, licenses and regulatory approvals

The development of below the water table mining at OB29/30/35 will be subject to the following licences:

- Department of Environment and Conservation Licence to Operate (L4503/1975/13) under Part V of the EP Act;
- Native Vegetation Clearing Permits (NVCPs); and
- a 5C groundwater licence under the *Rights in Water and Irrigation Act* 1911.

3.1.3 Iron Ore (Mount Newman) Agreement Act 1964

The approved OB29/30/35 mines are subject to the *Iron Ore (Mount Newman) Agreement Act 1964* which requires "*additional areas to be mined to have an environmental programme for rehabilitation, protection and management of the* environment": Section 9A(3)(k). Once additional areas are approved for mining, a continuous programme must be carried out to ascertain the effectiveness of the measures being taken to rehabilitate, protect and manage the environment. Reporting is required to be submitted to the Environment Minister from time to time as reliable information becomes available (but not more frequently than once every twelve months): Section 9A(12)(a).

3.1.4 Mining Act 1978

The majority of the OB29/30/35 mine are located within ML244SA and G52/52/257, which were granted pursuant to the *Iron Ore (Mount Newman) Agreement Act 1964*. Mining Lease M52/906 was issued pursuant to *Mining Act 1978*. BHP Billiton Iron Ore will seek to transfer this tenure to the State Agreement Act prior to mining related activities commencing on this tenure.

3.2 Closure guidelines and industry standards

BHP Billiton Iron Ore governs closure planning, on a corporate level, by GLD.034 Corporation Alignment Planning (BHPBIO 2013c). The purpose of this document is to ensure closure planning is included in the Business Planning Processes from "Cradle-to-Grave".

This MCP has been prepared to satisfy the relevant components of BHP Billiton's Corporation Alignment Planning process, and finalised for external review in line the DMP/EPA Guidelines. In addition, this MCP incorporates relevant aspects from other closure guidelines and industry standards. A list of relevant publications and a brief summary of their content is provided below.

- *Strategic Framework for Mine Closure.* This handbook was prepared by the Minerals Council of Australia, and the Australian and New Zealand Minerals and Energy Council (ANZMEC) in 2000. It outlines strategic framework concepts associated with stakeholder involvement, planning, financial provision, implementation, standards, and relinquishment. Examples of best practice are also included.
- *Mine Closure and Completion*. This document was prepared by the Department of Industry, Tourism and Resources (DITR) in October 2006 as part of an Australian Government initiative Leading Practice Sustainable Development Program for the Mining Industry. The publication addresses sustainable development and closure, mine life phases, planning during the operational phase and mine completion and relinquishment, including case studies.
- *Managing Acid and Metalliferous Drainage*. This handbook is one within the Leading Practice Sustainable Development in Mining Series, and was prepared by the DITR in February 2007. It encompasses social, economic and environmental aspects of the various mining phases, addressing the decision making, regulatory framework, identification and prediction, risk, minimisation, control and treatment, monitoring and performance evaluation and management processes of acid and metalliferous drainage (AMD). Case studies are also included.
- *Mine Rehabilitation*. This handbook was published in October 2006 within the Leading Practice Sustainable Development in Mining Series by the DITR. It outlines sustainable development and mine rehabilitation, planning, operations, and closure, and includes case studies addressing these aspects of mine rehabilitation.

Planning for mine closure and rehabilitation needs to be undertaken in an effective and progressive manner in order to prevent and minimise adverse long term environmental, social and economic impacts. Effective and progressive mine closure planning is a prerequisite for the creation of stable, safe and non-polluting landforms suitable for the agreed post mining land use. Planning for mine closure needs to be incorporated into the design and construction phases and be conducted as a LoM process. In general, mine closure works aim to:

- minimise the footprint of operations upon closure;

- determine the optimum strategies for effective closure and rehabilitation of the mine site;
- progressively rehabilitate disturbed areas during the mine life; and
- monitor the site during operations and upon completion of rehabilitation activities to demonstrate compliance with closure objectives.

4. Collection and analysis of closure data

The following section provides a summary of details on the physical and biological environment at OB29/30/35 including:

- local climatic conditions;
- local environmental conditions – topography, geology and hydrogeology;
- local and regional information on flora, fauna and subterranean fauna;
- local water resources details – type, location, extent, hydrology, quality, quantity and environmental values (ecological and beneficial uses); and
- soil and waste materials characterisation.

This information provides a basis for the development of completion criteria and performance indicators for closure monitoring.

The closure management of the mining operations is based on understanding the surrounding environment and the outcomes of monitoring and research trials.

4.1 Interim Biogeographic Regionalisation of Australia

The Australian Natural Resources Atlas identifies 85 bioregions across Australia and 403 subregions. The Operations are located within the Pilbara region of WA in the Interim Biogeographic Regionalisation of Australia (IBRA) (DSEWPAC 2011) (**Figure 6**).

The Pilbara region, which actively drains into the Fortescue, De Grey and Ashburton River systems is divided into four subregions; Chichester (PIL1), Fortescue Plains (PIL2), Hamersley (PIL3) and Roebourne (PIL4). The OB29/30/35 mining operations lie within the Hamersley subregion, which is described by Kendrick 2001 as follows:

"PIL3 is the Southern section of the Pilbara Craton. Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and Eucalyptus leucophloia over Triodia brizoides on skeletal soils of the ranges. The climate is Semi-desert tropical, average 300 mm rainfall, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon. Drainage into either the Fortescue (to the north), the Ashburton to the south, or the Robe to the west. Subregional area is 6,215,092 ha."

4.2 Climate

The OB29/30/35 mine is located in the Pilbara region of WA which has an arid climate and experiences regular cyclonic activity during November to March. Characteristic climatic features of the region include seasonally low rainfall with high temperatures, high evaporation rates and a high daily temperature range.

Climatic information described in this section has been sourced from the closest operating Bureau of Meteorology (BOM) station at Newman (BOM station number 007176).

4.2.1 Rainfall and evaporation

Rainfall in the Pilbara is highly variable with annual evaporation exceeding rainfall by as much as 2,500 mm per year. Highest rainfall events are typically associated with cyclonic activity and thunderstorms, which are common in the Pilbara region with approximately 20 to 30 occurring per year.

In 2012, the Newman area received approximately 453 mm of rain, with approximately 320 mm of this occurring in January and December (BOM, 2013). Mean monthly rainfall at Newman ranges from

4.4 mm in September to 76.3 mm in February. The average annual rainfall recorded at Newman is 318.2 mm (BoM 2013) (Accessed 07 May 2013).

The highest daily rainfall event occurred in December 1999 with approximately 214 mm recorded, with the second highest daily rainfall event occurring in January 1973 with approximately 138 mm recorded (BOM 2013).

4.2.2 Temperature

Temperatures are generally high, with average maximum monthly temperatures at Newman ranging between 23.0°C in July to 39.4°C in January. Average minimum monthly temperatures at Newman range from 6.1°C in July to 24.9°C in January. The hottest temperature experienced at Newman was 47°C in January 1998.

4.2.3 Climate change impacts

The predicted annual and seasonal temperature and rainfall changes for the OB29/30/35 mine area due to climate change has been obtained using the Commonwealth Scientific and Industrial Research Organisation (CSIRO) OzClim system for the medium climate sensitivity and the A1B emission scenario for years 2030 and 2070, shown in **Table 3** and **Table 4** (CSIRO 2012).

The current climate change prediction information suggests a wide range of potential scenarios, for example, annual rainfall in 2070 may vary from 1990 by -50 mm to -25 mm. Rehabilitation strategies which take into consideration the effects of climate change are addressed in Section 7.

Table 3: Predicted Seasonal and Annual Temperature Increase (Relative to 1990) for the OB29/30/35 Mine

Season	2030 (°C)	2070 (°C)
Annual	1.0 to 2.0	3.0 to 4.0
Summer	1.0 to 2.0	3.0 to 4.0
Autumn	1.0 to 2.0	3.0 to 4.0
Winter	1.0 to 2.0	3.0 to 4.0
Spring	1.0 to 2.0	3.0 to 4.0

Table 4: Predicted Seasonal and Annual Rainfall Change (Relative to 1990) for the OB29/30/35 Mine

Season	2030 (mm)	2070 (mm)
Annual	-25 to 0	-50 to -25
Summer	-20 to -10	-30 to -20
Autumn	-10 to 0	-10 to 0
Winter	0 to 10	-10 to 0
Spring	-10 to 0	-10 to 0

4.3 Overburden characteristics

Overburden materials at BHP Billiton Iron Ore sites are characterised at a high level based on their geological, geochemical, and physical characteristics. This characterisation process allows BHP Billiton Iron Ore to identify waste types and manage their disposal appropriately, including segregation and selective disposal of potentially acid forming (PAF) overburden. This approach is consistent with the *Mine Closure and Completion* handbook (DITR 2009) and *Managing Acid and Metalliferous Drainage* handbook (DITR 2007).

4.3.1 Geological overview

The OB29/30/35 are predominantly hosted by the upper members of the Marra Mamba Iron Formation (Mount Newman and MacLeod), although mineralisation does extend into the lower Marra Mamba (Nammuldi Member) and into the overlying West Angela Member of the Wittenoom Formation (**Figure 7**). Overlying detritals, where present, may also be mineralised (Kneeshaw 2008, as cited in RPS Aquaterra 2012). The regional geological sequence and stratigraphic descriptions are summarised below in **Table 5**.

Table 5: Local stratigraphic table

Formation	Member	Mineralisation	Stratigraphy
Mount McRae Shale	-	Unmineralised	Thin bedded shale and chert with some dolomite and banded ironstone formation (BIF).
Mount Sylvia Formation	-	Unmineralised	Thin bedded shale, chert and dolomite with BIF bands.
Wittenoom Formation	Bee Gorge	Unmineralised	Thinly laminated graphitic argillite, carbonate and chert.
	Paraburdoo	Unmineralised	Thin to thick-bedded dolomite, minor chert and argillite, tabular bedding.
	West Angela	Unmineralised	Dolomite, dolomitic argillite, minor chert.
Marra Mamba Iron Formation	Mount Newman	Mineralised	Mineralised ore. Thick macrobands of BIF, separated by thin bands of shale and chert.
	MacLeod	Mineralised	Mineralised ore. Interbeded thin shale, chert, and BIF.
	Nammuldi	Unmineralised	Mesobands of BIF with yellow to yellow-brown chert, shale and iron silicates.
Jeerinah Formation	Roy Hill Shale	Unmineralised	Dark-grey to black graphitic shale and chert; locally pyritic.
	Warrie Member	Unmineralised	Dolomite with interbedded chert (locally ferrugineous), shale and mudstone.

4.3.2 Environmental Geochemical Characteristics

BHP Billiton Iron Ore has developed procedures around the classification of PAF material that can be a contributing source to AMD. BHP Billiton Iron Ore classifies material according to the sulphur content, stratigraphy and degree of oxidation.

In accordance with the WAIO AMD Management Standard (BHPBIO, 2013a) a Preliminary AMD Risk Assessment was undertaken in June 2013 by SRK Consulting (SRK) for OB29/30/35, which addressed both current and proposed future mining operations (SRK 2013). This assessment incorporated information supplied by BHPBIO, including: chemical analyses; geological and mine planning information; and results of surface water, groundwater and ecological studies. The stratigraphic units that will be intersected throughout the LoM and contribute to mine waste are presented within **Table 6** below, along with their associated codes.

Table 6: Stratigraphic units considered within the SRK AMD Preliminary Risk Assessment (SRK 2013)

Stratigraphic Unit	Abbreviation
Tertiary Detritals	Detritals
Wittenoom Formation, Paraburdoo Member	PBD
Wittenoom Formation, West Angela Member - A2 (Shale Waste)	WA2
Wittenoom Formation, West Angela Member - A1	WA1
Marra Mamba Iron Formation, Mount Newman Member - N3	N3
Marra Mamba Iron Formation, Mount Newman Member - N2 (Shaley)	N2
Marra Mamba Iron Formation, Mount Newman Member - N1	N1
Marra Mamba Iron Formation, MacLeod Member	MM
Marra Mamba Iron Formation, Nammuldi Member	MU

The mined stratigraphies, present above and below the water table, were separated into waste and ore volumes by the relevant orebody cut-off criteria, and assessed in terms of their potential to generate acid using sulphur thresholds values of 0.2% (in line with the current BHP Billiton Iron Ore criteria for PAF classification) and a more conservative threshold of 0.1% (in recognition of the limited nature of geochemical data currently available for OB29/30/35).

BHP Billiton Iron Ore will continue to utilise their standard classification of PAF (>0.2% S), unless testing indicates that other classification criteria are more appropriate. It is proposed that a testing programme be conducted to establish empirically based classification criteria.

The potential for AMD from the OSAs is considered to be low, but cannot be discounted; further geochemical assessment is required to better understand the potential for AMD from mine materials.

In general, material mined from below the water table was found to contain less sulphur than the equivalent materials from above the water table. All the stratigraphies associated with mining below the water table contain sulphur values less than (<) 1%, with the exception of WA1 (>0.2%), WA2 (>0.2%) and N1 (>0.1%).

BHP Billiton Iron Ore anticipate the volumes of waste outlined in **Table 7** will be generated from each of the identified stratigraphic units. The volumes of PAF waste material to be removed from OB29/35, both above and below the water table, are presented in **Table 8**.

The assessment of the proportion of PAF material within the mined volume of OB30 was outside the scope of the SRK study as the overburden will be managed within the Mount Whaleback operation. The greatest volume of material requiring consideration with respect to placement of waste within the OSAs will be generated from OB29 (SRK 2013).

Table 7: Volume estimates of waste material to be removed from OB29/30/35 (above and below the water table) by stratigraphy (SRK 2013)

Stratigraphic Unit	Waste Volume (t)		
	Orebody 29	Orebody 30	Orebody 35
Detritals	33,600,000	1,800,000	8,700,000
PBD	*45,900,000	1,300,000	16,500
WA2	-	388,000	1,600,000
WA1	12,700,000	900,000	3,200,000
N3	6,000,000	800,000	5,500,000
N2	5,100,000	400,000	6,400,000
N1	7,900,000	600,000	5,800,000
MM	7,500,000	400,000	8,600,000
MU	200,000	200,000	4,800,000
Total	**119,100,000**	**10,200,000**	**44,800,000**

Table 8: Volume estimates of potentially acid forming waste material to be removed from OB29/35 (above and below the water table) by stratigraphy (SRK 2013)

Stratigraphic Unit	OB29	OB35
Detritals	4,033,000	87,000
PBD*	2,297,500	-
WA2*	-	16,500
WA1	600,000	32,500
N3	60,500	55,500
N2	51,000	64,000
N1	79,500	58,500
MM	76,000	86,000
MU	-	143,500
Total	**7,232,000**	**543,000**

*PBD and WA2 units were combined for OB29 because the mine model did not define the top surface of the WA2 unit.

Management for AMD materials across BHP Billiton Iron Ore's Pilbara sites is outlined at a high-level in the WAIO AMD Management Standard (See Section 7 for further detail).

4.3.3 Physical characteristics

As outlined in Section 4.3.1 OB29/30/35 waste materials are predominantly from the Marra Mamba formation. Landloch Pty Ltd (Landloch 2013)have undertaken an initial investigation on the Marra Mamba waste stratigraphies located at the Mount Whaleback mining operations focusing on OB29 and OB30. Investigations included:

- collection and analysis of bulk representative waste samples;
- assessment of erodability of waste samples; and
- assessing landform design options using validated run-off/erosion landform evolution models (WEBB and Siberia).

These investigations are designed to guide the development of a preferred design for the OSA batters, constructed with material from Marra Mamba ore, that will allow for a stable, long term

landform that has the ability to limit surface erosion to rates associated with natural landforms of similar materials types (Landloch 2013).

As part of developing a regional understanding of physical waste characteristics across the Pilbara operations this work also included the waste material mined at the Mining Area C valley pits to gain an understanding of the differences in the properties of the two geographically different mining operations in which Marra Mamba ore is mined.

The Landloch investigation (Landloch 2013) indicated that the Marra Mamba waste materials located at OB29, OB30 when compared to MAC are similar in many aspects, but do display differences in the particle size distribution of the materials. It has also clearly shown that the greatest percentage of particle sizes, are located in the smaller size fractions. This distribution supports the observation that Marra Mamba wastes are displaying differing rates of erosion compared to Brockman waste material when exposed to similar erosive events.

The key findings are as follows:

- the erosion rate of the Marra Mamba ores are higher than the typical Brockman type ores;
- careful consideration must be given to the design of batters; and
- consideration must be given to use more competent materials on the surface to prevent erosion and to allow the construction of OSA at a reduced foot print.

This initial work has identified the need for further investigation associated with gaining a clearer understanding of the required parameters to be applied to OSA designs and surface water management when designing landforms containing this material waste type.

Management of waste material characteristics is discussed in Section 7.3.

4.4 Slope stability and seismicity

A probabilistic seismic hazard assessment was conducted on selected BHP Billiton Iron Ore operations in the Pilbara in early 2012 (Meynink Engineering Consultants 2012). The assessment was based on area seismic sources as no evidence of recent fault activity was recognised close to the BHP Billiton Iron Ore operations in the Pilbara during the preliminary neotectonic observations. The observations show that an inferred segmented fault system appears to run across the site; however, there is no indication of recent fault activity. In the Australian context, the Peak Ground Acceleration values estimated from this study correspond to a low to moderate seismic hazard.

4.5 Landforms and land systems

Land systems across much of the grazing and pastoral lands of WA were surveyed, described and categorised during a series of surveys conducted by the Department of Agriculture. The Project lies within the Pilbara Region, which was surveyed in the period between 1995 and 1999, by Van Vreeswyk *et al.* (2004), with the results published in Technical Bulletin No. 92. The descriptions of the land systems below are consistent with those described in Technical Bulletin No. 92 (**Table 9**).

The survey by Van Vreeswyk *et al.* mapped 102 land systems for the Pilbara region, five of which underlie the OB29/30/35 footprint (**Figure 8**). These land systems include the Boolgeeda, Elimunna, Newman, River and Rocklea. The most predominant land system underlying OB29/30/35 is the Newman system which underlies 459 ha (44%) of the combined closure area of 1,037.5 ha.

Table 9: Land systems underlying the OB29/30/35 area

Land System	Description	Soil	Percentage of Closure Area (%)
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	Stony soils, red shallow loams, red loamy earths, minor self-mulching cracking clays, channels with river bed soils.	10.5
Elimunna	Stony plains on basalt supporting sparse *Acacia* and Cassia shrublands and patchy tussock grasslands.	Stony soils, red shallow loams, red/brown non-cracking clays, self-mulching cracking clays, red deep loamy duplex soils and red loamy earths.	9.5
Newman	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	Stony soils, red shallow loams, some red shallow sands, stony soils on upper margins with red loamy earths on lower margins, red loamy earths and channels with river bed soils.	45
River	Active flood plains and major rivers supporting grassy *Eucalyptus* woodlands, tussock grasslands and soft spinifex grasslands.	Mostly red deep sands with red sandy earths, red loamy earths and some river bed soils, deep red/brown non-cracking clays, red shallow loams, red shallow sands and river bed soils.	1
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.	Stony soils, red shallow loams, calcareous shallow loams, red shallow sandy duplex soils, red sandy earths, shallow red/brown non-cracking clays, self-mulching cracking clays, red shallow sands, channels with river bed soils and red loamy earths.	2.5
Mining	Area disturbed by mining activity		31.5

4.6 Soil characteristics

Tille (2006) collated the most recent and detailed mapping of WA's Rangelands and Arid interior into a hierarchy of soil-landscape mapping units. The OB29/30/35 mining operations fall within the Fortescue Province, an area that occupies 160,050 square kilometres (km^2) (6.3% of WA), and is located in the Pilbara between Dampier, Port Hedland, Jigalong, Paraburdoo and Pannawonica.

Soils and landform for the Fortescue Province are described by Tille (2006) as:

'*Hills and ranges (with stony plains and some alluvial plains and sandplains) on the volcanic, granitic and sedimentary rocks of the Pilbara Craton. Stony soils with red loamy earths and red shallow loams (and some red/brown non-cracking clays, red deep sandy duplexes and red deep sands). Spinifex grasslands with kanji and snappy gum (and mulga shrublands and tussock grasslands)'.*

The Fortescue Province contains ten soil landscape zones:

- Nullagine Hills Zone;
- De Grey-Roebourne Lowlands Zone;
- Chichester Ranges Zone;
- Abydos Plains and Hills Zone;
- Fortescue Valley Zone;

- Hamersley Plateaux Zone;
- Karratha Coast Zone;
- Warrawagine Hills Zone;
- Jigalong Plains Zone; and
- Harding Hills and Plains Zone.

OB29/30/35 is located within the Hamersley Plateaux Zone, which covers approximately 44,450 km^2. This zone is described by Tille (2006) as:

'*Hills and dissected plateau (with some stony plains and hardpan wash plains) on sedimentary and volcanic rocks of the Hamersley Basin (Ophthalmia Fold Belt). Stony soils with Red shallow loams and some Red/brown non-cracking clays and Red loamy earths. Spinifex grasslands with snappy gum and kanji (and some mulga shrublands). Located in the Pilbara coast between Pannawonica, Newman and Paraburdoo.'*

Topsoil in the Mount Whaleback area is scarce. All topsoil is stockpiled as close to the area of origin as practicable and stored in paddock dump formations, no more than 2 m in height. All areas are signposted and mapped in an electronic topsoil database (BHP Billiton Iron Ore 2012a).

In 2012, BHP Billiton Iron Ore conducted a review of the soil requirements for mine closure against existing stockpiles. In October 2012, approximately 1,300,000 m^3 of topsoil had been stockpiled in designated storage areas at the Mount Whaleback mining operations for future rehabilitation activity, including rehabilitation associated with OB29/30/35 above water table operations. Additional topsoil will be generated from clearing the footprint of the proposed OB35 OSA and open pit, and expanding the footprint of OB29 OSA.

A high level topsoil reconciliation was undertaken for Mount Whaleback, the approximate balance for Mount Whaleback (October 2012) is provided in **Table 10** below. The review concluded that the Mount Whaleback mine site (including OB29/30/35 above water table) requires approximately 3,800,000 m^3 of soil for closure. Excluding all transport areas (haul roads, tracks etc.), and voids, the current deficit has been estimated at 2,500,000 m^3. The reconciliation was based on current footprint, not long term projected topsoil stockpiles to closure.

Table 10: Current Mount Whaleback (including OB29/30/35) Topsoil Balance

Topsoil Component – October 2012	Preliminary estimated Volume (m^3)*
Existing topsoil stockpiles – October 2012	1,300,000
Current Topsoil requirements	3,800,000
Deficit based on current stockpiles	2,500,000

*These preliminary estimates are based on a standard stockpile height (1.75 m), therefore these figures are a rough approximation and still to be validated.

Management of Soils is addressed in Section 7.4

4.7 Surface water

4.7.1 Regional Hydrology

OB29/30/35 are located within the Whaleback Creek catchment area, which forms part of the greater Fortescue River Upper Catchment (**Figure 9**). Whaleback Creek flows in an easterly direction between Mount Whaleback and OB29/30/35. It then flows northeast, passing to the north of the Newman town site before its confluence with the Fortescue River, approximately 9 km east of the town site, upstream of Ophthalmia Dam. Due to climatic conditions, the creek is ephemeral with typically one to three flow events per year. These events are usually short, with little post rainfall flow persistence (Aquaterra 2006). Whaleback Creek flows just to the south of the OB30 open pit (**Figure 10** and **Figure 11**).

The Department of Water operates a number of stream gauging stations through the Pilbara. While these stations provide valuable information, they are focussed on the major river systems and require extrapolation to understand the likely hydrology of smaller systems. To improve the knowledge of how these smaller systems, such as those found around the OB29/30/35 project area respond to rain events, BHP Billiton Iron Ore has established a network of sites throughout the Pilbara in 2011 and 2012. These sites comprise a water level transmitter within a surveyed reach and rainfall monitoring stations.

4.7.2 Local hydrology

A surface water review conducted by Aquaterra in May 2006 divides the Whaleback Creek catchment area into four sub-catchments: A; B; C; and D (**Figure 10**). Orebodies 30 and 35 are situated within Sub-catchment D (**Figure 11**). OB29 is situated in the southeast portion of sub-catchment C (**Figure 12**).

Sub catchment D is the catchment area of Whaleback Creek which runs to the south of OB30; Sub catchment D is further divided into D1, (located directly to the west of OB35), and D2, located directly to the south of OB35. Both D1 and D2 drain towards the proposed OB35 Open Pit.

Runoff from the western portion of sub-catchment D drains north and south into Southern Creek which flows in an easterly direction before flowing to the north, towards OB35. Surface runoff is generally in a northern direction in the eastern section of sub-catchment D.

