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Iron Ore

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30th August 2013

Dr Paul Vogel
Chairman
Environmental Protection Authority
Locked Bag 33, Cloisters Square
Perth Western Australia 6850

Attention: Chris Stanley

Dear Paul,

OREBODY 29, 30 AND 35 BELOW WATER TABLE MINING, NEWMAN
Referral under Section 38(1) of the *Environmental Protection Act 1986*

BHP Billiton Iron Ore is seeking approval to extend the current above water table mining at Orebodies 29, 30 and 35, located approximately 7 kilometres west of Newman in the Pilbara, to below water table. The proposed project is known as the Orebody 29/30/35 Below Water Table Mining proposal.

Please find enclosed BHP Billiton Iron Ore's referral and supporting documentation, in accordance with Section 38(1) of the *Environmental Protection Act 1986.*

If you have any queries please do not hesitate to contact Mark Garrahy on (08) 6321 2183 or Mark.Garrahy@bhpbilliton.com or Sally Pickard on (08) 6321 2181 or sally.pickard@bhpbilliton.com. We look forward to working in cooperation with the Environmental Protection Authority on this proposed project.

Yours sincerely,

Gavin Price
Head of Environment

Enclosed:
- Section 38(1) Referral Form
- Attachment 1: Map of the Application Area
- Attachment 2: Referral Supporting Document
- Electronic copies of referral form, attachments 1, 2 and 3 and the shapefile of the Proposal Area

Environmental Protection Authority

GOVERNMENT OF WESTERN AUSTRALIA

EPA REFERRAL FORM PROPONENT

Referral of a Proposal by the Proponent to the Environmental Protection Authority under Section 38(1) of the *Environmental Protection Act 1986*.

PURPOSE OF THIS FORM

Section 38(1) of the *Environmental Protection Act 1986* (EP Act) provides that where a development proposal is likely to have a significant effect on the environment, a proponent may refer the proposal to the Environmental Protection Authority (EPA) for a decision on whether or not it requires assessment under the EP Act. This form sets out the information requirements for the referral of a proposal by a proponent.

Proponents are encouraged to familiarise themselves with the EPA's *General Guide on Referral of Proposals* [see Environmental Impact Assessment/Referral of Proposals and Schemes] before completing this form.

A referral under section 38(1) of the EP Act by a proponent to the EPA must be made on this form. A request to the EPA for a declaration under section 39B (derived proposal) must be made on this form. This form will be treated as a referral provided all information required by Part A has been included and all information requested by Part B has been provided to the extent that it is pertinent to the proposal being referred. Referral documents are to be submitted in two formats – hard copy and electronic copy. The electronic copy of the referral will be provided for public comment for a period of 7 days, prior to the EPA making its decision on whether or not to assess the proposal.

CHECKLIST

Before you submit this form, please check that you have:

	Yes	No
Completed all the questions in Part A (essential).	✓	
Completed all applicable questions in Part B.	✓	
Included Attachment 1 – location maps.	✓	
Included Attachment 2 – additional document(s) the proponent wishes to provide (if applicable).	✓	
Included Attachment 3 – confidential information (if applicable).	✓	
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping but excluding confidential information.	✓	

Following a review of the information presented in this form, please consider the following question (a response is optional).

Do you consider the proposal requires formal environmental impact assessment? ☐ Yes ☒ No ☐ Not sure
If yes, what level of assessment? ☐ Assessment on Proponent Information ☐ Public Environmental Review

PROPONENT DECLARATION (to be completed by the proponent)

I, ...Gavin Price....., *(full name)* declare that I am authorised on behalf of...BHP Billiton Iron Ore.... (being the person responsible for the proposal) to submit this form and further declare that the information contained in this form is true and not misleading.

Signature 	Name (print) Gavin Price
Position Head of Environment	Company BHP Billiton Iron Ore
Date 30 August 2013	

PART A - PROPONENT AND PROPOSAL INFORMATION
(All fields of Part A must be completed for this document to be treated as a referral)

1 PROPONENT AND PROPOSAL INFORMATION

1.1 Proponent

Name	BHP Billiton Iron Ore Pty Ltd
Joint Venture parties (if applicable)	BHP Billiton Iron Ore is authorised as the manager and agent of the Mount Newman Joint Venture (NJV). The NJV is comprised of the companies listed below with their respective interests: • BHP Billiton Minerals Pty Ltd (ABN 93 008 694 782) 85%; • Mitsui – Itochu Iron Pty Ltd (ABN 84 008 702 761) 10%; and • Itochu Minerals & Energy of Australia Pty (ABN 44 009 256 259) 5%.
Australian Company Number (if applicable)	
Postal Address (where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State)	BHP Billiton Iron Ore Pty Ltd PO Box 7122, Cloisters Square Perth WA 6850
Key proponent contact for the proposal: • name • address • phone • email	Mr. Gavin Price Head of Environment BHP Billiton Iron Ore 125 St Georges Terrace Perth WA 6000 Telephone: 08 6321 3455 Email: Gavin.H.Price@bhpbilliton.com
Consultant for the proposal (if applicable): • name • address • phone • email	

1.2 Proposal

Title	Orebody 29/30/35 Mining Below Water Table
Description	BHP Billiton Iron Ore proposes to extend mining below the water table at the satellite orebodies Orebodies 29, 30 and 35 (OB29/30/35) to sustain the Newman Hub mining operations, located at Mt Whaleback. The Proposal involves in-pit extraction of groundwater in order to allow campaign mining of iron ore and overburden below the groundwater table through conventional open cut mining methods. The Proposal requires dewatering ahead of mining to provide dry conditions for

	mining below the water table.
Extent (area) of proposed ground disturbance.	Approximately 150 ha within a Proposal area of 457 ha. This referral is not seeking approval for activities already authorised as part of the above water table mining operations, such as overburden storage or roads, as these are authorised under existing permits and approvals.
Timeframe in which the activity or development is proposed to occur (including start and finish dates where applicable).	BHP Billiton Iron ore proposes to commence mining below the water table in 2014, subject to market conditions and all relevant government approvals. However, advanced dewatering of the orebody prior to mining will be required.
Details of any staging of the proposal.	The Proposal is not staged. However, campaign mining of OB29/30/35 is proposed whereby ore will be mined on an as needs basis to complement the Mount Newman blend.
Is the proposal a strategic proposal?	No
Is the proponent requesting a declaration that the proposal is a derived proposal? If so, provide the following information on the strategic assessment within which the referred proposal was identified: • title of the strategic assessment; and • Ministerial Statement number.	No
Please indicate whether, and in what way, the proposal is related to other proposals in the region.	This Proposal is independent of other Proposals in the region. However, ore from OB29/30/35 will be used to complement the Mount Newman blend. The demand for ore from OB29/30/35 will be dependent on the requirements of the Mount Newman Blend.
Does the proponent own the land on which the proposal is to be established? If not, what other arrangements have been established to access the land?	The Proposal area is located primarily on Mineral Lease ML244SA with a portion of the Proposal area location on M52/906 and G52/257.
What is the current land use on the property, and the extent (area in hectares) of the property?	The Proposal area is approximately 457 ha. The land is currently used for mining and mineral exploration purposes with mining currently occurring at OB29/30/35 as authorised under approvals to mine above the water table. The mineral leases on which the Proposal occurs also contains the Mount Whaleback mining operations.

1.3 Location

Name of the Shire in which the proposal is located.	Shire of East Pilbara

For urban areas: • street address; • lot number; • suburb; and • nearest road intersection.	NA
For remote localities: • nearest town; and • distance and direction from that town to the proposal site.	The Proposal is located approximately 7 km west of the township of Newman in the Pilbara region of Western Australia.
Electronic copy of spatial data - GIS or CAD, geo-referenced and conforming to the following parameters: • GIS: polygons representing all activities and named; • CAD: simple closed polygons representing all activities and named; • datum: GDA94; • projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA); • format: Arcview shapefile, Arcinfo coverages, Microstation or AutoCAD.	Enclosed?: **Yes**

1.4 Confidential Information

Does the proponent wish to request the EPA to allow any part of the referral information to be treated as confidential?	No
If yes, is confidential information attached as a separate document in hard copy?	NA

1.5 Government Approvals

Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.		No	
Is approval required from any Commonwealth or State Government agency or Local Authority for any part of the proposal? If yes, please complete the table below.		Yes	
Agency/Authority	Approval required	Application lodged Yes / No	Agency/Local Authority contact(s) for proposal
Minister for Environment; Water/Environmental Protection Authority	*Environmental Protection Act 1986* (WA) - Part IV: Ministerial Statement	Purpose of this document	Paul Vogel OEPA The Atrium 168 St Georges Terrace PERTH WA 6000 (08) 6467 5600
Department of Water	*Rights in Water and Irrigation Act 1914* (WA):	No	Gary Humphries Department of

	5C License to Take Water		Water The Atrium 168 St Georges Terrace PERTH WA 6000
Department Environment Regulation	*Environment Protection Act 1986* (WA): Section 38 Referral of Proposal to Authority	No	Alana Kidd Karratha Regional Office PO Box 836 KARRATHA WA 6714 (08) 9182 2037
Department of Mines and Petroleum	*Environment Protection Act 1986* (WA): Section 51E Native Vegetation Clearing Permit	No, clearing is authorized under existing clearing permits.	Ryan Mincham Team Leader Minerals North Department of Mines and Petroleum Mineral House, 100 Plain Street, East Perth, Western Australia 6004

PART B - ENVIRONMENTAL IMPACTS AND PROPOSED MANAGEMENT

2. ENVIRONMENTAL IMPACTS

Describe the impacts of the proposal on the following elements of the environment, by answering the questions contained in Sections 2.1-2.11:

2.1 flora and vegetation;

2.2 fauna;

2.3 rivers, creeks, wetlands and estuaries;

2.4 significant areas and/ or land features;

2.5 coastal zone areas;

2.6 marine areas and biota;

2.7 water supply and drainage catchments;

2.8 pollution;

2.9 greenhouse gas emissions;

2.10 contamination; and

2.11 social surroundings.

These features should be shown on the site plan, where appropriate.

For all information, please indicate:

(a) the source of the information; and

(b) the currency of the information.

2.1 Flora and Vegetation

2.1.1 Do you propose to clear any native flora and vegetation as a part of this proposal?

[A proposal to clear native vegetation may require a clearing permit under Part V of the EP Act (Environmental Protection (Clearing of Native Vegetation) Regulations 2004)]. Please contact the Department of Environment and Conservation (DEC) for more information.

(please tick) ☐ Yes **If yes**, complete the rest of this section.

☑ No **If no**, go to the next section

Clearing required for this Proposal is authorised under approved Native Vegetation Clearing Permits as described in Section 2.7.3 of the supporting information document. As such, approval for activities already authorised as part of the above water table mining operations is not included as part of this Proposal.

The Proposal falls within areas previously assessed and approved for mining activities. OB29 has been extensively cleared and OB30 is partially cleared as a result of historical mining activities. OB35 is approved for above water table mining with activities due to commence in late 2013, and therefore has been assessed previously for land disturbance.

2.1.2 How much vegetation are you proposing to clear (in hectares)?

Clearing required for the project has been assessed and approved under existing permits and approvals as decribed above and in Section 2.7.3 of the supporting information document.

2.1.3 Have you submitted an application to clear native vegetation to the DEC (unless you are exempt from such a requirement)?

☐ Yes ☑ No **If yes**, on what date and to which office was the application submitted of the DEC?

Any required clearing will be covered under existing clearing permits. See Section 2.7.3 of the supporting information document for further information.

2.1.4 Are you aware of any recent flora surveys carried out over the area to be disturbed by this proposal?

☑ Yes ☐ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).

If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

Since the commencement of mining at Mt Whaleback in the 1960s, BHP Billiton Iron Ore have commissioned at least 40 flora and vegetation surveys of the Mt Whaleback and OB29, 30 and 35 areas to support environmental approvals and conditions.

Onshore Environmental were engaged in 2013 to undertake a review and consolidation of the previous surveys conducted within the ML244SA lease and to undertake a Groundwater Dependent Vegetation Impact Assessment of the Proposal area in February 2013. GHD completed a flora and vegetation survey of the OB35 area in 2010, covering a portion of ML244SA, M52/906, E52/2008, G52/1257 and other general purpose leases south of ML244SA.

2.1.5 Has a search of DEC records for known occurrences of rare or priority flora or threatened ecological communities been conducted for the site?

☑ Yes ☐ No If you are proposing to clear native vegetation for any part of your proposal, a search of DEC records of known occurrences of rare or priority flora and threatened ecological communities will be required. Please contact DEC for more information.

A search of Department of Parks and Wildlife (DPaW) records was undertaken as part of the flora and vegetation review undertaken by Onshore Environmental. No approval for vegetation clearing is being sought as part of this referral.

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2.1.6 Are there any known occurrences of rare or priority flora or threatened ecological communities on the site?

☐ Yes ☑ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

2.1.7 If located within the Perth Metropolitan Region, is the proposed development within or adjacent to a listed Bush Forever Site? (You will need to contact the Bush Forever Office, at the Department for Planning and Infrastructure)

☐ Yes ☑ No **If yes**, please indicate which Bush Forever Site is affected (site number and name of site where appropriate).

2.1.8 What is the condition of the vegetation at the site?

Onshore Environmental (2013b) reported that the 21 ha of remnant vegetation within the OB29 area was in variable condition, ranging from Excellent to Good. The majority of the OB29 Proposal area is totally cleared of native vegetation due to historical mining activities (approximately 90%).

GHD (2011) reported that the vegetation condition of the OB30 and OB35 areas ranged from Excellent to Degraded. The remanent vegetation of the OB30 Proposal area was considered predominantly Good to Degraded, with a southern section of Excellent vegetation condition. OB35 is considered to contain predominantly Excellent to Good vegetation condition as above ground mining is yet to commence in this area.

2.2 Fauna

2.2.1 Do you expect that any fauna or fauna habitat will be impacted by the proposal?

(please tick) ☑ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.2.2 Describe the nature and extent of the expected impact.

The Proposal falls within areas previously assessed and approved for mining activities. As such, approval for activities already authorised as part of the above water table mining operations is not sought for as part of this referral.

Due to the nature of the below water table mining and significant disturbance that has already occurred within OB29 and OB30, it is unlikely that any new impacts to terrestrial vertebrate fauna will be introduced. Impacts associated with the development of OB35 were previously assessed under the referral of that Proposal in 2012. It is not expected any impacts to vertebrate fauna will be additional or different to those identified and assessed in that Proposal.

The Proposal has the potential to directly impact stygofauna through the dewatering. The drawdown effects of dewatering within the Proposal area will be largely restricted to the immediate mining area. All of the species recorded within the area of predicted drawdown associated with the Proposal are also

known, or considered highly likely, to occur in locations not impacted by mining and associated activities. Additionally, habitat characterisation and regional stygofauna sampling suggest that the stygofauna habitat in the Proposal area is connected with stygofauna habitat in the downstream Ophthalmia floodplain.

2.2.3 Are you aware of any recent fauna surveys carried out over the area to be disturbed by this proposal?

☑ Yes ☐ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).

If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

The Proposal Area and surrounds have been subject to at least 26 vertebrate fauna surveys over an 18 year period.

BHP Billiton Iron Ore commissioned Onshore Environmental in 2013 to review previous vertebrate fauna and fauna habitat assessments completed in the vicinity of the Mt Whaleback site, the OB29 deposit and surrounds, with the aim to provide a consolidated baseline report and mapping.

BHP Billition Iron Ore also commissioned Biologic to prepare a fauna and fauna habitat impact assessment for the OB30, OB35, Western Ridge deposits and surrounds. As part of this work, Biologic (2011) reviewed former surveys covering area and also conducted a Level 2 fauna survey of the study area. The two season fauna survey (March and August 2010) also included a habitat assessment with particular emphasis on habitats considered likely to support conservation significant fauna.

In 2007, BHP Billiton Iron Ore commenced a broad Regional Subterranean Fauna Sampling Program in the Pilbara. As part of this program, BHP Billiton Iron Ore has undertaken extensive stygofauna sampling in the region.

BHP Billiton Iron Ore commissioned Bennelongia Pty Ltd (Bennelongia) in 2013 to survey and assess the potential impacts on stygofauna from mining activities associated with implementation of mine dewatering and mining below groundwater table at OB29/30/35 (Bennelongia, 2013). Data from the Regional Subterranean Fauna Sampling Program was used in conjunction with the results from the stygofauna surveys undertaken at OB29/30/35 to better understand the relationships between the local stygofauna community and that of the surrounding subregion. The Environmental Management Branch of the former DEC was consulted to confirm that the sampling undertaken was sufficent for the assessment (See Section 6.4) of the supporting information document for further information.

2.2.4 Has a search of DEC records for known occurrences of Specially Protected (threatened) fauna been conducted for the site?

☑ Yes ☐ No (please tick)

A search of DPaW records was undertaken as part of the vertebrate fauna and habitat review undertaken by Onshore Environmental. No approval for clearing or disturbance of fauna habitat is sought as part of this referral.

2.2.5 Are there any known occurrences of Specially Protected (threatened) fauna on the site?

☑ Yes ☐ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

The DPaW Priority 4 listed species *Macrodema gigas* (Ghost Bat) has been recorded from the Proposal area.

2.3 Rivers, Creeks, Wetlands and Estuaries

2.3.1 Will the development occur within 200 metres of a river, creek, wetland or estuary?

(please tick) ☑ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.3.2 Will the development result in the clearing of vegetation within the 200 metre zone?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.3.3 Will the development result in the filling or excavation of a river, creek, wetland or estuary?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.3.4 Will the development result in the impoundment of a river, creek, wetland or estuary?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.3.5 Will the development result in draining to a river, creek, wetland or estuary?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.3.6 Are you aware if the proposal will impact on a river, creek, wetland or estuary (or its buffer) within one of the following categories? (please tick)

Conservation Category Wetland	☐ Yes	☑ No	☐ Unsure
Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998	☐ Yes	☑ No	☐ Unsure
Perth's Bush Forever site	☐ Yes	☑ No	☐ Unsure
Environmental Protection (Swan & Canning Rivers) Policy 1998	☐ Yes	☑ No	☐ Unsure
The management area as defined in s4(1) of the *Swan River Trust Act 1988*	☐ Yes	☑ No	☐ Unsure
Which is subject to an international agreement, because of the importance of the wetland for waterbirds and waterbird habitats (e.g. Ramsar, JAMBA, CAMBA)	☐ Yes	☑ No	☐ Unsure

2.4 Significant Areas and/ or Land Features

2.4.1 Is the proposed development located within or adjacent to an existing or proposed National Park or Nature Reserve?

☐ Yes ☑ No **If yes**, please provide details.

2.4.2 Are you aware of any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) that will be impacted by the proposed development?

☐ Yes ☑ No **If yes**, please provide details.

2.4.3 Are you aware of any significant natural land features (e.g. caves, ranges etc) that will be impacted by the proposed development?

☐ Yes ☑ No **If yes**, please provide details.

2.5 Coastal Zone Areas (Coastal Dunes and Beaches)

2.5.1 Will the development occur within 300metres of a coastal area?

(please tick) ☐ Yes **If yes**, complete the rest of this section.

☑ No **If no**, go to the next section.

2.5.2 What is the expected setback of the development from the high tide level and from the primary dune?

2.5.3 Will the development impact on coastal areas with significant landforms including beach ridge plain, cuspate headland, coastal dunes or karst?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.5.4 Is the development likely to impact on mangroves?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.6 Marine Areas and Biota

2.6.1 Is the development likely to impact on an area of sensitive benthic communities, such as seagrasses, coral reefs or mangroves?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.6.2 Is the development likely to impact on marine conservation reserves or areas recommended for reservation (as described in *A Representative Marine Reserve System for Western Australia*, CALM, 1994)?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.6.3 Is the development likely to impact on marine areas used extensively for recreation or for commercial fishing activities?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact, and provide any written advice from relevant agencies (e.g. Fisheries WA).

2.7 Water Supply and Drainage Catchments

2.7.1 Are you in a proclaimed or proposed groundwater or surface water protection area?

(You may need to contact the Department of Water (DoW) for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

☑ Yes ☐ No **If yes**, please describe what category of area.

The Proposal area is located in the RIWI Pilbara Surface Water Area and in the Pilbara Groundwater Proclamation Area. However, there will be no abstraction of surface water from creeks.

2.7.2 Are you in an existing or proposed Underground Water Supply and Pollution Control area?

(You may need to contact the DoW for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

☐ Yes ☑ No **If yes**, please describe what category of area.

BHP Billiton Iron Ore holds a current 5C Licence to Take from DoW (GWL160418(6)) for abstraction from Orebody 29 and Orebody 30.

2.7.3 Are you in a Public Drinking Water Supply Area (PDWSA)?

(You may need to contact the DoW for more information or refer to the DoW website. A proposal to clear vegetation within a PDWSA requires approval from DoW.)

☑ Yes ☐ No **If yes**, please describe what category of area.

The Proposal is located within a P1 PDWSA area (Newman Water Reserve).

No approval to clear vegetation is being sought under this Proposal.

2.7.4 Is there sufficient water available for the proposal?

(Please consult with the DoW as to whether approvals are required to source water as you propose. Where necessary, please provide a letter of intent from the DoW)

☑ Yes ☐ No (please tick)

2.7.5 Will the proposal require drainage of the land?

☐ Yes ☑ No **If yes**, how is the site to be drained and will the drainage be connected to an existing Local Authority or Water Corporation drainage system? Please provide details.

2.7.6 Is there a water requirement for the construction and/ or operation of this proposal?

(please tick) ☑ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.7.7 What is the water requirement for the construction and operation of this proposal, in kilolitres per year?

Water requirements for operation of the project will not exceed the dewater volume. Additionally, excess water from implementation of the Proposal will be used for existing operations at the main Mount Whaleback.

2.7.8 What is the proposed source of water for the proposal? (e.g. dam, bore, surface water etc.)

BHP Billiton Iron Ore will source water required for the Proposal from the dewater resulting from implementation of the Proposal.

2.8 Pollution

2.8.1 Is there likely to be any discharge of pollutants from this development, such as noise, vibration, gaseous emissions, dust, liquid effluent, solid waste or other pollutants?

(please tick) ☑ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.8.2 Is the proposal a prescribed premise, under the Environmental Protection Regulations 1987?

(Refer to the EPA's *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* for more information)

☑ Yes ☐ No **If yes**, please describe what category of prescribed premise.

The Proposal is a Prescribed Premise 'by association' since it is covered by the existing Mount Whaleback licence L4503. The licence allows Category 5, 64 and 85 activities at Mount Whaleback under the Environmental Protection Regulations 1987.

2.8.3 Will the proposal result in gaseous emissions to air?

☑ Yes ☐ No **If yes**, please briefly describe.

The Proposal will result in minor volumes of gaseous emissions as a result of blasting, vehicle and mobile machinery use. However, these emissions will not be significantly greater than those of current operations. Gaseous emissions associated with the Proposal will not have a significant impact on air quality.

2.8.4 Have you done any modelling or analysis to demonstrate that air quality standards will be met, including consideration of cumulative impacts from other emission sources?

☐ Yes ☑ No **If yes**, please briefly describe.

As the Proposal is a continuation of existing approved operations, emissions will not be significantly greater than that already approved and as such it was considered unnecessary to undertake additional modelling.

Air quality modelling was undertaken in 2011 by ERM for the OB35 above water table mining referral. This included an assessment of cumulative impacts for existing and future predicted operations. A summary of this is included in the supporting information document.

Potential impacts can be managed under Part V of the EP Act (Environmental Licence to Operate), the Clean Energy Act 2011 (Cth) and the National Greenhouse and Energy Reporting Act 2007 (Cth).

2.8.5 Will the proposal result in liquid effluent discharge?

☐ Yes ☑ No **If yes**, please briefly describe the nature, concentrations and receiving environment.

2.8.6 If there is likely to be discharges to a watercourse or marine environment, has any analysis been done to demonstrate that the State Water Quality Management Strategy or other appropriate standards will be able to be met?

☐ Yes ☑ No **If yes**, please describe.

2.8.7 Will the proposal produce or result in solid wastes?

☑ Yes ☐ No **If yes**, please briefly describe the nature, concentrations and disposal location/ method.

Waste rock will be stockpiled at previously approved OSAs.

Minor volumes of domestic waste will be generated by the Proposal at crib rooms. Waste will be collected and transported for disposal at existing and suitably licensed facilities at the existing Mount Whaleback site and/or at the township of Newman.

2.8.8 Will the proposal result in significant off-site noise emissions?

☐ Yes ☑ No **If yes**, please briefly describe.

Noise emissions will not be significantly greater than those of current operations.

2.8.9 Will the development be subject to the Environmental Protection (Noise) Regulations 1997?

☐ Yes ☑ No **If yes**, has any analysis been carried out to demonstrate that the proposal will comply with the Regulations?

Please attach the analysis.

Yes, noise impacts will be managed under the Environmental Protection (Noise) Regulations 1997.

Previous Noise Assessments have shown that noise levels at sensitive receptors will not exceed Environmental Protection (Noise) Regulation thresholds as a result of the Proposal.

2.8.10 Does the proposal have the potential to generate off-site, air quality impacts, dust, odour or another pollutant that may affect the amenity of residents and other "sensitive premises" such as schools and hospitals (proposals in this category may include intensive agriculture, aquaculture, marinas, mines and quarries etc.)?

☑ Yes ☐ No **If yes**, please describe and provide the distance to residences and other "sensitive premises".

The Proposal will result in the generation of dust through vehicle and mobile machinery movement, as well as blasting, transfer and transport of ore and overburden. Dust may also be generated by wind over disturbed areas.

Dust generated by the Proposal is unlikely to have a significant impact on sensitive receptors given that the Proposal constitutes a continuation of existing operations and dust emissions will be similar to that of existing operations.

Refer to Section 5.11 of the supporting information document for more information on the potential impact of dust generated by the Proposal.

2.8.11 If the proposal has a residential component or involves "sensitive premises", is it located near a land use that may discharge a pollutant?

☐ Yes ☐ No ☑Not Applicable

If yes, please describe and provide the distance to the potential pollution source

2.9 Greenhouse Gas Emissions

2.9.1 Is this proposal likely to result in substantial greenhouse gas emissions (greater than 100 000 tonnes per annum of carbon dioxide equivalent emissions)?

☐ Yes ☑ No **If yes**, please provide an estimate of the annual gross emissions in absolute and in carbon dioxide equivalent figures.

2.9.2 Further, if yes, please describe proposed measures to minimise emissions, and any sink enhancement actions proposed to offset emissions.

2.10 Contamination

2.10.1 Has the property on which the proposal is to be located been used in the past for activities which may have caused soil or groundwater contamination?

☑ Yes ☐ No ☐ Unsure **If yes**, please describe.

The Proposal area is an active mining area.

2.10.2 Has any assessment been done for soil or groundwater contamination on the site?

☐ Yes ☑ No **If yes**, please describe.

2.10.3 Has the site been registered as a contaminated site under the *Contaminated Sites Act 2003*? (on finalisation of the CS Regulations and proclamation of the CS Act)

☑ Yes ☐ No **If yes**, please describe.

The Proposal area lies within an area that has been notified as "Contaminated – Remediation Required". The notified area encompasses the full extent of the ownership or lease, and not the actual extent of contamination.

2.11 Social Surroundings

2.11.1 Is the proposal on a property which contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed?

☐ Yes ☑ No ☐ Unsure **If yes**, please describe.

2.11.2 Is the proposal on a property which contains or is near a site of high public interest (e.g. a major recreation area or natural scenic feature)?