The development of the western end of the OB35 open pit will result in alteration to the localised surface hydrology, as the southern creek is intercepted (within sub-catchment D), (**Figure 11**). A bund will be installed around the toe of the OB35 OSA; and sediment traps will also be installed to prevent the movement of sediment from the OSA into the surrounding catchment. The diversion of this creekline did not trigger formal assessment and approval for this to occur has been granted.

Sub catchment C is further divided into C1, located directly to the east of and draining towards OB29. Runoff from the smaller sub-catchment C generally drains northwards towards Whaleback Creek (**Figure 12**). Due to the high elevation of OB29, the open pit is not subject to flooding from Whaleback Creek. OB29 intercepts small tributaries within sub-catchment C.

4.8 Groundwater

Marra Mamba orebodies are typically permeable and are likely to form significant localised aquifers mostly surrounded by impermeable country rock. Alluvium (where saturated) and the Paraburdoo Member of the Wittenoom Formation are known potential aquifer units in the region, and may contribute to some of the future dewatering volumes. Mostly, these units are present between OB29/30/35 and Mount Whaleback Pit, with relatively impermeable country rocks to the south and east (RPS Aquaterra 2012; 2013).

Analysis of groundwater taken from bores at OB29 indicates that the groundwater is fresh with total dissolved solids (TDS) in the range of 460 to 480 milligrams per litre (mg/L), with a slightly alkaline pH between 8.1 and 8.3 (SRK 2013).

The groundwater levels within Orebodies 29/30 are between 520 and 535 mRL (approximately 40 to 50 m below ground level (bgl)), which is the approximate regional groundwater level. It is therefore inferred that dewatering at Mount Whaleback has had no effect on the groundwater levels at OB29/30/35, indicating that the hydrogeology of the Mount Whaleback mine is not connected to that at OB29/30/35 (RPS Aquaterra 2013). A geological unconformity has subsequently been identified between OB29/30/35 and the Mount Whaleback deposit as a key groundwater feature of the area, resulting in two distinct hydrological regimes (RPS Aquaterra 2012).

Operations will require dewatering of the groundwater. As operational dewatering ceases, the groundwater table will progressively recover. Assessments indicate that any resulting pit lake will be a groundwater sink (RPS Aquaterra, 2013), with no impact on significant receptors. Further discussion on the management of the pit void at closure is provided in Section 7 and 10.

4.9 Vegetation

4.9.1 Regional flora and vegetation

The operations are also situated in the Fortescue Botanical District of the Eremaean Botanical Province of Western Australia (Beard, 1975).The Fortescue Botanical District is characterised by tree and shrub steppe communities of *Eucalyptus*, *Acacia* and *Trodia* (Beard 1975; Onshore Environmental 2013a). See Section 4.1 for further details.

4.9.2 Local flora and vegetation

Since the commencement of mining at Mount Whaleback in the 1960s, BHP Billiton Iron Ore has commissioned approximately 40 flora and vegetation surveys to support environmental approvals and conditions (Onshore Environmental 2013).

Onshore Environmental described and mapped a total of 20 vegetation associations from six broad floristic formations based on canopy structure within the Mount Whaleback and OB29 survey areas. Within the OB29 area, two broad floristic communities: *Triodia* Hummock Grassland and *Triodia* Open Hummock Grassland and three corresponding vegetation associations 3e, 3f and 4b appear. A significant portion of OB29 is degraded/previously disturbed land from historical, therefore there is minimal vegetation within the OB29 area.

GHD (2011) described and mapped a total of 22 vegetation associations from ten broad floristic formations within the OB30 and OB35 area and surrounds. Of these broad floristic formations, seven formations appear within the OB35 pit area: *Acacia* Low Open Forrest, *Acacia* Low Open Woodland, *Acacia* Low Woodland, *Acacia* Open Shrubland, *Eucalyptus* Low Woodland, *Themeda* Open Tussock Grasslands and *Triodia* Hummock Grassland. Nine corresponding vegetation associations appear within the OB35 area: 1b, 3a, 3c, 4b, 4c 6a, 8a, 9a and 10c.

Three broad floristic formations (plus degraded and existing mining areas) appear within the OB30 Proposal area: *Acacia* Low Open Forrest, *Acacia* Low Open Woodland and *Eucalyptus* Low Woodland. There are three corresponding vegetation associations occurring within the OB30 area: 1b, 3c and 8a (GHD, 2011).

4.9.3 Weeds and Declared Plants

The survey reports prepared by GHD (2011) and Onshore Environmental (2013a) indicated that, to date, a total of four introduced species have been recorded over the OB29/30/35 area: **Acetosa vesicaria,* **Bidens bipinnata*, **Cenchrus ciliaris* and **Portulaca oleracea.*

None of the introduced species recorded are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007*.

4.9.4 Groundwater dependent vegetation

Onshore Environmental undertook an assessment of groundwater dependent vegetation at OB29/30/35 (Onshore Environmental 2013b). There are no areas of groundwater dependent vegetation were identified to be at high risk from groundwater drawdown associated with proposed mining below the water table at OB29/30/35 (Onshore Environmental 2013b).

Vegetation associations occurring along the main drainage channel and adjacent floodplains support facultative tree species *Eucalyptus camaldulensis* subsp*. refulgens* and/ or vadophytic tree species *Eucalyptus victrix* and *Eucalyptus xerothermica.* The vegetation associations supporting these three tree species are determined to be at moderate risk from groundwater drawdown. However, pre-abstraction groundwater levels below these areas of moderate risk vegetation, and within the majority of the OB29/30/35 closure boundary, are in excess of 30 m below ground level (bgl), and groundwater at this depth is unlikely to be accessible for plant uptake and therefore these species are unlikely to be reliant on groundwater (Onshore Environmental 2013b).

The remaining vegetation associations within the OB29/30/25 area are identified as xerophytic, plant species with no reliance on groundwater and are determined to be at low to zero risk from being impacted by groundwater drawdown (Onshore Environmental 2013b).

4.9.5 Threatened or Declared Rare Flora

No Threatened or Declared Rare Flora species have been recorded within the collective OB29/30/35 closure boundary (GHD 2011; Onshore Environmental 2013a).

4.9.6 Priority flora

There were no Priority flora species recorded within the OB29/30/35 closure boundary (GHD 2011; Onshore Environmental 2013a).

4.9.7 Threatened or Priority Ecological Communities

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) have been recorded, or are considered likely to occur, within the collective OB29/30/35 closure boundary (GHD 2011; Onshore Environmental 2013a).

4.10 Fauna

A total of 26 vertebrate fauna surveys have been undertaken over an 18 year period, within and in the vicinity of the Mount Whaleback Operations (Onshore Environmental 2013a; Biologic, 2011)).

The Biologic (2011) and Onshore Environmental (2013a) reports described and mapped five major fauna habitat types within the closure boundary and surrounds, in addition to the historical clearing. These were:

- Hillcrest and Slopes;
- Gorge/Gully;
- Drainage Area;
- Mulga Woodland; and
- Major Drainage Lines (Whaleback Creek).

The Major Drainage Line and Gorge/Gully habitat have been identified to be of high value for fauna species as they provide suitable habitat for a number of conservation significant species, while the remaining habitats are deemed to be of lower habitat value. The OB29/30/35 closure boundary is dominated by the existing mine and infrastructure and therefore significantly disturbed.

The habitats found within the OB29/30/35 closure boundary are considered common and widespread throughout the Pilbara (Onshore Environmental, 2013a; Biologic, 2011)

4.10.1 Conservation significant fauna

A total of eleven conservation significant species consisting of two native mammals, seven birds and two reptiles were been recorded during previous survey work (Biologic, 2011). Of these eleven species, one was recorded as occurring within the Proposal boundary, namely the Department of Parks and Wildlife (DPaW) Priority 4 listed *Macrodema gigas* (Ghost Bat).

The Ghost Bat is listed as Priority 4 by DPaW and Vulnerable by the International Union for Conservation of Nature (IUCN). Three Ghost Bat caves are located in the vicinity of OB35. Very few scats were recorded within these caves, indicating that the caves are infrequently visited or rarely used. Biologic concluded that due to the number of recordings of the Ghost Bat during the 2011 survey, it is expected that the species is resident in a much wider area and not reliant on the OB29/30/35 closure boundary area.

The Ghost Bat impacts were discussed within the OB35 Environmental Referral Document (BHPBIO, 2011c) which received a Not Assessed outcome by the EPA. A NVCP was approved to cover

disturbance within these areas. Furthermore, caves suitable for Ghost Bat use are also located outside of the areas identified for mining.

4.10.2 Subterranean fauna

BHP Billiton Iron Ore has historically undertaken stygofauna sampling as part of their Regional Subterranean Fauna Sampling Program. In 2013 Bennelongia Environmental Consultants Pty Ltd (Bennelongia) assessed potential impacts to stygofauna from mining below the water table at OB29/30/35.

The surveys of the area recorded only nine species, which is depauperate in comparison with the wider Newman area, due to the OB29/30/35 area having poorer quality stygofauna habitat (the wider region is recognised as supporting at least 53 species). The main stygal habitat within the OB29/30/35 closure boundary is BIF, which is less prospective for stygofauna (Bennelongia 2013).

The Ethel Gorge aquifer stygobiont TEC is listed as Endangered under the EPBC Act; this TEC is located approximately 17 km east of Orebodies 29/30/35 and not expected to be impacted by the closure of OB29/30/35 (**Figure 13**) (Onshore Environmental 2013a).

4.11 Visual Amenity

The landscape in which OB29/30/35 is located consist of heavily weathered, roughly parallel ridgelines and dissecting valleys. It is generally sparsely vegetated, apart from the valleys, due to the lack of topsoil on the more elevated areas.

The following Visually Sensitive Receptors (VSRs) were identified in the visual and landscape impact assessment by Environmental Resources Management (ERM) in 2011:

- VSR 1 – Newman Residents

  Many of these residents work in the mining industry, with a portion employed at the Mount Whaleback mine, which has been in operation since the 1960s. The existing Mount Whaleback mine is a visually dominant feature of the area.

- VSR 2 – Recreational Visitors and Tourists

  These VSRs are transient, with much of their visual experience of the area gained from the road network or lookout points. The mining activity of the Pilbara and the areas around Newman are a tourist attraction, as evidenced by the haulage truck placed at the tourist information facility near the entry to the Mount Whaleback gate.

The OB29/30/35 closure boundary area is located in a highly modified landscape and the landforms present are not considered to be unique to the region (ERM 2011).

4.12 Cultural heritage

The OB29/30/35 mine area falls within the Nyiyaparli Native Title Claim [WC05_006] area and this group asserts their connection to the country and cultural sites within their traditional lands. In recognition of the Nyiyaparli people and their heritage and cultural concerns within the area, BHP Billiton Iron Ore remains committed to consulting with the Nyiyaparli people regarding proposed mining developments within this area.

4.13 Local land use

The current land use for areas not directly affected by mining in the vicinity of OB29/30/35 is low intensity grazing. The southern boundary of mining lease ML244SA overlaps the following pastoral stations:

- Prairie Downs Pastoral Station; and
- Ethel Creek Pastoral Station.

4.14 Rehabilitation monitoring, research and trials

BHP Billiton Iron Ore has undertaken progressive rehabilitation at a number of its Pilbara Operations, which enable learning's from one project area to be applied to new areas through the adaptive management approach. Rehabilitation Development Monitoring (RDM) is undertaken to assess initial rehabilitation, revegetation establishment, development over time, and determine whether completion criteria (see Section 8) have been met.

The outcomes of monitoring, research and trials are reported in further detail in the Annual Environmental Reports (AERs) for the site. Additional ongoing external research programs, including the Pilbara Seed Atlas through the Botanic Gardens and Parks Authority, continue to provide input to improving rehabilitation success across BHP Billiton Iron Ore's Pilbara Operations. Assessment of rehabilitation monitoring results assists with defining these successes, and provides input to the development of robust completion criteria metrics for revegetation. The rehabilitation monitoring program and ongoing assessment of results from this program enables the adaptive management approach which will continue to be used throughout the life of the OB29/30/35 mine.

A summary of the performance of previously rehabilitated areas at BHP Billiton Iron Ore other operations in the Pilbara is provided in **Table 11**. The findings presented in are examples of BHP Billiton Iron Ore's adaptive management approach to rehabilitation which involves regularly assessing performance and adjusting its management practices to facilitate continuous improvement.

Table 11: Summary of Findings - Rehabilitation Performance at BHP Billiton Iron Ore's Other Pilbara Operations

Site	Description of Findings from Rehabilitation Performance
General	• Scalloping has been demonstrated to be effective on appropriate waste materials on slopes below 20°, at slopes higher than 20° erosion tends to be more pronounced. • When using scalloping as a rehabilitation technique, the scallops must be 'interlocked' to minimise erosion and optimise the success of revegetation. • The construction of bunds on the top of OSAs around the perimeter is essential as it prevents water from flowing down the slopes and minimises erosion potential. • Material that has a higher sulphidic content can impact on the success of revegetation. It has been found that using inert waste material as a cover can minimise the impact of sulphidic material. • When applying topsoil it is preferable that it be incorporated (keyed-in) into the subsurface material to minimise surface erosion. • Contour ripping has been effective at slopes below 20°; however the contours must be surveyed accurately to minimise failure of rip lines. • Backfilling pits with waste material minimises visual impacts of the operations and reduces the need to disturb land for new out-of-pit OSA areas. • Increased revegetation success has been observed when seeding has occurred prior to the main wet season (i.e. before January).
Mount Whaleback and OB29/30/35	• Previous trials have found that revegetation performance generally increases with greater depth of topsoil application (i.e. there would be an ideal topsoil depth which would be dependent on the species). • OSAs with high pyritic content have been recognised as an issue for rehabilitation. As a result, trials are being conducted into appropriate surface treatments, species and seeding rates. The results will be used to improve OSA rehabilitation methodologies.
Jimblebar - Wheelarra Hill, OB18	• Prior to 2004, qualitative rehabilitation monitoring at the Wheelarra Hill mine showed some areas encountered problems due to plants being of the same age. By adjusting the rehabilitation method used, BHP Billiton Iron Ore has demonstrated that this issue can be overcome by undertaking additional seeding (or planting) in subsequent years. • Operational experience has indicated that due to the unpredictable rainfall in the Newman area, seed application should, where practicable, be timed to coincide with major rainfall events.

Site	Description of Findings from Rehabilitation Performance
	• Preliminary rehabilitation monitoring results indicate that rehabilitated stockpiled fines are capable of supporting local native species and are exhibiting growth on a trajectory that would suggest that a sustainable ecosystem will develop over time. • The batters of the rehabilitated stockpiled fines have not performed well in terms of stability. These batters were generally profiled to a final slope of 20°, and were directly seeded and contour ripped. • High litter development appears to be associated with higher densities of *Triodia* spp. on the rehabilitated stockpiled fines. Higher infiltration and nutrient cycling values recorded in the Landscape Function Analysis monitoring programme also appear to be correlated with the high litter content.
Marillana Creek (Yandi)	• Monitoring of OSA surfaces confirmed significantly advanced rates of recovery in rehabilitated areas with topsoil (i.e. greater than 25% foliar cover) when compared with rehabilitated areas without topsoil (i.e. less than 10% foliar cover). It was also determined that topsoil should be spread at a depth of 50 mm to 60 mm to achieve optimum use of available topsoil resources. • Promotion of soil harvesting and progressive rehabilitation has led to high success rates for rehabilitation. As a result of Yandi's soil harvesting, it has been possible for all rehabilitation areas to date to have topsoil applied. Operator ability has been identified as a key factor in successful rehabilitation. Rehabilitation operators where possible are preferentially selected based on their understanding and interest in environmental requirements to generate optimal rehabilitation results.
Yarrie/Nimingarra	• Operational experience has indicated that due to the unpredictable rainfall in the Goldsworthy area, seed application should, where practicable, be timed to coincide with major rainfall events.
Mount Goldsworthy	• Due to a lack of rehabilitation planning in the early stages of mine development, Mount Goldsworthy has a topsoil deficit. This highlights the need for life of mine planning for rehabilitation, in particular soil recovery and storage. • Scalloping has been used effectively on rehabilitated slopes at Goldsworthy. Due to the coarse waste material scalloping has been able to be used effectively on slopes up to 25°.

Sources: Wheelarra Hill Extension Project Environmental Protection Statement (BHP Billiton Iron Ore 2005a)

AERs –2004-2005 and 2011-2012 (BHP Billiton Iron Ore 2005b)

5. Stakeholder consultation

5.1 Objectives

BHP Billiton Iron Ore's Stakeholder Engagement Management Plan states that wherever the Company operates it will:

> *engage regularly, openly and honestly with our host governments and people affected by our operations, and take their views and concerns into account in our decision making.*

BHP Billiton Iron Ore recognises the importance of engaging with relevant stakeholders. The ability to build relationships and work collaboratively and transparently with our host communities is critical to the Company's long-term success. BHP Billiton Iron Ore has established a comprehensive consultation program to support ongoing, effective dialogue with stakeholders potentially impacted by, or interested in, the implications of the Company's growth. This approach is consistent with BHP Billiton Iron Ore's Charter that states a commitment to supporting communities and the BHP Billiton Code of Business Conduct that articulates how this underpins how the Company does business:

"*Our ability to build relationships and work collaboratively and transparently with our host communities is critical to our long-term success. Our aim is to be the company of choice, valued and respected by the communities in which we operate. We do this by engaging regularly, openly and honestly with people affected by our operations, and by taking their views and concerns into account in our decision-making*."

BHP Billiton Iron Ore is currently undertaking an ongoing consultation programme relating to its OB29/30/35 operations with government agencies (both state and local), non-government organisations and land-users that have expressed interest in, or are directly impacted by a proposed project. The objectives of the programme are to:

- provide information and the opportunity to comment to government agencies and other stakeholders who may potentially be interested in activities at the OB29/30/35 mine;
- identify the key issues and concerns of government agencies and other stakeholders in regards to the design and management of activities at the OB29/30/35 mine;
- discuss objectives for the development of the OB29/30/35 mine and its ultimate rehabilitation and closure;
- periodically provide updated information and results of the development and closure planning process to government agencies and other stakeholders as more information comes to hand; and
- allow for adjustments to the design and/or management of any proposed activities to accommodate concerns or issues raised by government agencies and other stakeholders, where relevant.

As part of the broad consultation program for OB29/30/35, BHP Billiton Iron Ore consults with identified stakeholders on closure related issues to ensure that legal requirements, risks and internal and external stakeholder expectations for closure at OB29/30/35 are taken into account at an appropriate time and as far as practicable.

5.2 Stakeholder Identification

The list of stakeholders that will be consulted during the closure planning process includes:

State Government agencies:

- Department of Environmental Regulation;
- Department of Mines and Petroleum;
- Department of State Development;

- Department of Water;
- Office of the Environmental Protection Authority;
- Environmental Protection Authority; and
- Department of Regional Development and Lands: Office of Pilbara Cities.

Shires, Local Governments and politicians:

- Town of Newman;
- Pilbara Development Commission;
- Newman Chamber of Commerce and Industry; and
- Local Member for the Pilbara – Tom Stephens.

Local groups:

- Newman Community Consultative Group;

Land owners and managers

- Traditional landowners (Nyiyaparli);
- Project employees; and
- Project contractors.

BHP Billiton Iron Ore has developed a WAIO Stakeholder Engagement Management Plan, which provides for communication of the results of the ongoing closure planning process.

An indicative stakeholder consultation programme for OB29/30/35 in line with the overall WAIO plan is shown in **Table 12**.

Table 12: Stakeholder Consultation Programme

Stage	Stakeholder(s)	Date	Purpose	Activity	Communications
Execution	Shire of East Pilbara	Six months prior to closure	Inform	Meeting	Advise key stakeholders that OB29/30/35 is being decommissioned.
Execution	Newman Community Consultative Group (CCG)	Six months prior to closure	Inform	Monthly CCG meeting	Advise key stakeholders that OB29/30/35 is being decommissioned.
Execution	Recreational users of the area	Two months prior to closure	Inform	Public Notices/signage	If there are safety issues with accessing the area, the public will need to be notified and signage erected

5.3 Consultation undertaken to date

BHP Billiton Iron Ore's locally based Community and Indigenous Affairs team are active members of the Newman community and through continued community engagement they have established:

- supportive working relationships between BHP Billiton Iron Ore and the Newman community;
- an environment conducive to productive dialogue; and
- an understanding of key issues and concerns of the community in relation to developments in the area.

- an avenue to share key project information as it becomes available.

In summary, during April, July and August 2013 OB29/30/35 mine briefing meetings were held with representatives from the following Government agencies:

- Department of Environment and Conservation, Pilbara Regional Branch / Licensing Regulation (now Department of Environmental Regulation);
- Department of Water in Perth;
- Environmental Protection Authority in Perth; and
- Department of State Development.

BHP Billiton Iron Ore will continue ongoing dialogue from selected stakeholders over the lifetime of the mine in line with the WAIO Stakeholder Engagement Management Plan, with closure remaining an ongoing point of discussion.

The key issues related to closure, raised during stakeholder consultation are presented within **Table 13**.

Table 13: Summary of Stakeholder Consultation

Stakeholder	Consultation Details	Issues Discussed	Proponent Response / Section
Department of Environment and Conservation – Regional Branch / Licensing Regulation (now Department of Environmental Regulation)	Meeting at Department of Environment and Conservation Karratha 21 March 2013	Dust, noise, pollution and short and long-term management of dewatering. Licence amendment for the Hydrodynamic Trial and future operational phase were discussed.	The existing Mount Whaleback Licence will be amended for the Hydrodynamic Trial to discharge to Ophthalmia Dam for 18 months.
Department of Water	Meeting at Department of Water, Perth, December 2012	Dewatering, licence amendments and closure expectations.	No concerns were raised.
Office of Environmental Protection Authority	Meetings on 24 April and 22 August 2013	An overview of the preliminary key environmental impacts, conclusion of the impact assessment and discussion regarding rehabilitation and closure mechanisms.	OEPA advised that further clarification regarding closure mechanisms would be required to support the referral.
Department of State Development	Meeting on 18 July 2013	Newman State Agreement obligations, Project Proposal requirements and commitments to closure and rehabilitation under the State Agreement Act. DSD advised they would discuss potential closure mechanisms with the OEPA.	BHP Billiton Iron Ore has provided a discussion in the Environmental Referral Document for OB29/30/35 Below Water table Mining.

6. Post mining land use and closure objectives

This MCP describes rehabilitation concepts for mine closure that fulfil the Closure Objectives and Guiding Closure Principles for the site.

BHP Billiton Iron Ore's Rehabilitation Vision is to:

> *Be the leading practitioner of sustainable rehabilitation by being a trusted and respected steward of the land* (BHPBIO 2011c).

This section outlines the objectives and principles that will be required to meet the overall vision, and Section 10 describes how implementation of these objectives will be achieved.

6.1 Rehabilitation Standard

BHP Billiton Iron Ore employs its Rehabilitation Standard (BHPBIO 2011c) across its Pilbara sites. The Rehabilitation Standard provides the *overarching framework* for successful restoration of areas impacted by BHP Billiton Iron Ore operations in the Pilbara, and apply to the following stages:

- Planning;
- Rehabilitation Options;
- Early Establishment;
- Maturing Rehabilitation; and
- Closure.

The Rehabilitation Standard provides a consistent approach for development of site-specific criteria and improvement actions across BHP Billiton Iron Ore's WAIO operations.

6.2 Closure objectives and guiding principles

The core objectives of rehabilitation and closure of BHP Billiton Iron Ore operations are as follows:

Rehabilitation must be safe and stable, and, within the limits of the altered post-mining environment, establish a native Pilbara ecosystem that provides for low intensity grazing, protection of water quality, and conservation, such that it:

- *is sustainable – areas must be demonstrated to be viable in the long-term (i.e. they should show an ecological recruitment cycle, and the ability to withstand normal disturbance events such as fire and drought, similar to that demonstrated by baseline surveys of reference sites);*
- *is sympathetic to the regional landscape – areas must be designed and constructed to reflect local ecological and landscape features;*
- *is functional – areas must show evidence of ecosystem processes, such as nutrient cycling, support of faunal assemblages;*
- *is based on the findings of monitoring and research into the establishment of biodiversity, ecosystem function and sustainability at rehabilitated BHP Billiton Iron Ore sites;*
- *takes into account the views of all relevant stakeholders;*
- *leaves areas that are safe and stable and do not impact on their immediate surrounds, particularly Whaleback - they will physically interface appropriately with adjacent features, ensuring natural hydrological linkages, and avoiding significant impacts on surrounding areas from erosion, slumping, run-off, and introduction of weeds; and*
- *is compatible with a 'whole-of-lease sustainable management' approach, so that rehabilitated areas can be integrated into local land management practices, and management requirements (e.g. maintenance of access tracks, fire) are not greater than those of areas*

prior to mining, or where extra management actions may be required, a mechanism has been put in place for addressing these.