☐ Yes ☑ No **If yes**, please describe.

2.11.3 Will the proposal result in or require substantial transport of goods, which may affect the amenity of the local area?

☐ Yes ☑ No **If yes**, please describe.

3. PROPOSED MANAGEMENT

3.1 Principles of Environmental Protection

3.1.1 Have you considered how your project gives attention to the following Principles, as set out in section 4A of the EP Act? (For information on the Principles of Environmental Protection, please see EPA Position Statement No. 7, available on the EPA website)

1. The precautionary principle.	☑ Yes	☐ No
2. The principle of intergenerational equity.	☑ Yes	☐ No
3. The principle of the conservation of biological diversity and ecological integrity.	☑ Yes	☐ No
4. Principles relating to improved valuation, pricing and incentive mechanisms.	☑ Yes	☐ No
5. The principle of waste minimisation.	☑ Yes	☐ No

3.1.2 Is the proposal consistent with the EPA's Environmental Protection Bulletins/Position Statements and Environmental Assessment Guidelines/Guidance Statements (available on the EPA website)?

☑ Yes ☐ No

3.2 Consultation

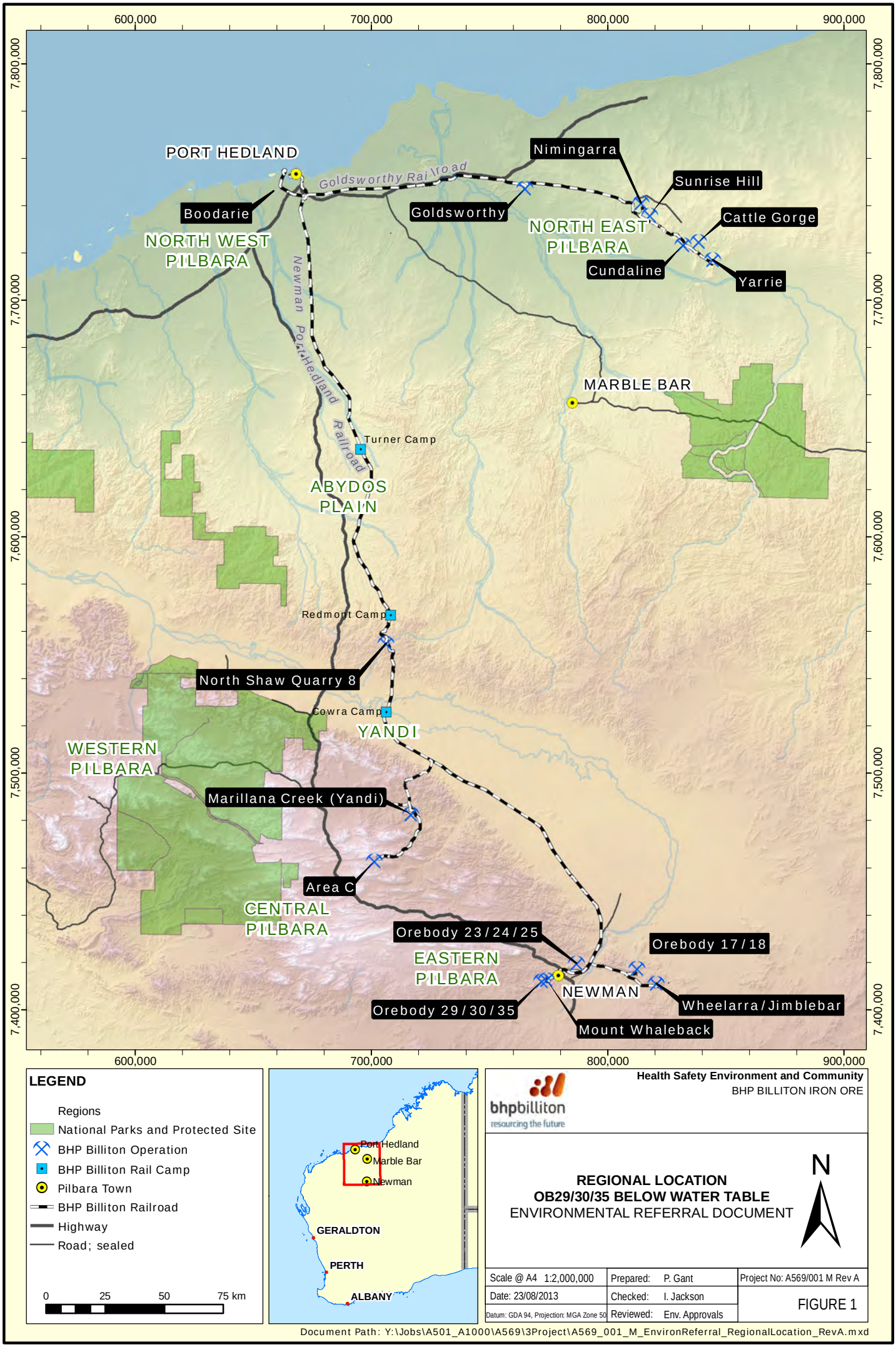
3.2.1 Has public consultation taken place (such as with other government agencies, community groups or neighbours), or is it intended that consultation shall take place?

☑ Yes ☐ No **If yes**, please list those consulted and attach comments or summarise response on a separate sheet.

Section 6.4 of the supporting information document contains information of consultation undertaken to date.

Attachment 1 – Maps of the Proposal Area

Note – these are referenced in the Environmental Referral Document



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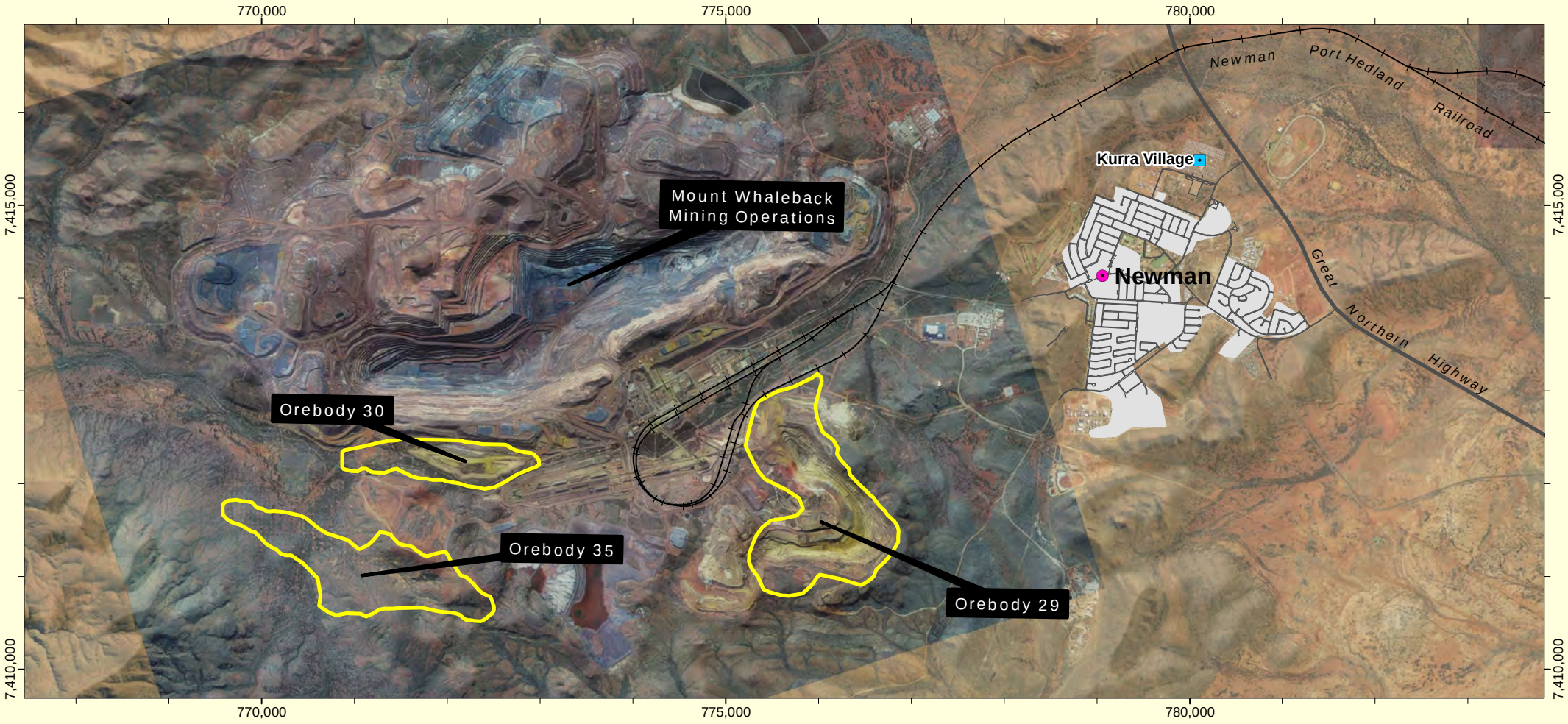
REGIONAL LOCATION
OB29/30/35 BELOW WATER TABLE
ENVIRONMENTAL REFERRAL DOCUMENT

N

Scale @ A4 1:2,000,000	Prepared: P. Gant	Project No: A569/001 M Rev A
Date: 23/08/2013	Checked: I. Jackson	FIGURE 1
Datum: GDA 94, Projection: MGA Zone 50	Reviewed: Env. Approvals	

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_001_M_EnvironReferral_RegionalLocation_RevA.mxd



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LOCAL OVERVIEW
OB29/30/35 BELOW WATER TABLE
ENVIRONMENTAL REFERRAL DOCUMENT

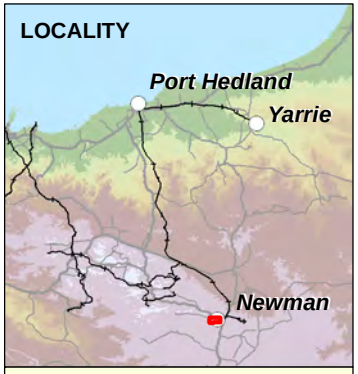
0 1 2 4
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:60,000	Prepared: P.Gant	Project No: A569/02 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 2
	Reviewed: Env. Approvals	

LOCALITY

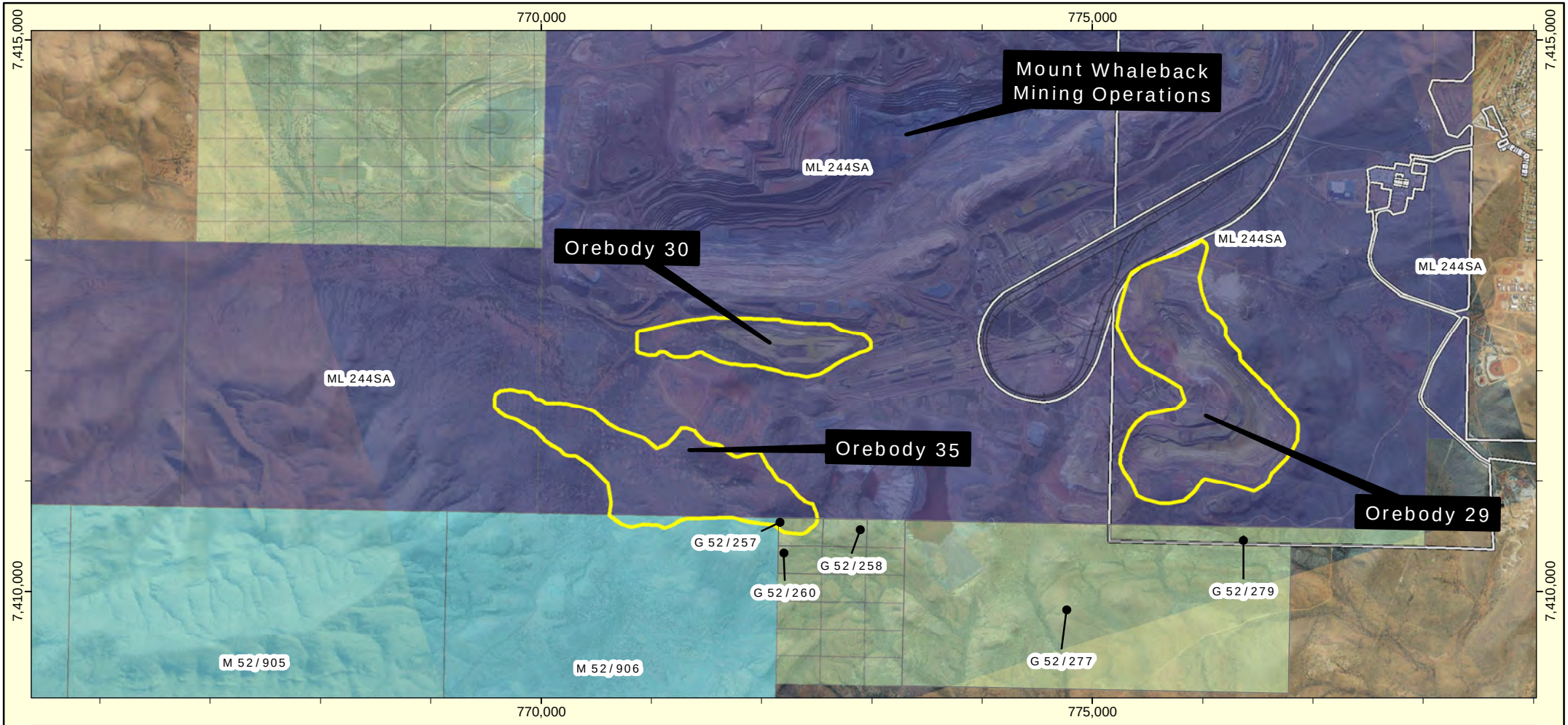


0 500
Kilometres

LEGEND

- Pilbara Town
- BHP Billiton Mine Accomodation
- Built Up Area
- BHPBIO Rail Line
- Highway
- Proposal Area

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_002_M_EnvironReferral_LocalOverview_RevA.mxd



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TENURE
OB29/30/35 BELOW WATER TABLE
ENVIRONMENTAL REFERRAL DOCUMENT

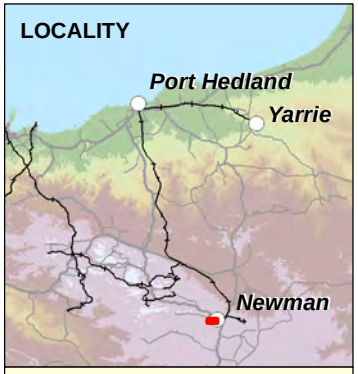
0 1 2
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:50,000	Prepared: P.Gant	Project No: A569/003 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 3
	Reviewed: Env. Approvals	

LOCALITY



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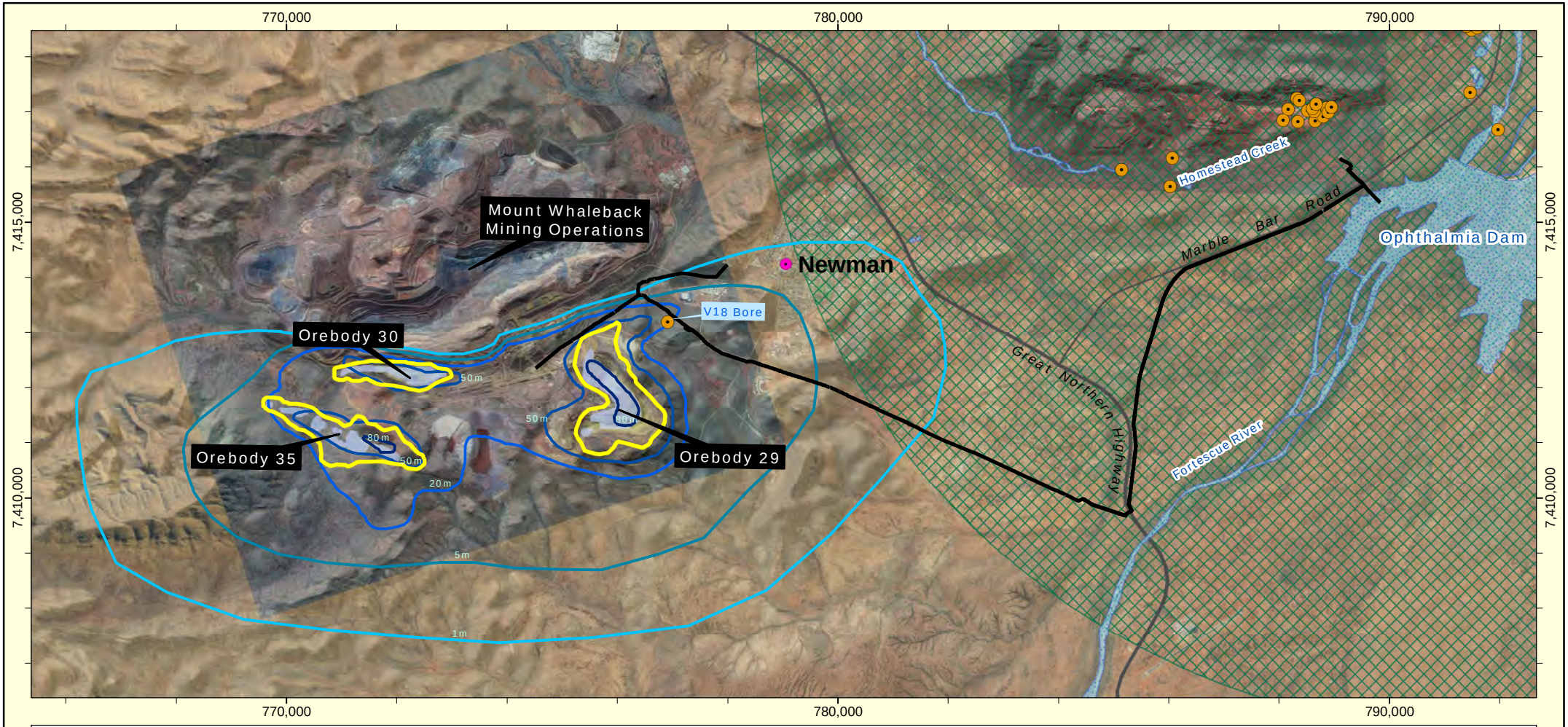
Kilometres

LEGEND

BHP Billiton Land Tenure
Crown Lease
BHP Billiton Mining Tenure
General Purpose Lease
Mineral Lease S.A.
Mining Lease
Proposal Area
BHPBIO Rail Line

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_003_M_EnvironReferral_Tenure_RevA.mxd



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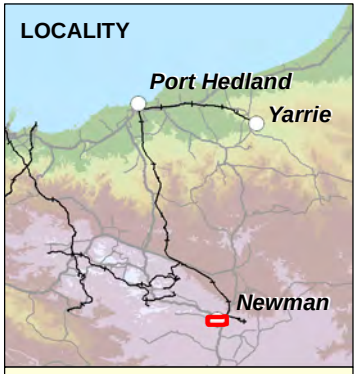
POTENTIAL GROUNDWATER DRAWDOWN, OPHTHALMIA BOREFIELD AND SURPLUS WATER DISCHARGE OB29/30/35 BELOW WATER TABLE
ENVIRONMENTAL REFERRAL DOCUMENT

0 1 2 4
Kilometres
N
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:100,000	Prepared: P.Gant	Project No: A569/007 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 4
	Reviewed: Env. Approvals	

LOCALITY



0 500
Kilometres

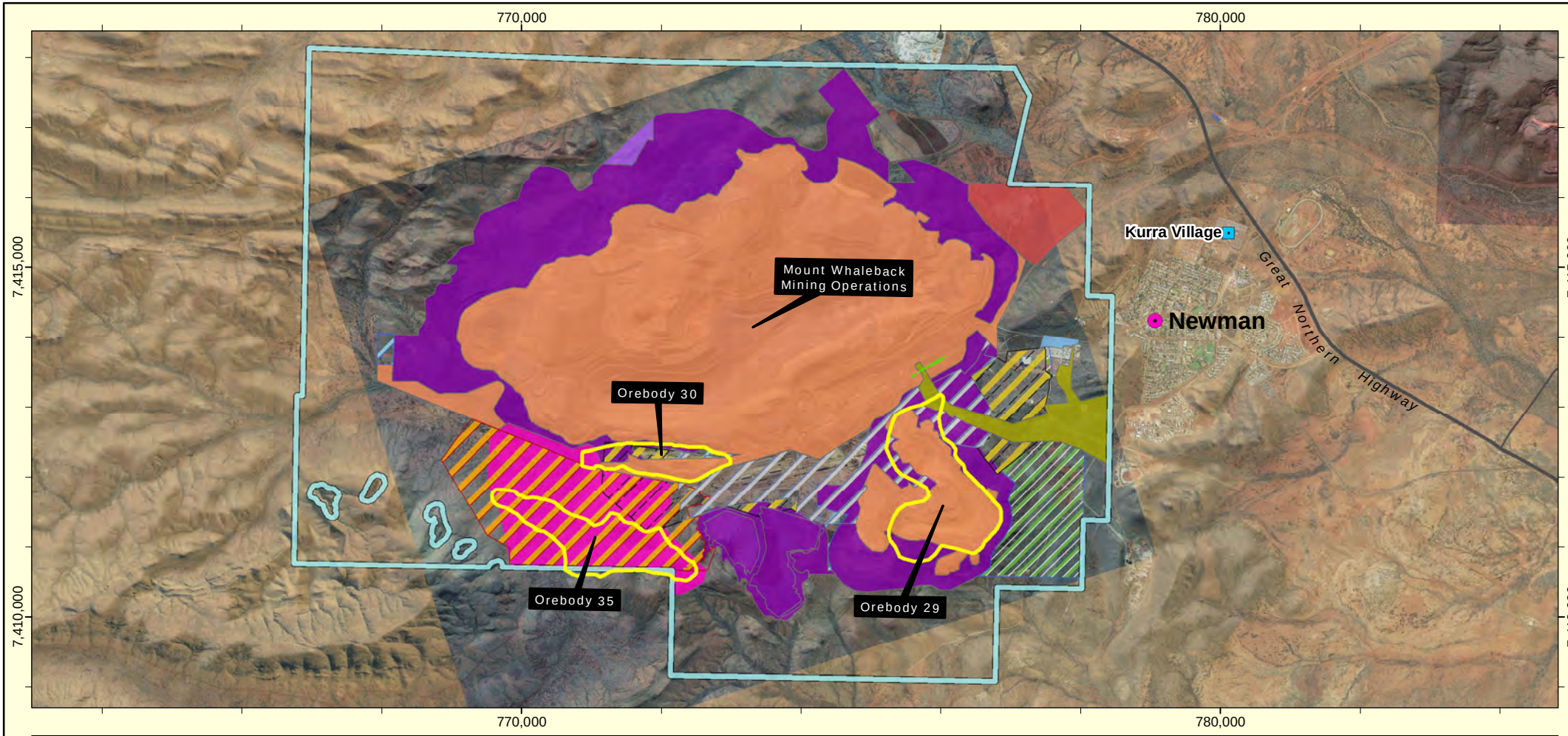
LEGEND

- Proposal Area
- Below Water Table Mining
- Ophthalmia Borefield Bores
- Surplus Water Discharge Pipeline
- Pilbara Waterbody
- Pilbara Town
- Highway
- Road; sealed
- Ethel Gorge Threatened Ecological Community Buffer

Drawdown

- 1m
- 5m
- 20m
- 50m
- 80m

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_007_M_EnvironReferral_Drawdown_RevA.mxd



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CURRENT AND PROPOSED NVCPS OB29/30/35 BELOW WATER TABLE
ENVIRONMENTAL REFERRAL DOCUMENT

0 1 2 4
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:80,000	Prepared: P.Gant	Project No: A569/004 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 5
	Reviewed: Env. Approvals	

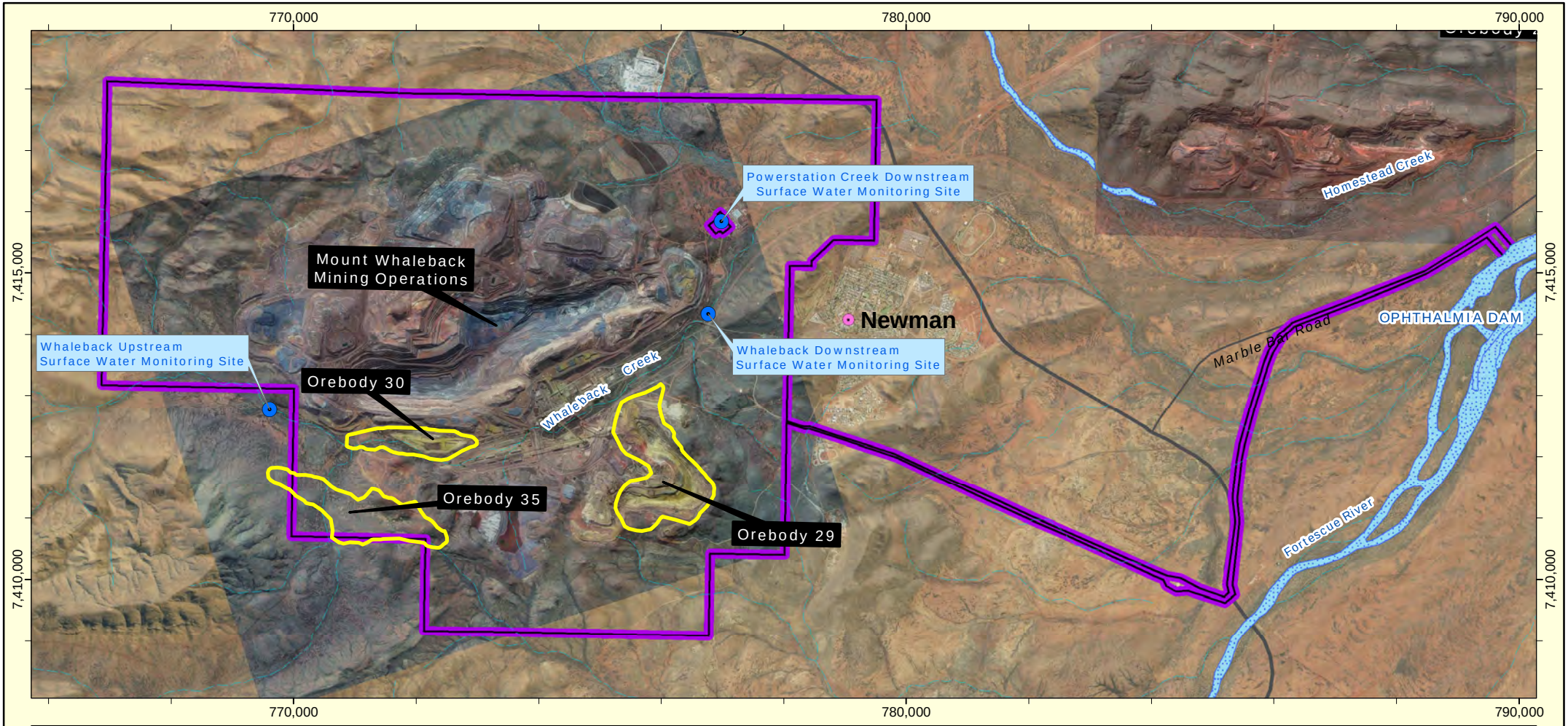
LOCALITY

0 500
Kilometres

LEGEND

- Pilbara Town
- BHP Billiton Mine Accomodation
- Highway
- Road; sealed
- Proposal Area
- Strategic NVCP Application Area
- NVCP 2989/1
- NVCP 1018/1
- NVCP 1565/2
- NVCP 2864/1
- NVCP 3072/1
- NVCP 3297/1
- NVCP 3329/1
- NVCP 3776/1
- NVCP 3821/1
- NVCP 4025/2
- NVCP 4737/1
- NVCP 4797/1
- NVCP 4998/1