The direction of rehabilitation for the Operation is consistent with that applied to BHP Billiton Iron Ore's operations more broadly. The Guiding Closure Principles are as follows:

- *No significant, physical off site impacts;*
- *No significant impact on baseline surface water quality and flow regimes in nearby creeks*
- *No unsafe areas where members of the general public could inadvertently gain access. Access to potentially unsafe areas will be impeded by safety bunds built to comply with the applicable DMP guidelines;*
- *Future mines will examine opportunities to minimise the number and size of out of pit overburden storage areas and changes to the water flow pattern by increasing the amount of overburden material used to infill final voids as void areas become available and/or as resources are mined out;*
- *Residual pit voids will be left as run-of mine where geotechnically stable, and profiled as necessary to achieve long-term closure objectives;*
- *Final landform designs will be similar to the existing regionally landforms, within the constraints imposed by the physical nature of the materials; and*
- *Long-term systems-based monitoring approach will be used track the trajectory of rehabilitated areas towards self-sustaining status.*

6.3 Final land use

As stated in the closure objectives the rehabilitation will provide for low intensity grazing as the provisional post mining land use. The provisional landuse provides an interim target to which closure and rehabilitation planning can work towards. The post-mining land use of the area will finally be determined through ongoing consultation with the administering authority and relevant stakeholders during the remaining life of the mine. Notwithstanding, the most likely final land use for the lease area is shown in **Table 14**. The likely post mining land uses are considered in mine planning, operations and rehabilitation.

Table 14: Provisional Final Land Use by Site Domain

Domain	Post closure land use	Specific Strategies to Facilitate Land Use
Overburden Storage Areas	Areas will support low intensity grazing.	Erosion will not compromise vegetation community and surface water objectives.
Infrastructure and Roads	Areas will support low intensity grazing.	Bitumen and debris will be removed and below ground infrastructure (e.g. within road easements) will be left in situ where appropriate.
Mine voids	Areas not currently planned to support a specific post-closure land-use due to ingress/egress restrictions.	Areas outside the open pit abandonment bunds will meet a geotechnical standard suitable for human access.

7. Identification and management of closure issues

The overall objective of sustainable closure and rehabilitation in the Pilbara requires a holistic, Company-wide, approach whereby corporate asset planning interfaces with operational level management to ensure that a cohesive, integrated outcome is realised. To achieve this, BHP Billiton Iron Ore founds its closure planning management interactions around the annual Corporation Alignment Planning cycle. This activity develops corporate level directional and delivery plans, including mine closure, as aligned with the BHP Billiton Company Charter (refer to GLD.034 – Corporation Alignment Planning).

Within the Corporation Alignment Planning framework, Directional Life of Asset Plans trigger closure scenario planning studies (e.g. final landform options – Sections 7.4.4) or discrete activities (e.g. stakeholder consultation – Section 5) based on mine development and closure scheduling. The scope and extent of such studies consider potential closure risk, impact and timing.

BHP Billiton Iron Ore's adaptive management approach includes updating specific mine closure plans to account for closure risk, liability and stakeholder requirements as informed by the outcomes of the Corporation Alignment Planning process.

BHP Billiton Iron Ore applies a suite of modelling and assessment tools to guide the application of management approaches to address closure issues. Monitoring programs provide data and information to support and inform the progressive development of the mine closure strategy for a site.

Acknowledging the preliminary status of this Mine Closure Plan the focus in management at this phase of the mine life is on developing an understanding of the closure issues and ensuring processes are in place to develop appropriate closure strategies.

7.1 Adaptive Management

The concept of adaptive management is a structured, procedural, iterative approach to decision making. By its very nature, adaptive management employs an inherent capacity to incrementally improve confidence through the re-integration of data into the forward planning process, thereby reducing risk. Therefore, in circumstances where potential impacts cannot be entirely avoided, the adaptive management approach allows for an evaluation of the preferred mitigation controls employed, such that they are progressively improved and refined, or entirely alternate solutions adopted.

BHP Billiton Iron Ore recognises that learning is at the heart of adaptive management. Models, research and development, and experience as they relate to closure and rehabilitation are the basis of learning. Management approaches can be subsequently informed through the cause-and-effect feedback mechanism under the adaptive management framework.

It is recognised that observation of outcomes alone is insufficient as a feedback mechanism, as interactions in complex systems can be iterative, dynamic, and discontinuous as external circumstances change and internal behaviour crosses systemic thresholds. Continuous testing and refinement of models, research and plan implementation against new data and new hypotheses is therefore a core component of any effective adaptive management strategy.

BHP Billiton Iron Ores application of adaptive management to closure and rehabilitation involves regularly assessing performance and adjusting management practises to facilitate continuous improvement.

This adaptive management approach will apply to the Operations and associated closure issues, and takes into consideration the results of rehabilitation and trials from BHP Billiton iron ore's other Pilbara Operations and best practice rehabilitation techniques used elsewhere in the mining industry.

7.1.1 Rehabilitation trials and research

As part of BHP Billiton Iron Ore adaptive management approach rehabilitation trials and research across the Pilbara operations are utilised to inform closure and rehabilitation planning.

Table 15 provides a summary of current research projects. Rehabilitation areas and trials will be monitored on a regular basis to assess the success or otherwise of a particular rehabilitation technique, with the results used to refine the OB29/30/35 mine rehabilitation programme.

Table 15: Summary of active rehabilitation research

Subject	Research Summary
Seed Management	Pilbara Seed Atlas: a five year research project involved with the development of practical recommendations for the collection, processing, storage, germination, and efficient use of seeds in mine-site restoration in collaboration with researchers from the Botanic Gardens and Parks Authority. Restoration Seed Bank: initiative is a five-year partnership between BHP Billiton Iron Ore (WA), the University of Western Australia, and the Botanic Gardens and Parks Authority to improve the existing 'restoration supply chain' from seed collection, cleaning, drying, storage, treatment, distribution, germination, establishment and monitoring, verification and reporting.
Growth Media	Yarrie/Nimingarra: Topsoil deficit has been identified as an issue for future rehabilitation works at As a result, BHP Billiton Iron Ore is conducting a trial to use shallow lateritic material as future growth media on rehabilitated landforms. Yarrie/Nimingarra: Growth media trails utilising in-situ waste materials are being incorporated into progressive rehabilitation works Growth Media Atlas: to enable successful establishment of vegetation in rehabilitated areas by assessing existing topsoil stockpiles for the chemical, physical and plant growth properties; and identify suitable alternative growth media materials that could be made available for rehabilitation
Fire Ecology	Jimblebar, Wheelarra Hill, Orebody 18, Marrillana Creek (Yandi): BHP Billiton Iron Ore is investigating fire ecology (i.e. response of ecosystems following fire) by monitoring areas which have been burnt. Findings from this investigation will be used to determine the possibility of using fire as a rehabilitation tool and to better manage fire affected areas.
Surface treatments	Yarrie/Nimingarra: Trial to assess the stability and revegetation success using alternative surface treatments to 'moonscaping', such as contour ripping, and the creation of contour banks. Yarrie/Nimingarra: Surface treatment trials are being undertaken to assess stability and revegetation success using no rip and minimal rip treatments, and are incorporated into progressive rehabilitation works. Area C: Rock armour trial undertaken to assess varying surface treatments and armour treatments on minimising surface erosion.

Sources: Wheelarra Hill Extension Project Environmental Protection Statement (BHP Billiton Iron Ore 2005a) AERs –2004-2005 and 2011-2012 (BHP Billiton Iron Ore 2005b)

In addition to BHP Billiton Iron Ore's rehabilitation research the adaptive management approach maintains rehabilitation planning flexibility to accommodate changes in method or technology which are developed more broadly in the mining, closure and rehabilitation industry.

7.2 Risk Management

Risk Management is an integral component of the BHP Billiton Iron Ores Closure planning process. Risk management is undertaken to qualitatively and quantitatively guide the selection of closure options, assess specific risks and identify controls for the design and execution of closure projects.

In accordance with BHP Billiton Iron Ore's Corporate Alignment Planning process (GLD.034, BHP Billiton 2013c) risk assessments are conducted for all of BHP's operations in order to prioritise and manage risks consistent with Australian Risk Management Standard AS/NZS ISO 31000:2009 Risk Management – Principles and Guideline.

The primary objective of BHP Billiton Iron Ore's risk assessment and management system is to minimise risk in all aspects of its operations; including closure planning. The risk assessment process and the development of a risk profile are undertaken in accordance with:

- BHP Billiton GLD.017 - Risk Management; and
- The WAIO Health Safety and Environment risk management procedure.

In the Closure context risk management processes include three main types of risk assessment:

- Closure Planning Risk Assessment (health, safety, environment, legal, community, financial): a predominantly qualitative assessment (including stakeholder consultation) to identify mine closure risks and opportunities associated with closure and management strategies to preserve, maintain or enhance values or beneficial uses. These assessments also include consideration of post closure event risks (i.e. failure).
- Scientific Risk Assessments: Scientific source, pathway and receptor risk assessment for environmental, ecological or human health risk. Involving technical specialists in quantitative assessment based on scientific data and information. For example AMD Risk Assessments and Ecological Risk Assessments.
- Construction/Workplace Risk Assessments: As a closure project reaches execution, risk management is used to guide the effective management of risk in the execution phase.

Closure Planning Risk Assessments are undertaken against closure scenarios to optimise the outcome. Mitigating unacceptable risks to a tolerable level may involve the development of control options against each of the risk factors, including the commissioning of additional technical studies and/or research. Such a process is iterative and is aimed at providing, on balance, the most appropriate closure outcome given the key risk drivers. Closure risks are reviewed on a regular basis and are recorded and maintained in a closure risk register.

For example Initial Closure Planning Risk Assessments identify risk issues with controls often directed to further investigations/studies programs which may include scientific risk assessments. Outcomes of the studies and investigations subsequently provide increased knowledge moving to controls directed to specific closure strategies and design features for the mine site. Subsequently as the Mine Closure Strategy is developed the risk assessments progressively mature with the increase in knowledge and information over the life of the mine.

The involvement of stakeholders and specialists varies depending on the nature of the risk assessment. Closure Planning Risk Assessments involve people with a cross-section of relevant knowledge and experience, including employees, contractors and other stakeholders. Evaluation of identified risks is undertaken by the level of management that is consistent with the significance of the closure risk. Scientific Risks Assessments are undertaken by specialists in the relevant field.

7.3 Preliminary identification of closure issues

A Closure Planning Risk Assessment was undertaken for the OB29/30/35 Closure considering the current operations and the proposed below water table mining. The assessment workshop involved stakeholders within BHP Billiton Iron Ore with expertise in technical closure disciplines. **Table 16** outlines the aspects have been identified as requiring specific attention in the Closure Planning process for OB29/30/35. This is based on the collection and analysis of closure data (Section 4) and the Closure Risk Assessment workshop.

Table 16: OB29/30/35 Closure issues summary

AMD	Surface Water	Groundwater	Final Landform	Rehabilitation
• Management in OSA's • Management in pit walls	• Flow and quality • Design and maintenance of management structures	• Flow and quality • Pit lake development (groundwater sink quality)	• Stability of mine voids and OSA's • Closure of mine void (backfill or pit lake) • Visual amenity	• Growth media • Soil management • Revegetation • Fauna habitat

The sections that follow provide an overview of proposed closure management of identified issues. Management measures will be refined progressively (in line with the adaptive management approach). The Closure Risk Assessment will be reviewed and updated prior to the next revision of this Mine Closure Plan.

7.4 Management of identified issues

7.4.1 Acid and metalliferous drainage

AMD is a consideration for mine closure if concentrated levels of acidic, metalliferous or saline drainage enter waterways. Drainage that contains elevated concentrations of sulphuric acid or toxic metals can present a risk to aquatic life, riparian vegetation, ground and surface water or users of these e.g. stock and humans. If the AMD risk is not managed during the life of the mine it may arise during operations and/or post closure. In WAIO operations potential sources of AMD include OSAs, exposed pit walls and other disturbances.

BHP Billiton Iron Ore is committed to managing and mitigating AMD risk using a structured approach, consistent with global leading practice guidelines including INAP (2012) and DITR (2007). Management for AMD materials across BHP Billiton Iron Ore's Pilbara sites is outlined at a high-level in the WAIO AMD Management Standard (BHPBIO 2013a). The overall strategy for AMD management is illustrated in Plate 1 with considerations across the full mine life cycle.

The approach as shown in Plate 1 is a risk based approach, based on increasing geochemical knowledge on the mine waste material, and subsequent integration of this knowledge into the closure plan. Specifically, the characterisation stage (Stage 1) as shown in Plate 1 would inform Stages 2 through 5 inclusive of OSA design as shown in **Plate 1**. The information would also inform the decision making process for pit closure and mine void management.

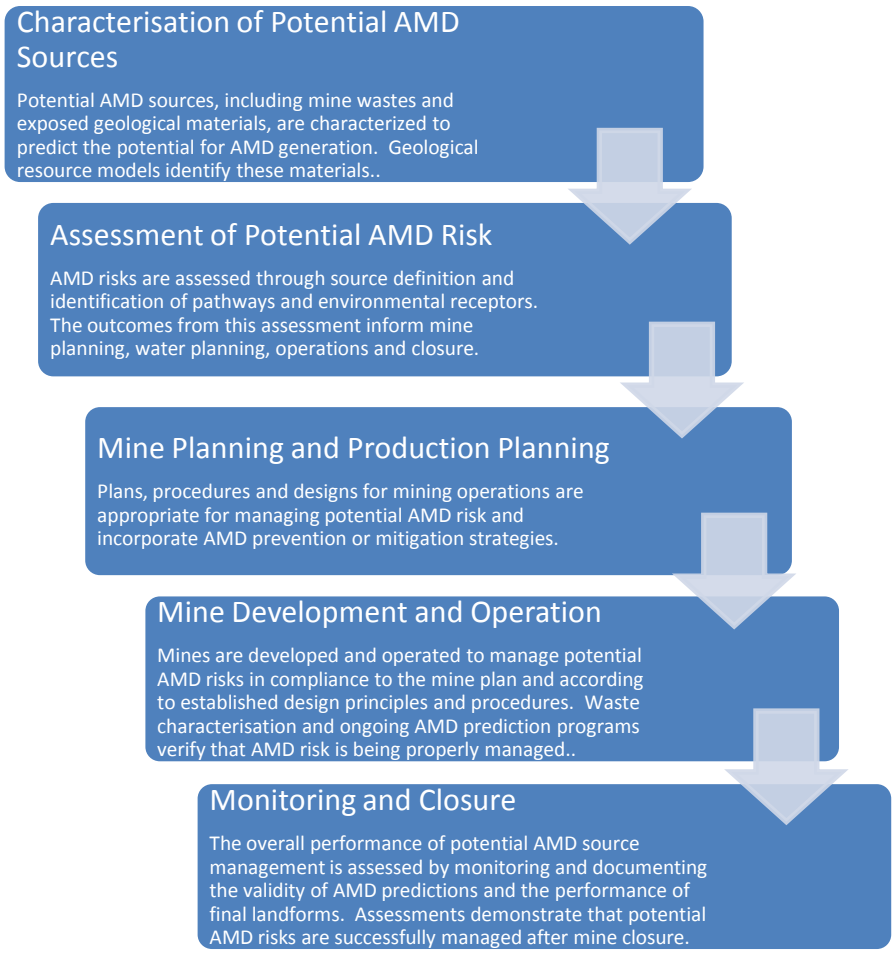

Plate 1: The AMD Management Process

Specifically BHP Billiton utilises the following tools to model and assess AMD risk:

Exploration Phase Waste Characterisation Sampling: Geochemical data and samples collected during the mine's exploration phase can be critical in early detection of higher AMD risk areas. From this initial characterisation, future work can be planned, in addition to adding the data to resource block models for preliminary waste volume and grade calculations.

Static and Kinetic Geochemical Waste Characterisation: Static and kinetic waste characterisation testing can classify waste materials and evaluate their AMD potential. BHP Billiton Iron Ore uses accepted short and long duration geochemical methods to quantify and predict the AMD potential in uncontrolled environments.

Testing and research based on site specific conditions and final landform alternatives, as required, can also be undertaken to reduce any uncertainty on AMD risk, and the predicted effectiveness of proposed AMD management controls. These results can feed into the OSA design considerations in addition to the mine pit void closure scenarios.

AMD Risk Assessment: AMD risk assessment including potential impacts can be undertaken using accepted geochemical and risk assessment methods, to define potential AMD sources, pathways and receptors. Geochemical, geological, hydrological and ecological data and current mine plans can be used to complete initial assessments of the relative severity of risks and impacts.

Closure scenario modelling can then incorporate these data such that geochemical factors are included into conceptual, provisional and detailed OSA design over the life of mine. OSA design refinements may be necessary to assess the effectiveness of AMD management controls, and mine void closure strategies may also require revision.

Hydrogeochemical Predictive Modelling: Conceptual and numerical predictive modelling can evaluate potential pathways and adverse impacts on receptors. The need and complexity of modelling is based on the severity of potential AMD risks. Inputs to the modelling include waste characterisation testing results, hydrological and geological data and models, and scenario designs for AMD management controls. Outcomes based modelling may also be conducted with thermodynamic mineral equilibrium models run based on baseline water quality criteria and mineral species to assess various management scenarios.

The hydrogeochemical model can be conceptual during early stages of mine and closure planning with additional data inputs to validate the model throughout the life of mine. Data from additional mineral waste characterisation in addition to hydrological and hydrogeological can be added to increase confidence in the model, and subsequently, closure strategies and landform design.

There are a variety of mine waste management and mitigation options applicable for higher risk stratigraphies that have AMD generation potential. Material would typically be encapsulated, co-disposed with inert or acid neutralising material, or a combination of the two. These are evaluated on a site specific basis following the completion of appropriate material characterisation, risk assessment and modelling. Alternatives include sub aqueous in pit disposal as appropriate, which also has the potential to address mine void legacy issues.

Based on the findings of the OB29/30/35 Preliminary AMD risk assessment (Section 4.3.2) the potential for AMD generation from PAF material is expected to be low. Should any PAF material be encountered the long term AMD management strategy for OB29/30/35 operations is to develop encapsulation cells within an out-of-pit or in-pit OSAs. The encapsulation area will be developed such that the potential for surface water and or ground water interaction with the PAF material will be minimised.

The management of PAF materials and the development of pit lakes was further explored in the Preliminary AMD Risk Assessment for the OB29/30/35 mine conducted by SRK in May 2013. A preliminary source-pathway-receptor risk assessment was completed to assess the magnitude of potential contaminant loading represented by each source (overburden stockpile areas, stockpiles, exposed pit walls, pit lakes) via potential contaminant transport pathways (surface water, groundwater) to the identified potential environmental receptors (including surface water bodies, groundwater, and ecology).

The potential for AMD from the overburden stockpile areas is considered to be low, but cannot be discounted. Similarly, the potential for AMD in pitwall runoff is considered to be low. The overall proportion of material with relatively high total sulphur content (in excess of 0.2%) exposed on the pitwalls is low (less than 2%). It is, however, noted that the sulphur-bearing materials form isolated ‘hot-spots’, generally located near the crest of the pit walls. As these locations lie above the expected level of any potential pit lake, it is possible they could represent a source of ongoing solute release in pit wall runoff. If this is the case, an approach will be developed for limiting the exposure and managing the release.

Pits remaining as open voids post closure would act as groundwater sinks and would capture some seepage and runoff from the OSAs. Under this scenario, although the pit lake would be anticipated to salinise over time due to evapo-concentration, the risk of any impacts on the key environmental receptors is considered negligible.

Based on the current state of knowledge AMD risk for OB29/30/35 closure and rehabilitation will be managed as follows:

- Should PAF materials be encountered it will be appropriately encapsulated within the OSAs, sub aqueous in pit disposal will also be considered.
- Further studies will be completed in accordance with the AMD Management Standard and as outlined in Section 7.5 to further guide closure planning.

7.4.2 Groundwater

Should pits be left as open voids at the completion of below water table mining, they will result in the development of pit lakes that reach equilibrium on a balance of pit inflows and evaporation, which have the potential to impact local and regional groundwater and surface water resources. Public safety also requires consideration.

BHP Billiton Iron Ore uses Hydrogeological Conceptual and Predictive Modelling to inform closure planning. Groundwater flow modelling is undertaken to predict the range of possible outcomes for pit voids post closure, which guides further technical studies and site-specific closure plans to focus on key uncertainties. Groundwater flow models provide predictions for water level recovery rates and equilibrium levels for the pit void options available at closure.

The initial conceptual model is updated and validated throughout the life of mine as more data became available. As with hydrological modelling, such updates and validations would inform closure strategies landform design from conceptual through to detailed, thereby reducing risk and increasing confidence.

The outputs from this work would guide closures strategies, provide input to hydrogeochemical assessments (section 7.4.1) and inform environmental impact assessments using and source, pathway, receptor approach.

Hydrogeological assessments predict OB29/30/35 pits will gradually become saline at rates defined by the salinity of groundwater and surface water inflows, the volumes of the pits and evaporation rates. The rate of salinity increase will be slow, typically less 5,000mg/L every 100 years, and the increases will initially be linear. However, after a thousand years or so, when the pit lakes will become hypersaline, the evaporation rates will start to decline and the rate of salinity increases will taper off.

However, as the pits are expected to be groundwater sinks, there is not expected to be an impact on surrounding groundwater or surface water quality. There is the potential, when the pit lakes become hypersaline (after a thousand years or so), for some density driven flow from the base of the pit. That is, dense saline water could “sink” through fresher groundwater. Further groundwater modelling is required to confirm the groundwater behaviour at closure.

The closure options for the OB29/30/35 pits include in-filling of pit voids at the completion of mining to above pre-mining water table levels, partial backfilling of the pits and leaving the pits as open voids. The in-filling of pits with waste rock and other material to above the pre-mining water table is unlikely to present any long-term impacts. The option of retaining open voids, can present changes to groundwater inflow and evaporative losses during the pit void recovery, however this impact is expected to be localised.

The impacts associated with the presence of PAF material within the OB29/30/35 pits was further explored in the Preliminary AMD Risk Assessment conducted by SRK in May 2013 and is discussed further in Section 7.4.1.

Based on the current state of knowledge, further studies (Section 7.5) will be undertaken will be undertaken to determine the mine void closure strategy (including consideration of backfill) to manage groundwater risks.

7.4.3 Surface Water

The surface water system at closure will be designed to meet the closure principle of no significant impact on baseline surface water quality and flow regimes in nearby creeks. Key considerations will

include an assessment of the likelihood that mine voids will 'capture' creek lines, or that major climatic events will result in damage to surface water controls that may in turn impact future groundwater/surface water interactions and hence, long term water balances.

The design of surface water management works to meet operational needs will include consideration of closure requirements. These designs will then be revisited 5 years prior to the closure of the site where closure design will be developed. The development of this design near to the end of the pit life will permit closure design to benefit from the data captured through the operational period as well as the increased certainty around final landforms.

The surface water management post closure will focus on ensuring long term stability of OSAs as well as Whaleback Creek and Southern Creek in the vicinity of the mined pits. The closure design will consider:

- Surface Water Runoff from OSAs
- Natural creek sections adjacent to Pits.
- Diversion/realignment Sections.

The drainage from the OSAs and any upstream catchments will be managed to ensure landforms are stable in the long term. The final shaping of OSAs is further discussed in Section 7.4.4.

The natural creek areas next to the pits will include flood protection bunds for protection during operation. The flood protection works required for closure will need to be stable, maintenance free landforms and may be different to the operational flood bunds. The options which would be considered include additional rock armouring, changes to the elevation and slope of protection bunds and stream management to locally reduce velocities at critical locations.

In creek sections which are diverted for mining operations, the initial diversion design will consider closure requirements. The systems will be designed to achieve comparable hydraulic and geomorphological characteristics to the original creek systems. Seepage from the creek base and interaction with groundwater will be studied and measures incorporated to reduce seepage where appropriate. The design Average Recurrence Interval (ARI) for the diverted creek sections will be selected on a case by case basis. Consideration will be made to the fate of flood events in excess of the design ARI to ensure that the system is stable in the long term. This consideration may include the use of spill out structures to divert an increasing proportion of the flow above the design ARI event into mine voids. Design features of spill out structures may include heavy rock armouring and include features such as launching aprons, baffles and weirs to improve stability.

Based on the current state of knowledge surface water closure issues will be addressed by:

- Data collection to improve understanding of creek hydrology
- Investigation of the suitability of operational surface water controls and the required modifications to meet closure requirements.
- Design of an integrated landforms across all domains taking account of the post closure surface water regime as detailed in Section 7.4.4.

7.4.4 Final Landforms

The development of the post mining landform design is an iterative process, integrating all the closure domains. Critical to the transfer of the operational domains, particularly OSAs, to a successful and sustainable landform design is a fundamental understanding of the chemical and physical properties of the soil and/or waste material used to construct the final landform. In particular, the surface materials must be appropriate to withstand erosive forces and sustain vegetation growth in the long term. Inherent in this consideration is the water and nutrient holding capability of the growing media. Similarly, its chemical properties must have low AMD and dispersivity / sodicity risk.

BHP Billiton follows the adaptive management framework, with the mine plan and closure landform designs evolving over the life of mine as constraints information and knowledge becomes available as

a function of time. Specifically BHP Billiton Iron ore undertakes a suite of work to inform and guide the landform design process including:

- **Resource Sterilisation Assessment:** Assessment of resource or potential mineralisation beneath an area typically selected for proposed OSA construction. Drilling, surface mapping, geological modelling and/or resource modelling data are typically used to identify and quantify any mineral resources within the area that may become 'sterilised' or economically unviable to mine if the proposed closure strategy proceeds. This assessment also applies to pit voids where backfill is proposed as part of the operations and/or closure strategy. It would add to the spatial dataset to assist with OSA positioning at the conceptual stage.
- **The Resource Block Model:** Contains geological resource information for planned and operational mines. The model contains amongst other things the relevant stratigraphies and geochemical properties of the rock mass allowing for the identification of ore and waste material. Examination of the resource model and associated drilling would be undertaken prior to closure being considered to ensure that a high level of certai**nt**y is held on sterilisation of the orebody.
- **Waste Characterisation:** A critical component of a sustainable landform is the physical and geochemical nature of the waste material used in landform construction. To this end, waste characterisation would inform a suitable material for use on final slopes, with any inappropriate material being buried within the OSA or mine void as appropriate.
- **Mine Plan Optimiser:** Mine planning software would be used to assist in generating an optimal pit design based on financial and geotechnical parameters, assuming an appropriate risk level. The mine planning software is also used to schedule multiple deposits based on optimal maximised net present value (in considerations of operational and environmental constraints). Schedules provide the necessary information to develop optimal waste strategies and are an iterative process. This informs waste production rates which would subsequently inform waste volumes and therefore, OSA design.
- **Numerical Erosion Potential Modelling:** Environmental surface erosion modelling can be undertaken as part of the detailed OSA design stage to evaluate the predicted rates and locations of erosion on a final landform. This process is supported by numerical inputs obtained from the material characterisation programs. This activity supports planning considerations aro**un**d final landform design and waste scheduling objectives.
- **Physical Erosion Potential Modelling:** The physical hydraulic examination of mine waste that forms the outer surfaces of OSA landforms is undertaken to determine the key erosion characteristics of the waste material. This is undertaken within laboratory conditions using predicted rainfall events using local rainfall data. It provides validated data for the numerical modelling on how well a specific waste rock type behaves in surface flow conditions, and would inform detailed OSA design considerations regarding stable slope angles and material use.

OB29/30/35 Closure Final Landform Design will require integration of all the domains as listed in **Table 2** (OSAs, infrastructure, mine voids (above and below water) and roads)

The opportunities to minimise the size of the OSAs by increasing the amount of overburden material used to infill final voids (as void areas become available and/or as resources are mined out) is explored as part of ongoing operational planning.

In regards to pit voids, current blasting practices used to reduce the potential for pit wall failure post-closure include the use of trim shots. Geotechnical and hydrological assessments will be used to inform the pit design and reduce stability issues, with surveys being undertaken to check final pit walls against designs.

The decision making process to determine how these domains will be integrated into a closure final landform design will take into consideration the full suite of potential closure impacts utilising tools discussed above. The final landform design or OB29/30/35 will develop over the life of mine based upon multi-disciplinary inputs including for example:

- exploration data;
- mine waste characterisation;
- hydrology, hydrogeology, and hydrogeochemistry information;
- end land use and tenure considerations;
- the physical footprint;
- cumulative impacts;
- visual impact considerations;
- mine planning, scheduling, and waste volumes;
- flora, fauna and heritage issues; and
- stakeholder inputs.

All of these factors interact over the life of mine in an iterative process such that the evolving mine closure strategy may progress from conceptual to detailed and include the specifics on landform design.

Based on the current state of knowledge the final landform for OB29/30/35 closure and rehabilitation will be developed iteratively throughout the life of the mine to integrate the suite of mine closure domains and be informed by further studies including waste characterisation as outlined in Section 7.5.

7.4.5 Rehabilitation

The revegetation program will be designed to establish native vegetation that blends with the surrounding areas and will provide habitat and foraging areas for native fauna.

The establishment of a robust soil profile is critical for the successful establishment of vegetation and compliance with the relevant completion criteria (see Section 8). Prior to use in rehabilitation, topsoil is stripped and stored (if required) in accordance with the procedures outlined BHP Billiton Iron Ore's Growth Media Management Procedure (BHPBIO 2011e).

The suitability of soils as growth media during rehabilitation is being investigated as part of the Growth Atlas Study between 2013 and 2015. The study will establish the quantity of current stockpiled material in addition to identifying alternative growth media materials within waste stockpiles that can be utilised for rehabilitation activities.

The Rehabilitation Standard requires that revegetation be conducted so as to establish plant species that will support the approved post-mining land use. The selection of plant species used in revegetation is to be selected from the revegetation species lists generated for each site as part of planning works, and must include a range of typical vegetation assemblages suited to the post-mined landform. The diversity of vegetation types used in rehabilitation must be maximised in order to improve habitat value and encourage colonisation by a wide range of fauna.

Revegetation at the OB29/30/35 mining operations will use local provenance native seed (from the local area, but as a minimum from within 100 km of site within the Pilbara Biogeographic Region) consistent with vegetation associations and native species recorded in the mine area prior to mining.

Based on the available climate change predictions, BHP Billiton Iron Ore considers that the most appropriate rehabilitation revegetation approach is to design landforms and select native species based on the current climatic conditions. If there were to be an effect on rehabilitated landforms and revegetation from climate change, those changes would reasonably be expected to be gradual and would be experienced across the entire region, including adjoining unmined areas. By revegetating based on the current climatic conditions the mine will blend in with the surrounding vegetation, regardless of the effect of climate change (i.e. any future changes would affect unmined and rehabilitated areas equally). Major differences between regional and post-mined vegetation will be

managed by ensuring sufficient diversity of species within rehabilitated sites, so that the natural adjustments to a changing climate will be accommodated within the local species pool.

Ecological barriers may exist for particular species in rehabilitated landforms. Examples of ecological barriers for certain Pilbara species include the absence of; old growth spinifex vegetation, suitable sized gravel/stones, caves and rock crevices or alluvial soils (Outback Ecology 2012). Many fauna including migratory species depend on temporary and permanent water sources and associated habitat that occurs along drainage lines.

During rehabilitation works suitable material will be identified for use in the creation of landforms that mimic those of surrounding areas, with natural drainage lines being restored where practicable. Specialised fauna habitats will be established if available resources can be identified, however there are currently no plans to disturb new areas to source these materials.

Revegetated landforms (as part of progressive rehabilitation) will be monitored to determine adequacy of habitat structure, recolonisation of landforms and success of revegetation batter.

Based on the current state of knowledge, the rehabilitation of disturbed areas of the OB29/30/35 operations will be undertaken consistent with the Rehabilitation Standard and include;

- WAIO Growth Atlas Study will be undertaken to study suitability of soils as a growth media;
- Growth media management in accordance with the BHP Billiton Iron Ore's Growth Media Management Procedure (BHPBIO 2011e); and
- Local provenance native seed (from the local area, but as a minimum from within 100 km of site within the Pilbara Biogeographic Region).

7.5 Closure improvement

Section 7.3 provided an overview of closure issues, modelling and assessment and management initiatives which BHP Billiton Iron Ore will undertake to progress Closure Planning during the life of the OB29/30/35 mine. **Table 17** summaries these activities to fill gaps in the existing knowledge base and further define the closure methodology.

Table 17: OB29/30/35 Closure Improvement Activities

Knowledge Gap	Proposed Activity	Indicative Timing
Waste characterisation	Expand the resource block model capability to differentiate between waste that is beneficial or problematic for closure outcomes.	2016
	Continue Marra Mamba waste material characterisation to inform OSAs closure design that meets closure objectives.	2015
Landform design	Develop the waste scheduling process that ensures the optimal placement of waste within OSA structures. Further development of scheduling processes that consider the wastes material characteristics for destination scheduling whilst optimising the ore schedule.	2016
	Develop the conceptual and detail closure management and design tools (including application timing) to identify the optimal closure OSA design and mine void outcomes	Less than 5 years to closure
	Detailed closure landform designs (integrating all domains) to be developed based on outcomes of technical studies and assessments.	Less than 2 years to closure

Knowledge Gap	Proposed Activity	Indicative Timing
Hydrogeology	Conduct hydrodynamic trial at OB29 and OB30, with comprehensive data collection, collation and monitoring to improve technical understanding and reduce uncertainty (monitoring and validation to continue during operational dewatering phases at OB29/30/35)	2015
	Develop numerical groundwater model for the OB29/30/35 area, calibrating to available data and refining closure scenario predictions.	2015
Surface Water Hydrology	Develop design principles for structures remaining post mining that will be exposed to surface drainage (weirs, diversion channels, flood protection structures, etc.).	2018
	Where OSAs encroach in the flood zones, additional studies will be completed to determine the 100 year Average Recurrence Interval (ARI) flood event.	When triggered
	Further develop the parameters and design objectives to ensure that surface water drainage requirements are included at the various stages of planning and execution.	2015
AMD	Static geochemical tests will be undertaken to characterise the AMD generating potential of the various waste rock types.	2014
	Further geochemical assessments (e.g., kinetic testing or hydrogeochemical modeling) will be conducted as appropriate to further assess risks and subsequently, closure strategies and landform design.	2015
Soils	WAIO Growth Atlas Study will be undertaken to study suitability of soils as a growth media.	2013-2015
Land use	Final land use planning study to be undertaken. Stakeholders to agree and endorse the final land use for OB29/30/35 operations.	Within 2 yrs of closure
Decommissioning Plans	Develop detailed decommissioning plans for site infrastructure	Within 3 yrs of closure
Government and stakeholder consultation	Consultation will continue to be undertaken with identified stakeholders in line with the broader Stakeholder Consultation Programme.	Ongoing
Potentially Contaminated sites	Contamination assessments will be undertaken for any potential contaminated site, in accordance with the requirements of the Department of Environmental Regulation and relevant technical guidelines. Prepare and implement remediation plan, as appropriate.	Ongoing
Completion Criteria	Review and refine completion criteria taking into consideration improved knowledge to develop more measurable criteria	Ongoing
Progressive Rehabilitation	Locations which may be available for a minimum of five years for rehabilitation/landform trials will be investigated	Ongoing

8. Completion criteria

Completion criteria are the measures against which implementation of closure objectives can be assessed. As closure objectives cover a broad spectrum of outcomes, so must the completion criteria for example; final land use, safety, landform, sustainability, hydrology, decommissioning, contaminated sites and land management.

BHP Billiton Iron Ore will continue to work with regulators and stakeholders to refine the criteria for the OB29/30/35 mining operations in order to produce robust measures for closure completion.

8.1 Basis for development

Working completion criteria for the OB29/30/35 mining operations have been developed with reference to the following sources of information:

- Relevant guidelines and codes of practice issued by the Australian and WA Governments, which currently includes:
  - Guidelines for Preparing Mine Closure Plans (EPA/DMP 2011);
  - Rehabilitation of Terrestrial Ecosystems (EPA 2006); and
  - DITR's Leading Practice Sustainable Development Program for the Mining Industry Handbooks on Mine Closure, Mine Rehabilitation, Biodiversity Management, and Performance Assessment – Monitoring and Auditing.
- Key guidelines on mine site closure and rehabilitation issued by industry and international councils that are relevant to OB29/30/35 mine, including:
  - the Strategic Framework for Mine Closure (ANZMEC and the Minerals Council of Australia 2000);
  - the Planning for Integrated Mine Closure Toolkit (ICMM 2008);
  - ICMM - Good Practice Guidance for Mining and Biodiversity (2006); and
  - Minerals Council of Australia - Enduring Value, the Australian Minerals Industry Framework for Sustainable Development (2005).

Development of the completion criteria for OB29/30/35 will integrate a number of key components related to the establishment, monitoring and management of rehabilitation including:

- rehabilitation objectives, including ecological completion criteria, must be achievable and based on the findings of relevant monitoring and research programs;
- rehabilitation performance will be measurable using accepted monitoring and performance indicators;
- rehabilitation must be sustainable under the designated post-mining land use;
- progressive rehabilitation initiated during early mine design stages, involving material chemical and physical characterisation to inform the design of OSAs and plan dumping and rehabilitation operations;
- the principle of progressive signoff will be adopted where applicable, to facilitate the development of rehabilitation to acceptable standards. Criteria that change over time will not be applied retrospectively;
- specific features that do not reflect typical land uses for the area (such as mine void pit lakes) will be subject to independent environmental risk audits'
- long-term management operations following mining/closure/signoff (e.g. maintenance of access tracks, fire) to be no greater than those of areas prior to mining, or where extra

management actions may be required, a mechanism has been put in place for addressing these; and

- ensuring operational criteria reflect key stages of the mining operation, including planning, operations, early establishment, development, and closure.

8.2 Approach

Assessment of rehabilitation against completion criteria will be applied throughout the various stages of rehabilitation planning, operations and management. Assessment of rehabilitation success during the early years of ecosystem development ensures that corrective actions can be carried out if necessary without disturbing older rehabilitation, and while mining operations are still nearby. However, it should be noted that for older rehabilitation, it may not be possible to assess some (perhaps many) of the operational and establishment criteria. For these areas, assessment of rehabilitation success will need to focus on the development stage.

Completion criteria standards and milestones will be formally reviewed every three years, where necessary they will be revised by mutual agreement between BHP Billiton Iron Ore, key stakeholders and regulatory authorities to adopt any significant advances in cost-effective rehabilitation techniques. More frequent review can take place over the next five to ten years where improvement opportunities are identified through research and development programs.

This process has been refined in consultation with regulators, and is applied on a site-by-site basis across BHP Billiton Iron Ore Pilbara operations to develop site-specific criteria. A timeline illustrating this approach is shown in Plate 2 below.

Criteria have been defined based on successive stages of closure:

- **Stage 1 Planning**: Describes criteria that must be met to confirm that the necessary planning and operating procedures have been developed and agreed with regulators and other stakeholders.
- **Stage 2 Rehabilitation Operations**: Describes criteria that must be met to confirm that rehabilitation operations have been implemented according to the above agreed planning and operating procedures. The assessment method for this will be by reviewing and auditing rehabilitation plans and records, and site inspections as required. Note that for older existing rehabilitation a simplified approach to setting agreed criteria may be developed.
- **Stage 3 Early Establishment Rehabilitation**: Assesses whether completed rehabilitation has established with no early problems (e.g. erosion, exposed dispersive material) apparent. The early establishment assessment provides confidence that vegetation is establishing and developing, and identifies where corrective work may be required. Assessment is initially by site inspection, followed by broad scale vegetation establishment monitoring. Note that for older existing rehabilitation, it may not be possible to determine whether some revegetation criteria have been met; nevertheless, rehabilitation records should help determine likely stability and performance.
- **Stage 4 Rehabilitation Development**: Determines whether the rehabilitation is developing appropriately towards the designated final land use and has reached or exceeded various development standards and milestones. Assessment is by site inspections, monitoring (both detailed monitoring of typical rehabilitation, and broad scale monitoring of other sites), and research projects where required.
- **Stage 5 Closure:** Addresses final closure stage management and land capability issues

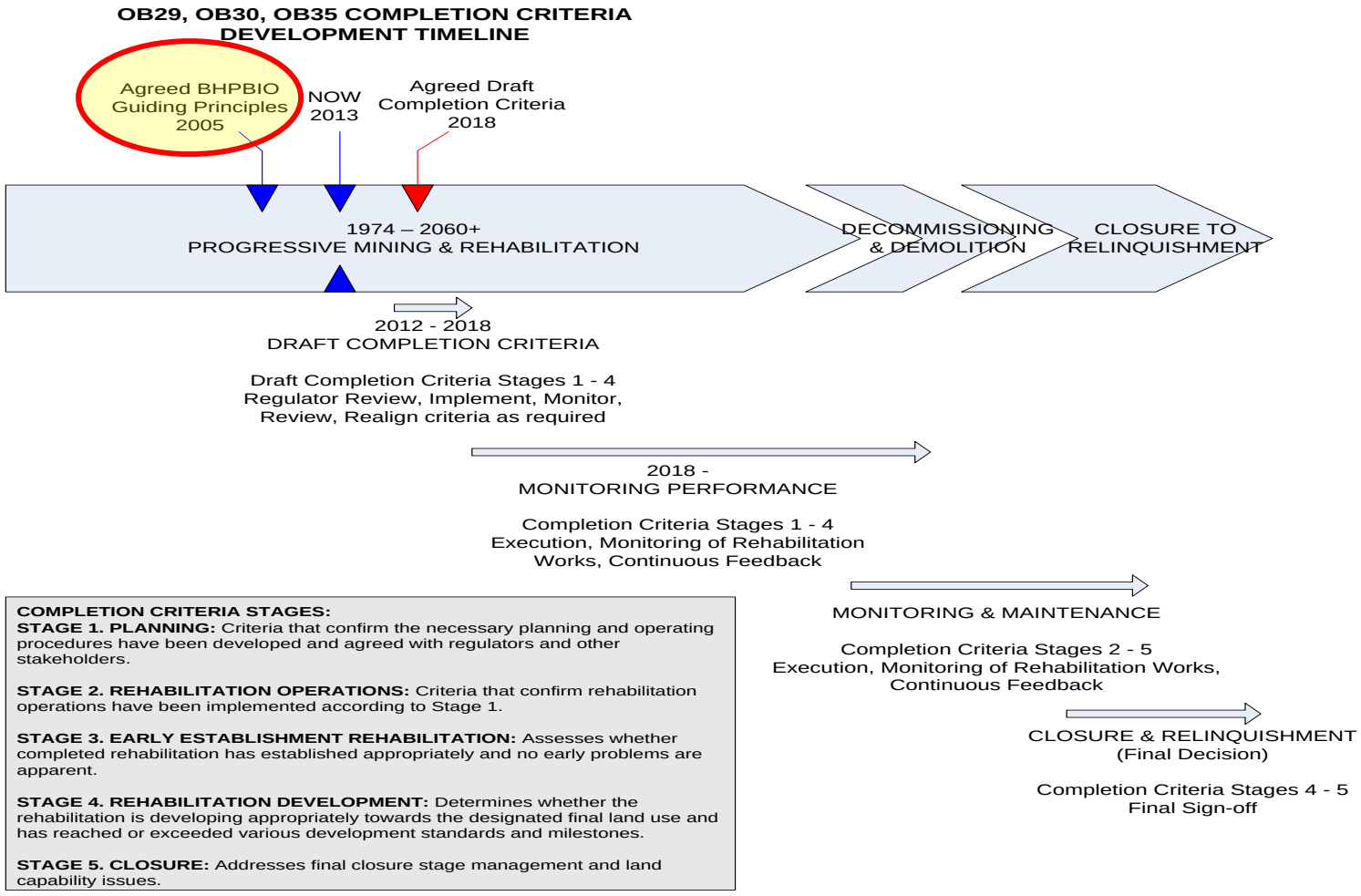

Plate 2: OB29/30/35 Completion Criteria Development Timeline

8.3 Development of criteria

Closure and rehabilitation objectives are based on the land uses applicable to the particular area, in recognition of the fact that the land is altered fundamentally from its pre-existing condition. The completion criteria for the Operations are designed to confirm that the objectives have been met. They provide both BHP Billiton Iron Ore and government with clear direction for the planning, establishment and management of mine rehabilitation at the site. They also provide a detailed understanding of the desired state of lands influenced by mining operations, at the time when any obligation for ongoing financial input or legal responsibilities by the mining companies effectively ceases, i.e. at signoff.

The purpose of the completion criteria is to ensure areas will display self-sustaining characteristics of surrounding areas and give Government regulators confidence that, to the maximum possible extent, they can be managed in the long term according to the intended land use (or uses), using normal management practices without the input of additional resources.

Completion criteria will continue to be developed by BHP Billiton Iron Ore over the next five years to integrate findings from ongoing research and development programs including landform trials, improved knowledge on the ecosystem development derived from rehabilitation monitoring programs and greening initiatives. Future revisions of the criteria will focus on developing measurable metrics based on site specific data.

The completion criteria for the OB29/30/35 mining operations are presented in **Table 18**. For clarity, column headings are defined as follows:

- **Criterion Objective:** The purpose or objective of the particular criterion.
- **Criterion Standard or Milestone:** An agreed standard or level of performance which demonstrates successful closure of a site for that particular objective.
- **Verification Procedure**: How BHP Billiton Iron Ore will demonstrate that the criterion has been met. This will generally require either reporting in the AER when a specific criterion is met, or production of a separate rehabilitation monitoring report addressing one or more criteria, e.g. development of vegetation.
- **Domain:** Areas of similar operational landuses and closure requirements. Additional information relating to closure implementation for each closure domain is provided in Section 10.2.

Table 18: OB29/30/35 Completion Criteria

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
1. FINAL LAND USE					
1.1 Final Land Use	Agreed final land use has been determined in consultation with relevant stakeholders.	All	End land use for the area is considered likely to revert to low intensity grazing on the underlying Pastoral Lease, however, this would be determined in consultation with stakeholders, and approved by the administering authority during the life of the mine. Specific rehabilitation objectives have been developed to ensure that, when met, areas will fulfil the post-mining land use requirements.	Land use and objectives are documented in the Mine Closure Plan as reviewed and agreed by the stakeholder groups mentioned.	Section 6.3
2. SAFETY					
2.1 Safety	The site is safe for use by humans and wildlife under the agreed final land use.	All	All hazards that could endanger the safety of any person or animal have been identified and eliminated where practical. All residual safety and health hazards have been identified, controlled through appropriate active controls, and appropriate isolations (e.g. fences) and warning signs have been put in place.	All relevant DMP Guidelines have been met. All sites are safe to access as determined following site inspection by a Mines Safety Inspector.	Sections 7 and 10
2.2 Landform Safety	Final landforms are safe.	All	Landforms have been constructed as described in criterion 2.1. They conform to DMP guidelines for structural stability, with no significant slumping or failure of constructed slopes or berms. No hazards to humans or wildlife have developed thorough erosion, subsidence, AMD or otherwise. Inspections of the rehabilitated landforms have been conducted to monitor their stability over time, with monitoring conducted after each significant rainfall season.	Report on landform construction methods, and any additional maintenance works undertaken. Rehabilitation inspections (including undertaken on maintenance earthworks) confirm earthworks have met final landform designs. Rehabilitation monitoring results (including erosion monitoring) Report on performance in relation to design criteria and DMP Guidelines.	Sections 7.4.1, 7.4.4 and 11.1.7

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
3. LANDFORMS					
3.1 Visual Amenity	Visual amenity of constructed landforms is compatible with that of local Pilbara landforms.	All except Voids	Within the constraints imposed by aspects such as the physical nature of the materials available, tenement boundaries, and proximity to streams, landforms have been constructed to blend into the surrounding landscape and are similar to the existing regional landforms.	Report on rehabilitation works confirms landform construction undertaken according to BHP Billiton Iron Ore relevant procedure. Rehabilitation inspections confirm earthworks have met final landform designs.	Section 7.4.4
3.2 Waste Characterisation	Materials with poor growth characteristics do not limit rehabilitation.	Anywhere problem materials present	All overburden placement in OSA's has been undertaken in accordance with a long term overburden storage plan produced and approved by the Mine Manager, all future overburden placement will be in accordance with this plan (BHPBIO, 2012a). Mine waste material likely to provide a poor growth medium (e.g. dispersive and incompetent material), has been placed appropriately in the OSA.	Waste characterisation report available for review. Report on landform construction methods available for review. Rehabilitation inspections confirm earthworks have met final landform designs.	Section 4.2 and 7.4.4
3.3 Landform Stability	Constructed landforms are structurally stable.	All	Post-mining landforms have been constructed according to guidelines and standards outlined in OB29/30/35 Mine Closure Plan. Detailed landform design standards include: Residual mine voids have been left as run-of-mine where geotechnically stable to DMP safety standards, possibly with open water or partially filled with overburden; A compacted bund has been constructed along the crest of the OSAs to reduce surface water runoff from OSA slopes and minimise potential erosion impacts; and Earthworks consist of reshaping the slope to less than 20°, however, the type of material used (defined in Criterion 3.2) will ultimately determine slope stability and therefore final gradient.	Report on rehabilitation works at construction confirms all DMP Guidelines have been met and sites constructed according to BHP Billiton Iron Ore relevant standards and procedures. Rehabilitation inspections confirm earthworks have met final landform designs.	Sections 7.4.4, 10.1.1, 10.2.1, 10.2.2 and 11.1.1.