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_004_M_EnvironReferral_NVCP_RevA.mxd



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MOUNT WHALEBACK OPERATING LICENCE AND SURFACE WATER MONITORING LOCATIONS OB29/30/35 BELOW WATER TABLE

ENVIRONMENTAL REFERRAL DOCUMENT

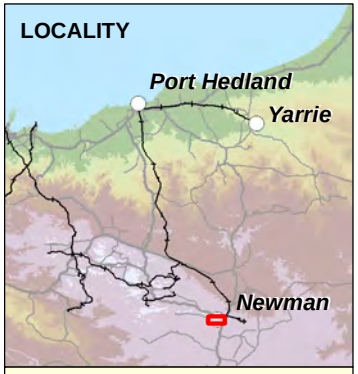
0 1 2 4
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:90,000	Prepared: P.Gant	Project No: A569/005 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 6
	Reviewed: Env. Approvals	

LOCALITY

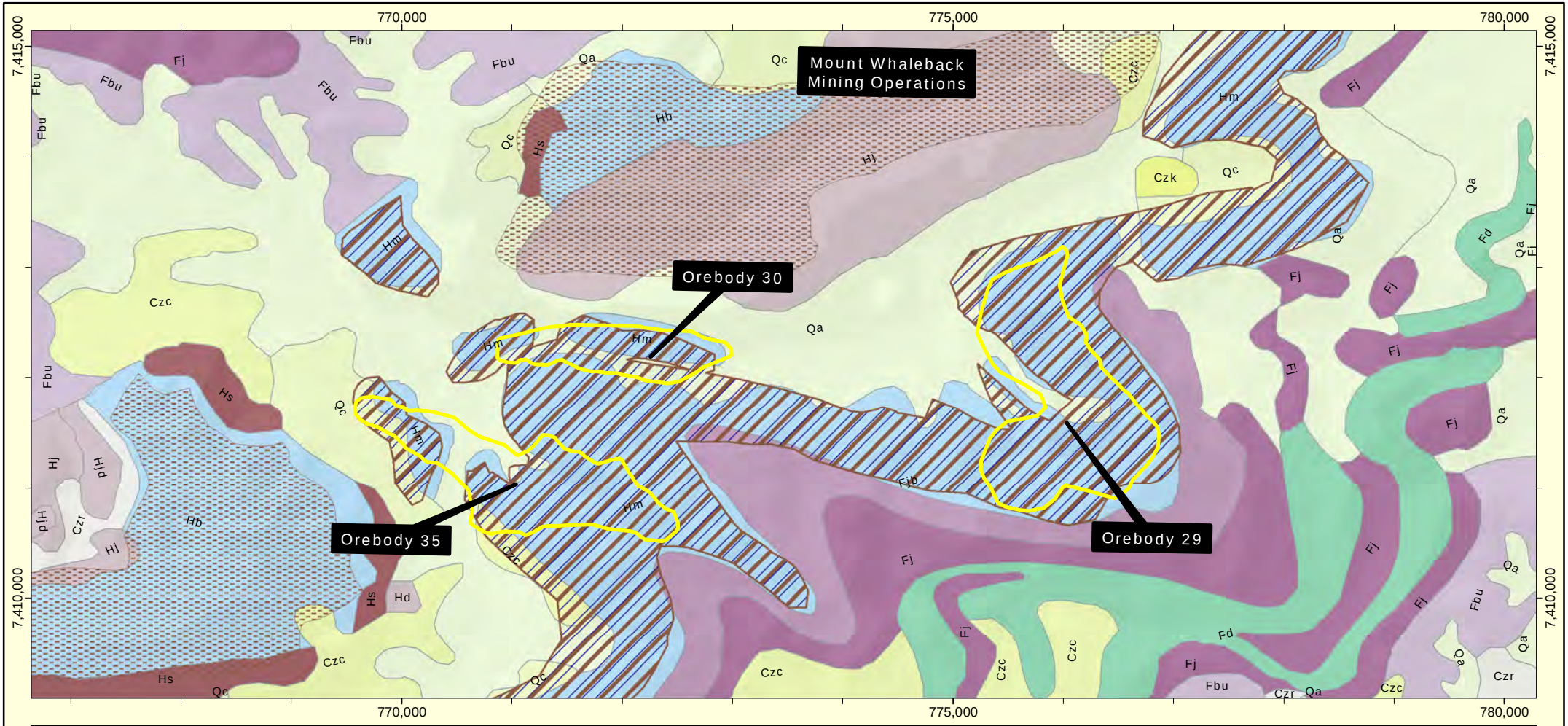


0 500
Kilometres

LEGEND

- Proposal Area
- Surface Water Monitoring Site
- Major, Non-perennial
- Minor Watercourse
- Pilbarra Waterbody
- Mount Whaleback L4503/1975/3 Amendment
- Pilbara Town
- Highway
- Road; sealed

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_005_M_EnvironReferral_MonitoringSites_RevA.mxd



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LOCAL GEOLOGY
OB29/30/35 BELOW WATER TABLE
ENVIRONMENTAL REFERRAL DOCUMENT

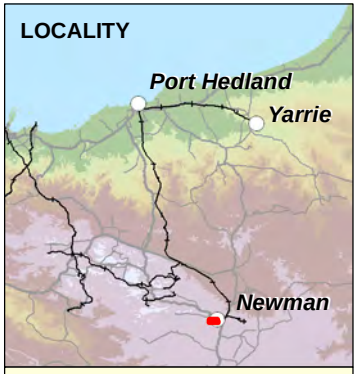
0 1 2
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:50,000	Prepared: P.Gant	Project No: A569/006 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 7
	Reviewed: Env. Approvals	

LOCALITY



0 500
Kilometres

LEGEND

- Proposal Area
- Marra Mamba Iron Formation
- Brockman Iron Formation

Geology

- Czc
- Czk
- Czr
- Fbu
- Fd
- Fj
- Fjb
- Hb
- Hd
- Hj
- Hjd
- Hm
- Hs
- Qa
- Qc

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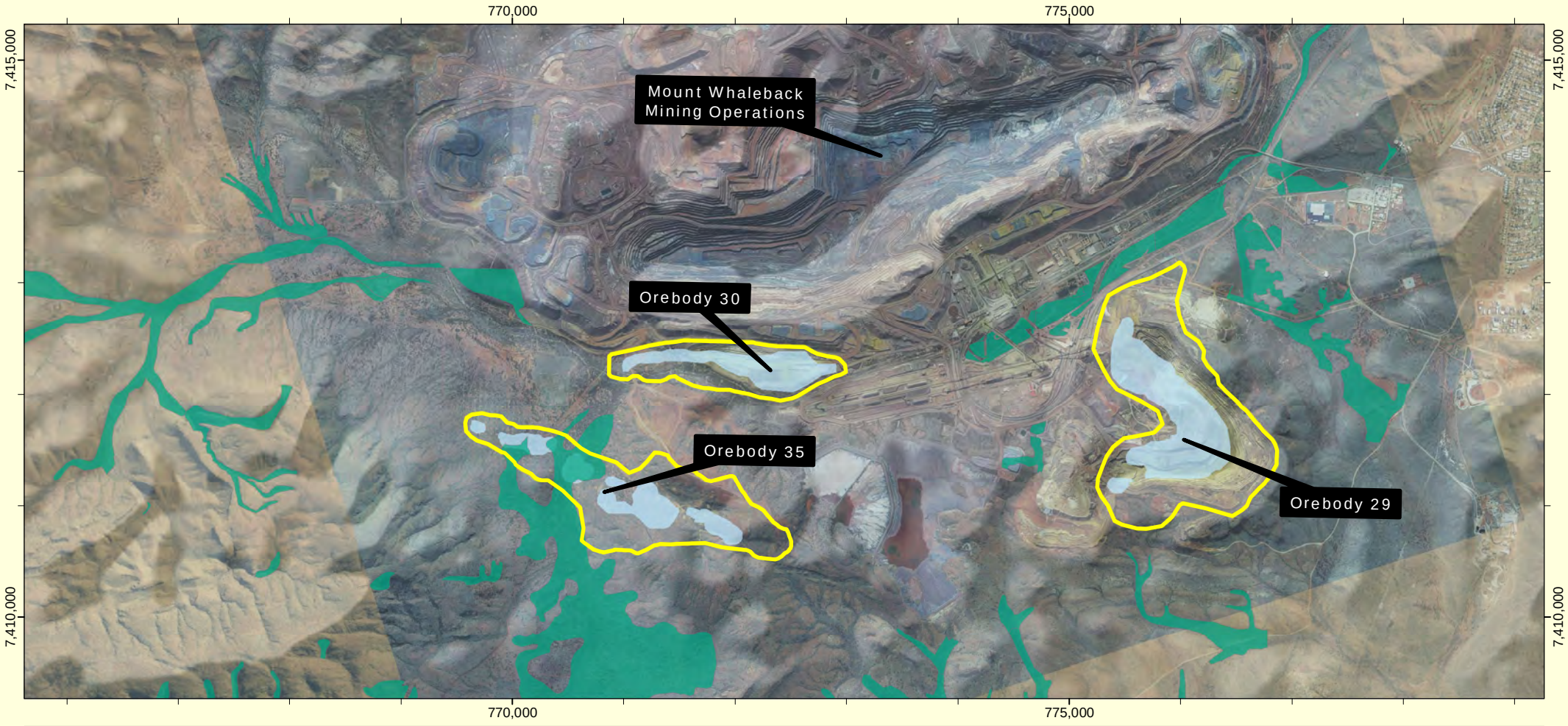

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GROUNDWATER DEPENDENT VEGETATION OB29/30/35 BELOW WATER TABLE

ENVIRONMENTAL REFERRAL DOCUMENT

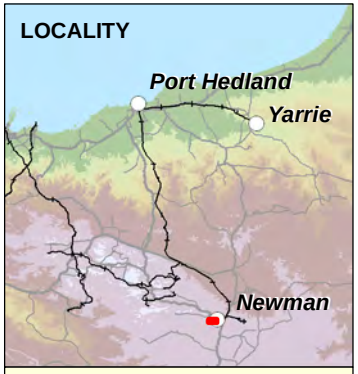
0 1 2
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:50,000	Prepared: P.Gant	Project No: A569/008 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 8
	Reviewed: Env. Approvals	

LOCALITY



0 500
Kilometres

LEGEND

- GDV Vegetation Moderate Risk
- Proposal Area - Above Water Table
- Below Water Table Mining

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_008_M_EnvironReferral_GWVegetation_RevA.mxd

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SUBTERRANEAN FAUNA SAMPLING
OB29/30/35 BELOW WATER TABLE
ENVIRONMENTAL REFERRAL DOCUMENT

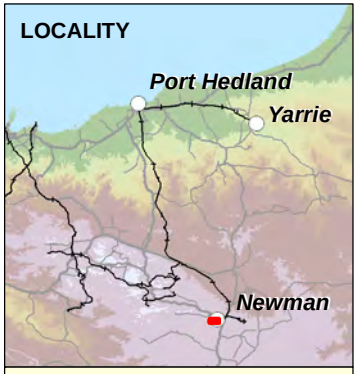
0 1 2
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:50,000	Prepared: P.Gant	Project No: A569/11 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 9
	Reviewed: Env. Approvals	

LOCALITY

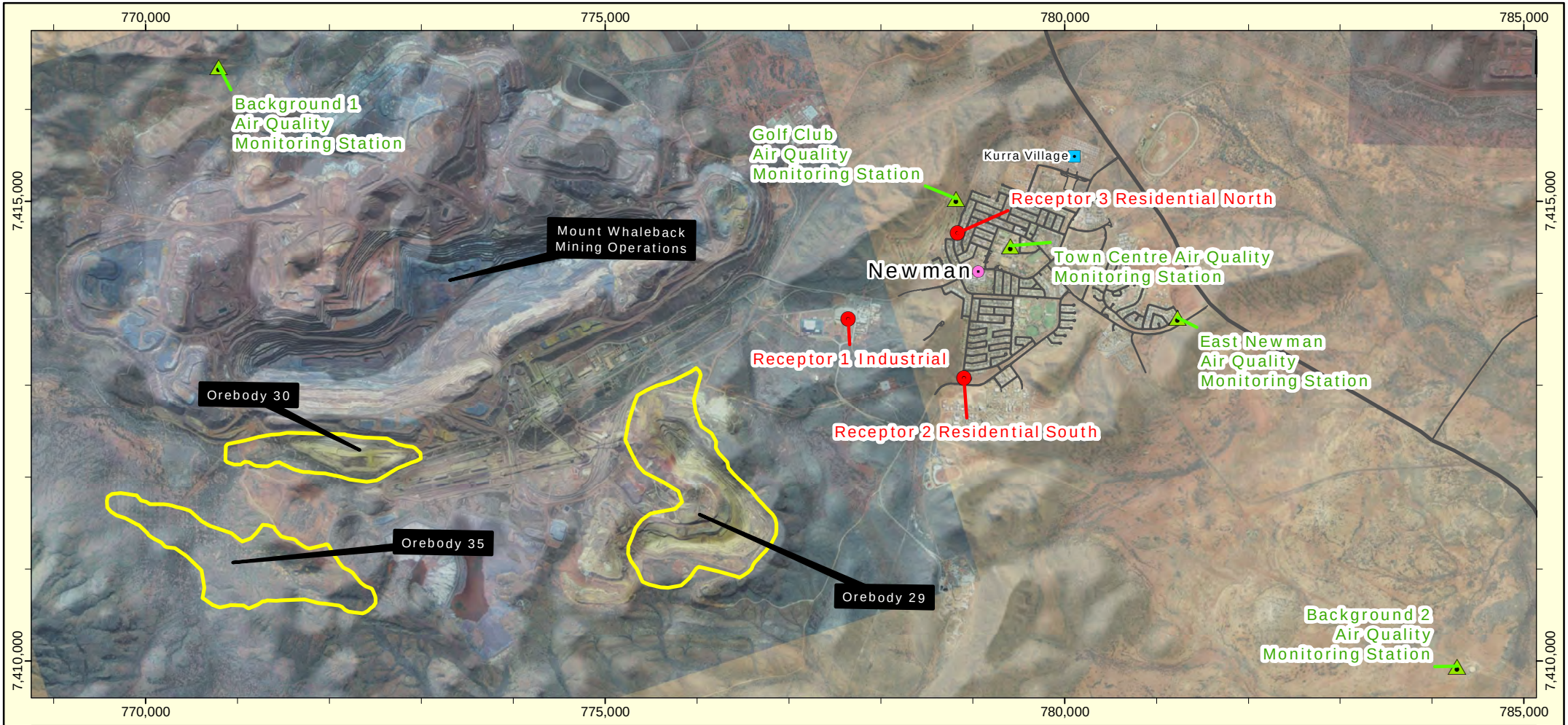


0 500
Kilometres

LEGEND

- Proposal Area
- Below Water Table
- Pilbara Town
- Stygofauna Sample
- Stygofauna Sample Impact
- Trog Scrapes Intersect Water (in impact)

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_011_M_EnvironReferral_Subterranean_RevA.mxd



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SENSITIVE NOISE RECEPTORS AND AIR QUALITY MONITORING LOCATIONS OB29/30/35 BELOW WATER TABLE

ENVIRONMENTAL REFERRAL DOCUMENT

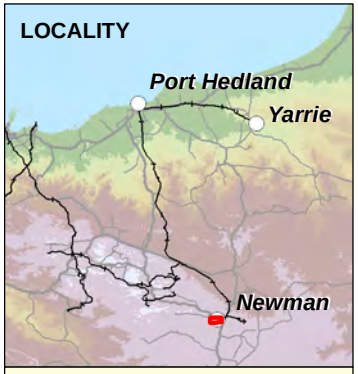
0 1 2 4
Kilometres

N

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A4: 1:60,000	Prepared: P.Gant	Project No: A569/015 M Rev A
Date: 28/08/2013	Checked: I. Jackson	FIGURE 10
	Reviewed: Env. Approvals	

LOCALITY



0 500
Kilometres

LEGEND

- Air Quality Monitoring Site
- Sensitive Noise Receptor
- Pilbara Town
- BHP Billiton Mine Accomodation
- Highway
- Road; sealed
- Proposal Area

Document Path: Y:\Jobs\A501_A1000\A569\3Project\A569_015_M_EnvironReferral_Noise_RevA.mxd

Attachment 2 – Environmental Referral Document

OB29/30/35

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Below Water Table Mining

Environmental Referral Supporting Information Document

August 2013

Document tracking

Item	Detail
Project name	OB29/30/35 Mining Below Water Table
Project/document number	-
Saved location of document	G:\AssetDev\Environmental Approvals (beta)\06 Sustaining Tonnes\001 Whaleback-OB29-30-35\0005 EP Act Approvals\00001 EIA\OB29 30 35 Below Water Table\11. Draft Submission\Rev B\OB29-30-35_s38 ERD_Draft_RevC_MASTER.docx
Prepared by	BHP Billiton Environmental Approvals Team (Sally Pickard, Felicity Ridgen)
Reviewed by	G:\AssetDev\Environmental Approvals (beta)\06 Sustaining Tonnes\001 Whaleback-OB29-30-35\0005 EP Act Approvals\00001 EIA\OB29 30 35 Below Water Table\11. Draft Submission..\OB29 30 35 Internal Review_Aug13.docx
Approved for release by	Gavin Price, Head of Environment
Status/version number	Draft Revision 0
Date saved	30/08/2013

EPA REFERRAL SUMMARY

BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) is seeking approval to extend mining to below the water table at the existing Orebodies 29, 30 and 35 (OB29/30/35) mining operations (the Proposal). BHP Billiton Iron Ore has been mining above the water table at Orebody 29 (OB29) and Orebody 30 (OB30) since 1974 and 1999 respectively, while Orebody 35 (OB35) mining is planned to commence in 2013. The Proposal is required to sustain existing mining operations at Mount Whaleback operations. The Proposal area is located approximately 2 kilometres (km) directly south of the Mount Whaleback mine site, and between 7 and 10 km west of the township of Newman in the Pilbara region of Western Australia (WA).

The Proposal involves campaign mining of Marra Mamba ore deposits on an 'as needs basis' to provide ore to blend with the Brockman ore from BHP Billiton Iron Ore's Mount Whaleback mining operations. Mining will be undertaken using conventional open pit iron ore mining activities below water table and will require mine dewatering ahead of mining to facilitate dry mining conditions.

The OB29/30/35 above water table mining operations were approved under and are subject to the *Iron Ore (Mount Newman) Agreement Act 1964*. 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 OB30 and 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 Environmental Protection Authority (EPA) in 2011, with the EPA decision being "Not Assessed – Public Advice Given".

BHP Billiton Iron Ore proposes to commence mining below the water table in 2014, subject to market conditions and all relevant government approvals being in place. Proactive dewatering of the orebody prior to mining will be required to lower the residual moisture content, create a safe working environment and prevent impacts to operations.

This Environmental Referral Document (ERD) provides supporting information to the EPA in order to determine the level of assessment. This document provides information about the existing environment, existing approvals in place for above water table mining operations, potential impacts of implementation of the Proposal, and proposed management measures to address potential impacts for each of the EPA's environmental factors.

BHP Billiton Iron Ore has operated in and around the Proposal area for over 30 years. Numerous specialist studies have been undertaken within the surrounding Mount Whaleback area in order to support previous government approval submissions, or as part of BHP Billiton Iron Ore's ongoing management of the site. BHP Billiton Iron Ore has used its knowledge of the environment together with these specialist studies to undertake a preliminary risk assessment for this Proposal. This risk assessment identified the environmental factors which may be relevant to the implementation of the Proposal and the aspects of the Proposal which may affect those factors. The risk assessment identified the following aspects as potential key environmental factors; Groundwater dependent vegetation, Stygofauna and Groundwater management (quality and quantity).

Following the issue of the EPA Environmental Assessment Guideline 8 for Environmental factors and objectives (EPA, 2013), BHP Billiton Iron Ore reviewed the preliminary environmental factors and identified the following as potentially being key environmental factors:

- hydrological processes (groundwater);
- inland waters environmental quality;
- flora and vegetation (groundwater dependant vegetation);
- subterranean fauna (Stygofauna);
- terrestrial environmental quality; and

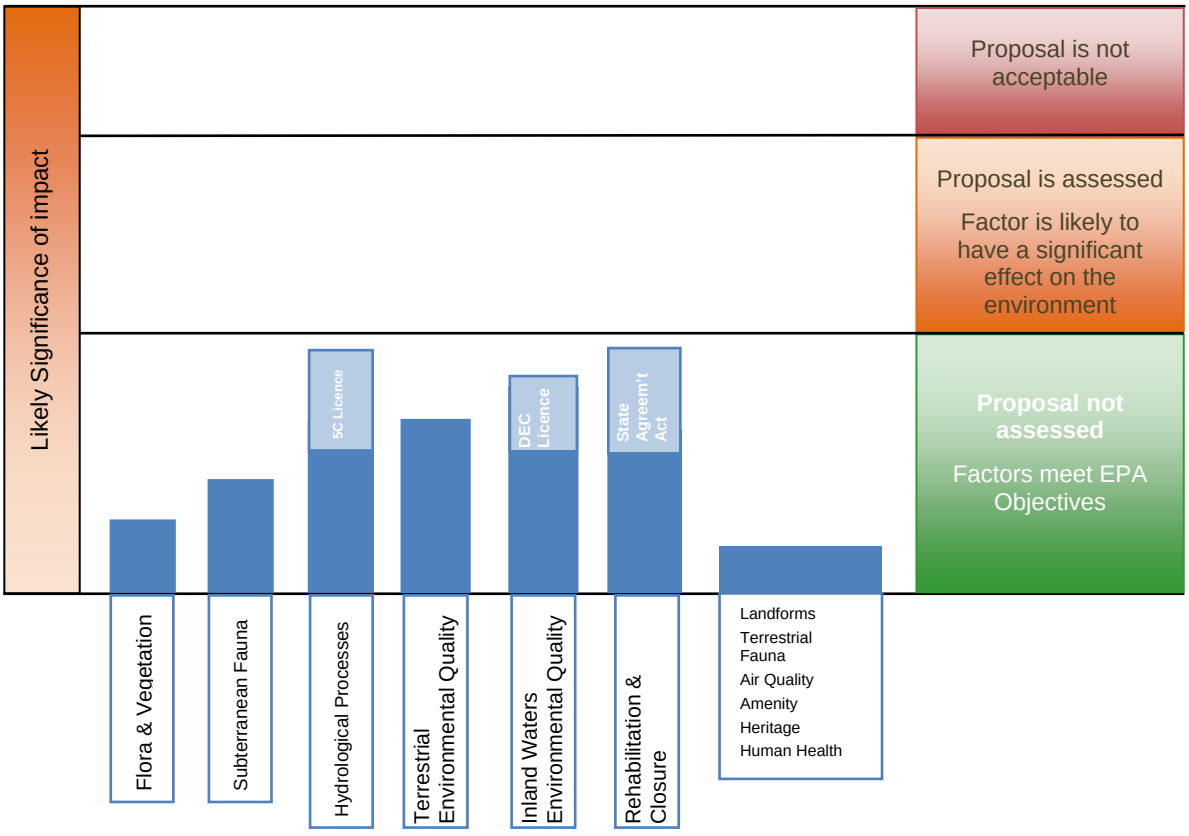
- rehabilitation and closure

A summary in relation to the key environmental aspects considered during the impact assessment process is provided in Table ES - 1. The other environmental factors, which were not considered to be potential key environmental factors, are also addressed in this Referral and a summary provided in Table ES - 1.

Through the preparation of the assessment of environmental factors, the significance of the implementation of the Proposal on the environmental factors was assessed, in line with the EPA Environmental Assessment Guideline 9 for Application of a significance framework in the environmental impact assessment process (EPA, 2013a),. BHP Billiton Iron Ore has concluded that all of the potential key environmental factors will not have a significant environmental impact with three factors able to be managed under existing approvals to further reduce potential impacts, this is shown in Chart ES-1 below.

The enclosed information is considered by BHP Billiton Iron Ore to be relevant in assisting the EPA to decide whether or not to assess the Proposal, and, if the proposal is to be assessed, the level at which the environmental impact assessment (EIA) is to be conducted.

Chart ES-1: Significance of Environmental Factors



In conclusion, the information and assessment presented in this ERD are considered to have adequately identified and addressed environmental aspects and issues relevant to the Proposal, and are adequate to enable the EPA to consider the Proposal. The Proposal is unlikely to result in significant impacts to the environment beyond the Proposal area, and appropriate management practices have been identified to minimise impacts under existing approvals or through implementation of the Mine Closure Plan. The Proposal is not considered to be a significant proposal.

Table ES-1: Environmental Factors Summary

EPA Environmental Factor	Environmental Objective	Environmental Impact Assessment Summary	Managed by Other Regulatory Processes	Proposed Management	Does the Proposal meet the EPA Objective
Hydrological Processes* Relevant Aspect: • Groundwater Not Relevant Aspect: • Surface water	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.	• Based on the current hydrogeological understanding of the OB29/30/35 area, the drawdown resulting from the required dewatering is anticipated to extend approximately 4 to 5 km to the east and west of the study area and potentially 3 to 4 km to the south, with negligible drawdown anticipated to the north, towards the existing Whaleback Pit. • The predicted drawdown is not expected to reach the regional environmental receptor, Ethel Gorge, which is approximately 20 km respectively from the study area. • The potential impact on stygofauna and groundwater dependent vegetation, resulting from the predicted drawdown is expected to be minimal. • Dewatering discharge is proposed to be used as a water supply at Whaleback, with any surplus water to be discharged into the Ophthalmia Dam and associated Aquifer Recharge Scheme ponds at approved discharge points. • The proposed discharge may result in a very minor increase in water levels within the dam and a very minor increase in the salinity of the dam water (estimated at increase of 7mg/L of total dissolved solids to 47mg/L, from current levels of 40mg/L). It is expected that any such influences will be masked by natural (seasonal) fluctuations in water levels. • The increased salinity of the seepage (and overflow) from the dam is not expected to have any significant effect on downstream groundwater quality and no impact on the overall quality of supply from the Ophthalmia Borefield.	• 5C Licence to Take and associated Groundwater Operating Strategy are approved for Mount Whaleback Operations • A 5C Licence Amendment will be sought for full below water table mining. • The 5C Licence allows for a Hydrodynamic Trial to be undertaken for additional information relating to mine planning and mine dewatering, to support the 5C Licence amendment. • Mount Whaleback Licence to Operate (L4503/1975/13)	• Monitoring of Whaleback Creek, in accordance with the requirements of the Mount Whaleback Licence to Operate (L4503/1975/13). • Management and reporting in accordance with the 5C Licence to Take. • Implementation of the approved Groundwater Operating Strategy.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor.** Studies undertaken to date indicate if the impacts on groundwater levels will be localised and there will be no significant impacts on regional groundwater and no impacts on key environmental receptors. Surplus water discharge to Ophthalmia Dam will not result in significant impacts to the water quality of the dam. Potential impacts can be managed under the RIWI Act (5C Licence) and Part V of the EP Act (Environmental Licence to Operate).