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
3.4 Surface Stability	The constructed soil surface is stable and showing no signs of significant erosion.	All	The post-mining landform is stable and responds to erosive forces in a similar manner to equivalent naturally occurring landforms composed of similar rock types. Soil surface on slopes is stable and showing no signs of significant erosion. Signs of significant erosion may include, but is not limited to, the following: channelised flow resulting in extensive active gullies; failure of banks, berms or bunds; evidence of significant sheet erosion e.g. large accumulation of silt at base of slope, exposed subsoil, poor seedling establishment; and maintenance works performed to improve performance, where necessary.	Report on landform construction methods, and any additional maintenance works undertaken. Rehabilitation inspections (including undertaken on maintenance earthworks) confirm earthworks have met final landform designs. Visual assessment and monitoring, taking into account slope, available materials and vegetation cover, and relevant research projects on surface stability of comparable rehabilitated landforms. Rehabilitation monitoring results (including erosion monitoring) indicate gullies and rills are stabilising.	Sections 10.1.1 and 11.1.1
3.5 Landform Surface	Landform surface material promotes water infiltration and reduces erosion and crusting.	All (excluding Voids)	There has been ripping (light or deep) of rehabilitated surfaces as required to maximise water infiltration, to reduce erosion potential and support establishment of vegetation (BHPBIO 2011b).	Report on landform construction methods. Rehabilitation inspections confirm earthworks have met final landform designs.	Section 10.1.2
4. SUSTAINABILITY					
4.1 Sustainability	Rehabilitation is sustainable and the land capability and groundwater are suitable for the agreed end land use	All where relevant	Monitoring, research data and site inspections indicate that the rehabilitation will be sustainable and will continue to fulfil rehabilitation objectives relating to the agreed final land use in terms of flora, vegetation, fauna, and surface and groundwater hydrology.	Documented in relevant monitoring and research reports; site inspections.	Section 11.1

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
4.2 Resilience	Vegetation is sustainable and resilient to likely impacts such as fire, drought and grazing (where applicable, if managed according to agreed guidelines).	All where relevant	Monitoring and/or research results have shown that recruitment of native perennial species is occurring or is likely to occur on the site (e.g. evidence of flowering, fruiting, soil seed bank or second generation seedlings). Research trials in rehabilitation representative of the same age and technique have demonstrated its ability to regenerate following burning (in terms of key parameters such as cover, richness and density); rehabilitation has reached the age where plants are likely to tolerate fire or regenerate/reseed. Monitoring has shown that the rehabilitation can survive one or more seasons of low rainfall.	Review of progress and performance of Rehabilitation Development Monitoring results, and related rehabilitation monitoring procedures. Monitoring results reported in AER. Research findings from trials on representative rehabilitated areas investigating post-disturbance recovery of revegetation.	Sections 10.1.3 10.2.2 10.3 and 11.1
4.3 Growth Media	A suitable growth medium has been constructed to facilitate plant establishment and growth.	All where revegetation is planned	The depth and characteristics of newly constructed landforms surface soils and subsoils are suitable for plant growth in terms of their structure, water holding capacity, and lack of materials that might affect plant growth or survival (i.e. they are suitable for establishing target vegetation communities and supporting the agreed final land use). Topsoil stripping has been undertaken following the relevant BHP Billiton Iron Ore Rehabilitation Standard and procedures. Topsoil stockpiles have been managed BHP Billiton Iron Ore Rehabilitation Standard and Procedures, and the relevant plans and databases have been prepared, updated and maintained. Where available, topsoil has been used to provide a suitable medium for plant establishment and a source of propagules.	Topsoil reconciliation database information available. Review of site waste characterisation report. Report on landform construction methods. Rehabilitation inspections confirm earthworks have met final landform designs. Rehabilitation monitoring results provide feedback to determine suitability of growth medium.	Sections 4.5, 7.4.5, 10.1, 10.3 and 11.1.

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
4.4 Provenance	Vegetation is locally endemic.	All	Revegetation at OB29, OB30, and OB35 has used local provenance native seed from the Pilbara IBRA region consistent with vegetation associations and native species recorded in the OB29, OB30, and OB35 area prior to mining.	Site Rehabilitation Report including seed mix summary. Seed Database. Rehabilitation monitoring results.	Sections 7.4.5, 10.1.3 and 11.1
4.5 Vegetation Development	Vegetation is suited to the agreed final land use.	All with revegetation	Established vegetative cover should be self-sustaining and similar to the surrounding undisturbed vegetation. Monitoring of rehabilitated areas has been undertaken until it can be demonstrated that the landscape and vegetation is progressing towards a self-sustaining state. Rehabilitation Development stage density or cover target to be developed.	Monitoring of rehabilitation development vegetation using BHP Billiton Iron Ore Rehabilitation Monitoring Procedures. Monitoring results reported in AER. Report on performance in relation to rehabilitation methods, using site inspection and rehabilitation monitoringsites to assess whether criteria have been met.	Sections 7.4.5, 10.1.3 and 11.1
4.6 Weeds	Potential for rehabilitation to meet the agreed post-mining use is not limited by the presence of weeds.	All with revegetation	All requirements of the WAIO Weed Control Management Procedure have been implemented. No Declared Pests (as defined under the *Biosecurity and Agriculture Management Act 2007*) are present in greater abundance than baseline surveys indicate. Populations of environmental weeds have been monitored and controlled; weed abundance does not exceed that in areas representative of the agreed final land use. All Declared Pests and environmental weeds recorded in the rehabilitation have been effectively managed.	Review weed monitoring and control undertaken to ensure compliance with the WAIO Weed Control and Management Procedure (BHPBIO, 2010c). Report on weed monitoring and control records. Measurement of weed abundance compared to representative reference sites, using cover or counts (as appropriate according to the species). Monitoring and visual inspection of vegetation establishment and representative reference areas.	Section 11.1

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
4.7 Fauna Recolonisation	There is evidence that local native fauna are colonising the rehabilitation.	All where opportunities exist	As per the BHP Billiton Iron Ore Rehabilitation Standard and Procedures include, where practical, the creation of habitat features similar to those found in the OB29, OB30, and OB35 area prior to mining. Habitat creation initiatives include, but are not limited to the following: Creation of rock piles in OSAs and/or mine void areas to provide potential habitat for sheltering and breeding of fauna species. Return of vegetation debris, logs and rocks to areas which have been disturbed to provide microhabitats for recolonising fauna Vegetation includes locally endemic species of known importance to fauna. Vertebrate fauna surveys have been conducted in representative rehabilitated areas; these demonstrate that local bird, mammal and reptile species are recolonising in typical rehabilitated sites. Signs of fauna recolonisation are apparent. Vertebrate pests (rabbit, dingo, donkey, goat and cat) have been controlled where necessary.	Rehabilitation inspections confirm earthworks have met final landform designs. Fauna habitat assessment using site inspection and evaluation of vegetation monitoring results. Vertebrate fauna surveys using standard methods have been undertaken and reviewed in representative rehabilitation areas. Vertebrate pest species have been controlled as required.	Sections 10.1 and 11.1.3

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
5. HYDROLOGY					
5.1 Surface Hydrology	Rehabilitation drainage patterns have been established and impacts on natural surface water flows minimised.	All where relevant	The quality of water returned to local and regional surface water resources will not result in significant deterioration of those resources. Surface water quality should fall within guidelines for specific-end land use (e.g. stock watering requirements). Water quality monitoring of surface water will be undertaken after significant rainfall events, typically greater than 25mm, produce flows in Whaleback Creek in the general vicinity of OB29/30/35, and monitoring results reported in AER. There are no significant, physical off-site impacts A drainage management plan will be prepared, showing the inputs, outputs and control structures needed for surface water flow.	Documents reviewed and signed off as required. Monitoring results reported in the AER. Report on landform construction methods. Site inspection to verify no unplanned impacts on surrounding natural drainage patterns.	Sections 4.7, 7.4.3 and 11.1.4.
5.2 Groundwater Hydrology	Mining-related impacts on groundwater have been minimised.	All where relevant	Ponding from storm water that may occur in the pit will be left to evaporate or infiltrate into the formation. In the event that monitoring identifies that contamination of groundwater resources in the mine areas or borefield is occurring; an investigation has been conducted to determine whether the contamination is the result of mining-related activities; and where this is the case, management measures have been implemented to decontaminate the affected area, unless otherwise agreed with the administering authority.	Review compliance of operations with the relevant water extraction licence(s) issued under the Rights in Water and Irrigation Act, 1914 and discharge licence(s) issued under Part V of the EP Act. Review of water monitoring reports to ensure there are no unplanned impacts to receptors.	Sections 4.8, 7.4.2 and 11.1.5

OB29/30/35 Completion Criteria					
Criterion	**Criterion Objective**	**Domain**	**Criterion Standard or Milestone**	**Verification Procedure**	**MCP Section**
6. DECOMMISSIONING					
6.1 Infrastructure	Infrastructure has been decommissioned and removed	All where infrastructure exists	Agreement has been reached with Government regarding whether any infrastructure is required to remain post-mine closure. Infrastructure not required has been removed (and recycled/reused where practicable) and the site rehabilitated to the approved post-mining land use.	Site inspection and documentation of infrastructure removal and rehabilitation operations.	Sections 10.2.3 and 10.2.4.
7. CONTAMINATED SITES					
7.1 Contaminated Sites	Contaminated sites have been documented and addressed	All where relevant	All commitments relating to the identification and management of contaminated sites, as per *Contaminated Sites Act 2003* have been fulfilled.	Report documenting compliance with specific requirements.	Section 10.1.5.
8. LAND MANAGEMENT					
8.1 Land Management	Long-term management requirements have been addressed.	All	At the time mine closure is considered complete, site land management requirements will be no greater than those of areas prior to mining (or comparable unmined areas); alternatively, where additional management actions are required, these will be identified in agreement with regulators, and BHP Billiton Iron Ore will make adequate provisions so that this additional management can be undertaken.	Reports into sustainability and long-term management requirements identified in the monitoring and research carried out during Criterion 4.	Section 6.

9. Financial provisioning for closure

BHP Billiton Iron Ore will ensure that financial provisions for the expected closure and rehabilitation cost of environmental disturbance (representing a present obligation) are recognised at the annual reporting date. As the extent of disturbance increases over the life of an operation, the provision will be increased accordingly. Costs included in the provision encompass all closure and rehabilitation activities expected to occur progressively over the life of the operation, at the time of closure and during the post closure period (e.g. monitoring). This includes all expected indirect costs, such as project management costs, statutory reporting fees and technical support costs.

The financial provision preparation is undertaken in accordance with GLD.034 Corporation Alignment Planning (BHP Billiton Limited 2013c), GLD.004.01 Accounting Interpretations (BHP Billiton Limited 2012b), GLD.031.01 Capital Cost Estimate Classification (BHP Billiton Limited 2011) and GLD.031 Major Capital Projects (Minerals) (BHP Billiton Limited 2012a).

In some cases, substantial judgements and estimates are involved in forming expectations of future activities and the amount and timing of the associated cash flows. These expectations are formed based on existing environmental and regulatory requirements or, if more stringent, Company standards or policies giving rise to a constructive obligation.

Adjustments to the estimated amount and timing of future closure and rehabilitation cash flows are a normal occurrence in light of the substantial judgements and estimates involved. Factors influencing those changes include:

- revisions to estimated mine life;
- developments in technology;
- regulatory requirements and environmental management strategies;
- changes in the estimated extent and costs of anticipated activities; and
- movement in economic input assumptions (interest rates, inflation).

BHP Billiton Iron Ore maintains sufficient closure input assumption documentation to support the closure model financial provision outcomes. The provision process and outcomes are subject to internal and external audit on an annual basis.

Provision for the Operations is made up of:

- OSAs and general land disturbance rehabilitation;
- open pit mine void closure (abandonment bund etc.);
- infrastructure removal;
- post closure monitoring costs; and
- human resource allowances.

10. Closure implementation

This section describes how the OB29/30/35 operations will be rehabilitated and closed in a manner that satisfies closure objectives, completion criteria and in accordance with the DMP/EPA guidelines. Closure implementation strategies defined below are based on experience across BHP Billiton Iron Ore's Pilbara Operations and on the BHP Billiton Iron Ore Rehabilitation Standard (BHPBIO 2011a).

Rehabilitation of disturbed areas may be conducted progressively during the mine life with complete closure of the mine not expected to occur until 2038.

10.1 Standard closure and rehabilitation strategies

BHP Billiton Iron Ore has developed and will implement the Rehabilitation Standard (BHPBIO 2011a) which covers all procedures relevant to rehabilitation works including rehabilitation planning, growth media, earthworks for rehabilitation, audit and inspect, seed management, rehabilitation data management and rehabilitation monitoring. This Rehabilitation Standard is used across BHP Billiton Iron Ore's Pilbara mine sites and other areas where appropriate. Rehabilitation and revegetation of the final mine landforms and infrastructure and support facilities will be conducted in accordance with the Rehabilitation Standard. A description of each is provided in the sub-sections below.

The approach to closure implementation for rehabilitation and decommissioning of the key components of the Operation are discussed in the following paragraphs.

10.1.1 Earthworks

The BHP Billiton Iron Ore Earthworks for Rehabilitation Procedure (BHPBIO 2010d) describes the rehabilitation earthworks required across BHP Billiton Iron Ore Pilbara mining operations to meet closure objectives stated in Section 6. It has been prepared to provide a consistent methodology based on previous rehabilitation success and identified issues. The results of rehabilitation monitoring are assessed for performance and are used to adjust and refine this methodology in accordance with BHP Billiton Iron Ore adaptive management approach (Section 7.1).

Rehabilitation earthworks aim to re-profile the land surface to create landforms that are consistent with the surrounding landscape, within the constraints imposed by the physical nature of the materials, in accordance with the stated closure objectives.

Earthworks consist of reshaping the slope. Generally this will be to 15° to 18°, however, the nature of the material used (determined by waste characterisation studies and modelling of erosion potential (see Section 7.4.4) will ultimately determine the final design for stability.

OSAs typically require the creation of a compacted bund approximately 1 m high and 5 m wide along the crest of the OSA to prevent surface water runoff down the slopes of the OSA. This reduces erosion and the likelihood of OSA slope failure.

10.1.2 Surface treatment

A number of surface treatments may be used, depending on the size and nature of the rehabilitated area. The proposed surface treatments for rehabilitation areas at OB29/30/35 have been developed to satisfy the stated closure objectives and may consist of one or more of the following:

- deep ripping of compacted surfaces;
- selective application of topsoil material (or alternative growth media) to provide a medium to support plant growth;
- surveyed contour ripping of surfaces following the application of soils to maximise water infiltration and enhance revegetation success; and

- selective placement of logs or smaller woody debris and/or boulders (if available) across the re-profiled surface and/or constructing rocky cliff features (where potential exists) to provide additional habitat areas for fauna species recorded prior to mining.

The Growth Media Management Procedure (BHPBIO 2011) provides general information on soils of the Pilbara region and methods for soil stripping, stockpiling and use in rehabilitation.

Direct placement of topsoil onto rehabilitation areas is preferable. If direct placement is not possible, soil should be stockpiled in low mounds, ideally no more than 2 m high to maintain biological activity. Compaction of the topsoil stockpiles should be minimised by building from the edge (rather than the top of the stockpile), deep ripping and spreading stripped plant material to encourage revegetation. Revegetating the stockpiles will also minimise dust, erosion and weed establishment.

10.1.3 Revegetation

The Rehabilitation Standard requires that revegetation be conducted so as to establish plant species that will support the approved post-mining land use. The selection of plant species used in revegetation is to be selected from the revegetation species lists generated for each site as part of planning works, and must include a range of typical vegetation assemblages suited to the post-mined landform. The diversity of vegetation types used in rehabilitation must be maximised in order to improve habitat value and encourage colonisation by a wide range of fauna.

Revegetation at the OB29/30/35 mining operations will use local provenance native seed (from the local area, but as a minimum from within 100 km of site within the Pilbara Biogeographic Region) consistent with vegetation associations and native species recorded in the mine area prior to mining (BHP Billiton Iron Ore 2011e).

The BHP Billiton Iron Ore Seed Management Procedure (BHPBIO 2011e) describes the types of seed species mixes and seeding rates that BHP Billiton Iron Ore uses at its Pilbara mining operations. This mix can be adapted to suit the particular characteristics of the site through BHP Billiton Iron Ore adaptive management approach (refer Section 7.1). The procedure also lists appropriate seed vendors which collect seed which meets the standards set by the Seed Management Procedure.

To promote vegetation density, species diversity and plant age heterogeneity, additional seeding (in subsequent years) will be conducted if required.

Two rainfall periods occur at OB29/30/35 area – one from January to March and the other from May to August. The most reliable rainfall period occurs from January to March. Accordingly, revegetation activities will be completed during November and December where practicable.

10.1.4 Cultural heritage

There is the potential for closure works to impact on sites of cultural significance via direct or indirect disturbance (e.g. erosion). All activities that require land disturbance, including during decommissioning and rehabilitation, will be authorised by BHP Billiton Iron Ore via the Project Environmental Aboriginal Heritage Review (PEAHR) procedure. For each planned disturbance area, the following details are addressed in the PEAHR form:

- A summary of the proposed disturbance activities;
- A plan showing the location of the proposed works;
- The anticipated environmental, land access and Aboriginal heritage impacts; and
- Specific management measures where necessary.

The primary mechanism for protection of cultural heritage sites identified as being significant at OB29/30/35 will be avoidance of identified sites. Any post closure issues (including ongoing management) relevant to these sites will be discussed with the relevant Nyiyaparli people through the stakeholder engagement process (Section 5).

10.1.5 Site contamination

Site contamination as a result of activities during minesite operation has the potential to compromise environmental values and result in non-compliance against relevant closure criteria. In areas where the potential for soil contamination is identified (e.g. areas used for storage of process chemicals, explosives, fuels and/or lubricants) soil samples (and potentially groundwater samples) will be taken and analysed. Any potentially contaminated soils identified by this assessment will be managed in accordance with the Department of Environmental Regulation and *Contaminated Sites Act 2003* requirements. Further sampling and analysis will then be undertaken to confirm the performance of the contaminated soil management measures.

Remaining surfaces will be reshaped to conform to surrounding landforms, with surface treatment and revegetation implemented as outlined in Sections 10.1.2 and 10.1.3.

10.1.6 Dust emissions

Dust has the potential to be emitted during decommissioning and bulk earthworks activities during closure. Dust control measures will be implemented during closure e.g. regular watering of unsealed roads, exposed surfaces and active earthwork areas. Upon closure dust generation from the rehabilitated surfaces is expected to be similar to other nearby natural landforms.

10.2 Closure strategies for specific domains

In line with the Guidelines for Preparing Mine Closure Plans (DMP/EPA 2011), BHP Billiton Iron Ore has adopted a domain model for closure implementation; identified domains are defined as those areas of similar operational land uses and subject to similar closure strategies. Implementation strategies have been informed by the standard rehabilitation strategies outlined in the previous section and the outcomes of further studies as discussed in Section 7.1.1.

Closure domains identified at the Operations are shown in **Figure 3**, **Figure 4** and **Figure 5** and are as mine voids, OSAs, infrastructure, and roads and rail.

10.2.1 Mine voids

As outlined in Section 7.4.2 the need to backfill of mine voids to manage post closure groundwater risks will be assessed through further studies. In the interim residual open pit mine voids will be left as run-of-mine where geotechnically stable.

Parts of the final pit walls will create a permanent depression in the landscape and depending on the angle from which they are viewed, the final pit voids will appear as stepped cliff lines. Safety bunds will be established around the final pit walls. The bunds will be constructed as per the DMP recommended practice. The bunds will be a minimum 2 m high with a base width of minimum 5 m and constructed at least 10 m away from the edge of the area known to contain potentially unstable rock mass as per recommended practice (DoIR 1997).

10.2.2 Overburden storage areas

The final landform designs of the out-of-pit OSAs will be rehabilitated in accordance with the stated earthwork strategies outlined in the Rehabilitation Standard (BHPBIO 2011a). In general, the OSAs will be designed to meet characteristics of the waste material. The final shape of the OSAs will be designed to minimise erosion by creating a compacted bund directly along the crest to prevent surface water runoff from the crest down the slopes.

Formation work during rehabilitation will be undertaken by bulldozing the overburden to a morphometry (shape and scale) similar to an elevated landform common in the region (e.g. mesa, ridge or hill). The final surface will be prepared using earthmoving equipment to create a surface suitable for revegetation. Stockpiled topsoil or alternative growth media will be used in the preparation of the landform surface.

The landforms are to be designed and constructed as weathering structures and are to contain appropriate internal gullies and alluvial fans at the base to promote water shedding. Slopes will be constructed with concave faces to facilitate water-shedding.

BHP Billiton Iron Ore will monitor the stability and revegetation success of the OSAs during the mine life. Monitoring of rehabilitation is discussed in Section 11.

Any low grade ore that is encountered will be placed adjacent to the OSAs, as it is likely that low-grade ore will be both added and removed depending on ore blending requirements. Market demand will determine how much, and when it is viable to process the low grade material. No separate stockpile for low grade will be established. In the event that this material is not blended with the high grade ore, BHP Billiton Iron Ore will re-profile these areas into the OSAs.

Following re-profiling of the land surface, additional surface treatment and revegetation works for OSAs will be implemented in accordance with the Rehabilitation Standard (BHPBIO 2011a).

10.2.3 Infrastructure

Decommissioning of fixed site assets will be carried out by a specialist mining contractor who, as part of the contract, currently provides the majority of the infrastructure and equipment needed to conduct mining operations. The mining contractor will be required to remove all its assets from site at the completion of the contract.

BHP Billiton Iron Ore's office buildings and minor equipment will be removed from site.

At closure the infrastructure associated with dewatering the OB29/30/35 pits ahead of mining will be removed; the water bores will be capped in accordance with the requirements of the relevant government administering authority.

Following the removal of infrastructure and re-profiling of the land surface, additional surface treatment and revegetation works will be implemented in accordance with the standard rehabilitation procedures described in the Rehabilitation Standard (BHPBIO 2011a).

10.2.4Road and rail

The closure of the rail tracks and the majority of the roads is not captured within this MCP. Bitumen roads included in the scope of this MCP (within closure boundaries as shown in **Figure 2**) will be removed from sealed roads and disposed to an appropriate landfill. Road and track surfaces will be deep ripped and re-profiled where required. It is unlikely that roads or tracks will require seeding as they are typically narrow corridors that can be recolonised naturally following earthworks.

Haul roads that have not been progressively rehabilitated during the mine life will be re-profiled (including removal of portions of haul road embankment where necessary) to blend in with surrounding topography. Where necessary, road surfaces will be re-profiled to allow free drainage and minimise interference with surface flows.

Following re-profiling of the land surface, additional rehabilitation works will be implemented in accordance with the procedures described in the Rehabilitation Standard (BHPBIO 2011a).

10.3 Progressive revegetation

Progressive rehabilitation and ongoing performance assessment will be carried out in areas where mining operations have been completed and further disturbance is unlikely.

The majority of the landform development will be carried out as a normal part of overburden removal and placement during the mining operations. Some final shaping of landforms will be needed to establish drainage lines and place selected materials in the required positions to protect those drainage lines against erosion. Topsoil and other alternative growth media recovered during mine development will then be placed on the final landform.

The rehabilitation programme will aim to re-establish local native vegetation that is appropriate to the environmental characteristics of the final mine landforms and the agreed final land use in accordance with the site closure objectives.

The main components of the progressive rehabilitation programme are described in the Rehabilitation Standard (BHPBIO 2011a) and reported annually within the AER. Planning for rehabilitation is undertaken annually in the development of the Five Year Rehabilitation Plan.

10.4 Implementation schedule

Table 19 provides an overview of the proposed schedule of closure works, including progressive rehabilitation of identified closure domains over the life of mine. It should be noted that closure dates for selected domains have not been determined, and will depend on the following the completion of the Long Term Plan for the Operations.