EPA Environmental Factor	Environmental Objective	Environmental Impact Assessment Summary	Managed by Other Regulatory Processes	Proposed Management	Does the Proposal meet the EPA Objective
Inland Waters Environmental Quality* Relevant Aspect: • Surplus water discharge • Pit lake formation Not Relevant Aspect: • Surface water	To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.	• AMD Risk Assessment (SRK Consulting) has been prepared. • Risk Assessment indicates that there is low likelihood of acidification of pit lakes, however long-term salinisation may occur. • Impacts on groundwater due to pit lake formation are expected to be localised and no significant impacts on regional resources are expected to result from implementation of the Proposal. • No additional impacts to surface water quality from the Proposal operations are expected, given that the activities associated with the Proposal will be generally contained within the existing pit areas. • Discharge to Ophthalmia Dam may result in a very minor increase in water levels within the dam and a very minor increase in the salinity of the dam water. It is expected that any such influences will be masked by natural (seasonal) variations.	• Mount Whaleback Licence to Operate (L4503/1975/13) • Project Proposal for individual pits at OB29/30/35, approved under the *Iron Ore (Mount Newman) Agreement Act 1964* • Tenure requirements of the Mining Lease, issued under the *Iron Ore (Mount Newman) Agreement Act 1964*	• Discharge to Ophthalmia Dam undertaken in accordance with the requirements of the Mount Whaleback Licence to Operate (L4503/1975/13). • WA Iron Ore Potential Acid Forming Material Procedure. • OB29/30/35 Mine Closure Plan (draft provided).	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor.** Studies undertaken to date indicate: • the risk of pit voids generating AMD is considered to be low; • impacts will be localised with no significant impacts to regional water resources; • activities associated with the Proposal will be generally contained within the existing pit areas and as such, no additional impacts to surface waters are anticipated; and • discharge to Ophthalmia Dam will not result in significant impacts to the water quality of the dam.
Flora and Vegetation* Relevant Aspect: • Groundwater Dependent Vegetation Not Relevant Aspect: • Clearing	To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	• GDV Impact assessment undertaken to support application (Onshore Environmental 2013). • Current groundwater levels are greater than 30m below ground level, therefore it is considered unlikely that species such as *Eucalyptus camaldulensis* subsp. *refulgens* and/or vadophytic trees species *Eucalyptus victrix* are dependent on groundwater for survival. • GDV Impact assessment states that there is unlikely to be any impact on native vegetation resulting from proposed dewatering activities.	• Native Vegetation Clearing Permits are in place across the site. • 5C Licence to Take is approved for Mount Whaleback OperationsA 5C Licence Amendment will be sought for full below water table mining.	• Management and reporting in accordance with the 5C Licence to Take. • Implementation of the approved Groundwater Operating Strategy. • Management and reporting in accordance with Native Vegetation Clearing Permits.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. The GDV Impact assessment concludes that there is unlikely to be any impact on native vegetation resulting from proposed dewatering activities. It is expected that the abundance, diversity, geographic distribution and productivity of the groundwater dependant vegetation species and communities will be maintained.

EPA Environmental Factor	Environmental Objective	Environmental Impact Assessment Summary	Managed by Other Regulatory Processes	Proposed Management	Does the Proposal meet the EPA Objective
Subterranean Fauna* Relevant Aspect: • Stygofauna Not Relevant Aspect: • Troglofauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	• Stygofauna Impact assessment undertaken to support application (Bennelongia 2013) using regional and historical monitoring data (BHP Billiton Iron Ore Regional Subterranean Fauna Sampling Program). • Habitat within the Proposal impact footprint is relatively poor (Banded Iron Formations, no calcretes). • There is potential aquifer connectivity extending beyond the Proposal area, indicating that stygofauna species and communities may be interconnected and not limited to the Proposal area. • Stygofauna impact assessment considers that the Proposal poses little threat to the conservation status of species within the Proposal area.	• 5C Licence to Take is approved for Mount Whaleback Operations • A 5C Licence amendment is being sought to undertake a Hydrodynamic Trial associated with mine dewatering • A 5C Licence Amendment will be sought for full below water table mining.	• Management and reporting in accordance with the 5C Licence to Take. • Implementation of the approved Groundwater Operating Strategy.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. The Proposal is considered to have minimal impact on stygofauna species persistence, irrespective of any habitat changes that may occur, due to: • poor potential habitat occurring within the Proposal area; and • potential aquifer connectivity extending beyond the Proposal area, indicating that stygofauna species and communities may be interconnected and not limited to the Proposal area.
Terrestrial Environmental Quality* Relevant Aspect: • PAF/AMD Not Relevant Aspect: • General Waste	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.	• AMD Risk Assessment (SRK Consulting) being prepared to support application. • Risk Assessment has concluded that the potential for AMD from Marra Mamba Iron Formation is considered to be low due to the oxidised nature of the ore.	• Mount Whaleback Licence to Operate (L4503/1975/13)	• WA Iron Ore Potential Acid Forming Material Procedure. • OB29/30/35 Mine Closure Plan (draft provided).	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. BHP Billiton Iron Ore is obliged under its the tenure requirements of the Mining Lease, issued under the *Iron Ore (Mount Newman) Agreement Act 1964* ensure that premises are closed, decommissioned and rehabilitated in an manner consistent with current government standards and without unacceptable liability to the State. Risk Assessment has concluded that the potential for AMD from Marra Mamba Iron Formation is considered to be low due to the oxidised nature of the ore. BHP Billiton Iron Ore has well established management strategies for management of PAF at its Mount Whaleback operations. These management strategies will be continued to be implemented for the Proposal.

EPA Environmental Factor	Environmental Objective	Environmental Impact Assessment Summary	Managed by Other Regulatory Processes	Proposed Management	Does the Proposal meet the EPA Objective
Rehabilitation and Closure* Relevant Aspect: • Closure mechanism • Pit lake formation Not Relevant Aspect: • Landforms	To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.	• Mine Closure Plan (draft) developed for OB29/30/35. • Studies undertaken to date indicate if the pits are left as open voids, the impacts on groundwater and surface water will be localised and there will be no significant impacts on regional groundwater or surface water and no impacts on key environmental receptors. • The AMD Risk Assessment indicates that there is low likelihood of acidification of pit lakes, however long-term salinisation may occur.	• Project Proposal for OB30 and OB35, approved under the *Iron Ore (Mount Newman) Agreement Act 1964* • Tenure requirements of the Mining Lease, issued under the *Iron Ore (Mount Newman) Agreement Act 1964*	• OB29/30/35 Mine Closure Plan (draft provided).	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. BHP Billiton Iron Ore is obliged under its the tenure requirements of the Mining Lease, issued under the *Iron Ore (Mount Newman) Agreement Act 1964* ensure that premises are closed, decommissioned and rehabilitated in an manner consistent with current government standards and without unacceptable liability to the State. To support this requirement, BHP Billiton Iron Ore has prepared a Mine Closure Plan.
Terrestrial Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	• Impacts to terrestrial fauna resulting from the Proposal are not expected to be greater than or different to those from existing operations.	• Native Vegetation Clearing Permits are in place across the site.	• Management and reporting in accordance with Native Vegetation Clearing Permits. • Project Environment and Aboriginal Heritage Review (PEAHR) must be in place prior to land disturbance.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. The Proposal falls within areas previously assessed and approved for mining activities. Vertebrate fauna are not expected to be impacted by the Proposal given that there is no vegetation clearing which is additional to the approved or existing clearing is proposed.
Landforms	To maintain the variety, integrity, ecological functions and environmental values of landforms and soils.	• As the Proposal involves deepening of existing pits, no additional impacts to landscape are expected as a result of implementation of this Proposal.	• N/A	• PEAHR must be in place prior to land disturbance.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. The Proposal area is located in a highly modified landscape. The Proposal involves the deepening of existing pits to enable mining below the water table and as such, impacts to landform will not be greater to or different from those already present.

EPA Environmental Factor	Environmental Objective	Environmental Impact Assessment Summary	Managed by Other Regulatory Processes	Proposed Management	Does the Proposal meet the EPA Objective
Human Health (Noise)	To ensure that human health is not adversely affected.	• Noise impacts resulting from the Proposal are not expected to be greater than or different to those from existing operations.	• Mount Whaleback Licence to Operate (L4503/1975/13) • *Environmental Protection (Noise) Regulations 1997*	• BHP Billiton Iron Ore remains committed to ongoing consultation with the Newman community.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. Emissions from the Proposal are not expected to be greater than or different to those from existing operations. Noise impacts can be managed under the *Environmental Protection (Noise) Regulations 1997.*
Air Quality (including Greenhouse Gas Emissions)	To maintain air quality for the protection of the environment and human health and amenity.	• Dust impacts resulting from the Proposal are not expected to be greater than or different to those from existing operations. • Modelling of cumulative PM10 concentrations for future projected emissions from Whaleback, Newman Hub and OB29/30/35 indicate that emission related to mining will meet NEPM criteria at Newman. • Greenhouse gas emissions will not be significantly greater than those of current operations.	• Mount Whaleback Licence to Operate (L4503/1975/13)	• Management in accordance with the requirements of the Mount Whaleback Licence to Operate (L4503/1975/13). • Reporting as required under the *National Greenhouse and Energy Reporting Act 2007.*	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. Potential impacts can be managed under Part V of the EP Act (Environmental Licence to Operate), the *Clean Energy Act 2011* (Cth) and the *National Greenhouse and Energy Reporting Act 2007* (Cth). Dust emissions resulting from the Proposal are not expected to be greater than or different to those from existing operations. Greenhouse gas emissions are not expected to be significantly greater than those from the existing operations.
Heritage	To ensure that historical and cultural associations are not adversely affected.	• No heritage sites are expected to be impacted by implementation of this Proposal.	• N/A	• PEAHR must be in place prior to land disturbance. • Should any heritage site be identified and if that site cannot practicably be avoided, BHP Billiton Iron Ore would consult the relevant traditional owners and seek approval under the AHA before the site is disturbed.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor**. No aboriginal heritage sites are known to occur within the Proposal area and as such, it is not expected that Aboriginal Heritage values will be impacted by implementation of this Proposal.

EPA Environmental Factor	Environmental Objective	Environmental Impact Assessment Summary	Managed by Other Regulatory Processes	Proposed Management	Does the Proposal meet the EPA Objective
Amenity	To ensure that impacts to amenity are reduced as low as reasonably practicable.	• As the project involves deepening of existing pits, no additional impacts to amenity are expected as a result of the implementation of this Proposal.	• N/A	• BHP Billiton Iron Ore remains committed to ongoing consultation with the Newman community.	**The Proposal meets the EPA's objective for this factor and is therefore not considered a key environmental factor.** The Proposal involves the deepening of existing pits. As such no additional impacts to amenity are predicted above those previously assessed for above water table mining of OB29/30/35.

* Identified as a potential key environmental factor during the preliminary risk assessment

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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
BIF	Banded Iron Formation
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
DSD	Department of State Development
EAG	Environmental Assessment Guideline
EIA	Environmental Impact Assessment
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
ERD	Environmental Referral Document
ERM	Environmental Resources Management Australia
ESD	Ecologically Sustainable Development
GDV	Groundwater dependent vegetation
GL/a	Gigalitres per annum
GWL	Groundwater licence
ha	Hectares
HSEMS	Health, Safety and Environmental Management System
km	kilometre
km^2	Square kilometre
LCU	Landscape Character Unit
LVIA	Landscape and visual impact assessment
m	metres
m bgl	metres below ground level
mg/L	milligrams per Litre
ML/d	Megalitres per day
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
OB25	Orebody 25
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
PM_{10}	Particulate matter 10 micrometers or less in diameter
$PM_{2.5}$	Particulate matter 2.5 micrometers or less in diameter
RIWI Act	*Rights in Water and Irrigation Act 1914*
TAR	Triennial Aquifer Review
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TSP	Total Suspended Particulates
VSR	Visually Sensitive Receptor

1. Introduction

1.1 Overview

BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) is seeking approval to extend mining below the water table at existing Orebodies 29, 30 and 35 (OB29/30/35) mining operations (the Proposal). BHP Billiton Iron Ore has been mining above the watertable at Orebody 29 (OB29) and Orebody 30 (OB30) since 1974 and 1999 respectively, while OB35 mining is planned to commence in 2013. The Proposal is required to sustain existing mining operations at Mount Whaleback operations.

The Proposal will involve conventional open pit iron ore mining activities below water table and will require mine dewatering ahead of mining below the water table to facilitate dry mining conditions. The Proposal involves campaign mining of Marra Mamba ore deposits on an 'as needs basis' to provide ore to blend with the Brockman ore from BHP Billiton Iron Ore's Mount Whaleback mining operations. The Proposal area is located approximately 2 kilometres (km) directly south of the Mount Whaleback mine site, and between 7 and 10 km west of the township of Newman in the Pilbara region of Western Australia (WA) (**Figure 1** and **Figure 2**).

A Referral Form has been prepared for the Proposal in accordance with Section 38(1) of the *Environmental Protection Act 1986* (EP Act) and the Western Australian Environmental Protection Authority's (EPA's) *General Guide on Referral of Proposals* (EPA, 2010a).

The purpose of this Environmental Referral Document (ERD) is to provide supporting information to the EPA in order to determine the level of assessment. This document provides information about the existing environment, potential impacts of implementation of the Proposal and proposed management measures to address potential impacts for each of the EPA's environmental factors. The enclosed information is considered by BHP Billiton Iron Ore to be relevant in assisting the EPA to decide whether or not to assess the proposal, and, if the proposal is to be assessed, the level at which the environmental impact assessment (EIA) is to be conducted.

1.2 Structure of this Environmental Referral Document

The structure of this ERD is as follows:

- Section 1: Describes the purpose and structure of this ERD.
- Section 2: Provides an overview of the Proponent, the Proposal, its location, land tenure and existing environmental approvals.
- Section 3: Describes the existing knowledge of the environment presented in annual reports, such as Annual Environmental Reports.
- Section 4: Describes the methods used to prepare this ERD, identify preliminary key environmental factors and assessment of significance of EPA environmental factors in relation to this Proposal.
- Section 5: Describes the existing environment, identifies potential impacts and management measures and assesses the potential impacts of the Proposal on the preliminary key environmental factors.
- Section 6: Presents BHP Billiton Iron Ore's management approach, lists principles of environmental protection that are applicable to the proposed Project and provides a summary of the consultation that has been undertaken.
- Section 7: Provides a list of documents referred to in this ERD.

2. Proponent and Proposal information

2.1 The proponent

This Proposal is submitted by BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) of 125 St. George's Terrace, Perth, Western Australia, acting as manager and agent for the Mount Newman Joint Venture (NJV).

The NJV is comprised of the companies listed below with their respective interests:

- BHP Billiton Minerals Pty Ltd (ABN 93 008 694 782) 85%;
- Mitsui – Itochu Iron Pty Ltd (ABN 84 008 702 761) 10%; and
- Itochu Minerals & Energy of Australia Pty (ABN 44 009 256 259) 5%.

BHP Billiton Iron Ore is authorised as the manager and agent of the proponents to submit this proposal and execute the works as approved. All references to BHP Billiton Iron Ore are references to it acting in that capacity. Refer to the letter in **Appendix A** which confirms BHP Billiton Iron Ore has the authority to act for the NJV.

2.2 Proposal location and tenure

The Proposal area is located in the Pilbara region of WA (**Figure 1**) and is located between 7 and 10 km west of the township of Newman in the Pilbara region of Western Australia (**Figure 2**). The Proposal area is located approximately 2 km south of BHP Billiton Iron Ore's Mount Whaleback iron ore mining operations. Mining operations at Mount Whaleback are authorised and approved under the *Iron Ore (Mount Newman) Agreement Act 1964* (Newman State Agreement). The Proposal area is located primarily on Mineral Lease ML244SA and therefore also subject to the same State Agreement legislation. The Proposal area also covers a portion of M52/906 and G52/257 (**Figure 3**).

2.3 The Proposal

BHP Billiton Iron Ore proposes to extend mining below the water table at the satellite orebodies OB29/30/35 to sustain the Newman Hub mining operations, located at Mount Whaleback (**Figure 2**). The Proposal involves in-pit extraction of groundwater in order to allow campaign mining of iron ore and overburden below the groundwater table through conventional open cut mining methods. The Proposal requires dewatering ahead of mining to provide dry conditions for mining below the water table. Activities already authorised as part of the above water table mining operations are not part of this Proposal.

2.4 Proposal description

In summary, the key components of the Proposal are listed below:

- campaign open pit mining below the water table at existing satellite orebodies OB29/30/35 to a mining rate of 15 million tonnes per annum (Mtpa); and
- dewatering of the orebody aquifers and use of the water for operational purposes, with an option to surface discharge of surplus water into Ophthalmia Dam.

2.4.1 Mining method

The Proposal involves campaign mining of iron ore and overburden below the groundwater table through conventional open cut mining methods. Campaign mining involves drilling, blasting, and categorisation of blasted material into iron ore or waste rock. The materials will be loaded by hydraulic excavators and/or front end loaders into off-highway rear dump haul trucks and either transported via haul road to the Mount Whaleback crushers, or to the overburden storage areas (OSAs) at OB29/30/35 and/or Mount Whaleback mine site according to their categorisation. Given BHP Billiton Iron Ore's existing operations at OB29/30/35, the Proposal will seek to utilise existing machinery and infrastructure as far as practicable.

2.4.2 Ore processing and transport

The Proposal will be supported by existing infrastructure and facilities at the Mount Whaleback mining operations, including machinery fleet, support services and facilities. Approximately 220 million tonnes (Mt) of iron ore is estimated to be mined above and below water table from OB29/30/35.

Once mined the ore will be loaded into haul trucks and transported via existing access roads to the primary crusher at Mount Whaleback mine site. Crushed rock will be sorted, blended and stored on site, prior to loading onto trains and transported to Port Hedland. Overburden from the mine, with low iron content, is currently processed by ore beneficiation facilities or retained on site in OSAs. This infrastructure is associated with the existing above water table mining operations. Should any additional facilities or infrastructure be required to process ore associated with the Proposal, approvals for this will be sought under Part V of the EP Act.

2.4.3 Overburden removal

Overburden will be stockpiled in existing or approved OSAs. Where practicable, overburden may also be placed back into the pit void to assist in achieving closure objectives for the site. Topsoil, where recoverable, will first be removed and placed into stockpile areas for later use in rehabilitation. The likelihood of encountering potentially acid-forming (PAF) material (e.g. black shale material) is low given the lithologies underlying OB29/30/35 (i.e. Marra Mamba ore type). Further discussion supporting the low likelihood of encountering PAF and a broader assessment of Acid and Metalliferous Drainage (AMD) risk is discussed in Section 5.7 and a Preliminary Acid Mine Drainage Risk Assessment provided in **Appendix F**. Should PAF material be encountered in the future, it will be managed in accordance with BHP Billiton Iron Ore AMD Management Standard.

2.4.4 Mine dewatering, water use and disposal of surplus water

Groundwater abstraction (i.e. dewatering volumes and monitoring) is regulated by the Department of Water (DoW) licensing (5C licence) and Groundwater Operating Strategy under the *Rights in Water and Irrigation Act 1914* (the RIWI Act). The Proposal requires in-pit and ex-pit mine dewatering (i.e. groundwater abstraction) to facilitate dry mining conditions. A hydrodynamic trial is underway in order to improve the understanding of the groundwater conditions, address technical challenges and risks and increase confidence in the dewatering volume requirements. The hydrodynamic trial is presented further in Section 2.8.1.

The abstracted water will be used as a preference to supplement Mount Whaleback mining operations water requirements. However, the dewatering volume is anticipated to be on average greater than the demand and surplus water will be produced. Surplus water not utilised at Mount Whaleback operations will be transported via current NJV water infrastructure (an existing pipeline) and disposed at licensed discharge points into the Ophthalmia Dam artificial recharge system (**Figure 4**).

2.5 Key characteristics of the Proposal

A preliminary list of key characteristics of the Proposal is presented in Table 1.

Table 1: Key characteristics of the Proposal

Element	Proposed Authorisation Extents
Mine Dewatering*	Average between 2 and 5 gigalitres per annum (GL/a), with periodic peaks up to 8 GL/a, or in accordance with the 5C Licence to Take.
Surplus Water Discharge*	Average between 2 and 5 GL/a, with periodic peaks up to 8 GL/a to be discharged to Ophthalmia Dam, or in accordance with the site Licence to Operate.
Depth of Final Pits (below water table)	OB29 – up to 90 metres below water table (BWT) (435 mRL) OB30 – up to 60 metres BWT (465 mRL) OB35 – up to 70 metres BWT (455 mRL)

* A hydrodynamic trial is underway in order to understand the groundwater conditions and dewatering requirements more accurately. Until this work has been completed these numbers are indicative only. Groundwater abstraction and environmental discharge will be managed through the relevant approvals (i.e. Licence to Take under the RIWI Act and Licence to Operate under Part V of the EP Act).

2.6 Timeframe

BHP Billiton Iron Ore proposes to commence mining below the water table in 2014, subject to market conditions and all relevant government approvals. However proactive dewatering of the orebody prior to mining will be required to lower the residual moisture content, create a safe working environment and prevent impacts to operations.

2.7 Existing environmental approvals

2.7.1 State Agreement Act

The Mount Whaleback mining operation and the OB29/30/35 above water table mining operations are approved and subject to the Newman State Agreement and located within Mineral Lease ML244SA, Mining Lease M5200906, Miscellaneous General Purpose Leases; G52/257, G52/258, G52/260, G52/277 and G52/279 (**Figure 3**).

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 OB30 and Orebody 35 (OB35) above water table mining operations were approved under a State Agreement Act Project Proposal in 1999 (BHPIO, 1999).

Further discussion of BHP Billiton Iron Ore's obligations under the Newman State Agreement is presented in Section 5.6 in relation to closure.

2.7.2 Part IV approvals – Environmental Protection Act

In 2011, BHP Billiton Iron Ore referred the OB35 proposal to mine above water table to the EPA under Section 38 of the EP Act. The EPA set a level of assessment as Not Assessed – Public Advice Given 2011.

2.7.3 Part V approvals – Environmental Protection Act – Native Vegetation Clearing Permits

BHP Billiton Iron Ore holds eight Native Vegetation Clearing Permits (NVCPs) over the Proposal area for mining and associated activities (**Figure 5**). The permits have been issued by the Department of Mines and Petroleum (DMP) and are summarised in Table 2.

BHP Billiton Iron Ore has recently submitted a Strategic NVCP application (CPS 5617/1) for the whole of the Mount Whaleback operations, including those at OB29/30/35. This application seeks to consolidate current NVCPs (13 permits in total) into a single permit covering mining and associated operations. Once granted, this Strategic NVCP would allow for the development of ongoing mining related infrastructure, including OSAs, haul roads and other land disturbance requirements. **Figure 5** provides an illustration of the current NVCPs and the proposed Strategic NVCP.

Table 2: BHP Billiton Iron Ore current NVCPs

Permit Number	Purpose	Area of Clearing Approved (ha)	Total amount Cleared to end of FY12	Area Remaining	Expiry Date
CPS1018/1	General mining activities including (but not limited to) access roads, over burden storage areas, topsoil stockpiles, and increasing the	1200.95	357.1	843.85	30 September 2015

Permit Number	Purpose	Area of Clearing Approved (ha)	Total amount Cleared to end of FY12	Area Remaining	Expiry Date
	capacity of the existing tailings storage facility.				
CPS1565/2	Mineral production and associated activities.	135.84	6.7	129.2	18 March 2017
CPS2864/1	Mineral production.	21.32	0.1	21.2	1 September 2014
CPS3297/1	Mineral production.	440	24.2	415.8	1 September 2014
CPS3776/1	Mineral Exploration.	100	0	100	1 September 2016
CPS4025/2	Mineral production and associated activities.	46.79	15.3	31.5	31 December 2015
CPS4737/1	Mineral production and associated activities.	20	0	20	25 February 2022
CPS4797/1	Mineral production and associated activities.	392	0	392	31 July 2022
Total		**2,501.52**	**408.5**	**2,093.07**	

2.7.4 Part V approvals – Environmental Protection Act – Licence to Operate

BHP Billiton Iron Ore currently holds a Licence to Operate for the Mount Whaleback operations area (L4503/1975/13) that includes the current OB29/30/35 mining operations (**Figure 4**). This licence is currently being amended to include the NJV water infrastructure (k-line pipeline) and a discharge point at Ophthalmia Dam for disposal of surplus water from the hydrodynamic trial. A licence amendment would be sought to dispose of excess dewater for the full dewatering operations associated with the Proposal, once the excess water volumes are further defined.

BHP Billiton Iron Ore has consulted with the Department of Conservation and Environment (DEC), now the Department of Environment Regulation (DER), about the Proposal and potential amendments to Mount Whaleback Licence to Operate L4503/1975/13.

2.8 Rights in Water and Irrigation Act 1914

The groundwater abstraction (i.e. dewatering volumes and monitoring) is managed by DoW licensing (5C licence) and Groundwater Operating Strategy under the RIWI Act. BHP Billiton Iron Ore currently holds a DoW 5C licence for water abstraction from OB29 and OB30 (GWL160418(6)) for 2,500,000kL/year. The taking of water is allowed for dust suppression for earthworks and construction purposes, earthwork and construction purposes, dewatering for mining purposes, mineral ore processing and other mining purposes and potable water supply purposes. The licence is valid until 30 September 2020, when a renewal would be sought. The 5C Licence to Take Water has been recently amended to allow for the hydrodynamic trial at OB29, described below. An amendment to the Licence would be sought for the full mine dewatering, once the dewatering rates and volumes are known.

The groundwater licence (GWL) Operating Strategy for Newman (Operations at Mount Whaleback, Eastern Ridge, OB29, OB30 and Ophthalmia Borefield) (GWL Operating Strategy) describes the management of groundwater at the Newman Water Supply System which is managed by BHP Billiton Iron Ore and which includes the operations at Mount Whaleback, Eastern Ridge (OB23 and OB25), OB29, OB30 and the Ophthalmia Borefield. The GWL Operating Strategy has been reviewed and

approved by the DoW on the 28 June 2013. It is a requirement of the GWL to comply with the commitments of the operating strategy.

2.8.1 Hydrodynamic Trial

There is the need to undertake further test pumping for a period of up to 18 months to support the conceptual hydrogeological model and evaluate risks. The hydrodynamic trial would seek to inform the possible hydraulic connection to aquifers in the dolomite adjacent to the orebodies, or any other local structural complexity. It will also inform future depressurisation requirements to improve pit slope designs, and improve understanding of materials handling requirements. The results of the hydrodynamic trial will inform pit and infrastructure design requirements, along with refining estimated dewatering rates and volumes required for the 5C Licence to the full below water table mining operations.

The activities of the trial do not form part of the Proposal. The trial has been approved and will be managed (licensing and reporting) through the 5C GWL process and Environmental Licence to Operate for Mount Whaleback, should discharge to the environment be required.

3. Existing operations and knowledge

BHP Billiton Iron Ore has been operating in the Newman area since the late 1960's. The environmental baseline and monitoring data acquired since initial operations began gives BHP Billiton Iron Ore a higher certainty in the potential environmental impacts from the Proposal. The sources and evidence of the environmental data available and relevant to the proposal is described below.

3.1 Annual Environmental Reports

Mount Whaleback and OB29/30/35 mining operations have environmental reporting and statutory requirements in accordance with Licence to Operate L4503/13, issued by DER (formerly DEC) under Part V of the EP Act. As required, BHP Billiton Iron Ore reports annually on key environmental parameters for its mining operations in the Annual Environmental Report (AER). The AER includes reporting requirements such as mining activities, overburden management, land disturbance, topsoil management, rehabilitation activities and monitoring, surface water and groundwater quality, air quality monitoring and dust management, native flora and weed management, native fauna and introduced species, and so on. For more information on these environmental parameters, please refer to the latest BHP Billiton Iron Ore AER.

The level of information available from current and historical operations monitoring (such as stygofauna) lowers the uncertainty associated with potential impacts to key environmental factors.

3.2 Annual and Triennial Aquifer Reviews

BHP Billiton Iron Ore's Triennial Aquifer Review (TAR) for Mount Whaleback (BHP Billiton Iron Ore, 2010) provides a history of groundwater monitoring at Mount Whaleback mining operations. The TAR also includes an analysis of groundwater levels and water quality trends.

Mine dewatering at Mount Whaleback mining operations commenced in 1984. The groundwater abstracted from dewatering bores is used to meet operational demands including dust suppression, ore processing, drilling, earthworks and construction. The dewatering rate from the Mount Whaleback mining operations is insufficient to meet the current water requirements and this is augmented by groundwater supply bores from the Ophthalmia Borefield and dewatering from Orebody 23 (OB23) and Orebody 25 (OB25), located approximately 15 km east of Mount Whaleback mine.

BHP Billiton Iron Ore's Annual Aquifer Review (AAR) for Mount Whaleback (BHP Billiton Iron Ore, 2011) reports that:

- The monitoring data (water levels and water quality) shows there are currently no adverse impacts during the review period as a result of groundwater abstraction.
- The groundwater levels at OB29 and OB30 are between 517 and 525 metres Reduced Level (mRL) which is the approximate regional groundwater level. This indicates that dewatering at Mount Whaleback has had very little effect on groundwater levels at these orebodies.
- The groundwater in the area is fresh to brackish with Total Dissolved Solids (TDS) in the range of 480 to 1,110 milligrams per Litre (mg/L).
- The abstracted water is near neutral with pH ranging from 6.5 to 7.7.

4. Methodology

4.1 Assessment process

The ERD has been developed using the following process:

- prepare preliminary project scope;
- conduct an internal preliminary risk assessment to identify the environmental factors of the Proposal and aspects of the Proposal which may affect those factors (Section 4.2);
- undertake environmental impact studies to quantify the potential environmental impacts and determine the significance of the environmental factors identified in the preliminary risk assessment (Section 5);
- define the framework for environmental management and mitigation measures, including stakeholder consultation (Sections 5 and 6); and
- refer the Proposal to the EPA under Part IV of the EP Act.

This assessment process substantially improves the likelihood that all potential environmental impacts are identified, investigated and mitigated as far as practicable.

4.2 Preliminary Risk Assessment - Identification of relevant environmental factors

BHP Billiton Iron Ore has operated in and around the Proposal area for over 30 years. A number of specialist studies have been undertaken within the surrounding Mount Whaleback area in order to support previous government approval submissions, or as part of BHP Billiton Iron Ore's ongoing management of the site. BHP Billiton Iron Ore has used its knowledge of the environment together with these specialist studies to undertake a preliminary risk assessment for this Proposal. This risk assessment identified the environmental factors which may be relevant to the implementation of the Proposal and the aspects of the Proposal which may affect those factors.

The risk assessment identified the follow aspects as potential Key Environmental Factors:

- Groundwater dependent vegetation
- Stygofauna
- Groundwater management (quality and quantity)

The other environmental factors considered were:

- Flora and Fauna
- Conservation Areas
- Surface Water
- Dust and Noise
- Closure and Rehabilitation

It is noted that the preliminary risk assessment was undertaken prior to the release of the EPA Environmental Assessment Guideline for Environmental factors and objectives in June 2013 (EPA, 2013).

Impact assessments for the Proposal were undertaken for the potential key environmental factors for the Proposal. The relevant key environmental factors considered include flora and vegetation (groundwater dependant vegetation), subterranean fauna (Stygofauna) and hydrological processes (groundwater). Closure and rehabilitation studies were also undertaken to support the referral.

4.3 Assessment of Environmental Factors

BHP Billiton Iron Ore has addressed all relevant factors identified by the EPA Environmental Assessment Guideline 8 for Environmental factors and objectives (EPA, 2013). The assessment is presented in Section 5. Particular focus has been given to those environmental factors identified as having the greatest potential impacts to the environment. Those potential key environmental factors considered during the impact assessments are summarised in Table 3.

It is noted that specialist studies have only been undertaken for the potential key environmental factors. However, BHP Billiton Iron Ore has drawn on specialist studies of the surrounding Mount Whaleback area conducted to support previous government approval submissions, work undertaken as part of BHP Billiton Iron Ore's ongoing management of the site, current environmental approvals (such as Licence to Operate), and publically available information to support the assessment of factors as relevant.

Table 3: Relevant environmental factors

Environmental Factor	Relevant Proposal Activity	Key Considerations	Key References used to assess potential significance	Section where addressed in this ERD Supporting Technical Report
Hydrological Processes	The Proposal requires removal of groundwater in order to access below water table ore deposits.	Potential to impact hydrogeological regimes	Western Australia Water in Mining Guideline (DoW, 2013); DoW Operational Policy No. 1.02: DoW Operational Policy No. 5.08	**Section 5.1** RPS Aquaterra (2013)
Inland Waters Environmental Quality	The Proposal requires disposal of mine dewater to the environment.	Potential impact to water quality at Ophthalmia Dam from discharge of mine dewater. Potential to impact groundwater quality from formation of pit lakes at mine closure.	EPA Environmental Assessment Guideline 12 Water Quality Protection Guidelines – Mining and Mineral processing	**Section 5.2** RPS Aquaterra (2013) SKR (2013)

Environmental Factor	Relevant Proposal Activity	Key Considerations	Key References used to assess potential significance	Section where addressed in this ERD Supporting Technical Report
Flora and Vegetation	Dewatering of orebody leads to lowering of groundwater table.	Potential to impact on Groundwater Dependant Vegetation	EPA Guidance Statement No. 51.	**Section 5.3** Onshore Environmental Consultants (2013a)
Subterranean Fauna	Disturbance of stygofauna habitat from mine dewatering activities.	Potential impact to stygofauna habitat and the Ethel Gorge TEC from discharge of mine dewater.	EPA Environmental Assessment Guideline 12 EPA Guidance Statement No. 54a.	**Section 5.4** Bennelongia Environmental Consultants (2013)
Terrestrial Environmental Quality	Mining of PAF material.	Potential for acid mine drainage to occur if potentially acid forming materials are encountered.	Leading Practice Sustainable Development Program for the Mining Industry - Managing Acid and Metalliferous Drainage	**Section 5.5** SRK (2013)
Rehabilitation and Closure	Post-closure impacts of the mine, particularly formation of pit lakes in mine voids.	That premises can be closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land use.	EPA Guidance Statement No. 6 Guidelines for Preparing Mine Closure Plans	**Section 5.7** Outback Ecology (2013)

4.4 Significance of environmental factors

Through the preparation of environmental impact assessments, the significance of the implementation of the Proposal on the environmental factors was assessed. This assessment and a summary of the potential impact for each factor are presented in Section 5.

Of the potential key environmental factors, the following was concluded:

- Hydrological Processes - groundwater management (quality and quantity): Drawdown is anticipated to extend 4 to 5 km to the east and west of the study area and potentially 3 to 4 km to the south. The predicted cumulative drawdown is not expected to reach the key regional environmental receptor, Ethel Gorge, which is approximately 20 km from the Proposal area. The proposed discharge of surplus dewater to Ophthalmia will result in a very minor increase in water levels within the dam and a very minor increase in the salinity of the

dam water. This will have some minor influence on downstream groundwater levels. It is expected that any such influences will be masked by natural (seasonal) fluctuations in groundwater levels. The increased salinity of the seepage (and overflow) from the dam is not expected to have any significant effect on downstream groundwater quality and no impact on the overall quality of supply from the Ophthalmia Borefield. Dewatering operations will be managed under the DoW 5C Licence and associated Groundwater Operating Strategy. Surplus water discharge will be managed under the DER Licence for Mount Whaleback.

- Inland waters environmental quality: The development of pit lakes within pit voids post closure is not expected to have significant impacts on regional groundwater or surface water and no impacts on key environmental receptors. The AMD risk assessment concluded that the likelihood for pit voids to generate AMD is low and it is considered unlikely that the quality of groundwater or surface water will be impacted, enabling the ongoing maintenance of environmental values. Surplus water discharge will be managed under the DER Licence for Mount Whaleback. BHP Billiton Iron Ore will implement the OB29/30/35 Mine Closure Plan, including undertaking regular review of the Plan.
- Flora and Vegetation - Groundwater dependent vegetation: while there are some species that may be at moderate risk from groundwater drawdown effects, the current groundwater level is over 30m below groundwater. As such it is unlikely that these species are dependent on groundwater for survival. There is unlikely to be any impact on native vegetation resulting from proposed dewatering activities. All clearing of native vegetation is approved under the existing NVCPs for the site.
- Subterranean Fauna - Stygofauna: None of the stygofauna species collected in the Proposal impact footprint is considered likely to be restricted to, or have a substantial proportion of its population within, the Proposal impact footprint. Additionally, potential stygofauna habitat within the Proposal impact footprint is relatively poorer than some other parts of the Newman area (Banded Iron Formation, no calcretes). As such the Proposal poses little threat to the conservation status of species within the Proposal area.
- Terrestrial Environmental Quality: There is potential presence of minor PAF material within mined volumes from OB29/30/35, though the majority of materials have a low to negligible acid generation potential. Sulphur-bearing materials form isolated ‘hot-spots’, generally located near the crest of the pit walls. BHP Billiton Iron Ore has well established management strategies for management of PAF at its Mount Whaleback operations. These management strategies will be continued to be implemented for the Proposal.
- Rehabilitation and Closure: The existing regulatory and legislative requirements will ensure that premises associated with the Proposal are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State. The studies undertaken to date indicate that if the pits are left as open voids, the impacts on groundwater and surface water will be localised, there will be no significant impacts on regional groundwater or surface water and no impacts on key environmental receptors. Further studies are proposed as part of the ongoing operations and detailed in the Mine Closure Plan (draft).

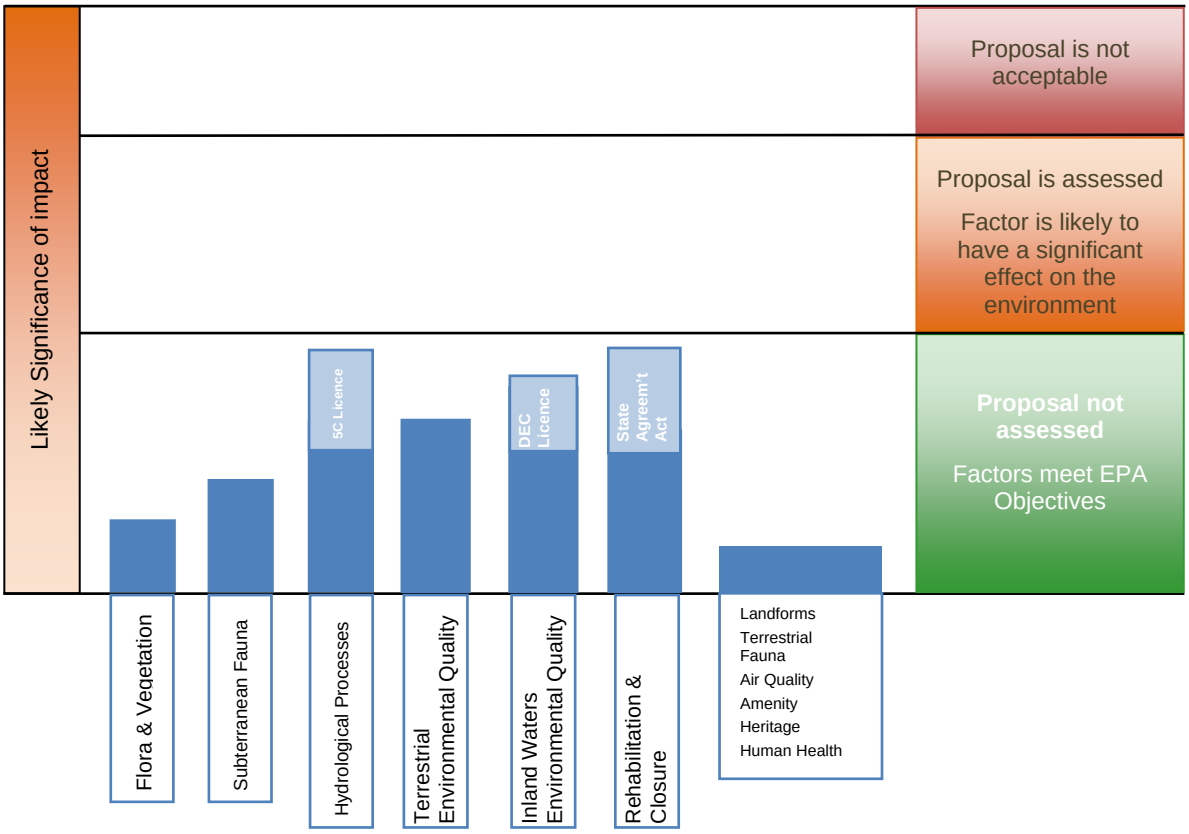
The following factors were not considered significant in the preliminary risk assessment and the detailed environmental impact assessment, presented in Section 5, confirms this:

- Landforms
- Terrestrial Fauna
- Air Quality
- Amenity
- Heritage
- Human Health

It was concluded that the impacts from the above factors were not additional to or different from the impacts associated with the existing above water table mining operations. Impacts associated with the existing operations are managed under the Licence to Operate, NVCPs and 5C Licence, as discussed in Section 2.7.

As such, BHP Billiton Iron Ore has concluded that no environmental factors are significant and as such the Proposal meets the EPA's Objectives. These conclusions are depicted in Chart 1, in line with the EPA Significance Framework (EPA, 2013a).

Chart 1: Significance of Environmental Factors



5. Assessment of environmental factors

This chapter provides information about the potential environmental impacts associated with the Proposal and BHP Billiton Iron Ore's proposed management approach.

5.1 Hydrological processes

5.1.1 Introduction

This section provides an overview of BHP Billiton Iron Ore's completed and proposed hydrogeological studies and investigations.

To date OB29 and OB30 have been mined to just above pre-mining water levels. OB35 is currently under development and will commence above water table mining in 2013.

BHP Billiton Iron Ore commissioned RPS Aquaterra to undertake a preliminary groundwater assessment (RPS Aquaterra, 2013) to support this application (**Appendix B**).

5.1.2 EPA objective

The EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may affect hydrological processes:

> *To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.*

5.1.3 Relevant guidelines and approvals

Relevant environmental policy and guidance

The groundwater impact assessment has been developed in consideration of the following guidance documents, where practicable:

- *Western Australia Water in Mining Guideline* (DoW, 2013);
- *Pilbara Regional Water Plan 2010-2030* (DoW, 2012a);
- *Pilbara Groundwater allocation Plan, draft* (DoW, 2012b);
- *Strategic Policy 2.09: Use of mine dewatering surplus* (DoW, 2013b);
- *Operational Policy No. 1.02: Policy on Water Conservation/Efficiency Plans, Achieving Water Use Efficiency Gains through Water Licensing* (DoW, 2009b); and
- *Operational Policy No. 5.08: Use of Operating Strategies in the Water Licensing Process* (DoW, 2010c).

Existing approvals obligations – Licence to Take (5C)

BHP Billiton Iron Ore currently holds a DoW 5C licence for water abstraction from OB29 and OB30 (GWL160418(6)) for 2,500,000kL/year. The taking of water is allowed for dust suppression for earthworks and construction purposes, earthwork and construction purposes, dewatering for mining purposes, mineral ore processing and other mining purposes and potable water supply purposes. Section 2.8 describes further details regarding the current 5C Licence and GWL Operating Strategy.

5.1.4 Existing environment

OB29/30/OB35 is located in the Newman Hub area immediately south of the Mount Whaleback Pit. All three orebodies 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.

Overlying detritals, where present, may also be mineralised and enriched to ore grade (**Figure 6**). Marra Mamba orebodies are typically permeable and are likely to form significant localised aquifers where situated below the water table.

OB29/30/35 is in close proximity to the existing Mount Whaleback Pit (**Figure 2**) where dewatering has occurred for around 30 years. Mining in the Mount Whaleback Pit is currently at approximately 380 mRL. The final Mount Whaleback pit will require in excess of 300 metres (m) total drawdown from pre-mining water levels. Pre-mining water levels at OB29/30/35 have not been influenced to date by Mount Whaleback dewatering operations.

Local groundwater characteristics

To date OB29 and OB30 have been mined to just above pre-mining water levels. OB35 mine is under development with mining expected to commence later this year.

At OB29/30/35, the orebodies are hosted predominantly in the upper members of the Marra Mamba although mineralisation does occur in lower members of the Marra Mamba and the overlying West Angela Member of the Wittenoom Formation.

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.

The beneficiation plant tailings dam immediately east of the proposed pit is expected to responsible for localised groundwater mounding, however the extent of mounding and hydraulic connection to the orebody is unknown.

A potable water bore, V18, is located in the vicinity of Mount Whaleback operations (**Figure 4**). This bore is to be transitioned to a production water bore during September 2013.

Inter-orebody connectivity

Due to the close proximity of the OB29/30/35 pits to one another, the degree of hydraulic connection between the Marra Mamba ore bodies is an important consideration. If a hydraulic connection between ore bodies exists, abstraction volumes required to achieve dewatering may increase or decrease depending upon relative timing of dewatering operations for either deposit.

The first deposit is likely to experience higher required pumping rates due to increased inflows while drawdown effects related to dewatering of the first deposit will lessen the dewatering requirements at the second deposit. This will have an impact upon dewatering infrastructure design and water resource management if the abstracted water is to be used as supply to operations or the township of Newman. The Hydrodynamic Trial, described in Section 2.8.1, will assist in providing further information for the planning and management of the operational dewatering program.

Typically, groundwater quality measured in the proposed Proposal area is fresh, with salinity ranging between 500 and 1080 mg/L TDS.

Mount Whaleback Operations

Mount Whaleback operations are currently in a water deficit situation, where all dewatering volumes are utilised for processing demand requirements. Additional to this, dewatering volumes from OB25 are directed to Whaleback as a supplementary water supply to meet water demand requirements.

It is expected that a large proportion of the abstraction volumes associated with the implementation of the Proposal would be utilised in the Whaleback processing demand. There is likely to be a smaller proportion of the Proposal abstraction volumes that will be surplus to local demand requirements – these volumes will need to be directed to an Ophthalmia Dam discharge point via existing pipeline infrastructure to approved discharge points.

Ophthalmia Dam and Borefield

The Ophthalmia Borefield is located approximately 15 km to the east of the study area, providing potable quality water to Newman and the nearby mining operations. The Ophthalmia Dam, which was installed in 1981, is located on the Fortescue River and was installed to impound surface water along the upper Fortescue for subsequent replenish into the underlying and downstream aquifers which support the Ophthalmia Borefield (as part of a long term Aquifer Recharge Scheme).

Ophthalmia Dam itself, along with several recharge ponds located in neighbouring calcretes, also receives surplus volumes from BHP Billiton Iron Ore dewatering operations. Dewatering volumes are preferentially utilised in processing and dust suppression activities at both Eastern Ridge and Mount Whaleback, with the remainder being directed to the dam and associated ponds. The outcome of this managed aquifer recharge approach is that regional drawdown associated with active dewatering operations is mitigated to reduce the magnitude of water level changes in the Ethel Gorge area. Water level data collected over 40 years indicates that the groundwater level within the aquifer system downstream of Ophthalmia Dam remains at pre-mining conditions owing to the controlled infiltration.

The natural stream flow salinity to the Ophthalmia Dam is approximately 40 mg/L with the salinity of the dam water (without dewatering discharge) ranging between 40 mg/L when the dam is full (after a rainfall event) to 250 mg/L as the storage empties (DoW, 2009c).

Potential Environmental Receptors

Ethel Gorge, located approximately 20 km to the northeast of OB29/30/35, is identified as the key environmental receptor within the Newman / Mount Whaleback area.

Ethel Gorge is a regional outflow zone for the upper reaches of the Fortescue River Catchment, with the Homestead, Whaleback, Shovelanna and Warrawandu Creeks all converging with the Fortescue River just upstream of Ethel Gorge. The Ethel Gorge Threatened Ecological Community is discussed in Section 5.4. The habitat of the stygofauna community in the area is expected to be related to saturated shallow calcretes and gravels of an extensive Tertiary overburden sequence.

5.1.5 Potential impacts

Two potential hydrological process impacts have been identified, those associated with dewatering of the orebodies and those associated with disposal of surplus dewater. No potential impacts to surface water hydrological processes are expected from the implementation of the project, given that activities already authorised as part of the above water table mining operations are not part of the Proposal.

The following potential impacts to the local environment have been identified from the dewatering of OB29/30/35:

- Local impacts to the groundwater levels – described below.
- Potential impacts on Groundwater Dependent Vegetation – described in Section 5.3;
- Potential impacts on Subterranean Fauna (Stygofauna) – described in Section 5.5;

The potential drawdown from the Proposal is not anticipated to impact the identified environmental receptor (Ethel Gorge Threatened Ecological Community (TEC)) (RPS Aquaterra, 2013).

No impact to potable water supply schemes, including bore V18, are expected. Bore V18 will have been transitioned to a production bore prior to the commencement of dewatering.

The discharge of surplus dewater to Ophthalmia Dam has the potential to have the following impacts to the receiving environment:

- Potential increase in groundwater levels associated with the discharge of surplus water from implementation of the Proposal at Ophthalmia Dam – described below.
- Potential water quality (water volumes and salinity) impacts associated with the discharge of surplus water from implementation of the Proposal at Ophthalmia Dam – this aspect are discussed in Section 5.2.

No impacts on the Ethel Gorge Stygobiont TEC are anticipated from the predicted groundwater drawdown associated with the proposed mine dewatering operations from implementation of the Proposal – described in Section 5.5.

Potential drawdown impacts

The drawdown of the water table in the OB29/30/35 area is expected to commence with dewatering abstraction, with the rate of drawdown being driven by the sequence of mining the orebodies and the individual mine schedules. The preliminary (combined) maximum potential groundwater drawdown around the Proposal area assumes that the water table at each orebody is drawn down to below the proposed maximum mining depth at the same time. In the area of the pits the rate of drawdown is anticipated to be in the order of 10's of meters per year with the area of influence increasing over time until the ultimate drawdown cones of depression (i.e. maximum lateral and vertical extent of drawdown as a result of dewatering) are reached.

In assessing the potential impact of dewatering, the rate of drawdown and the progression of the individual drawdown cones around each pit contribute to a combined maximum potential drawdown around all pits (i.e. the interference drawdown). **Figure 4** presents the results of the preliminary assessment of the maximum potential drawdown associated with the dewatering at OB29/30/35 assuming that the water table at each orebody will be drawn down to below the proposed maximum mining depth at the same time. These drawdown contours were developed based on the conceptual hydrogeological model for the area which is based on the existing geological and hydrogeological information available for the specific OB29/30/35 and Whaleback area, combined with knowledge and experience gained from the dewatering of other orebodies in the Pilbara region.

Consistent with the conceptual hydrogeological model, dewatering induced drawdown is largely restricted to the immediate vicinity of the pits (and orebody aquifers), with the lateral spread of drawdown away from the pits being constrained by low permeability basement rocks.

There is expected to be minimal drawdown to the south of the pit, while drawdown to the north shows the interference effects of dewatering from both OB29 and the Whaleback pits (**Figure 4).** There is drawdown within the alluvium of Whaleback Creek between the pits, but this is limited to the immediate mine area.

The orebodies themselves are believed to be in hydraulic connection therefore significant interference drawdown has been assumed in the area between the pits.

The drawdown to the north, towards Whaleback Pit is anticipated to be minimal due to limited hydraulic connection in this direction (through the low-permeability Mount Sylvia and McRae Shale Formations). This is supported by the evidence that there has been minimal drawdown in the OB29/30/35 area in response to the significant Mount Whaleback dewatering to date.

The potential drawdown shown to the east, west and south of the OB29/30/35 area (**Figure 4**) is considered to provide conservative overestimates of drawdown. There is the potential for each of the orebodies to be in hydraulic connection with permeable dolomite of the Wittenoom Formation. Should this be the case, there is the potential for the water table to be drawdown along strike in the dolomite (i.e. to the northeast of OB29 and the west of OB30) and potentially along the south western side of the OB35 Pit. The OB29/30/35 area is also known to be structurally complex, therefore there is the potential for the drawdown to extend along zones of secondary permeability (i.e. faulting and fracturing) through stratigraphic units which are generally known to be of lower permeability (i.e. the MacLeod and Nummuldi Members of the Marra Mamba Formation). This has been partially accounted for by the potential drawdown extending to the south and east of OB29 and the south of OB30.

The potential drawdown from the proposed OB29/30/35 dewatering is not anticipated to extend to the identified environmental receptors or water supply schemes in the region.

Potential dewater discharge impacts – groundwater levels

The discharge of surplus dewatering from OB29/30/35 to Ophthalmia Dam via the existing pipeline (**Figure 5**) will result in some minor rise in dam water levels and minor increased seepage from the

dam which will, in turn, have some influence on groundwater levels immediately downstream of the dam. An impact assessment for possible surplus dewatering discharge to Ophthalmia Dam was undertaken previously for the Jimblebar Iron Ore Project (RPS Aquaterra, 2010).

Water and salt balance modelling was conducted to assess the potential impact of discharging surplus dewatering water (generally ranging between approximately 9 and 21 Megalitres per day (ML/d)) from South Jimblebar into the dam. The water/salt balance outcomes for the nine ML/d case would closely reflect the influence of excess dewatering discharge from OB29/30/35 (where dewatering is expected to be less than 10 ML/d).

The water balance modelling indicated that (for 8.9 ML/d excess discharge to the dam):

- The average dam level would rise by 0.2 m.
- The average overflow from the dam would increase by less than one per cent (2 ML/d).
- The average seepage (to groundwater) from the dam would increase by 11 per cent (5 ML/d).

To put the surplus dewatering discharges and likely influences on dam overflow and seepage, into context:

- Any surplus discharge from OB29/30/35 (which will be less than the expected maximum dewatering of 10 ML/d) will be less than is currently discharge to the dam from OB23 and OB25 dewatering (up to 23 ML/d since 2007 – BHPBIO, 2012).
- The volume of the dam at the main spillway level is 22,000 ML. The peak volume is 100,000 ML (Parsons Brinkerhoff, 2013).
- The estimated volume of groundwater in storage downstream of the dam within the Tertiary detritals down to Ethel Gorge is over 20,000 ML.
- Groundwater inflow to the area downstream of the dam (including recharge from Homestead/Shovelanna Creeks) is around 12 ML/d (RPS Aquaterra, 2013).

It is expected that any influence of increased seepage from the dam as a result of surplus dewatering discharge will be masked by both the drawdown impacts of dewatering (close to pits) and by seasonal fluctuations away from the pits.