Table 19: OB29/30/35 Closure Implementation Schedule

Domain	Indicative Commencement Date
Overburden storage areas	2038
Mine voids	2038
Infrastructure (excluding boreholes)	2038
Roads	2060

10.5 Unplanned or unexpected closure

BHP Billiton Iron Ore is required to review a range of risks associated with the closure of its facilities annually as assessed using the risk processes described in GLD.017 Risk Management (BHP Billiton Limited 2013b). One of these risks is unexpected or unplanned closure. In the event that unplanned or unexpected closure occurs, the site will be decommissioned and rehabilitated in line with the objectives and strategies outlined in this document. In the absence of more detailed information, the overall objective under this scenario will be to make landforms such as OSAs secure and non-

polluting following decommissioning and decontamination activities, with application of topsoil prioritised for these areas.

Annual cost provisioning for closure in line with the closure cost estimating methodology outlined in Section 9 provides an understanding of the current closure liability, with present closure obligation costs representing an unplanned or unexpected closure scenario.

11. Closure monitoring and maintenance

11.1 Monitoring programme overview

Across its Pilbara mining operations, BHP Billiton Iron Ore has implemented monitoring programmes to evaluate the performance of rehabilitated mine landforms and to assess whether they have either met the site completion criteria or are showing satisfactory progress towards meeting these criteria. These programmes will be expanded as new areas of the mine are rehabilitated, and will be refined based on monitoring results and rehabilitation success.

Ecological monitoring post closure will be in accordance with the Rehabilitation Standard (BHPBIO 2011a) and the Rehabilitation Monitoring Procedure (BHPBIO 2012c). An important component of leading practice rehabilitation is the use of monitoring and research to track the progress of rehabilitation, and ensure continuous improvement through adaptive management:

- monitoring procedures shall be used to assess whether initial establishment has been successful, rehabilitation is developing satisfactorily and is ready for signoff; and
- research activities shall be undertaken where knowledge gaps or deficiencies in rehabilitation progress occur.

BHP Billiton Iron Ore's adaptive management approach to rehabilitation involves regularly assessing performance by taking into consideration results of rehabilitation and trials from BHP Billiton Iron Ore's operations in the region and adjusting its management practices to facilitate continuous improvement. Rehabilitation areas and trials will be monitored on a regular basis to assess the success or otherwise of a particular rehabilitation technique, with the results used to further refine the Operations rehabilitation programme.

Monitoring events will be undertaken in line with the process outlined in within this section, with the outcomes informing rehabilitation strategies, facilitating refinement in completion criteria and directing maintenance and remedial action plans.

11.1.1 Rehabilitation monitoring methodology

Progressive rehabilitation and ongoing performance assessment will be carried out in areas where mining and related operations have been completed and further disturbance is unlikely. Monitoring procedures will be used to assess whether initial establishment has been successful, rehabilitation is developing satisfactorily, and is ready for signoff. A review of the BHP Billiton Iron Ore Pilbara rehabilitation monitoring system was undertaken during 2011. This resulted in the establishment of a three stage monitoring process:

- Rehabilitation Establishment Assessment, 3 to 24 months of age. Rehabilitation Establishment Assessment provides feedback on the stability and erosion of rehabilitation areas and an assessment of vegetation establishment.
- Rehabilitation Development Monitoring, Years 3, 5, 7, 9, 12, 15. Rehabilitation Development Monitoring is an in-depth assessment of rehabilitation involving Landscape Function Analysis, erosion monitoring and quadrat vegetation monitoring using existing monitoring transects. It is applied to maturing rehabilitated areas. Rehabilitation Development Monitoring methodology was followed for the first time in 2011, with positive results in quantifiable vegetation measures that will assist in the development of completion criteria.

- Rehabilitation Landform Appraisal, Years 3, 7, 12 and thereafter if required. Rehabilitation Landform Appraisal provides a summary of the status of large scale rehabilitated landforms and areas not covered by Rehabilitation Development Monitoring.

Assessing whether a particular area has met all criteria will require compilation of all relevant site records of rehabilitation operations, monitoring data, photographic records and summarising these in a short report. Assessment procedures used against particular criteria will generally fall into one of three categories:

1. Using 'operational criteria' to confirm that operations have been carried out according to agreed Ministerial Statements, and any other commitments and procedures;
2. Determining whether agreed criteria milestones and standards have been met as measured using monitoring procedures, visual inspection and other methods as appropriate; and
3. Using more detailed trials and research investigations in typical rehabilitated areas to determine whether more in-depth criteria, such as those relating to sustainability following burning, have been met.

Should ongoing monitoring indicate potential non-compliance with established closure criteria the appropriate maintenance and/or remedial work will be undertaken. Further monitoring will be subsequently undertaken on repaired areas to demonstrate compliance with relevant criteria.

To ensure quality control is maintained at all stages of the rehabilitation processes (e.g. execution of rehabilitation works, maintenance and monitoring), activities will be completed in line with BHP Billiton Iron Ore's suite of procedures which provide guidance on aspects such as:

- rehabilitation audit and inspection;
- rehabilitation data capture; and
- rehabilitation monitoring.

11.1.2 Weed Monitoring

BHP Billiton Iron Ore weed management procedures describe the weed monitoring to be conducted, in addition to measures used to prevent the introduction and spread of weeds and the ongoing effectiveness of weed control measures.

Post-mining control measures and monitoring programmes (and completion criteria) will be developed and/ or refined during the mine life in consultation with the relevant authorities. Approved changes to the monitoring programmes and completion criteria will be documented in the AER and revisions of the BHP Billiton Iron Ore weed control and management procedures.

11.1.3 Fauna monitoring of rehabilitation areas

Assessment of rehabilitation is often focussed on revegetation success and few studies on whether rehabilitated areas in the Pilbara provide suitable habitat for fauna have been undertaken to date. A recent study of re-colonisation of rehabilitated mine sites in the Pilbara by Outback Ecology (2011) found that fauna assemblages were 'broadly comparable' to reference sites, however, some species may be absent due to ecological barriers (Outback Ecology 2012). The appropriate methodology for fauna monitoring including approach/frequency/key performance indicators will be undertaken and executed initially by 2017.

11.1.4 Surface water monitoring

Inspections of drainage surfaces and erosion control measures will be carried out as soon as possible after periods of heavy rainfall to assess structural integrity of surface hydrological features such as rehabilitated OSAs. Follow up monitoring will occur progressively throughout the closure monitoring period.

If failures are identified appropriate maintenance/remedial actions will be determined and implemented.

11.1.5 Groundwater monitoring

BHP Billiton Iron Ore has a groundwater monitoring programme for Mount Whaleback and the OB29/30/35 mining operations to support and inform closure groundwater assessments, enabling progressive improvement in understanding and confidence in the achievement of the stated closure objectives for groundwater. Key parameters in areas that represent risks to closure such as the Acid Rock Drainage dam, existing contaminated sites and outer pit piezometers all form part of the existing groundwater monitoring.

The groundwater monitoring programme is reviewed and revised as necessary during the life of the Mount Whaleback and OB29/30/35 mining operations. Any changes to the programme will be reported in the AER.

11.1.6 Off-site Impacts and landform stability monitoring

As part of the general monitoring of the site visual inspections will be conducted to identify obvious off-site impacts. Visual inspections will occur in conjunction with the public safety inspections.

Rehabilitated landforms will be inspected after significant rainfall to assess stability and to monitor for areas where unacceptable erosion has occurred. Where necessary, maintenance works will be undertaken to improve performance.

11.1.7 Public safety monitoring

During operations and after mine closure, periodic inspections will be conducted to determine the condition of the safety bunds (and any other safety measures) erected around the open pits and a record kept of those inspections. Where the integrity of the bunds has been compromised to the extent that inadvertent public access could occur, maintenance will be conducted.

11.2 Reporting

The progress and performance of rehabilitation monitoring sites and any new rehabilitation activities conducted at the OB29/30/35 mining operations will continue to be reported on an annual basis through the AER, which covers all of BHP Billiton Iron Ore's Pilbara operations. Rehabilitation details reported in the AER will include a summary of the rehabilitation monitoring results for the reporting period, maintenance/remedial actions completed or planned and the area and nature of any new rehabilitation that has been undertaken on-site. Any rehabilitation activities planned for the future reporting period will continue to be reported as environmental initiatives on an annual basis. Reporting results will also be made available to the relevant authorities on request.

12. Data management

BHP Billiton Iron Ore will collect, store and manage closure data in line with its existing data management procedures, including the WAIO-wide Rehabilitation Data Capture Procedure (BHPBIO, 2011e).

The MCP and related information will be managed by BHP Billiton Iron Ore. All data will be stored in a central and readily accessible location in accordance with existing BHP Billiton Iron Ore standards and procedures. After lease relinquishment BHP Billiton Iron Ore will transfer the MCP and all associated information to the DMP for its files.

BHP Billiton Iron Ore will progressively update this MCP over time to capture and summarise current closure planning information associated with:

- closure planning prior to cessation of operations;
- implementation of the closure program of works; and
- the post closure monitoring and reporting period.

BHP Billiton Iron Ore will communicate closure planning progress to the regulators via existing AER channels. BHP Billiton Iron Ore will update the MCP as knowledge gaps are filled and closure plans are refined.

13. Abbreviations and Acronyms

Abbreviation/Acronym	Full Title
%	per cent
µg/m^3	micrograms per cubic metre
AAR	Annual Aquifer Review
AER	Annual Environmental Report
AHA	*Aboriginal Heritage Act 1972*
AMD	Acid and Metalliferous Drainage
ARI	Average Recurrence Interval
BIF	Banded Ironstone Formation
bgl	Below ground level
BOM	Bureau of Meteorology
BWT	Below water table
DEC	Department of Environment and Conservation
DER	Department of Environment Regulation
DMP	Department of Mines and Petroleum
DoW	Department of Water
DPaW	Department of Parks and Wildlife
DSD	Department of State Development
EAG	Environmental Assessment Guideline
EIA	Environmental Impact Assessment
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environmental Protection Biodiversity and Conservation Act 1999*
EPA	Environmental Protection Authority
ERM	Environmental Resources Management Australia
ESD	Ecologically Sustainable Development
GDV	Groundwater dependent vegetation
ha	Hectares
IBRA	Interim Biogeographic Regionalisation of Australia
km	kilometre
km^2	Square kilometre
m	metres
mm	Millimetres
MCP	Mine Closure Plan
m bgl	metres below ground level
mg/L	milligrams per Litre
mRL	metres Reduced Level
Mt	Million tonnes
Mtpa	Million tonnes per annum
Newman State Agreement	*Iron Ore (Mount Newman) Agreement Act 1964*
NJV	Mount Newman Joint Venture
NVCP	Native Vegetation Clearing Permit
OB23	Orebody 23
OB29	Orebody 29

OB29/30/35	Orebodies 29, 30 and 35
OB30	Orebody 30
OB35	Orebody 35
OEPA	Office of the Environmental Protection Authority
OSA	Overburden Storage Area
PAF	Potentially acid forming
PEAHR	Project Environment and Aboriginal Heritage Review
PEC	Priority Ecological Communities
RIWI Act	*Rights in Water and Irrigation Act 1914*
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TSP	Total Suspended Particulates
VSR	Visually Sensitive Receptor
WA	Western Australia

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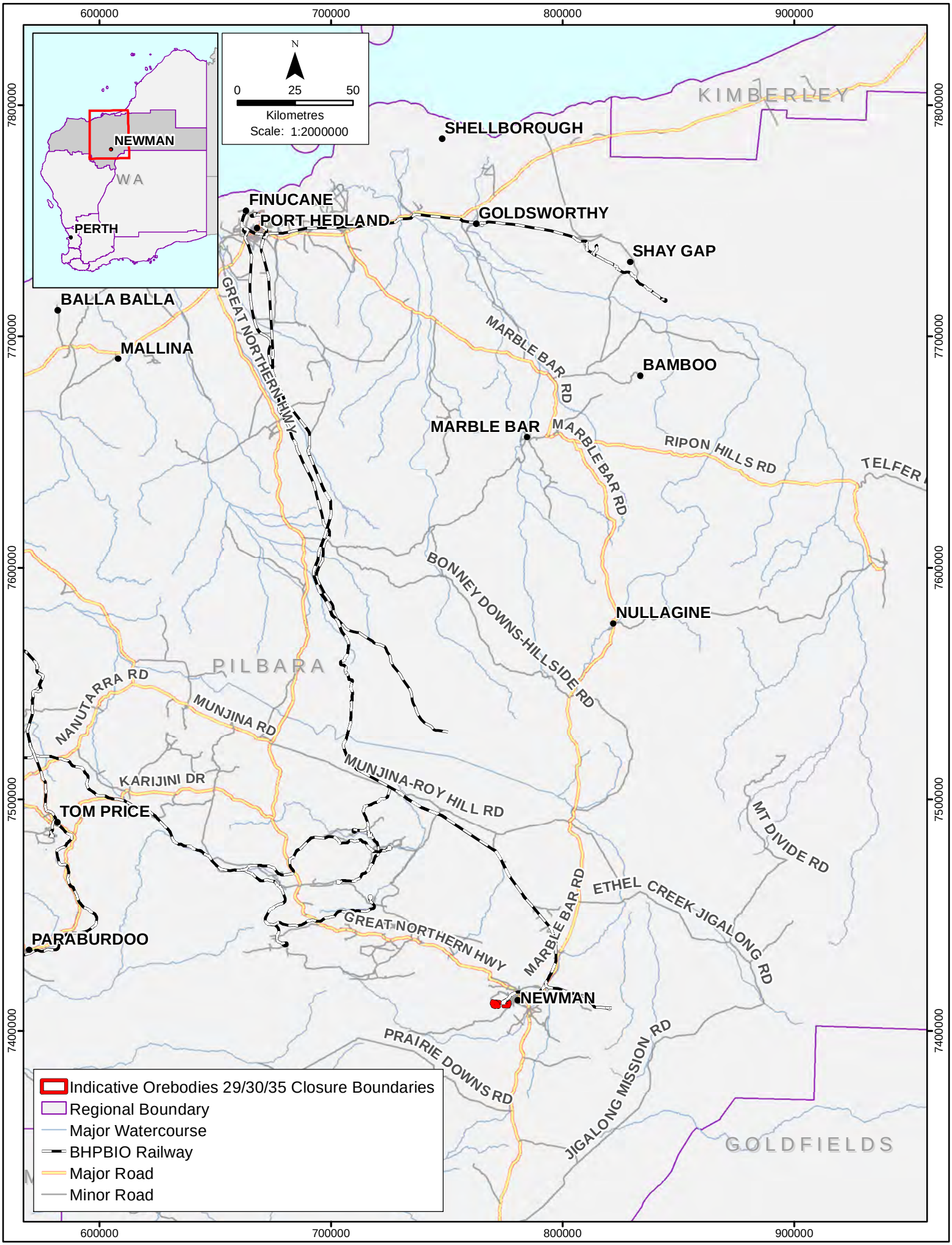
Figures

Figure 1: Regional Location of the Operations



Source:
Study area from BHPBIO.
Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013)
Shaded relief from ESRI / BING

outback ecology
MWH

Coordinate System:
GDA 1994 MGA Zone 50

Name:
WHAL_CP_13001_Reglocn_v3

Date:
30/08/2013

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OREBODIES 29/30/35
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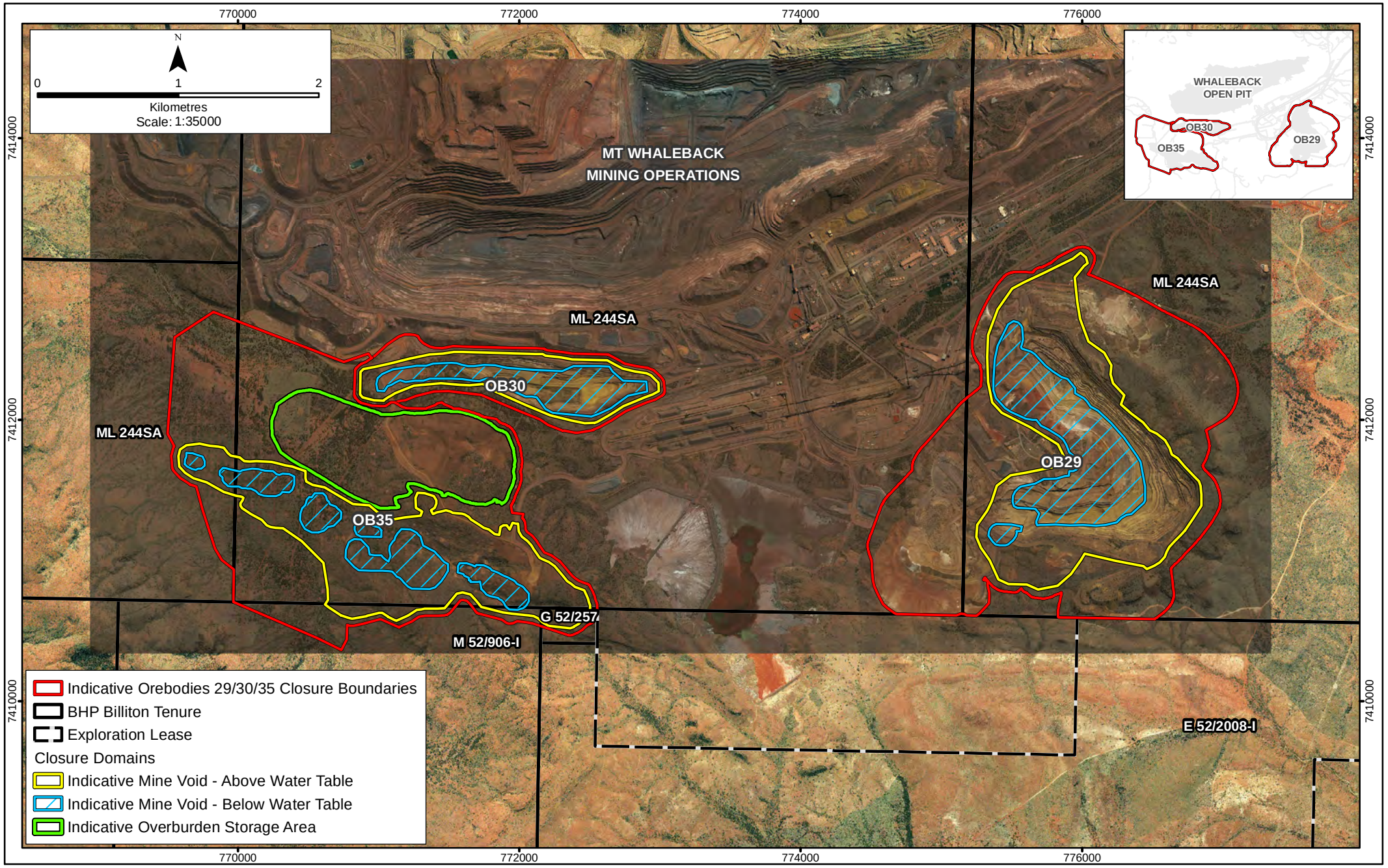
Figure 1

Regional Location of the Operations

Figure 2: Overview of the Operations



Source:
Site features from BHPBIO
Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013).

Date Saved:
30/08/2013

File Name:
WHAL_CP_13001_OpsOverview_v3

Coordinate System:
GDA 1994 MGA Zone 50

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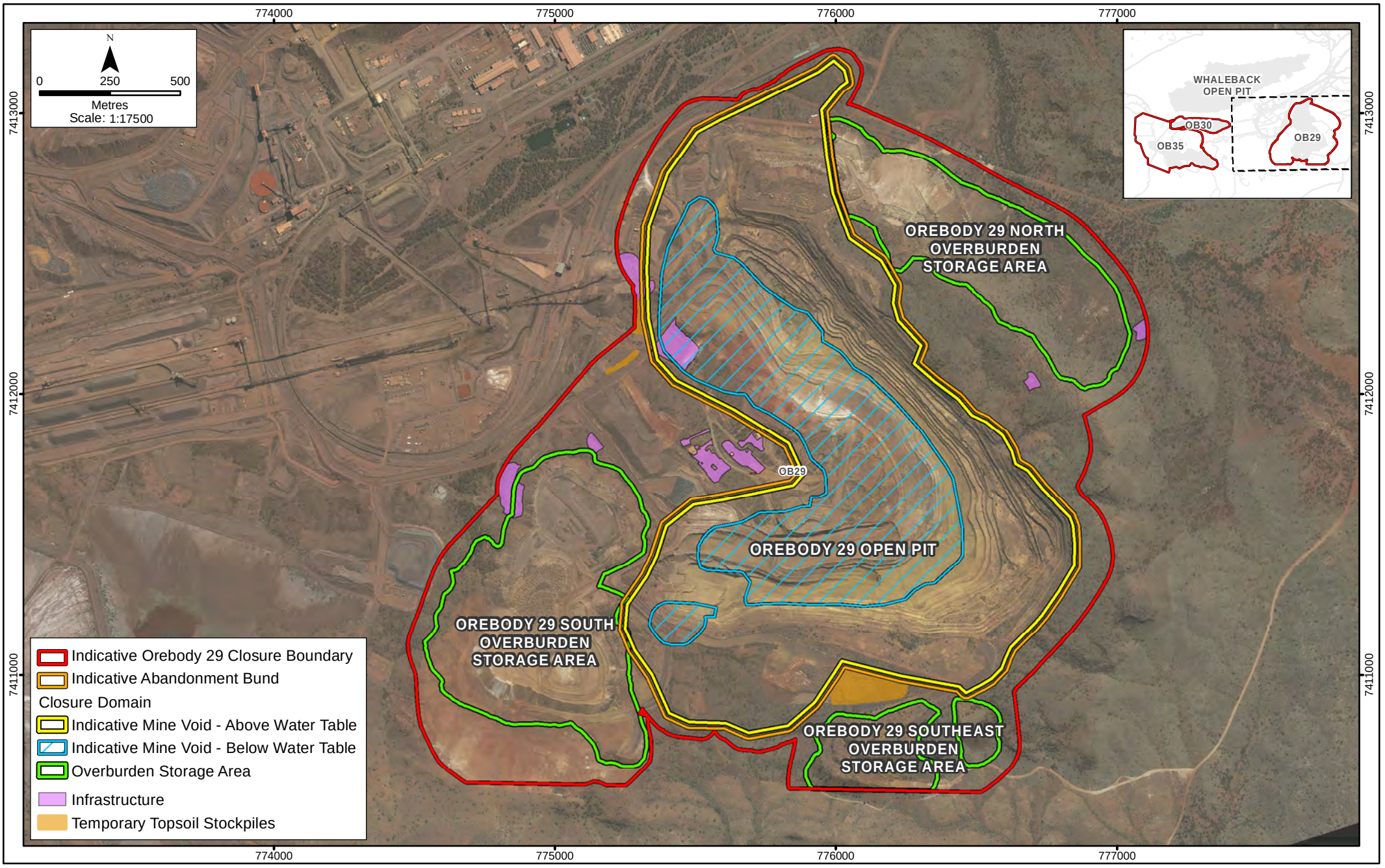
Figure 2

Overview of
the Operations

Figure 3: Orebody 29 Domains and Features



Source:
Study Area, Site Data and Imagery from BHPBIO
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Date Saved:
30/08/2013

File Name:
WHAL_CP_13001_OB29_v3

Coordinate System:
GDA 1994 MGA Zone 50

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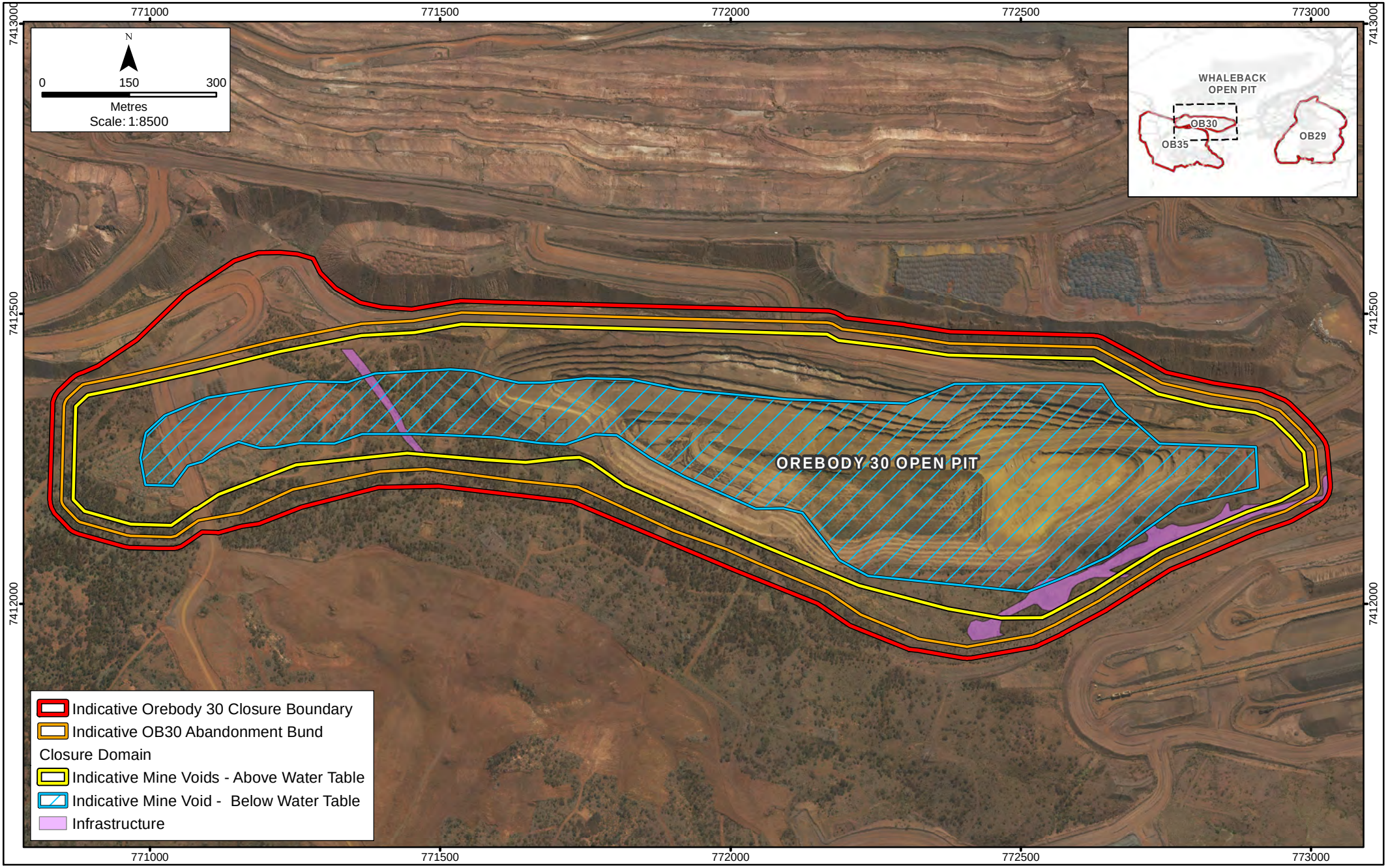
Figure 3

Orebody 29
Domains and
Features

Figure 4: Orebody 30 Domains and Features



Source:
Study Area, Site Data and Imagery from BHPBIO
Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013).