Potential dewater discharge impacts – water quality

Modelling results indicated that the salinity of the dam water would increase marginally with the proposed surplus water discharge. In terms of possible downstream impacts, the key outcomes of the modelling were that:

- The average salinity in dam overflow would increase from 40 mg/L (TDS) to 47 mg/L
- The average salinity in dam seepage increase from 65 mg/L to 225 mg/L

By comparison, existing downstream groundwater quality ranges from 600 to 1500 mg/L (TDS – recorded in Ophthalmia borefield pumping bores). Taking into account the relative volumes of the predicted increases in dam overflow, dam seepage and the groundwater throughflow and storage, it was concluded that dam seepage and overflow would have minimal impact on downstream groundwater quality due to dilution (RPS Aquaterra, 2013).

5.1.6 Management measures

Overview

In accordance with EPA environmental objectives, BHP Billiton Iron Ore will aim to maintain the quantity and quality of groundwater so that existing and potential environmental values, including ecosystem maintenance, are protected.

Dewatering

Dewatering volumes would be managed through the Department of Water 5C GWL process.

Surplus Water Management

Dewatering discharge is proposed to be used as a water supply at Whaleback, with any surplus water to be discharged into the Ophthalmia Dam and associated Aquifer Recharge Scheme ponds at approved discharge points.

BHP Billiton Iron Ore will seek amendment the Environmental Licence to Operate for Mount Whaleback to allow for the discharge of surplus water to Ophthalmia Dam. Preliminary discussion with DER Industry Regulation Branch in Karratha have indicated that the discharge point will be licenced in a similar way to the existing BHP Billiton Iron Ore licensed discharge points at Ophthalmia Dam for disposal of surplus water from the OB23 and OB25 operations.

Surplus water quality and volume will be managed, measured and reported in accordance with Licence conditions.

5.1.7 Summary

Based on the current hydrogeological understanding of the OB29/30/35 area, the drawdown resulting from the required dewatering is anticipated to extend approximately 4 to 5 km to the east and west of the study area and potentially 3 to 4 km to the south, with negligible drawdown anticipated to the north, towards the existing Whaleback Pit. The predicted drawdown is not expected to reach the regional environmental receptor, Ethel Gorge, which is approximately 20 km respectively from the study area, however the 1m drawdown contour does intersect the buffer of the Ethel Gorge TEC. The potential impact on stygofauna and groundwater dependent vegetation, resulting from the predicted drawdown is not expected to impact the habitat of the stygobiont community, associated with calcretes around Ethel Gorge, (Sections 5.3 and 5.4).

Dewatering discharge is proposed to be used as a water supply at Whaleback, with any surplus water to be discharged into the Ophthalmia Dam and associated Aquifer Recharge Scheme ponds at approved discharge points.

The proposed discharge may result in a very minor increase in water levels within the dam and a very minor increase in the salinity of the dam water. This could have some minor influence on downstream groundwater levels. It is expected that any such influences will be masked by natural (seasonal) fluctuations in groundwater levels. The increased salinity of the seepage (and overflow) from the dam is not expected to have any significant effect on downstream groundwater quality and no impact on the overall quality of supply from the Ophthalmia Borefield. Additionally, the bore V18 is being transitioned from a potable water supply bore to a production supply bore during September 2013.

Existing 5C GWL and Environmental Licence to Operate for Mount Whaleback would be used to manage extraction of dewater and discharge of surplus water to the environment.

5.2 Inland waters environmental quality

5.2.1 Introduction

The potential impacts of the project to inland water environmental quality relate to the potential formation of a pit lake at closure and the discharge of surplus dewater to the environment during operations. These aspects are discussed further in Section 5.6.5 and Section 5.1.5 respectively.

This section provides an overview of these issues and the relevant supporting studies and investigations.

5.2.2 EPA objective

The EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013) in its assessment of proposals that may affect inland water environmental quality:

> *To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.*

5.2.3 Relevant guidelines and approvals

Relevant environmental policy and guidance

The groundwater impact assessment has been developed in consideration of the following guiding documents, where practicable:

- Water Quality Protection Guidelines No 1: Water Quality Management in Mining and Mineral Processing: An Overview (Water and Rivers Commission, 2000d);
- Operational Policy No. 1.02: Policy on Water Conservation/Efficiency Plans, Achieving Water Use Efficiency Gains through Water Licensing (DoW, 2009b);
- Operational Policy No. 5.08: Use of Operating Strategies in the Water Licensing Process (DoW, 2010c);
- Water Quality Protection Note No 30: Groundwater Monitoring Bores (DoW, 2006);
- Water Quality Protection Guidelines No. 4: Mining and Mineral Processing, Installation of Minesite Groundwater Monitoring Bores (Water and Rivers Commission, 2000e);
- Water Quality Protection Guidelines No. 5: Mining and Mineral Processing, Minesite Water Quality Monitoring (Water and Rivers Commission, 2000f);
- Water Quality Protection Guidelines No. 9: Mining and Mineral Processing, Acid Mine Drainage (Water and Rivers Commission, 2000g); and
- Water Quality Protection Guidelines No. 11: Mining and Mineral Processing, Mine Dewatering (Water and Rivers Commission, 2000h).

Additional water management guiding documents considered for the proposed Project are listed in Section 5.1.3.

Existing approvals obligations – Licence to Operate

The existing BHP Billiton Iron Ore Licence to Operate for Mount Whaleback requires the following in relation to surface water quality:

- Take representative water samples from the monitoring sites listed in the Table below and shown on **Figure 6**. Samples are to be analysed for the parameters listed in the table below in the units specified.
- BHP Billiton Iron Ore is required to collect water samples in accordance with AS/NZS 5667

Table 4: Whaleback Licence to Operate – surface water monitoring program

Monitoring Sites	Sampling Frequency	Parameter	Measuring Units
Whaleback Creek upstream; Whaleback Creek	Quarterly when flowing	pH	pH units
		Electrical Conductivity	µS/cm

Monitoring Sites	Sampling Frequency	Parameter	Measuring Units
downstream; and Power Station Creek downstream		Total dissolved solids (TDS), total suspended solids (TSS), total petroleum hydrocarbons (TPH), chemical oxygen demand (COD), arsenic (As), Chromium (Cr), cadmium (Cd), copper (Cu), mercury (Hg), manganese (Mn), nickel (Ni), silver (Ag), selenium (Se), zinc (Zn), lead (Pb), iron (Fe), molybdenum (Mo), aluminium (Al), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), chlorine (Cl), carbonate (CO_3), sulphates (SO_4), nitrate (NO_3), bicarbonate (HCO_3), and total oil and grease	mg/L

(Water and Rivers Commission, 2000b).

5.2.4 Existing environment

Hydrological Environment

Existing drainage features within the Proposal and surrounding area are shown on **Figure 6**. Most of the area adjacent to the Proposal drains to Whaleback Creek. Other parts of the existing above water table operations drain to an unnamed tributary of Whaleback Creek and a small eastern portion of the area drains to the Fortescue River upstream (southeast from OB35) from the Whaleback Creek confluence.

Fortescue River Catchment

The Proposal is located adjacent to the Whaleback Creek in the upper portion of the Fortescue River catchment which drains to the Fortescue Marsh. The Fortescue Marsh is located within Fortescue Valley approximately 12 km downstream from the Proposal The marsh is an extensive intermittent wetland and occupies an area around 1,000 square kilometres (km^2), and has a total catchment area of approximately 31,000 km^2. The upper Fortescue River system that drains to the Fortescue Marsh is considered to be a closed system. The marsh bed is subject to frequent inundation as flood storage.

Ophthalmia Dam, located on the Fortescue River around 10 km east from Newman (Figure 6), partially reduces the volume of surface water runoff reaching the Fortescue Marsh.

Whaleback Creek

The Proposal area is located within the Whaleback Creek catchment in its entirety. Whaleback Creek has a catchment area of 54 km^2 upstream of the Proposal with an additional 29 km^2 draining through the mine area. Upstream of the mine area the catchment has a bed gradient of 0.3%. The creek flows in an easterly direction, extending to the north of Newman Township.

Whaleback Creek to the north of the Proposal is a well-defined channel, dominated by gravel and cobbles to 300 mm diameter, indicating a relatively high energy flow zone. Near the junction with the unnamed tributary, Whaleback Creek is around 18 m wide and has a bank height of 1.5 m.

The creek meanders in an easterly direction to its confluence with the Fortescue River, about 20 km east of the Proposal and upstream of Ophthalmia Dam. Due to climatic conditions, the creek is ephemeral with typically one to three flow events per year. Its catchment area of 215 km^2 at the Fortescue River confluence represents just 5% of the total Ophthalmia Dam catchment area (RPS Aquaterra 2011).

Hydrogeological Environment

The local hydrogeological environment is described above in Section 5.1.4.

5.2.5 Potential impacts

The potential impacts of the Proposal to inland water environmental quality relate to the potential formation of a pit lake at closure and the discharge of surplus dewater to the environment during operations. A discussion of the potential impact relating to discharge of surplus dewater to the environment is provided in Section 5.1.5.

There are not expected to be any impacts to the surface water quality that are different or additional to those associated with existing above water table operations. Given that the activities associated with the Proposal will be generally contained within the existing pit areas, it is not expected that there will be additional impact to surface water quality from the Proposal operations.

Pit Lake Formation

The potential impacts of the OB29/30/35 Pits on the local and regional groundwater and surface water resources, and key environmental receptors are dependent on the closure options adopted for the final pit voids. If the pit voids are infilled (to above the pre-mining water table), no long term impact is expected. However, even if the pits are left as open voids, any potential impact of pit lake formation on groundwater and surface water are expected to be very localised and subsequently no impact key environmental receptors is anticipated.

Pit Lake Salinity

The pits will gradually become saline to an equilibrium concentration defined by the salinity and rate of groundwater and surface water inflows, the pit lake water volume and evaporative water outflow rates. The rate of salinity increase will be slow, typically less than 5,000 mg/L every 100 years, and the increase will initially be linear. However, after a thousand years or so, when the pit lakes will become hypersaline, the rate of evaporation is expected to decline and the rate of salinity increase will taper off.

However, initial analysis indicates that the final pits are likely to be groundwater sinks. If this is the case there will be no impact on surrounding groundwater or surface water quality. Further groundwater modelling is required to confirm the groundwater behaviour at closure. 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. Fate transport assessment, or other appropriate analysis, will be undertaken prior to closure to understand the hydraulic connection and the likely development and movement of hypersaline post-closure. This is discussed further in the Mine Closure Plan (draft) (**Appendix F**).

5.2.6 Management measures

BHP Billiton Iron ore standard surface water management actions will be implemented as part of the Proposal. These include:

- Capturing surface flows from stockpiles and directing runoff to sediment basins prior to discharge to natural drainage systems. Bunding and potential rock armouring, where appropriate, will be incorporated into the sediment basin designs;
- Diverting natural runoff around disturbed areas as best as practicable;
- Installing culverts or other engineering design features at drainage crossings to allow for unobstructed flow as best as practicable;
- Ensure appropriate containment at the temporary fuel storage area;
- Monitoring of impacts at Mount Whaleback Creek under licence L4503 will continue; and
- Post closure pit lake development assessments, where more data becomes available through operations, to ensure adaptive management is applied as necessary.

Surplus Water Management

Dewatering discharge is proposed to be used as a water supply at Whaleback, with any surplus water to be discharged into the Ophthalmia Dam and associated Aquifer Recharge Scheme ponds at approved discharge points.

BHP Billiton Iron Ore will seek amendment the Environmental Licence to Operate for Mount Whaleback to allow for the discharge of surplus water to Ophthalmia Dam. BHP Billiton Iron Ore currently has several licensed discharge points at Ophthalmia Dam for disposal of surplus dewater from the OB23 and OB25 operations.

Water quality and volume is measured and reported in accordance with Licence conditions.

Liquid Waste

Domestic wastewater and sewage associated with proposed administration and workshop areas will be managed through existing infrastructure and in accordance with the Mount Whaleback Licence to Operate (L4503/1975/13).

Pit Lake Management

Management of any voids or potential pit lakes will be in accordance with the approved Mine Closure Plan and any agreements with the Department of State Development or other relevant agencies. A draft of the OB29/30/35 Mine Closure Plan is provided in **Appendix F**.

5.2.7 Summary

The assessments undertaken on leaving open pit voids with pit lake formation conclude that impacts on groundwater and surface water will be localised and there will be no significant impacts on regional groundwater or surface water and no impacts on key environmental receptors.

Additionally the AMD Risk Assessment has concluded that the likelihood for pit voids to generate AMD is considered low. Consequently it is considered unlikely that the quality of groundwater or surface water will be impacted, enabling the ongoing maintenance of environmental values.

Given the results of the studies undertaken it is considered that the Proposal meets the EPA Objective.

5.3 Flora and vegetation (groundwater dependent ecosystems)

5.3.1 Introduction

This section provides an overview of BHP Billiton Iron Ore's completed studies and investigations with respect to flora and vegetation, in particular the groundwater dependent ecosystems in the Proposal area and surrounds.

Since the commencement of mining at Mount Whaleback in the 1960s, BHP Billiton Iron Ore have commissioned at least 40 flora and vegetation surveys of the Mount Whaleback and OB29/30/35 areas to support environmental approvals and conditions. Onshore Environmental were engaged in 2013 to undertake a review and consolidation of the previous surveys conducted within the ML244SA lease (Onshore Environmental 2013b). GHD completed a flora and vegetation survey of the OB35 area, covering a portion of ML244SA, M52/906, E52/2008, G52/1257 and other general purpose leases south of ML244SA (GHD, 2011).

The Proposal involves mining below the water table within existing approved orebodies. OB29 has been extensively cleared and OB30 is partially cleared as a result of historical mining activities. OB35 is approved for above water table mining with activities due to commence in late 2013, and therefore has been assessed previously for land disturbance (see Section 2.7.2). The below water table zone within each orebody falls within the pre-approved pit boundaries and therefore the only potential impacts are associated with groundwater drawdown and impacts to potential groundwater dependant vegetation. Given areas associated with above water table mining are either already cleared of native vegetation or are approved to be cleared only impacts related to potential groundwater dependant vegetation will be discussed in this Section.

Description of work completed to date relating to Groundwater Dependant Ecosystems

The Proposal and surrounding areas have been subject to a number of site-specific multi-seasonal biological surveys, which provided a basis for further assessment of groundwater dependent ecosystems (GHD, 2011; Onshore Environmental, 2013a).

Onshore Environmental were commissioned to undertake a Groundwater Dependent Vegetation (GDV) Impact Assessment of the Proposal area in February 2013 (**Appendix C**). The assessment focused on the potential impacts of the proposed below water table mining on GDV, as a result of groundwater drawdown due to dewatering activities.

5.3.2 EPA objective

The EPA applies the following objectives, according to *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may affect flora and vegetation:

> *To maintain representation, diversity, viability and ecological function at the species, population and community level.*

5.3.3 Relevant guidelines and approvals

The discussion of the existing environment, impacts and management of flora and vegetation within the Proposal area has been developed in consideration of the following guiding documents, where practicable:

- *Position Statement No. 2, Environmental Protection of Native Vegetation in WA* (EPA, 2000a);
- *Position Statement No. 3, Terrestrial Biological Surveys as an element of Biodiversity Protection* (EPA, 2002a);
- *Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA* (EPA, 2004a); and
- *Checklist for Documents Submitted for EIA on Marine and Terrestrial Biodiversity* (EPA, 2010b).

Existing approvals obligations – Native Vegetation Clearing Permits

BHP Billiton Iron Ore holds current Native Vegetation Clearing Permits for the Proposal area. Any vegetation clearing to be undertaken within the Proposal area would be done under the authority of the existing NVCPs. Details of these permits are provided in Section 2.7.3.

Furthermore, BHP Billiton Iron Ore has submitted an application for a Strategic NVCP that covers the Proposal area (**Figure 5**). The Strategic NVCP area, currently under assessment for land disturbance, is considered sufficient to cover for any additional land disturbance associated with the development of the Proposal. Any additional land clearing associated with development of the Proposal would be in accordance with the existing NVCP, however, BHP Billiton Iron Ore will amend the existing NVCP if required. Section 2.7.3 provides an overview of the Strategic NVCP for Mount Whaleback.

5.3.4 Existing environment

Groundwater-dependent ecosystems are ecosystems which have their species composition and their ecological processes largely determined by groundwater. Groundwater-dependent ecosystems relevant to the Proposal area are considered to consist of localised GDV at a species and vegetation association level.

In the Pilbara region, GDV species are common along watercourses or occur where there is permanent and shallow water (within 5 m) beneath the ground surface (UWA, 2012). Species considered indicative of GDV in the Pilbara context include *Melaleuca argentea, Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* and *Eucalyptus xerothermica*, however, the level of dependency of these species on groundwater varies. These species are common along watercourses

throughout the region, with *Melaleuca argentea* in particular, only occurring where there is water permanently near (within 5 m) of the surface.

Based on vegetation association mapping conducted from previous studies (GHD, 2011; Onshore Environmental, 2013a and 2013b) in combination with analysis of pre-abstraction groundwater levels (RPS Aquaterra, 2012), it has been determined that *Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* and *Eucalyptus xerothermica* are the only recorded tree species that are considered to be at risk from groundwater drawdown associated with the Proposal. These taxa occur in vegetation associations 1b, 2a and 5b described by Onshore Environmental (2013a) and vegetation associations 3a, 4a, 5a and 7b described by GHD (2011). The vegetation associations considered at risk from groundwater drawdown are shown in **Figure 8**.

The phyreatophytic[1] tree species *Melaleuca argentea*, considered to be a species at high risk from groundwater drawdown, has not been previously recorded in the Proposal area or surrounds. *Melaleuca argentea* therefore has not been considered in further sections as it will not be impacted by the proposed groundwater dewatering activities in the Proposal area (Onshore Environmental 2013).

The majority of the Proposal area, with the exception of areas within the OB29 and OB30 pits, has pre-abstraction groundwater levels estimated at greater than 30 m bgl (metres below ground level). Pre-abstraction groundwater information indicates that water levels within sections of the OB29 and OB30 pits are approximately 15-30 m bgl, which corresponds to previously mined sections of the pits and not natural pre-mined ground levels (Onshore Environmental 2013a).

5.3.5 Potential impacts

The Proposal has the potential to impact groundwater dependant ecosystems within the vicinity of the Proposal area through below water table mine operations in particular groundwater drawdown due to dewatering.

Vegetation associations found along a main drainage line and associated flood plains in and within the vicinity of the Proposal area have been defined as supporting the facultative phreatophyte[2] *Eucalyptus camaldulensis* subsp. *refulgens* and/or the vadophytic[3] tree species *Eucalyptus victrix* and *Eucalyptus xerothermica*. These vegetation associations are determined to be at moderate risk from groundwater drawdown (**Figure 8**). Approximately 18.4 hectares (ha) of moderate risk GDV falls within the Proposal area boundary. Table 3 provides a summary of the tree species in the Proposal area and the associated dependence on groundwater.

Table 5: Summary of potential risk to GDV (Source: Onshore Environmental, 2013b)

Species Dependence on Groundwater	Plant Physiology/Water Use	Indicator Species
High	Phreatophyte	*Melaleuca argentea* (not recorded from the study area)
Moderate	Facultative phreatophytes or vadophytes	*Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* and *Eucalyptus xerothermica*
Low - None	Xerophyte	All remaining tree species within the Onshore Environmental (2013b) study area.

[1] Phyreatophytes are plant species that rely on water sourced directly from the watertable.

[2] Facultative Phyreatophytes are capable of functioning as both a vadophytes and a phyreatophytes.

[3] Vadophytes primarily use water held in the vadose (unsaturated) zone that occurs above the water table.

The maximum predicted groundwater drawdown in the Proposal area is estimated to range between a maximum of 50 m to 80 m close to abstraction operations within the OB29 and OB35 pits and 21 m to 50 m for OB30. The predicted groundwater drawdown reduces to 6 m to 20 m for the area between and surrounding the pits. Predicted groundwater drawdown levels decreases sharply to approximately 2 m to 5 m outside the perimeter of the three pits (**Figure 4**).

Predicted drawdown confirms that altered groundwater levels within the Proposal area will range from approximately 55 m to 185 m bgl. There will be two localised areas within OB29 and OB30 pits where predicted drawdown would increase groundwater depth from 15 to 25 m bgl to greater than 30 m bgl, which is considered to be the maximum depth threshold for tree roots from susceptible Groundwater Dependent Vegetation. However, both of the areas with groundwater drawdown of greater than 30 m bgl have been extensively cleared of vegetation and therefore will not comprise of GDV.

Outside of the pit area, the pre-abstraction water table is greater than 30 m depth. As such, any vegetation which includes the indicator species outlined above is unlikely to be dependent on groundwater as their roots cannot reach these depths.

5.3.6 Management measures

The potential impacts to flora and vegetation from the implementation of the Proposal are considered to be low, given that the below water table mining areas fall within existing or pre-approved above water table pits at OB29, OB30 and OB35. No clearing of native vegetation is included in this Proposal as BHP Billiton Iron Ore has existing approvals in place that authorise these activities.

In relation to conservation significant species, there were no species identified within the three Proposal boundaries. Similarly there was no vegetation of local significance or conservation significance that would be disturbed. All clearing of vegetation would occur under existing NVCPs and in accordance with the conditions of these permits.

BHP Billiton Iron Ore will commit to the following measures for the operational life of the below water mining at OB29/30/35:

- Results from future groundwater modelling in the area will be used to review the predicted impacts to groundwater dependant vegetation in future and BHP Billiton Iron Ore will consider additional management measures, if required.
- Inspect tree health in the vicinity of the OB29/30/35 Proposal areas prior to dewatering and at regular intervals during below water table mining, and if any trees appear to exhibiting stress during dewatering activities, initiate a Tree Monitoring and Remedial Programme or similar; and
- Report on environmental performance on an annual basis in the BHP Billiton Iron Ore Annual Environmental Report.

The Proposal would be managed in accordance with the BHP Billiton Iron Ore Mount Whaleback and OB29/30/35 Mines relevant site procedures and guidelines.

5.3.7 Summary

Since the commencement of mining at Mount Whaleback in the 1960s, BHP Billiton Iron Ore have commissioned at least 40 flora and vegetation surveys of the Mount Whaleback and OB29/30/35 area to support environmental approvals and conditions. . This level of information provides a higher level of certainty with respect to the flora and vegetation of the existing environment.

Implementation of the Proposal is not considered to introduce additional nor different impacts to flora and vegetation, given that the OB29/30/35 areas have been previously assessed and approved, other than in relation to potentially GDV. All below water table mining areas will fall within existing approved boundaries and approvals have been in place for all previous ground disturbance in the Proposal area. Any additional land clearing associated with development of the Proposal would be under existing NVCP, however, BHP Billiton Iron Ore will amend the existing NVCP if required.

The Onshore Environmental (2013a) assessment of GDV in the OB29/30/35 area concluded that the predicted water table drawdown was unlikely to have an impact on native vegetation, particularly

vegetation considered to be at high risk from groundwater drawdown (i.e. vegetation associations and species with phreatophytic characteristics).

The tree species *Melaleuca argentea*, considered high risk, has not been previously recorded within, or in the vicinity of the OB29/30/35 area (GHD, 2011; ENV Australia, 2006a, 2006b, 2010; Onshore Environmental, 2009, 2013a) and there are no defined occurrences of naturally occurring shallow groundwater in the Proposal area (RPS Aquaterra, 2012). The tree species considered at moderate risk from groundwater drawdown includes *Eucalyptus camaldulensis* subsp. *refulgent*, *Eucalyptus victrix* and *Eucalyptus xerothermica*.

Hydrological information indicates that current pre-abstraction groundwater levels are in the range of 15 m bgl to 115 m bgl, (averaging 40-50 m bgl). The shallower pre-abstraction groundwater levels occur in previously mined areas of the OB29 and OB30 pit void, are cleared of native vegetation, and are not taken from the natural ground level.

The mapping of vegetation associations supporting facultative phyreatophyte and vadophyte species (**Figure 8**) confirms the majority of the area considered at moderate risk, overlays pre-abstraction groundwater levels in excess of 30 m bgl (Onshore Environmental 2013a). These pre-abstraction groundwater levels are considered deeper than the maximum root system of these species and therefore the species within the majority of the Proposal area and surrounds are unlikely to be reliant on groundwater for survival.

OB35 is the only pit with moderate risk vegetation inside or in the immediate vicinity of the Proposal area. This vegetation overlays a pre-abstraction groundwater level of approximately 45 m to 65 m bgl, with groundwater drawdown from dewatering activities expected to be less than 30 m. Therefore groundwater drawdown from dewatering is not considered to pose a risk to these species.

The remaining vegetation associations within the Proposal area support xerophytic species and are determined to be at low to nil risk of being impacted by groundwater drawdown (Onshore Environmental, 2013a).

The conclusion of the GDV impact assessment is that it is unlikely that any tree species in the OB29/30/OB35 area would utilise these groundwater resources, given their roots cannot reach these depths, and therefore it is concluded that there is unlikely to be any impact on native vegetation from proposed dewatering activities during mining below existing groundwater levels at OB29/30/OB35 (Onshore Environmental, 2013a).

BHP Billiton Iron Ore considers that any minor additional impacts to flora and vegetation can be managed through implementation of the current management practices and regulation of this environmental aspect will occur through the existing NVCP for Mount Whaleback.

5.4 Subterranean Fauna

5.4.1 Introduction

Stygofauna are aquatic subterranean invertebrates which can be generally found in groundwater habitats with substantial fissures or voids (EPA, 2003a). Within the Newman area this includes saturated Tertiary alluvium as well as orebody, dolomite and fractured rock aquifers.

Mine dewatering and mining below the groundwater table poses a potential impact to any restricted stygofauna species within the Proposal area, due to affects from groundwater drawdown (Bennelongia, 2013).

Troglofauna are not expected to be impacted by the Proposal given their habitat is in the air spaces above the saturated zone, which does not form part of the activities of this Proposal. The below water table nature of the Proposal means that the Proposal is entirely in the saturated zone and as such no air space habitat is expected to be present. For this reason, Troglofauna is not considered a key environmental factor relevant to this Proposal and therefore has not been discussed further.

Description of work completed to date

In 2007, BHP Billiton Iron Ore commenced a broad Regional Subterranean Fauna Sampling Program in the Pilbara. As part of this program, BHP Billiton Iron Ore has undertaken extensive stygofauna sampling in the region. The Program now involves thirty survey areas across the Pilbara region.

BHP Billiton Iron Ore commissioned Bennelongia Pty Ltd (Bennelongia) to assess the potential impacts on stygofauna from mining activities associated with implementation of mine dewatering and mining below groundwater table at OB29/30/35 (Bennelongia, 2013). Data from the Regional Subterranean Fauna Sampling Program was used in conjunction with the results from the stygofauna surveys undertaken at OB29/30/35 (**Figure 9**) to better understand the relationships between the local stygofauna community and that of the surrounding subregion (Bennelongia, 2013).

The Bennelongia (2013) report is included as **Appendix D**.

5.4.2 EPA objective

The EPA applies the following objective, according to the *Environmental Assessment Guideline 8 for Environmental factors and objectives* (EPA, 2013) in its assessment of proposals that may affect subterranean fauna, including stygofauna is:

> *To maintain the representation, diversity, viability and ecological function at the species, population and assemblage level.*

5.4.3 Relevant guidelines and approvals

The stygofauna survey programme and impact assessment have been conducted in consideration of the following guiding documents, where practicable:

- *Position Statement No. 3, Terrestrial Biological Surveys as an element of Biodiversity Protection* (EPA, 2002a);
- *Environmental Assessment Guideline 12 for Consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA, 2013b);
- *Checklist for Documents Submitted for EIA on Marine and Terrestrial Biodiversity* (EPA, 2010b); and
- *Draft Guidance No. 54a, Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (EPA, 2007a).

5.4.4 Existing environment

Bennelongia (2013) reviewed the geology and stratigraphy of the regional and local area within and around the Proposal area. The stratigraphy within and around the Proposal area is generalised as consisting of sequences of Tertiary Detritals underplayed by the Hamersley Group bedrock and Jeerinah Formation of the Fortescue group. The Proposal area is mostly hosted by the upper members of the Marra Mamba Iron Formation although mineralisation extends to the lower Nammuldi member and into the overlying West Angela Member of the Wittenoom Formation.

The local aquifers within the Proposal area are a Marra Mamba aquifer system that has the potential to be hydraulically connected more widely via the underlying Wittenoom Formation aquifer system and overlying Tertiary Detritals (which has limited saturated extent) (RPS Aquaterra, 2012). All aquifers within the Proposal area and surrounds are likely to contain voids, cavities or fractures, and therefore represent prospective stygofauna habitat, however, Tertiary Detritals and underlying dolomite of the Wittenoom Formation are likely to contain more fauna. Previous surveys in the region suggest that the Marra Mamba Formation aquifer, dominating the Proposal area, is likely to contain less fauna than the surrounding aquifer systems (Bennelongia, 2013)

Bennelongia analysed the stygofauna species distribution within the Proposal area and immediate surrounds, based on 43 samples collected where predicted drawdown is greater than 2 m. Furthermore, an additional 1658 samples collected within the wider Newman area provided a sound local context for the assessment of stygofauna impacts within the Proposal area.

Bennelongia recorded at least nine species from five higher level taxonomic groups within the Proposal area, including Oligochaeta (2 species), Ostracoda (1 species), Copepoda (3 species), Amphipoda (2 species) and Nematoda (treated as one species, possibly more).

The species abundance within the Proposal area was regarded as depauperate in stygofauna compared with the wider Newman area, which has at least 53 species. The likely explanation for fewer stygofauna species in the Proposal area is that it contains poorer quality stygofauna habitat than some other parts of the Newman area (Bennelongia, 2013). Bennelongia concluded that a low quality stygofauna habitat was present due to:

- the small volume of saturated Tertiary Detritals present;
- the lack of calcretes present within the potential drawdown area (i.e. minimal potential habitat, found elsewhere in the Newman area); and
- the presence of banded iron formation habitat, which is less prospective for stygofauna.

In addition, it appears that aquifer connectivity extends beyond the Proposal area into the surrounding Ophthalmia floodplain. Therefore, stygofauna species and communities may not be limited to the Proposal area.

5.4.5 Potential impacts

The Proposal has the potential to directly impact stygofauna through the dewatering of the OB29, OB30 and OB35 pits resulting in the loss, or substantial disturbance, of habitat. Indirect impacts to stygofauna associated with the Proposal are considered to be limited, given the exclusion of overburden storage areas affecting infiltration of rainfall, the lack of bulk hydrocarbon and chemical storage, and that proposed vibration and blasting methods are not significantly different to the current situation.

Assessment and modelling completed by RPS Aquaterra (2012 and 2013) indicated that the predicted dewatering over the life of the Proposal will proceed to approximately:

- 90 m below the water table at OB29;
- 60 m below the water table at OB30; and
- 70 m below the water table at OB35.

The drawdown effects of dewatering within the Proposal area will be largely restricted to the immediate mining area as shown in **Figure 4** (RPS Aquaterra, 2013). The maximum potential drawdown and associated impacts over the life of the Proposal is further discussed in the in Section 5.1.

All of the species recorded within the area of predicted drawdown associated with the Proposal are also known, or considered highly likely, to occur in locations not impacted by mining and associated activities. Additionally, habitat characterisation and regional stygofauna sampling suggest that the stygofauna habitat in the Proposal area is connected with stygofauna habitat in the downstream Ophthalmia floodplain (Bennelongia, 2013). This conclusion is based on the considerable amount of regional and local survey information, within the Pilbara and Ophthalmia floodplain area.

In conclusion, the Proposal is considered to have minimal impact on stygofauna species persistence, irrespective of any habitat changes that may occur, due to:

- poorer potential habitat occurring within the Proposal area when compared with other surrounding areas; and
- the potential aquifer connectivity extending beyond the Proposal area, indicating that stygofauna species and communities may be interconnected and not limited to the Proposal area.

5.4.6 Management measures

The range of management measures available to mitigate potential stygofauna impacts is limited given the need to dewater and mine open pits, however following will be applied:

- Hydrocarbons and chemicals will be appropriately stored and managed in accordance with Dangerous Goods Safety (Storage and handling for Non-explosives) Regulations 2007, *AS1940: The storage and handling of flammable and combustible liquids* and the Licence to Operate (L4503/1975/13); and
- Results from future groundwater modelling in the area will be used to review the predicted impacts to stygofauna habitat in future and BHP Billiton Iron Ore will consider adaptive management measures, if required.

5.4.7 Summary

The stygofauna habitat characterisation and sampling conducted within the proposal area, provides evidence to support the proposition that the dewatering in the OB29, OB30 and OB35 pits will not have a significant impact on stygofauna. It is anticipated that the EPA objective for fauna, including stygofauna, will be met.

BHP Billiton Iron Ore will ensure that any impacts to vertebrate fauna from mining operations will be managed via existing management practices and in accordance with any existing approvals (such as NVCPs).

5.5 Terrestrial Environmental Quality

5.5.1 Introduction

This section provides an overview of BHP Billiton Iron Ore's completed and proposed geochemical characterisation studies and investigations.

Description of work completed to date

BHP Billiton Iron Ore commissioned SRK Consulting Pty Ltd (SRK Consulting) to assess the potential risk of AMD from the development of the Proposal (SRK Consulting, 2013). For specific details about the SRK Consulting (2013) report, it is included as **Appendix E.**

BHP Billiton Iron Ore also commissioned RPS Aquaterra Consulting Pty Ltd (RPS Aquaterra) to develop interim conceptual hydrogeological models for OB29/30/35 and estimate preliminary mine pit inflows. RPS Aquaterra prepared Hydrogeological Assessment for OB29, OB30 and OB35 (RPS Aquaterra, 2013). For specific details about the RPS Aquaterra (2013) report, it is included as **Appendix B**.

5.5.2 EPA objective

The EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may affect terrestrial environmental quality:

> *To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.*

5.5.3 Relevant guidelines and approvals

Relevant environmental policy and guidance

The completed preliminary statement of findings and proposed materials geochemical characterisation programme has considered the following guiding documents, where practicable:

- Commonwealth Department of Industry, Tourism and Resources [DITR] (2007) *Leading Practice Sustainable Development Program for the Mining Industry - Managing Acid and Metalliferous Drainage*;
- International Network for Acid Prevention (2012) *Global Acid Rock Drainage Guide* (GARD Guide); and

- Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000), *Australian Water Guidelines for Fresh and Marine Waters* and its updates.

5.5.4 Existing environment

The geology at OB29/30/35 is 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. Overlying detritals, where present, may also be mineralised and enriched to ore grade (RPS Aquaterra, 2012).

5.5.5 Potential impacts

PAF material has the potential to generate acidic and/or metaliferous runoff/seepage if not appropriately characterised and managed. PAF material can be potentially problematic if exposed in OSAs or pit walls.

The preliminary AMD assessment (SRK, 2013) concluded that the potential for AMD from Marra Mamba Iron Formation is considered to be low due to the oxidised nature of the ore.

The lithological units with the highest proportions of PAF classified materials comprised the:

- Detrital, Paraburdoo Member (Wittenoom Formation) (PBD), West Angela Member – A1 (Shale waste) (Wittenoom Formation) (WA1) and West Angela Member – A2 (Wittenoom Formation) (WA2) units at OB29; and
- Marra Mamba Iron Formation, MacLeod Member (MM) and Marra Mamba Iron Formation, Nammuldi Member (MU) units at OB35.

Most of the other lithological units contained only a small number of sulfur analyses in excess of the 0.2% threshold; usually outliers representing between 1 and 5% of the assays.

In general, material mined from below the water table was found to contain less sulfur than the equivalent materials from above the water table.

5.5.6 Solid waste

Management of solid waste (e.g. industrial waste [scrap metal, wire]), vehicle and equipment parts (oil filters, batteries, tyres, etc.), packaging, general refuse, office and administrative wastes and domestic putrescible wastes associated with the Proposal managed using existing infrastructure, in accordance with relevant approvals and legislation and BHP Billiton Iron Ore's (2010) Waste Management Plan which observes the waste management hierarchy of elimination, reduction, reuse, recycling, treatment and disposal. BHP Billiton Iron Ore's Mount Whaleback Licence to Operate (L4503/1975/13) contains specific requirements for the management of solid waste for operations within the prescribed premise boundary. This would include the Proposal and associated operations.

5.5.7 Management measures

In accordance with EPA environmental objectives, BHP Billiton Iron Ore will aim to ensure that emissions (water) do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

The range of management measures that may be used to mitigate potential impacts are focused on prevention and minimisation, rather than control and treatment. Such management measures include:

- undertaking additional total-sulphur assays and other geochemical testing (e.g., acid-base accounting and metals analysis) in advance of mining to allow PAF material to be delineated with a high degree of spatial solution and confidence;
- undertaking geochemical testwork during mining to accurately categorise and segregate waste materials;

- progressively optimising pit shells to reduce PAF material management risks, where practicable;
- managing PAF overburden by leaving the material in-situ with an appropriate cover, in-filling the material within the open pits or encapsulating the material within out-of-pit OSAs; and
- managing PAF material exposed within the final pit walls during detailed closure planning (e.g. either submerging the material beneath the final water table or adequately covering the material with overburden to reduce oxidation).
- Results from future groundwater modelling in the area will be used to review the predicted impacts to stygofauna habitat in future and BHP Billiton Iron Ore will consider additional management measures, if required.

5.5.8 Summary

The preliminary AMD assessment (SRK, 2013) concluded that the potential for AMD from Marra Mamba Iron Formation is considered to be low due to the oxidised nature of the ore.

BHP Billiton Iron Ore has well established management strategies for management of PAF at its Mount Whaleback operations. These management strategies will be continued to be implemented for the Proposal.

Given the results of the studies undertaken and the well established management strategies for PAF, it is likely that the EPA Objective to maintain the quality of the land and soils so that ecological values can be protected can be met.

5.6 Rehabilitation and closure

5.6.1 Regulatory Context

As OB29/30/35 is located on a State Agreement mineral lease, the Proposal will function in a regulatory environment that is subject to BHP Billiton's State Agreement rights. Unlike mining operations regulated by the Mining Act, there are no specific tenement conditions requiring the preparation of a mine closure plan for existing sites on State Agreement tenure.

The Guidelines for Preparing Mine Closure Plans (2011) issued by the DMP and the EPA state that where a mine is not on Mining Act tenure, mine closure may be assessed by the EPA as part of the EIA process under Part IV of the EP Act. Through this formal assessment process, the EPA may recommend that conditions are imposed for the preparation and implementation of a mine closure plan. This approach towards closure applies at many of BHP Billiton Iron Ore's mining operations in the Pilbara, where a Ministerial Statement with specific conditions relating to rehabilitation and closure exists.

The document, Administration of Mine Closure Plans, issued by the DMP (2011a) states that for operations not administered under the Mining Act or the EP Act, operators are expected to liaise with relevant regulators and encouraged to have in place mine closure planning and implementation consistent with the Guidelines for Preparing Mine Closure Plans. BHP Billiton Iron Ore's older mines, e.g. Mount Whaleback and Goldsworthy mining operations, fall into this category.

BHP Billiton Iron Ore has met with officers from the EPA to discuss appropriate management mechanisms to ensure that EPA objectives in relation to closure and rehabilitation are met.

In relation to this Proposal:

- The EPA will consider whether or not assessment will be required under Part IV of the EP Act. However, in the event that assessment is not required, there will be no Ministerial Statement and no specific conditions requiring the preparation and implementation of a mine closure plan.
- In the absence of a Ministerial Statement, BHP Billiton Iron Ore has committed, in line with the Administration of Mine Closure Plans (DMP, 2011a), to prepare, submit and review the mine closure plan every three years.

- BHP Billiton Iron Ore has prepared a draft Mine Closure Plan to support this referral (**Appendix F**). A final of the Mine Closure Plan would be submitted if the EPA formally assesses the Proposal and/or to support the Project Proposal submission under the Newman State Agreement.

BHP Billiton Iron Ore understands that, in the absence of a Ministerial Statement or mine closure plan under the Mining Act, regulators have the ability to enforce mine closure obligations for OB29/30/35 via two main mechanisms:

- Through the submission of proposals by BHP Billiton Iron Ore under the Newman State Agreement; and
- BHP Billiton Iron Ore is required to comply with its obligations under environmental statutes and common law. The State Agreement does not exempt BHP Billiton Iron Ore from complying with environmental laws (clause 1, *Iron Ore (Mount Newman) Agreement Act 1964*).

Approvals obligations and proposals – Iron Ore (Mount Newman) Agreement Act 1964

BHP Billiton Iron Ore operates its OB29/30/35 operations under the Newman State Agreement. The mining tenure ML244SA was issued pursuant to the Newman State Agreement and is required to submit to the Minister for State Development, a Project Proposal, prior to the commencement of any substantial works under this legislation. This mechanism is similar to that also in place under the Mining Act.

The OB29/30/35 deposits have existing approved State Agreement Project Proposals for above water table mining. State Agreement proposals have yet been submitted for mining below the water table. BHP Billiton Iron Ore intends to submit proposals for mining below the water table, as this is likely to amount to a significant modification, expansion or other variation of its activities within the meaning of clause 9A(11) of the Newman State Agreement. As part of these proposals, BHP Billiton Iron Ore will submit the Mine Closure Plan. It is anticipated that any approval of a project proposal by the Minister for State Development will therefore include approval of that mine closure plan and any conditions attached to it (for example requiring the update of the mine closure plan as the pits are progressively mined).

In addition to compliance with the Newman State Agreement, BHP Billiton Iron Ore is required to comply with all environmental laws. There are various other obligations which will apply to mining the pits under standard legislation and Court appointed law.

These include:

- To not cause detrimental environmental impact, under the EP Act, including sections:
  - 49 (Pollution);
  - 49 (Unreasonable Emissions);
  - 50A and 50B (Material and Serious Environmental Harm);
  - 50 (Placement of Waste Likely to Cause Pollution);
  - 51C (Unauthorised Clearing); and
  - 58 (Breach of Environmental Licence, and hence restrictions on discharges), and
  - relevant regulations such as the Unauthorised Discharges Regulations.
- To not cause or be likely to cause significant impacts to matters of national environmental significance, under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Responsibility for remediation and management of contaminated sites under the *Contaminated Sites Act 2003*.
- Protections under the *Wildlife Conservation Act 1950* for protected flora and fauna.

- Under the *Mines Safety and Inspection Act 1994*, from an occupational health and safety closure perspective.
- Under the *Occupiers Liability Act 1985*, to reasonably protect people accessing land BHPBIO is responsible for.
- Common law obligations, including to not cause nuisance or negligent harm.

BHP Billiton Iron Ore considers that the regulatory and legislative requirements applicable to its operations will ensure that pits associated with a Proposal are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.

5.6.2 EPA objective

The EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals in relation to rehabilitation and closure:

> *To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.*

5.6.3 Relevant guidelines and approvals

EPA Guidance Statement No. 6: Rehabilitation of Terrestrial Ecosystems

The EPA Guidance Statement No. 6 (EPA, 2006) provides guidance on the rehabilitation of terrestrial ecosystems following disturbance. The Guidance Statement indicates that the key aims of rehabilitation are to:

- Ensure the long-term stability of soils, landforms and hydrology required for the sustainability of sites.
- Partially to full repair the capacity of ecosystems to provide habitats for biota and services for people.

Actions relevant to the rehabilitation planning and design include the development of relevant rehabilitation objectives, as well as the development of clear targets for rehabilitation that can be effectively monitored and audited.

BHP Billiton Iron Ore has incorporated rehabilitation objectives and outcomes for rehabilitation into the draft Mine Closure Plan (**Appendix F**).

EPA Environmental Protection Bulletin No. 19: EPA involvement in mine closure

The EPA *Environmental Protection Bulletin No. 19: EPA involvement in mine closure* (EPA, 2013c) provides guidance on the roles of the DMP and the EPA in mine closure and explains the circumstances when the EPA will assess mine closure.

Mine closure strategies and guidelines

BHP Billiton Iron Ore subscribes to the intent and advice of several established guidelines that assist companies in achieving acceptable standards of mine closure and rehabilitation. Applicable mine closure guidelines include;

- *Guidelines for Preparing Mine Closure Plans* (DMP/EPA, 2011);
- *Planning for Integrated Mine Closure: Toolkit* (ICMM, 2008);
- *Mine Void Water Issues in Western Australia* (Johnson & Wright, 2003); and
- *Strategic Framework for Mine Closure* (ANZMEC & MCA, 2000);

BHP Billiton Iron Ore recognises that there is no requirement to prepare a mine closure plan for existing sites on non-Mining Act tenure (i.e. State Agreement tenure).

The Guidelines for Preparing Mine Closure Plans state that where a mine is not on Mining Act tenure, mine closure may be assessed by the EPA as part of the EIA process under Part IV of the EP Act. Through this formal assessment process, the EPA may recommend that conditions are imposed for the preparation and implementation of a mine closure plan. This approach towards closure applies at many of BHP Billiton Iron Ore's mining operations in the Pilbara, where a Ministerial Statement with specific conditions relating to rehabilitation and closure exists.

The document, Administration of Mine Closure Plans, issued by the DMP (2011a) states that for operations not administered under the Mining Act or the EP Act, operators are expected to liaise with relevant regulators and encouraged to have in place mine closure planning and implementation consistent with the Guidelines for Preparing Mine Closure Plans. BHP Billiton Iron Ore's older mines, e.g. Mount Whaleback and Goldsworthy mining operations, fall into this category.

In relation to the Proposal:

- The EPA will consider whether or not assessment will be required under Part IV of the EP Act. It is possible that assessment will not be required, in which case there will be no Ministerial Statement and no specific conditions requiring the preparation and implementation of a mine closure plan.
- In the absence of a Ministerial Statement, BHP Billiton Iron Ore has committed, in line with the Administration of Mine Closure Plans (DMP, 2011a), to prepare, submit and review a mine closure plan after three years, then on a regular basis.
- BHP Billiton Iron Ore has prepared a draft Mine Closure Plan to support this referral (**Appendix F**). A final of the Mine Closure Plan would be submitted if the EPA formally assesses the Proposal and/or to support the Project Proposal submission under the Newman State Agreement.

5.6.4 Existing environment

The draft Mine Closure Plan (BHPBIO, 2013; **Appendix F**) 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 to develop completion criteria and performance indicators for closure monitoring and performance. The proposed preliminary closure management of the mining operations is based on understanding the surrounding environment and the outcomes of monitoring and research trials.

5.6.5 Potential impacts

Risk management is recognised as an integral part of good management practice within BHP Billiton Iron Ore. It is an iterative process consisting of steps, which when undertaken in a sequence, enable continuous improvement in decision making.

An internal BHP Billiton Iron Ore risk assessment was undertaken for the whole mining process at OB29/30/35, with the following aspects considered:

- management of PAF materials;
- groundwater (flow and quality);

- final landform stability (open pits, OSA);
- pit lake development (groundwater sink, quality);
- revegetation (flora and fauna); and
- site safety.

With respect to the Proposal is expected to be fully implemented during the life of the OB29/30/35 mining operations. Given that the Proposal involves deepening of existing mine pits, below the water table, with no new ground disturbance, key potential impacts associated with the Proposal are:

- the option of leaving pits as open voids at the completion of mining will result in the development of pit lakes due to watertable recovery, which have the potential to impact local and regional groundwater and surface water resources; and
- exposure of any PAF material within the below water table section of the pit voids.

The range of closure options available for the OB29/30/35 pits includes:

- in-filling of pit voids to above water table;
- partial in-filling of pit voids to reduce pit lake surface area; and
- leaving the pits as fully open voids allowing pit lake formation.

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 and would enable groundwater levels to recover to regional levels. The option of retaining open voids, can present changes to groundwater inflow and evaporative losses during the groundwater recovery in the pit void, however this impact is expected to be localised. Partial backfill scenarios would be investigated further during the life of operations.

The impacts associated with the presence of PAF material within the OB29/30/35 pits was further explored in the Preliminary AMD Risk Assessment (SRK, 2013) and is discussed further in Section 5.7.

Additional discussion of the potential impacts and ongoing studies are discussed further in the draft Mine Closure Plan (**Appendix F**).

5.6.6 Management measures

The key issues identified during the preparation of this document were considered and incorporated in the OB29/30/35 Mine Closure Plan (draft). The draft Mine Closure Plan provides for the management of the following closure aspects, which adheres to the requirements of the Guidelines for Preparing Mine Closure Plans (DMP/EPA, 2011):

- design and maintenance of surface water management structures;
- management of soils;
- dispersive and sodic materials;
- cultural heritage;
- contaminated sites;
- visual amenity;
- hazardous materials;
- dust emissions; and
- pit lake formation.

The OB29/30/35 Mine Closure Plan (draft) provides for an adaptive management approach to closure and rehabilitation, which involves BHP Billiton Iron Ore regularly assessing performance and adjusting management practices to facilitate continuous improvement. Closure and rehabilitation strategies have been identified in the OB29/30/35 Mine Closure Plan (draft), for specific domain types including

pit voids. Additionally, groundwater and surface water monitoring and maintenance programmes have also been incorporated to meet the site completion criteria and objectives.

5.6.7 Summary

BHP Billiton Iron Ore considers that the existing regulatory and legislative requirements will ensure that premises associated with the Proposal are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.

Should a Ministerial Statement not be issued for the Proposal, BHP Billiton Iron Ore has committed, in line with the Guideline for Preparation of Mine Closure Plans (DMP/EPA, 2011), to prepare and maintain a mine closure plan, with an initial review occurring three years.

Additionally, the studies undertaken to date indicate if the pits are left as open voids, the impacts on groundwater and surface water will be localised and there will be no significant impacts on regional groundwater or surface water and no impacts on key environmental receptors. The AMD Risk Assessment indicates that there is low likelihood of acidification of pit lakes, however long-term salinisisation may occur.

It is considered that the implementation of the Proposal is not significant, that appropriate regulatory mechanisms exist to ensure appropriate closure and rehabilitation of the site, and as such the Proposal meets the EPA Objective.

5.7 Terrestrial Fauna

The Proposal falls within areas previously assessed and approved for mining activities and due to the nature of the below water table mining and significant disturbance that has already occurred within OB29 and OB30, it is unlikely that any new impacts to vertebrate fauna will be introduced. Impacts associated with the development of OB35 were previously assessed under the referral of that Proposal in 2012. It is not expected any impacts to vertebrate fauna will be additional or different to those identified and assessed in that Proposal.

Vertebrate fauna are not expected to be impacted by the Proposal given that there is no additional vegetation clearing proposed, therefore there will be no additional removal of habitat of conservation significant species. The below water table nature of the Proposal means that the Proposal is entirely in the existing disturbed area and as such no vertebrate fauna habitat is expected to be present. For this reason, vertebrate fauna is not considered a key environmental factor relevant to this Proposal and therefore has not been discussed further.

5.8 Landforms

5.8.1 Introduction

The following section discusses the existing environment and impact assessment as it relates to the landforms of the Proposal area and surrounds.

The proposal involves the deepening of existing open pits which have been mined to just above the water table. No additional OSAs are required as part of this Proposal. As such, the impact to landforms will be minor and within that already present due to existing operations.

Description of work completed to date

Environmental Resources Management Australia (ERM) undertook a visual and landscape impact assessment (LVIA) to support the referral of OB35 for above water table mining (ERM, 2011a). A summary of the findings is provided in Section 5.9.4.

5.8.2 EPA objective

EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may affect landforms:

To maintain the variety, integrity, ecological functions and environmental values of landforms and soils.

5.8.3 Relevant guidelines and approvals

Relevant environmental policy and guidance

The following guiding documents are relevant in the consideration of impacts to amenity:

- *EPA Guidance Statement No. 33, Environmental Guidance for Planning and Development* (EPA, 2008).
- *Visual Landscape Planning in Western Australia* (WAPC, 2007).

Existing approvals obligations – State Agreement Act (SP/FR)

Obligations under the State Agreement Act are closely linked to closure obligations. These have been discussed in Section 5.6.1.

5.8.4 Existing environment

The landscape in which the Proposal is located is 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 landscape of the Proposal area has been highly modified by previous and exiting operations. Existing modifications to landforms include the creating of open pits and a number of OSAs. These have been previously approved and are not subject to this referral.

The LVIA undertaken by ERM (2011a) identified five Landscape Character Units (LCUs). These units correspond closely to Vegetation Associations and fauna habitat (Table 6).

The draft Mine Closure Plan (**Appendix F**) provides a summary of details on the physical and biological environment at OB29/30/35 including:

- local environmental conditions – topography and geology; and
- soil and waste materials characterisation.

Table 6: Landscape Character Units and Corresponding Vegetation Associations & Fauna Habitats

LCU	Description*	Corresponding Vegetation Association / Fauna Habitat
LCU1 – Degraded Areas	Typically in the form of roads or areas with visible signs of earthworks such as broad areas of cut and/or fill. They are characterised by a lack of vegetation, exposed soils and visible human modifications	**Vegetation Associations:** • Mining Area/Cleared **Fauna Habitats:** • Cleared

LCU	Description*	Corresponding Vegetation Association / Fauna Habitat
LCU2 – Grassland	Characterised by low growing grasses consisting of *Triodia* and *Themeda* species, varying in density with occasional shrubs and small trees, mostly consisting of *Acacia* and *Eucalyptus* species	**Vegetation Associations:** • *Triodia* Hummock Grassland • *Triodia* Open Hummock Grassland • *Themeda* Open Tussock Grasslands • *Triodia* Hummock Grassland to Open Hummock Grassland **Fauna Habitats:** • Hillcrest and Slope • Drainage Area
LCU3 – Shrubland	Characterised by medium to tall shrubs of *Acacia* and *Eremophila* species over grass species including *Triodia* and *Themeda*, Scattered low trees of *Corymbia* and *Eucalyptus* species can also be found.	**Vegetation Associations:** • *Acacia* Open Shrubland • *Acacia* Low Woodland • *Acacia* Low Open Woodland • *Acacia* Low Open Forest **Fauna Habitats:** • Mulga Woodland • Drainage Area
LCU4 – Open Woodland and Forest	Located on lower slopes and gently undulating sites. This LCU is characterised by tree species including *Eucalyptus, Corymbia* and *Ficus* over shrubs such as *Acacia* and *Eremophila* species with some areas of grasses including *Themeda* and *Triodia* species.	**Vegetation Associations:** • *Eucalyptus* Low Woodland • *Acacia* Low Open Forest • *Acacia* Low Woodland **Fauna Habitats:** • Major Drainage Lines
LCU5 – Rocky Outcrops and Gullies	Characterised by exposed rock formations, they are generally devoid of dense vegetation but *Triodia* species and small *Eucalyptus* species can be found.	**Vegetation Associations:** • *Triodia* Hummock Grassland • *Triodia* Open Hummock Grassland **Fauna Habitats:** • Hillcrest and Slope • Gorge/Gully

* LCU descriptions sourced from ERM (2011a)

5.8.5 Potential impacts

The Proposal involves the deepening of existing pits. Activities associated with above water table mining operations, such as overburden storage, are not included in this Proposal. As such, there is not expected to be any additional impact from the Proposal above that of the existing operations.