Outback Ecology
MWH

Date Saved:
30/08/2013

File Name:
WHAL_CP_13001_OB30_v3

Coordinate System:
GDA 1994 MGA Zone 50

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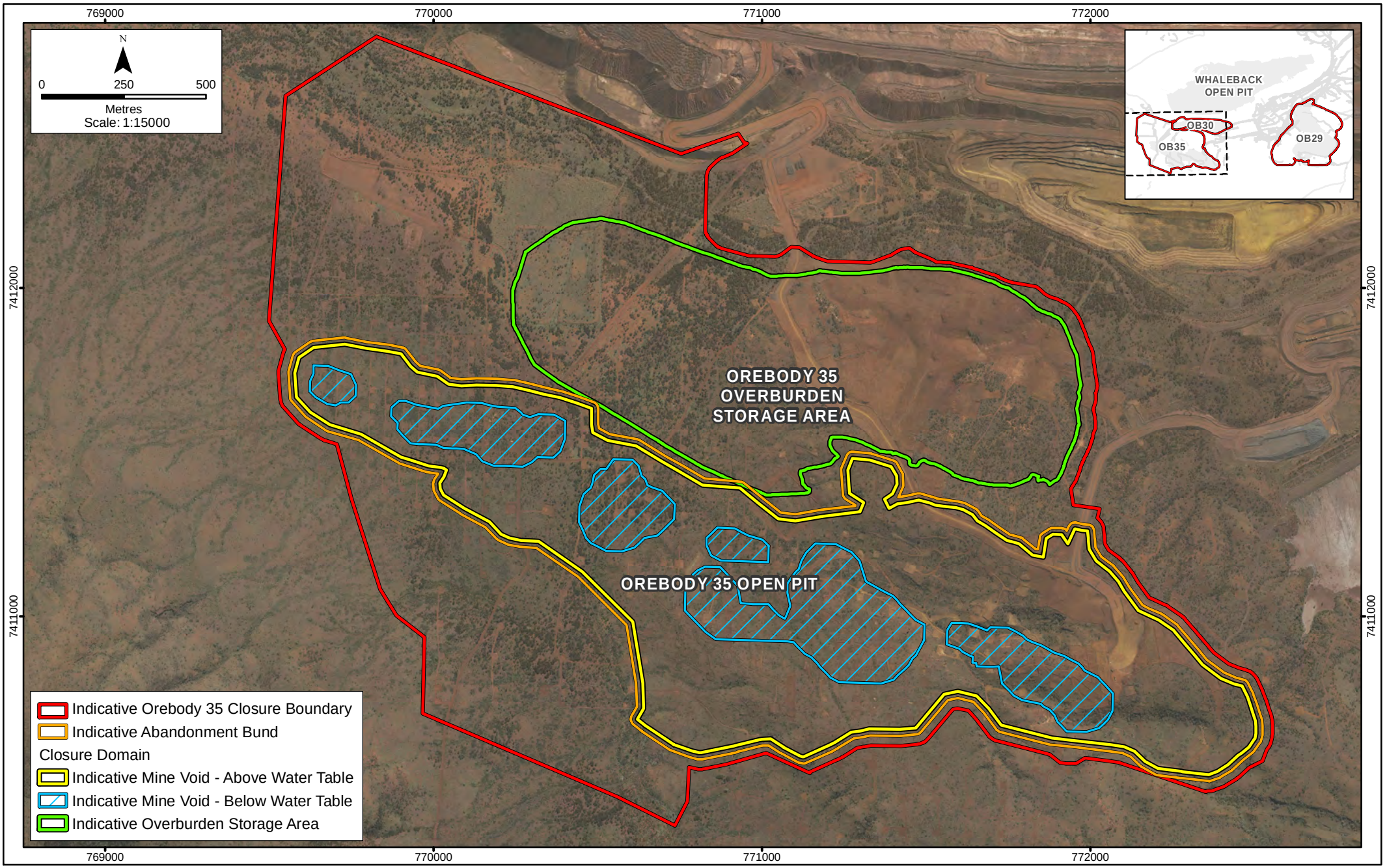
Figure 4

Orebody 30
Domains and
Features

Figure 5: Orebody 35 Domains and Features



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Outback Ecology
MWH

Date Saved: 30/08/2013

File Name: WHAL_CP_13001_OB35_v3

Coordinate System: GDA 1994 MGA Zone 50

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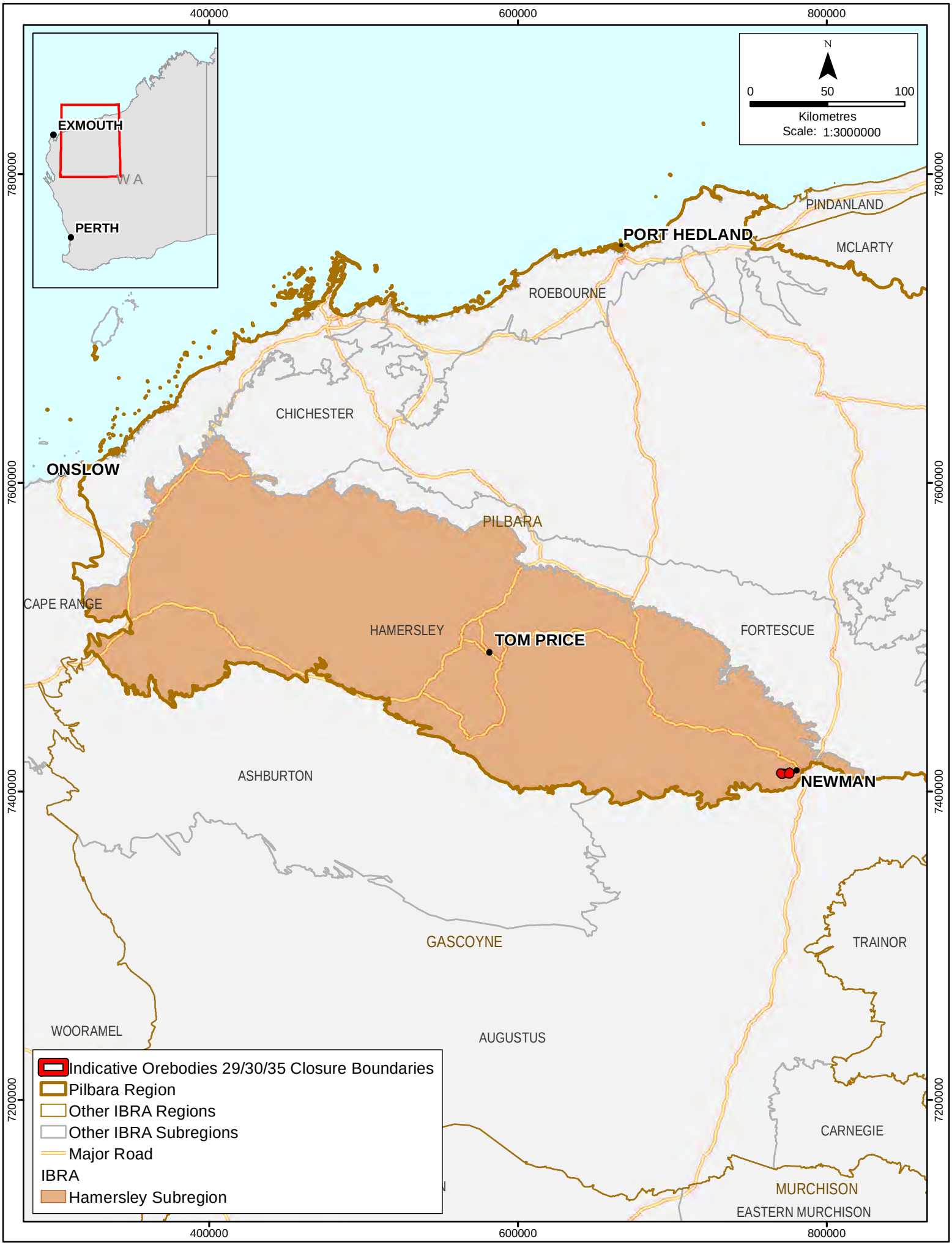
Figure 5

Orebody 35 Domains and Features

Figure 6: Location of the Operations within the Interim Biogeographic Regionalisation for Australia Subregion



Source:
Study area from BHPIO.
IBRA from DSEWPaC.
Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013)

outback ecology
MWH

Coordinate System:
GDA 1994 MGA Zone 50

Name:
WHAL_CP_13001_IBRA_v3

Date:
30/08/2013

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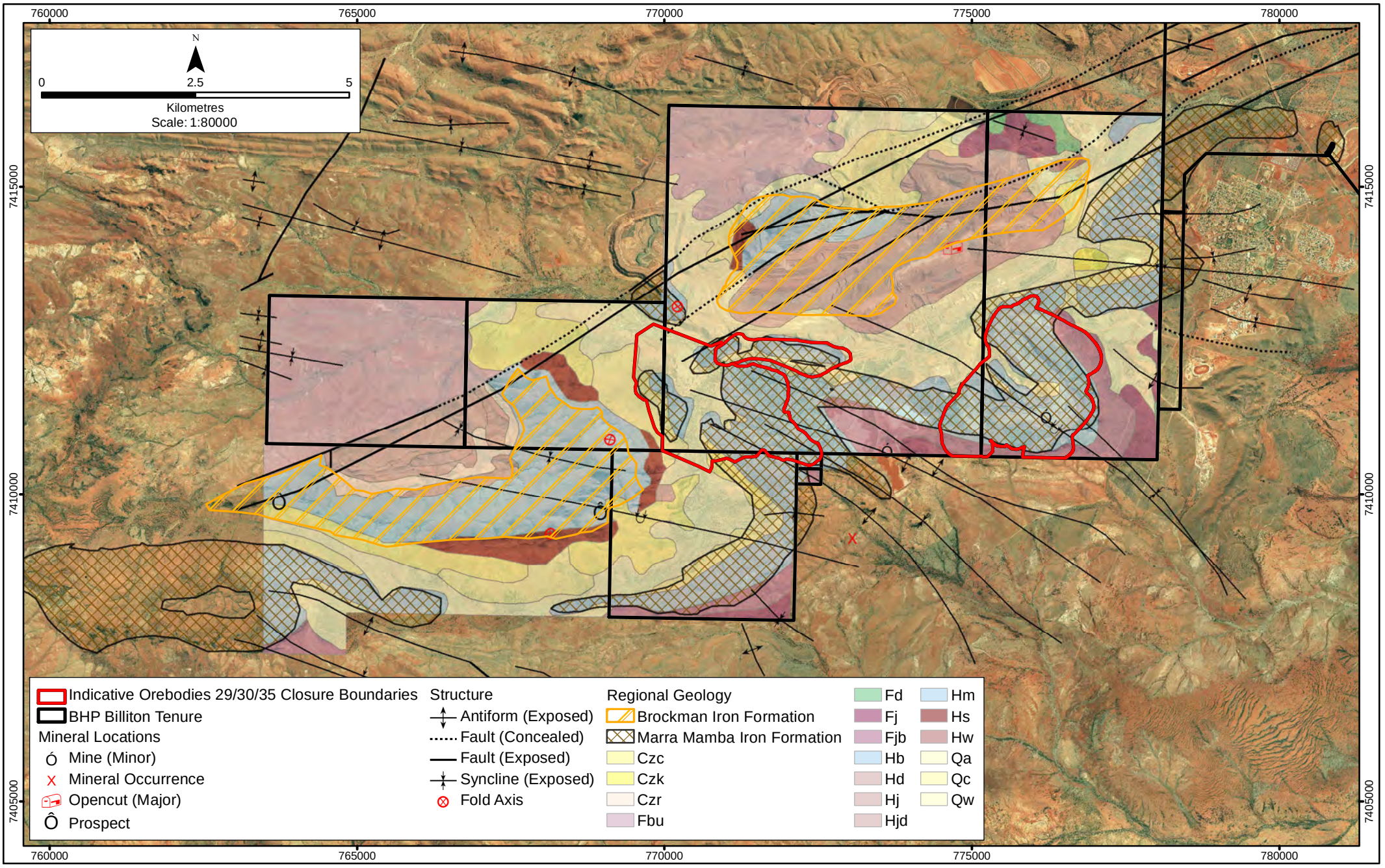
Figure 6

Location of the Operations within the IBRA Subregions

Figure 7: Orebody 29/30/35 Regional Geology



Source:
Study Area, Geology and Imagery from BHPBIO
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Outback Ecology
MWH

Date Saved:
30/08/2013

File Name:
WHAL_CP_13001_LocalGeology_v3

Coordinate System:
GDA 1994 MGA Zone 50

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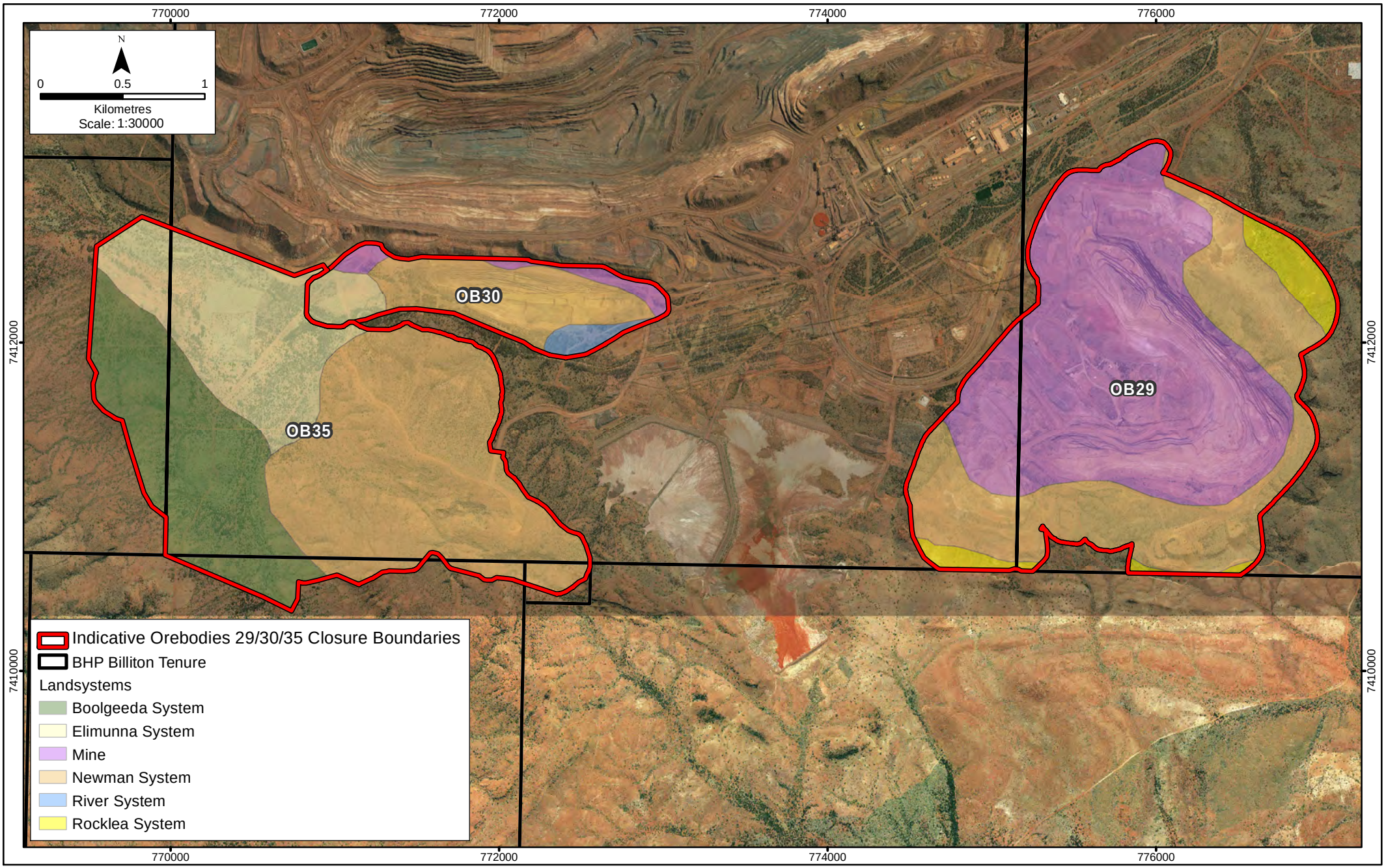
Figure 7

Orebodies 29/30/35
Regional Geology

Figure 8: Land Systems Underlying the OB29/30/35 Operations



Source:
Study Area and Imagery from BHPBIO
Land Systems from DAFWA
Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013).

Outback Ecology
MWH

Date Saved:
27/08/2013

File Name:
WHAL_CP_13001_LandSystems_v3

Coordinate System:
GDA 1994 MGA Zone 50

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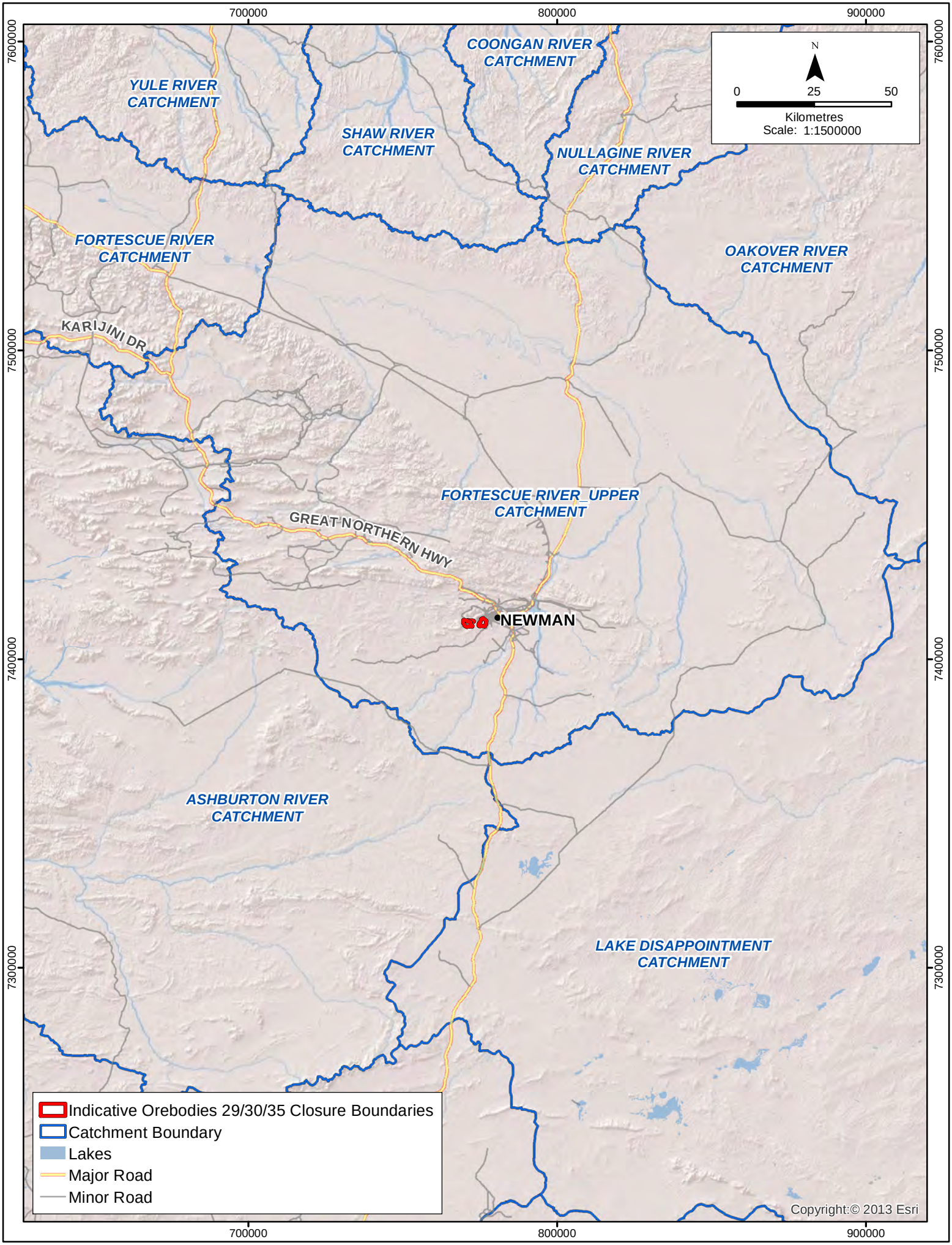
Figure 8

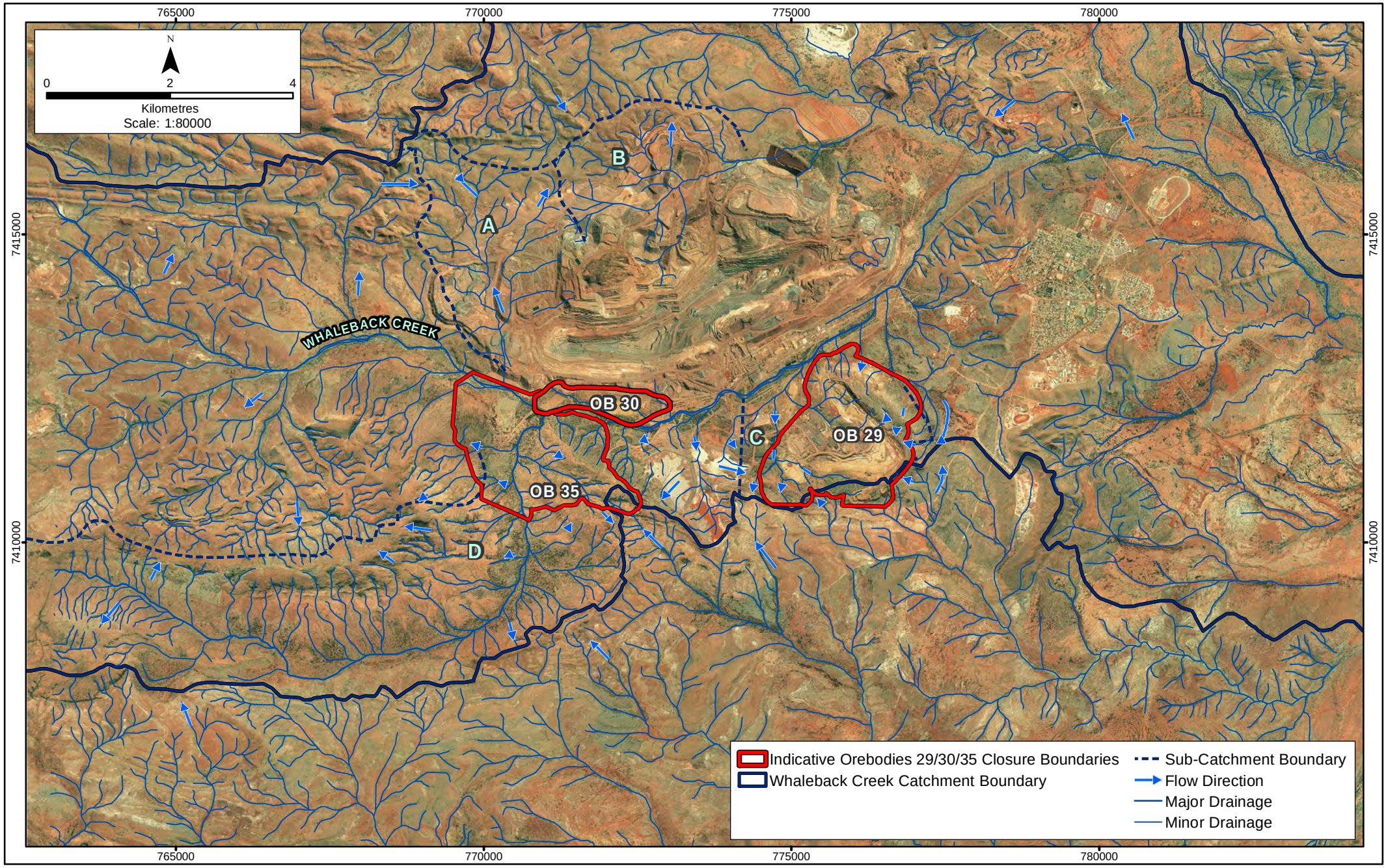
Land Systems underlying the OB29/30/35 Operations

Figure 9: Regional Surface Water Hydrology



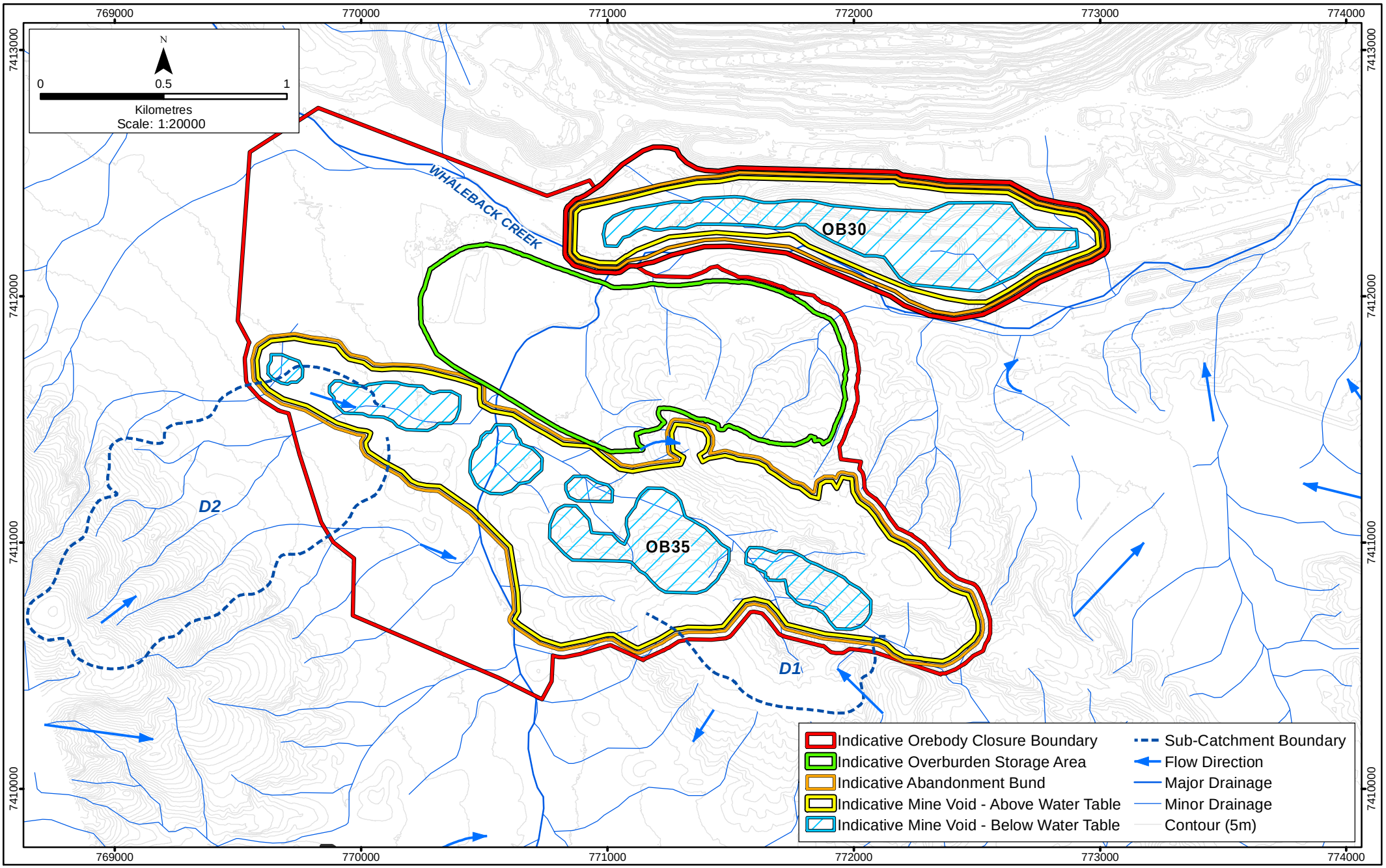
Source: Study area from BHPBIO. Hydro data from DOW. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013) Shaded relief from ESRI / BING	outback ecology MWH	Coordinate System: GDA 1994 MGA Zone 50 Name: WHAL_CP_13001_RegSurfaceHydro_v3 Date: 27/08/2013	BHP BILLITON IRON ORE OREBODIES 29/30/35 MINE CLOSURE PLAN	bhpbilliton resourcing the future	**Figure 9** Regional Surface Hydrology

Figure 10: Whaleback Creek Surface Water Catchment



Source: Hydrology from BHPBIO, based on Aquaterra (2006). Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013).	Outback Ecology MWH	**Date Saved:** 30/08/2013 **File Name:** WHAL_CP_13001_SurfaceWaterCatch_v2 **Coordinate System:** GDA 1994 MGA Zone 50	BHP BILLITON IRON ORE OREBODIES 29/30/35 MINE CLOSURE PLAN	bhpbilliton resourcing the future	**Figure 10** Whaleback Creek Surface Water Catchment

Figure 11: Orebody 30 and 35 Whaleback Creek Sub-catchment D



Source:
Hydrology from BHPBIO, based on Aquaterra (2006).
Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013).

Outback Ecology
MWH

Date Saved:
30/08/2013

File Name:
WHAL_CP_13001_OB3035SubCatch_v2

Coordinate System:
GDA 1994 MGA Zone 50

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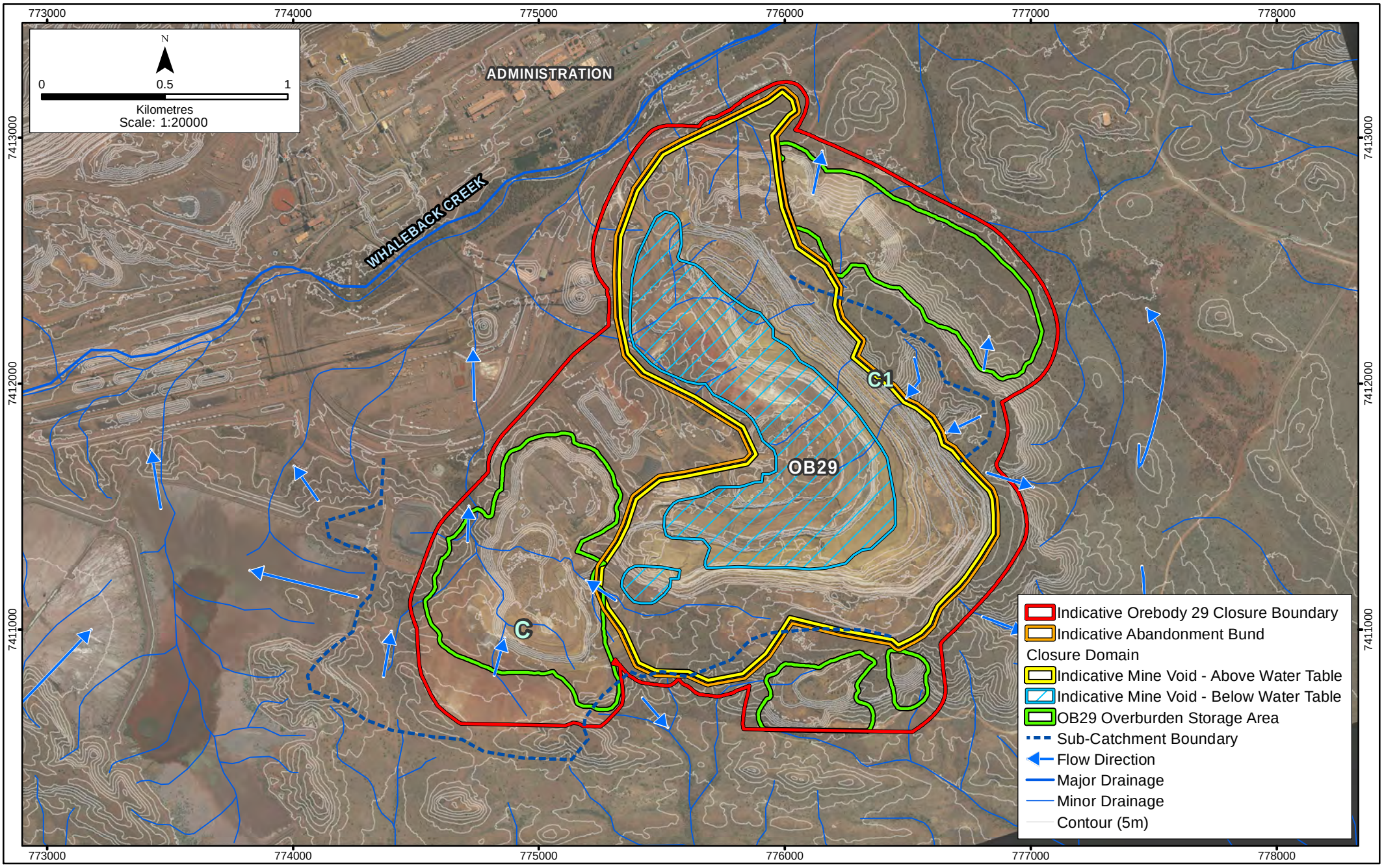
Figure 11

Orebodies 30 and 35
Whaleback Creek
Sub-Catchment D

Figure 12: Orebody 29 Whaleback Creek Sub-catchment C



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Hydrology from BHPBIO, based on Aquaterra (2006).
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Outback Ecology
MWH

Date Saved: 30/08/2013

File Name: WHAL_CP_13001_OB29SubCatch_v2

Coordinate System: GDA 1994 MGA Zone 50

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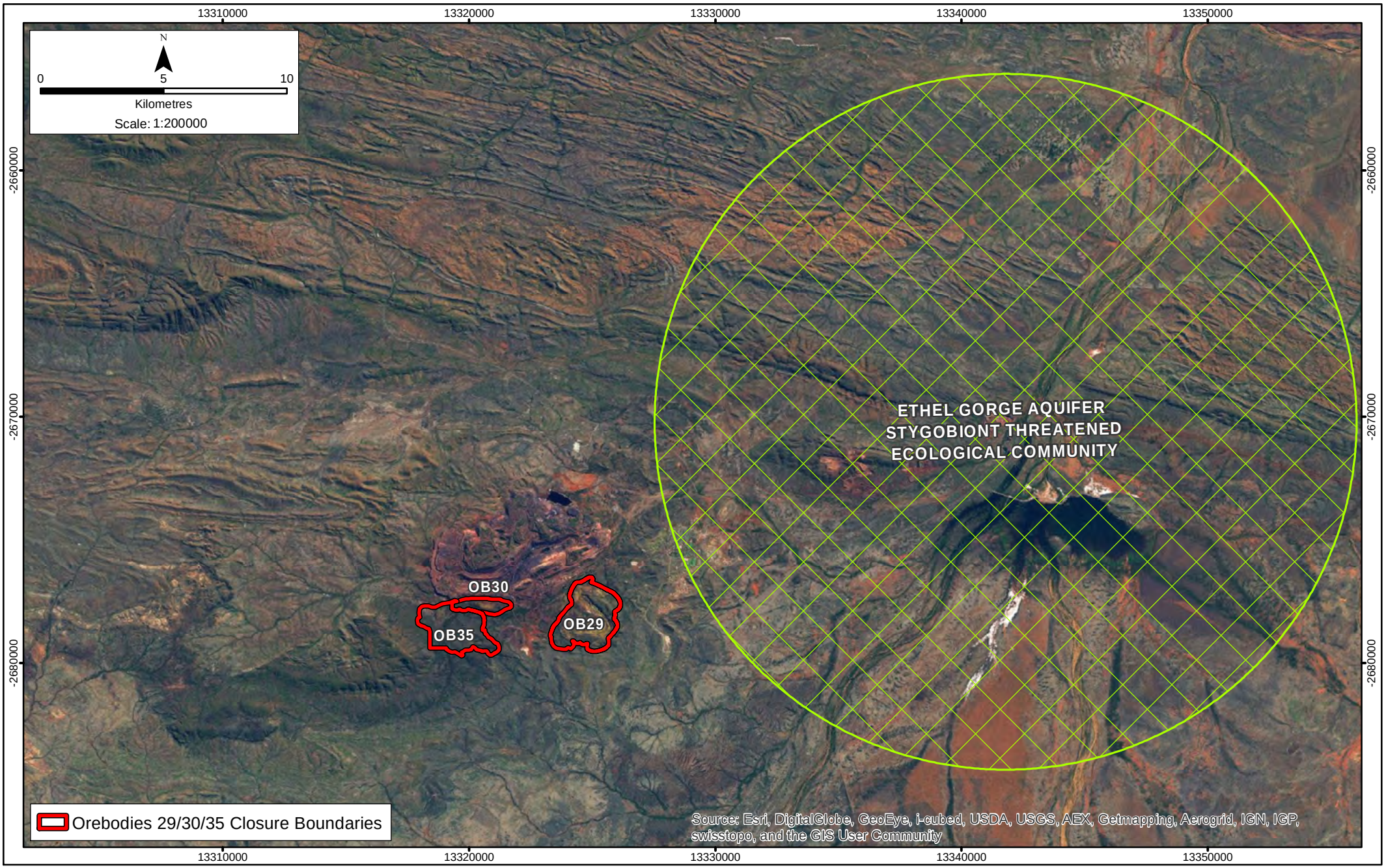
Figure 12

Orebodies 29
Whaleback Creek
Sub-catchment C

Figure 13: Threatened Ecological Communities In Relation to the Operations



Source: Study Area and Imagery from BHPBIO TEC data from DEC WA. Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2013).	Outback Ecology MWH	**Date Saved:** 6/08/2013 **File Name:** WHAL_CP_13001_TEC **Coordinate System:** WGS 1984 Web Mercator Auxiliary Sphere	BHP BILLITON IRON ORE OREBODIES 29/30/35 MINE CLOSURE PLAN	bhpbilliton resourcing the future	**Figure 13** Threatened Ecological Communities In Relation To the Operations

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Appendix A: Closure Conditions and Commitments

A1: Approval Document for Clearing Reference Number CPS 3776/1 – September 2010 until September 2016

Aspect	Relevant Closure Conditions
Obligation	The Permit Holder must clear more than 100 ha of native vegetation. All clearing must be within the area cross-hatched yellow on attached Plan 3776/1.
Flora	In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference: (i) avoid the clearing of native vegetation; (ii) minimise the amount of native vegetation to be cleared; and (iii) reduce the impact of clearing on any environmental value.
Weeds	When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spreads of weeds: (i) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared; (ii) ensure that no weed-affected soil, mulch, fill or other material is brought into the area to be cleared; and (iii) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.
Rehabilitation and Closure	The Permit Holder shall: (a) Retain the vegetative material and topsoil removed by clearing authorised under this permit and stockpile the vegetation material and topsoil within the area cross-hatched yellow on Plan 3776/1. (b) Within 12 months following clearing authorised under this permit revegetation and rehabilitate the areas that are no longer required for the purpose for which they were cleared under this Permit by: (i) re-shaping the surface of the land so that it is consistent with the surrounding 5 metres of uncleared land; (ii) laying the vegetative material and topsoil retained under Condition 4(a). (c) Within 4 years of laying the vegetative material and topsoil on the cleared area in accordance with Condition 4(b) of this Permit: (i) engage an environmental specialist to determine the species composition, structure and density of the area revegetated and rehabilitated; and (ii) where, in the opinion of an environmental specialist, the composition, structure and density determined under Condition 4(c)(i) of this Permit will not result in a similar species composition, structure and density to that of pre-clearing vegetation types in that area, revegetate the area by deliberately planting and/or direct seeding native vegetation that will result in a similar species composition, structure and density of native vegetation to pre-clearing vegetation types in that area and ensuring only local provenance seeds and propagating material are used.
Record Keeping	In relation to the revegetation and rehabilitation of areas pursuant to Condition 4 this Permit: (i) the location of any areas revegetated and rehabilitated recorded using a GPS set to GDA94 in Easting and Northings; (ii) a description of the revegetation and rehabilitation activities undertaken; (iii) the size of the area revegetated and rehabilitated (in hectares); and (iv) the species composition, structure and density of revegetation and rehabilitation.
Reporting	The Permit Holder shall provide a report to the Director, Environment Division of DMP by 1 September each year for the life of this permit, demonstrating adherence to all conditions of this permit, and setting out the records required under Conditions 5(a) and 5(b) of this permit in relation to clearing carried out between 1 July and 30 June of the

Aspect	Relevant Closure Conditions
	previous financial year. Prior to 1 September 2016, the Permit Holder must provide to the Director, Environment Division, DMP a written report of records required under Conditions 5(a) and 5(b) of this Permit where these records have not already been provided under Condition 6(a) of this Permit.

A2: Approval Document for Clearing Reference Number CPS 1565/2 – June 2011 until March 2017

Aspect	Relevant Closure Conditions
Flora	In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference: (i) avoid the clearing of native vegetation; (ii) minimise the amount of native vegetation to be cleared; and (iii) reduce the impact of clearing on any environmental value. The Permit Holder shall: (a) retain the vegetative material and topsoil removed by clearing authorised under this Permit and stockpile the vegetative material and topsoil in an area that has already been cleared. (b) Within 12 months following completion of clearing authorised under this permit, revegetate and rehabilitate the areas that are no longer required for the purpose for which they were cleared under this Permit by: (i) laying the vegetative material and topsoil retained under Condition 5(a) on the cleared area; and (it) ripping the ground on the contour to remove soil compaction.
Rehabilitation and closure	Within 4 years of undertaking revegetation and rehabilitation in accordance with Condition 5(b) of this Permit: (i) engage an environmental specialist to determine the species composition, structure and density of the area revegetated and rehabilitated; and (ii) where, in the opinion of an environmental specialist, the composition structure and density determined under Condition 5(c)(i) of this Permit will not result in a similar species composition, structure and density to that of pre-clearing vegetation types in that area, revegetate the area by deliberately planting and/or direct seeding native vegetation that will result in a similar species composition, structure and density of native vegetation to pre-clearing vegetation types in that area and ensuring only local provenance seeds and propagating material are used.
Record keeping	In relation to file revegetation and rehabilitation of areas pursuant to Condition 5 of this Permit: (i) the location of any areas revegetated and rehabilitated, recorded using a GPS set to GDA94, expressing the coordinates in Eastings and Northings or decimal degrees; (ii) a description of the revegetation and rehabilitation activities undertaken; and (iii) the size of the area revegetated and rehabilitated (in hectares).

A3: Approval Document for Clearing Reference Number CPS 4998/1 – August 2012 until October 2022

Aspect	Relevant Closure Conditions
Rehabilitation and closure	The Permit Holder shall retain the vegetative material and topsoil removed by clearing authorised under this Permit and stockpile the vegetative material and topsoil that in an area that has already been cleared. Within 12 months following clearing authorised under this permit, revegetate and rehabilitation the area that are no longer required for the purpose for which they were cleared under this permit by: (i) re-shaping the surface of the land so that it is consistent with the surrounding 5 metres of uncleared land. (ii) ripping the ground on the contour to remove soil compaction; and (iii) laying the vegetative material and topsoil retained under Condition 9(a) Within 4 years of laying the vegetative material and topsoil on the cleared area in accordance with condition 9(b) of this permit: (i) engage a environmental specialist to determine the species composition, structure and density of the revegetated and rehabilitated; and (ii) where, in the opinion of an environmental specialist, the composition, structure and density determined under Condition 9(c)(i) of this Permit will not result in a similar species composition, structure and density to that of pre-clearing vegetation types in that area, revegetate the area by deliberately planting and/or direct seeding native vegetation that will result in a similar species composition, structure and density of native vegetation to pre-clearing vegetation types in that area and ensuring only local provenance seeds and propagating material are used.
Record keeping	In relation to the revegetation and rehabilitation of areas pursuant to condition 4 this permit: i) the location where the clearing occurred, recorded using a GPS unit set to GDA94, expressing the coordinates in Eastings and Northings; (ii) a description of the revegetation and rehabilitation activities undertaken (iii) the size of the area revegetated and rehabilitated (in hectares); and (iv) the species composition, structure and density of revegetation and rehabilitation.

A4: Approval Document for Clearing Reference Number CPS 797/1 – March 2012 until July 2022

Aspect	Relevant Closure Conditions
Rehabilitation and closure	The Permit Holder shall: (a) retain the vegetative material and topsoil removed by clearing authorised under this Permit and stockpile the vegetative material and topsoil in an area that has already been cleared. (b) within 12 months following clearing authorised under this permit, revegetate and rehabilitate the areas that are no longer required for the purpose for which they were cleared under this Permit by: (i) re-shaping the surface of the land so that it is consistent with the surrounding 5 metres of uncleared land; and (ii) laying the vegetative material and topsoil retained under Condition 10(a).(c) within 4

Aspect	Relevant Closure Conditions
	years of laying the vegetative material and topsoil on the cleared area in accordance with Condition 10(b) of this Permit: engage an environmental specialist to determine the species composition, structure and density of the area revegetated and rehabilitated; and (ii) where, in the opinion of an environmental specialist, the composition, structure and density determined under Condition 10(c)(i) of this Permit will not result in a similar species composition, structure and density to that of pre-clearing vegetation types in that area, revegetate the area by deliberately planting and/or direct seeding native vegetation that will result in a similar species composition, structure and density of native vegetation to pre-clearing vegetation types in that area and ensuring only local provenance seeds and propagating material are used.
Record keeping	The Permit Holder must maintain the following records for activities done pursuant to this Permit: (a) In relation to the clearing of native vegetation authorised under this Permit, (i) the location where the clearing occurred, recorded using a GPS unit set to GDA94, expressing the coordinates in Eastings and Northings or decimal degrees; (i) the location of any areas revegetated and rehabilitated, recorded using a GPS set to GDA94, expressing the coordinates in Eastings and Northings or decimal degrees; (ii) a description of the revegetation and rehabilitation activities undertaken; and (iii) the size of the area revegetated and rehabilitated (in hectares).

A5: Environmental Protection Act 1986 – Amendment to License: L4503/1975/13, Mount Whaleback/Orebody 29/30/35, 7th November 2012

Aspect	Relevant Closure Conditions
No Conditions or commitments relevant to Closure.	

A6: *Iron Ore (Mount Newman) Agreement Act 1964* – Proposal for Mining at Orebody 30 and Orebody 35, September 1999

Aspect	Relevant Closure Conditions
Overburden storage areas	Final Landform: Flat topped spurs, 20 degree scree outslopes, stablilised; blends with natural topography. Final Vegetation: Early successional species first, final objective is grasses with scattered shrubs.
Open Pit	Final Landform: Open pit to DME safety standards, possible with occasional open water or partially filled with overburden. Final Vegetation: Accessible internal benches and pit floors will be ripped and seeded, as necessary.
Road	Final Landform: Consistent with existing topography. All infrastructure removed. Final Vegetation: Site topsoiled, ripped and seeded consistent with the vegetation on adjacent areas, as necessary, to achieve a grassland of scattered shrubs.