5.8.6 Management measures

While the Proposal will not result in any additional impacts to landforms, BHP Billiton Iron Ore will endeavour to ensure that the integrity, ecological functions and environmental values of landforms are considered and measures are adopted to reduce impacts to landforms to as low as reasonably practicable.

Management measures that may be used to mitigate potential visual impacts include:

- Designing OSAs to integrate and blend in with the surrounding topography as far as practicable.
- Rehabilitating mine landforms when they are not required.
- Conserving topsoil resources where practicable.

5.8.7 Summary

The Proposal area is located in a highly modified landscape and the landforms present are not considered to be unique to the region. Due to the highly modified nature of the Proposal area, and as the Proposal involves the deepening of existing pits to enable mining below the water table, the impact to landforms will not be significantly greater than that already present.

As such this factor is not considered significant to the assessment of the Proposal.

5.9 Human health (previously noise and vibration)

5.9.1 Introduction

This section provides an overview of BHP Billiton Iron Ore's completed noise and vibration investigations. Noise and vibration emissions resulting from the Proposal will not be significantly different to those from existing operations.

Description of work completed to date

Previous noise assessments were undertaken by Vipac Engineers & Scientists (2006) and SVT Engineering Consultants (2005). These assessments indicated that noise levels at the nearest residential receptors would be 35 decibels (A). This is well below the assigned noise level for daytime operations and equal to the night-time assigned noise level.

ERM undertook an assessment of noise and vibration emissions for the Proposal area to support the referral of OB35 for above water table mining (ERM, 2011b). This assessment concluded that cumulative noise impacts at Newman from existing operations and OB35 operations would remain at or below the assigned noise levels (ERM, 2011b).

5.9.2 EPA objective

The EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may affect noise and vibrations:

> *To ensure that human health is not adversely affected.*

5.9.3 Relevant guidelines and approvals

The noise and vibration assessment has been undertaken in consideration of the following guiding documents:

- *Draft EPA Guidance Statement No. 8, Environmental Noise* (EPA, 2007b);
- *Environmental Protection (Noise) Regulations 1997*; and
- *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (Australian and New Zealand Environment Council [ANZEC], 1990).

5.9.4 Existing environment

The town of Newman is approximately five km from the location of the Proposal. The acoustic environment at Newman will consist of a number of different noise sources including noise from within the town (such as traffic, aircraft, industrial, commercial and domestic noise) and noise from the existing Whaleback operations.

Previous noise assessments have identified locations chosen as representative sensitive receptors. These locations are as follows **Figure 10**:

- Sensitive Receptor 1 (R1) – located at the light industrial area on the western side of Newman, approximate 5.8 km east north east of OB35;
- Sensitive Receptor 2 (R2) – located at the south-west corner of the Newman residential area approximately 6.8 km east north east of OB35
- Sensitive Receptor 3 (R3) – located at the north-west corner of the Newman residential area approximately 7.3 km east north east of OB35.

These are considered representative of the areas with the highest exposure to noise from both existing operations and proposed mining operations.

Previous noise assessments (Vipac Engineers & Scientists, 2006; SVT Engineering Consultants 2005) indicated that noise levels at the nearest residential receptors would be 35 decibels (A). This is well below the assigned noise level for daytime operations and equal to the night-time assigned noise level.

5.9.5 Potential impacts

Excessive noise and vibration has the potential to impact environmental and social values within the proposed Project area and surrounds (e.g. residential areas, other land users, fauna and caves).

The main sources of noise from the proposed Project would be associated with:

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

Noise emissions from the Proposal are not expected to be significantly greater than current emissions. Ore processing operations are not part of this Proposal and as such, noise associated with crushing and screening has not been considered.

The main source of vibration from the proposed Project would be from blasting. As blasting has been occurring during above water table mining, vibration resulting from blasting during below water table mining will not differ significantly from the current situation.

5.9.6 Management measures

BHP Billiton Iron Ore will manage the proposed Project to protect the amenity of nearby residents from noise and vibration impacts resulting from activities associated with the proposal by ensuring levels meet statutory requirements and acceptable standards.

In order to minimise any impacts on the township of Newman, blasting at OB29/30/35 will be carried out in accordance with schedules and conditions that apply to blasting at the Mount Whaleback Mine. Additionally, BHP Billiton Iron Ore has committed to reducing noise levels by using low-noise equipment, silencers and exhaust mufflers and undertaking blasting during daylight hours.

5.9.7 Summary

The previous noise modelling indicates that cumulative noise impacts at sensitive receptors in and around Newman from Proposal operations not be additional or different to existing mining activities at the Mount Whaleback operations. In addition, noise levels at existing operations are either at or below the relevant noise level criteria assigned by the Environmental Protection (Noise) Regulations 1997. It is therefore considered that this factor meets the EPA Objective.

5.10 Air quality

5.10.1 Introduction

Air Quality monitoring within the Proposal area and surrounds has been conducted by BHP Billiton Iron Ore. This has included monitoring of two background sites and three sites within the town of Newman (**Figure 10**).

The existing Licence to Operate outlines the controls required for dust management throughout the Mount Whaleback operational area. These controls will be adhered to for this Proposal.

Description of work completed to date

ERM undertook an air quality assessment for the Proposal area to support the referral of OB35 for above water table mining (ERM, 2011c). This assessment determined the existing (background) dust concentrations, modelled the expected emissions from OB35 and assessed the cumulative impacts of future projected emissions from Whaleback, Newman Hub and OB29/30/35.

5.10.2 EPA objective

The EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may affect air quality:

> *To maintain air quality for the protection of the environment and human health and amenity*

5.10.3 Relevant guidelines and approvals

Relevant environmental policy and guidance

The air quality, including dust, impact assessment and management discussion has been undertaken in accordance with:

- *EPA Guidance Statement No. 18, Prevention of Air Quality Impacts from Land Development Sites* (EPA, 2000b).

In addition, the National Environment Protection Measure (Ambient Air Quality) 1998 (NEPM) sets air quality standards for major air pollutants. The standards relating to potential emissions from the Proposal are outlined in Table 7.

Table 7: NEPM (Ambient Air Quality) standards

Pollutant	Averaging Period	Maximum Concentration	Maximum Allowable Exceedences
Particles as PM10	24 hour	50 µg/m^3	5 days in a year
Particles as PM2.5	Annual	8 µg/m^3	NA
	24 hour	25 µg/m^3	NA

Existing approvals obligations – Licence to Operate

The existing BHP Billiton Iron Ore Licence to Operate for Mount Whaleback requires the following in relation to dust and emissions effecting air quality:

- Maintain and operate all installed dust collection and dust control systems to ensure that dust emissions are minimised.
- Employ measures to ensure that dust emissions from haul roads, access roads, stockpiles and active work areas are minimised.
- Odour emitted from the premises does not unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person who is not on the premises.
- Monitoring of ambient air quality in line with Table 8.

Table 8: Air quality monitoring requirements

Monitoring Location	Monitoring Technique	Sample Frequency	Reporting Frequency	Parameter ($\mu g/m^3$)	Target ($\mu g/m^3$) 24 hour average	Method
Newman 1 Town Centre	TEOM	Continuous	10 minutes	PM_{10}	70	AS/NZS 3580.9.11:2008
	BAM SM200 Opsis	Continuous	1 hour	$PM_{2.5}$	-	AS/NZS 3580.9..6:2003
			1 hour	TSP	-	AS/NZS 3580.9.3-2003
Newman 2 Golf Club	TEOM	Continuous	10 minutes	PM_{10}	70	AS/NZS 3580.9.11:2008
	BAM SM200 Opsis	Continuous	1 hour	TSP	-	AS/NZS 3580.9.3-2003
Newman 3 McLennan Drive	TEOM	Continuous	10 minutes	PM_{10}	70	AS/NZS 3580.9.11:2008
	BAM SM200 Opsis	Continuous	1 hour	TSP	-	AS/NZS 3580.9.3-2003

The DEC notes that there is a medium level of community interest or concern at the Newman town site. Conditions on the Licence reflect the level of community interest.

BHP Billiton Iron Ore manages community concerns via a complaints and grievance mechanism.

5.10.4Existing environment

Climate

The Pilbara regional has hot summers and cold winters with low rainfall and humidity levels. Winds are predominantly from the east and south east during the morning with afternoon winds normally from the east, except for September through to November when afternoon winds are predominantly from the west or north west.

Natural sources of (wind-blown) dust in this dry environment contribute significantly to existing air quality conditions. Measured PM_{10} concentrations at Newman are already well in excess of the NEPM standards.

Background air quality

Continuous ambient air monitoring was undertaken for the five sites outlined in Section 5.10.1 for a period of 12 months from April 2010 to March 2011 (ERM, 2011c). Concentrations of PM_{10} and Total Suspended Particulates (TSP) were monitored at all five sites while site Newman 1 Town Centre also monitored concentrations of $PM_{2.5}$.

The top 10 24 hour average concentrations at each site for PM_{10}, TSP and $PM_{2.5}$ (where applicable) along with the annual average are shown in **Table 9**. This illustrates that PM_{10} concentrations are already in excess of the NEPM standards. Investigations into exceedances of the Licence to Operate target (70 micrograms per cubic metre (µg/m^3)) at the Newman air quality monitoring sites during the July 2011 to June 2012 reporting period found that only one of the 29 exceedances was potentially mining related (BHP Billiton Iron Ore, 2012).

Table 9: Background air quality concentrations near Newman

Background 1 (µg/m^3)		**Newman 1 Town Centre (µg/m^3)**			**Newman 2 Golf Club (µg/m^3)**		**Newman 3 McLennan Drive (µg/m^3)**		**Background 2 (µg/m^3)**	
TSP	**PM_{10}**	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**TSP**	**PM_{10}**	**TSP**	**PM_{10}**	**TSP**	**PM_{10}**
24 hour average										
356.2	151.7	135.0	79.8	17.2	90.9	105.1	128.7	114.1	196.6	72.1
311.3	133.1	131.2	78.3	15.4	90.6	86.4	90.8	78.3	181.9	61.4
290.8	131.7	113.2	73.6	13.0	86.9	85.0	89.3	78.0	161.6	58.3
278.8	113.5	102.4	66.5	11.5	83.6	80.4	75.7	70.4	155.2	53.4
274.1	105.8	85.4	61.8	11.5	76.7	63.7	75.5	59.2	118.7	52.7
261.0	99.4	72.2	61.1	11.4	74.9	63.7	69.3	55.1	115.2	48.0
252.6	96.9	69.2	57.8	11.2	69.9	53.9	67.5	54.3	115.0	45.8
216.3	96.1	68.5	56.3	8.6	66.9	48.0	66.5	54.3	107.9	45.5
215.7	87.7	67.3	54.9	8.5	58.4	46.9	66.2	53.3	105.0	44.4
214.7	85.8	64.1	51.2	8.1	56.8	45.0	64.5	51.3	103.0	43.5
Annual average										
64.7	28.8	33.2	19.4	2.5	19.0	15.1	25.3	21.9	29.5	17.2

Sensitive receptors

The nearest sensitive receptors are the town of Newman residential areas. These are the closest non BHP Billiton Iron Ore residences (**Figure 10**).

5.10.5Potential impacts

The main potential air quality issues resulting from this Proposal are particulate emissions associated with:

- excavating and handling of iron ore and overburden including blasting;
- wind erosion from iron ore stockpiles and overburden storage areas; and
- vehicle movements associated with the transfer of iron ore and overburden.

Impacts from the Proposal are not expected to be greater than or different to those from the existing above water table operations.

Modelling of cumulative PM_{10} concentrations for future projected emissions from Whaleback, Newman Hub and OB29/30/35 indicate that emission related to mining will meet NEPM criteria at Newman.

5.10.6 Management measures

BHP Billiton Iron Ore will endeavour to make sure that air emissions do not adversely affect environmental or social values by meeting statutory requirements and acceptable standards; and to minimise emissions to levels as low as practicable on an ongoing basis.

The existing Licence to Operate outlines the controls required for dust management throughout the Mount Whaleback operational area.

The range of management measures that may be used at the proposed Project to minimise potential impacts on air quality include:

- Minimising the area of native vegetation that is cleared and the duration for which cleared areas are left open before being rehabilitated or otherwise stabilised.
- Using road watering and/or alternative dust control measures to manage dust generation from haul roads, access roads and active work areas.
- Using water sprays and/or alternative dust control measures to manage dust generation from ore stockpiling and transport areas.

5.10.7 Summary

Natural sources of (wind-blown) dust contribute significantly to existing air quality conditions at Newman. Measured PM_{10} concentrations at Newman are already well in excess of the NEPM standards.

Dust impacts resulting from the Proposal are not expected to be greater than or different to those from existing operations. Modelling of cumulative PM_{10} concentrations for future projected emissions from Whaleback, Newman Hub and OB29/30/35 indicate that emission related to mining will meet NEPM criteria at Newman.

The Mount Whaleback Licence to Operate manages the limits and criteria for dust monitoring, management and reporting. The Licence will continue to manage the potential impacts of implementation of the Proposal.

It is therefore considered that this factor is not significant.

5.11 Greenhouse gas emissions

5.11.1 Introduction

No greenhouse gas emissions assessment was undertaken for the Proposal, as the activities under the Proposal will replace existing activities on site. Potential sources of greenhouse gas emissions have been identified as diesel combustion and electricity use.

5.11.2 EPA objective

The EPA applies the following objective, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may result in greenhouse gas emissions:

> *To maintain air quality for the protection of the environment and human health and amenity.*

5.11.3 Relevant guidelines and approvals

Relevant environmental policy and guidance

The greenhouse gas emissions assessment for the Proposal considers the following guiding documents:

- *Guidance Statement No. 12, Minimising Greenhouse Gas Emissions* (EPA, 2002b);
- *Guidance Statement No. 18, Prevention of Air Quality Impacts from Land Development Sites* (EPA, 2000b); and

- *National Greenhouse Accounts (NGA) Factors* (Commonwealth Department of Climate Change and Energy Efficiency, 2010).

Existing approvals obligations –Licence to Operate

The existing BHP Billiton Iron Ore Licence to Operate requires management of air quality emissions, as detailed in Section 5.10.3. There are no specific requirements pertaining to greenhouse gas emissions.

5.11.4 Potential impacts

Greenhouse gas emissions from the proposed Project would be generated through the combustion of hydrocarbons, clearing of native vegetation, use of explosives during blasting operations and the use of electricity.

Emissions will essentially be similar to current emissions. The only additional source will be from pumps used to dewater the mine pits.

5.11.5 Management measures

BHP Billiton Iron Ore would aim to minimise emissions to levels as low as practicable on an ongoing basis and consider greenhouse gas offsets. The range of management measures that may be used to minimise greenhouse gas emissions from the Proposal includes:

- Restricting the amount of native vegetation that is cleared to a practical minimum.
- Rehabilitating mine landforms and disturbed areas when they are no longer required.
- Maintaining and replacing fixed and mobile equipment to minimise fuel consumption.
- Minimising haulage distances and grades, and the double handling of overburden.

5.11.6 Summary

Greenhouse gas emissions are not expected to be significantly greater than or different to existing above water table operations at OB29/30/35. BHP Billiton Iron Ore will aim to mitigate greenhouse gas emissions as far as reasonably practicable. It is considered that this factor is not significant.

5.12 Heritage

5.12.1 Introduction

The Proposal is situated entirely within the Nyiyaparli [WC05/6] Native Title Claim (NTC). No heritage sites will be disturbed, given the Proposal is wholly located within previously disturbed and active mining areas.

As a commitment of the Comprehensive Agreement between the Nyiyaparli People and BHP Billiton, representatives from both parties meet through the Implementation Committee on a six monthly basis. This is a forum that seeks to share relevant information, and to resolve any concerns, between BHP Billiton and the Nyiyaparli People, including matters related to heritage and environment. A Heritage Sub Committee has also been formed and this Committee will meet each quarter to consider heritage matters in more detail.

5.12.2 EPA objective

The EPA applies the following objectives, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013) in its assessment of proposals in relation to heritage:

> *To ensure that historical and cultural associations are not adversely affected.*

5.12.3 Relevant guidelines and approvals

Relevant environmental policy and guidance

EPA Guidance Statement No. 41, Assessment of Aboriginal Heritage (EPA 2004c) is relevant to this section.

Existing approvals obligations – Section 18 approval under the Aboriginal Heritage Act 1972

BHP Billiton Iron Ore has the relevant Section 18 approvals to implement the current mining projects in the area. No further approvals will be required to implement the Proposal.

5.12.4 Existing environment and Potential Impacts

Ethnographic surveys have been conducted over the entire proposed Proposal area with representatives of the relevant Traditional Owners. Archaeological surveys have also been conducted over the proposed Project area. Representatives from the relevant Traditional Owner group participated in the archaeological survey work. No further archaeological surveys will be required.

No potential heritage sites exist within the Proposal area, given all the Proposal area is existing pits and disturbed areas.

Heritage surveys have recorded sites within the wider area. BHP Billiton Iron Ore is aware of the location of heritage sites and, where possible, would adopt engineering solutions to avoid them. If any heritage site cannot practically be avoided BHP Billiton Iron Ore would consult with the relevant Traditional Owners and seek approval under Section 18 of the *Aboriginal Heritage Act 1972* before the site is disturbed.

5.12.5 Management measures

BHP Billiton Iron Ore manages and protects Aboriginal heritage in compliance with the WA *Aboriginal Heritage Act 1972* (AHA). Potential impacts to heritage sites associated with this project will continue to be managed through BHP Billiton Iron Ore's internal heritage management procedures, including:

- Identified heritage sites are avoided where practicable through design, planning and engineering solutions;
- Entry into a previously recorded heritage site by unauthorised persons is prohibited;
- All employees and contractors are informed of their obligations under the AHA including the requirement to promptly report any potential heritage sites discovered; and
- The BHP Billiton Iron Ore internal land disturbance approval process known as the Project Environment and Aboriginal Heritage Review (PEAHR), is used to manage all ground disturbing activities.

An approved PEAHR must be in place prior to land disturbance. If any Aboriginal heritage site cannot be avoided, BHP Billiton Iron Ore will seek approval from the Minister under Section 18 of the Aboriginal Heritage Act 1972 before any heritage site is disturbed.

5.12.6 Summary

No heritage sites will be impacted by implementation of this Proposal. Should any heritage site be identified during works for this Proposal, this site will avoided until an engineering solution is reached or if that site cannot practicably be avoided, BHP Billiton Iron Ore would consult the relevant traditional owners and seek approval under the AHA (1972) before the site is disturbed.

Given that it is unlikely Aboriginal Heritage values will be impacted by the implementation of this Proposal, it is considered that the EPA Objective for this factor is met.

5.13 Amenity

5.13.1 Introduction

The following section discusses the existing environment and impact assessment as it relates to the amenity of the Proposal area and surrounds.

BHP Billiton Iron Ore remains committed to ongoing consultation with the Newman community to address impacts and realise opportunities created by its growth program.

Description of work completed to date

ERM undertook a LVIA to support the referral of OB35 for above water table mining (ERM, 2011a). A summary of the findings is provided in Section 5.9.4.

5.13.2 EPA objective

The EPA applies the following objective, according to the *Environmental Assessment Guideline 8 for Environmental Factors and Objectives* (EPA, 2013), in its assessment of proposals that may result in impacts to amenity:

> *To ensure that impacts to amenity are reduced as low as reasonably practicable.*

5.13.3 Relevant guidelines and approvals

The following guiding documents are relevant in the consideration of impacts to amenity:

- *EPA Guidance Statement No. 33, Environmental Guidance for Planning and Development* (EPA, 2008).
- *Visual Landscape Planning in Western Australia* (WAPC, 2007).
- *Guidance Notes for the Reduction of Obtrusive Light* (The Institution of Lighting Engineers, 2005).

5.13.4 Existing environment

The landscape in which the Proposal is located is 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 LVIA:

- 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.

5.13.5 Potential impacts

The Proposal involves the deepening of existing pits. No new OSA's will be created as part of the Proposal. As such, there will not be any additional impact from the Proposal above that of the existing operations.

Lighting will be required to provide a safe work environment during mining of the open pits. Lighting requirements will be the same as that currently in place for the above water table operations and as such, no additional impacts will result.

5.13.6 Management measures

While the Proposal will not result to additional impacts on amenity, BHP Billiton Iron Ore will endeavour to ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable.

The range of management measures that may be used to mitigate potential visual impacts include:

- designing OSAs to integrate and blend in with the surrounding topography as far as practicable;
- rehabilitating mine landforms when they are not required;
- using vegetation and/or earth and rock bunds as visual screens; and
- adopting directional lighting or light shielding as necessary.

5.13.7 Summary

The LCUs within the Proposal area and surrounds are considered relatively abundant in the region. In the majority of cases, changes to the landscape are considered reversible and/or can be rehabilitated.

The Proposal involves the deepening of existing pits. As such no additional impacts to amenity are predicted above those previously assessed for above water table mining of OB29/30/35. Therefore, it is considered that the Proposal meets the EPA Objective for this factor.

6. BHP Billiton Iron Ore management approach

6.1 Environmental management overview

BHP Billiton has developed a Company Charter and Sustainable Development Policy for its operations. The *Company Charter and Sustainable Development Policy* are guiding resources for maintaining an emphasis on health, safety, environment and community and clarifying a broader commitment to aspects of sustainability including biodiversity, human rights, ethical business practices and economic contributions at all BHP Billiton sites. To interpret and support the Company Charter and Sustainable Development Policy, BHP Billiton has developed a series of Group Level Documents. The Group Level Documents, such as Management Standards, form the basis for the development and application of management systems at all levels of BHP Billiton's operations.

6.2 Health, Safety and Environmental Management System

BHP Billiton has developed and implemented a Health, Safety and Environmental Management System (HSEMS) for its operations that is certified to Australian/New Zealand Standard ISO 14001. The HSEMS describes the organisational structure, responsibilities, practices, processes and resources for implementing and maintaining environmental objectives at all BHP Billiton sites. The principal components of the HSEMS include:

- planning;
- implementation and operation;
- monitoring and corrective action; and
- management review.

6.3 Principles of environmental protection

6.3.1 Protection principles

The concept of sustainable development came to prominence at the World Commission on Environment and Development (1987), in the report entitled Our Common Future, which defined sustainable development as:

> *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

In recognition of the importance of sustainable development, the Commonwealth Government developed a National Strategy for Ecologically Sustainable Development (Commonwealth of Australia, 1992) that defines Ecologically Sustainable Development (ESD) as:

> *…using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.*

The principles of ESD are incorporated into the Environmental Protection Act and the EPA's Position Statement No. 7 - Principles of Environmental Protection (EPA, 2004c). These principles are listed below:

- The Precautionary Principle;
- The Principle of Intergenerational Equity;
- The Principle of the Conservation of Biological Diversity and Ecological Integrity;
- Principles in relation to Improved Valuation, Pricing and Incentive Mechanisms; and
- The Principle of Waste Minimisation.

Table 4-1 provides a summary of how BHP Billiton Iron Ore has considered the principles of ESD for the proposed Project.

6.3.2 EPA guidance material

The following EPA documents have been considered in this ERD or will be addressed during the development of the EIA.

- Environmental Protection Bulletins:
  - Environmental Protection Bulletin No. 1: Environmental Offsets – Biodiversity (EPA, 2010c).
  - Environmental Proection Bulletin No.19 EPA involvement in mine closure
- Position Statements:
  - Position Statement No. 2: Environmental Protection of Native Vegetation (EPA, 2000a);
  - Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002a);
  - Position Statement No. 4: Environmental Protection of Wetlands (EPA, 2004d);
  - Position Statement No. 5: Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia (EPA, 2004e);
  - Position Statement No. 7: Principles of Environmental Protection (EPA, 2004c);
  - Position Statement No. 8: Environmental Protection in Natural Resource Management (EPA, 2005); and
  - Position Statement No. 9: Environmental Offsets (EPA, 2006a).
- Guidance Statements:
  - Guidance Statement No. 6: Rehabilitation of Terrestrial Ecosystems (EPA, 2006b);
  - Draft Guidance Statement No. 8: Environmental Noise (EPA, 2007b);
  - Guidance Statement No. 12: Minimising Greenhouse Gas Emissions (EPA, 2002b);
  - Guidance Statement No. 18: Prevention of Air Quality Impacts from Land Development Sites (EPA, 2000b);
  - Guidance Statement No. 19: Environmental Offsets - Biodiversity (EPA, 2008a);
  - Guidance Statement No. 20: Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia (EPA, 2009a);
  - Guidance Statement No. 33: Environmental Guidance for Planning and Development (EPA, 2008b);
  - Guidance Statement No. 41: Assessment of Aboriginal Heritage (EPA, 2004f);
  - Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a);
  - Draft Guidance Statement No. 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia (technical appendix to EAG 12) (EPA, 2007a);

- Guidance Statement No. 55: Implementing Best Practice in Proposals Submitted to the Environmental Impact Assessment Process (EPA, 2003b); and
- Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004b).

- Environmental Assessment Guidelines (formally Guidance Statements):
  - Defining a Proposal (EAG 1) (EPA, 2009b); and
  - Timelines for Environmental Impact Assessment of Proposals (EAG 6) (EPA, 2010d).
  - Joint Guidelines for Preparing Mine Closure Plans (EPA and DMP, 2011); and
  - Environmental Assessment Guideline 8 for Environmental Factors and Objectives (EPA, 2013)
  - Environmental Assessment Guideline 9 for Application of a significance framework in the environmental impact assessment process (focusing on key enviornmental factors) (EPA, 2013a)
  - Subterranean Fauna in Environmental Impact Assessment in Western Australia (EAG 12) (EPA, 2013b).
- Technical Guide:
  - Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and DEC, 2010).

Table 10: Consideration of principles of ecologically sustainable development

OEPA* Principle	Description in *Environmental Protection Act 1986*	Relevant Yes/No	If Yes, Consideration
Precautionary Principle	Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: - careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and - an assessment of the risk-weighted consequences of various options.	Yes	Biological surveys, technical investigations and risk assessments have been used in this ERD to assess potential impacts and propose plausible management measures.
Intergenerational Equity	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	Yes	BHP Billiton Iron Ore will mitigate environmental impacts as low as reasonably practicable, and prepare a credible EIA to inform the public debate about whether and how the Proposal should proceed. Mine closure has been considered as part this EIA.
Conservation of Biological Diversity and Ecological Integrity	Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Yes	Baseline biological surveys and impact assessments have been completed. Standard industry management measures can be used or adapted to mitigate biodiversity and ecological impacts associated with implementation of the Proposal.
Improved Valuation, Pricing and Incentive Mechanisms	Environmental factors should be included in the valuation of assets and services. The polluter pays principle - those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the	Yes	Environmental factors have been considered throughout the planning process for the devevelopment of the Proposal. The Proposal includes impact evaluations and management measures which will aim to minimise pollution and waste.

	ultimate disposal of any wastes. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.		
Waste Minimisation	All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	Yes	Standard waste management measures have been included and will continue to be a key element for the implementation of this Proposal, which will include recognition of the waste management hierarchy (i.e. avoidance, reuse, recycling, recovery of energy, treatment, containment and disposal).

*OEPA = Office of the Environmental Protection Authority.

6.4 Consultation

BHP Billiton Iron Ore has consulted with key government agencies in relation to the Proposal. A summary of the consultation undertaken is provided in Table 11.

Table 11: Summary of Consultation

Stakeholder	Consultation Details	Issues Discussed	Proponent Response / Section
DEC – EMB (now DER)	Meeting at DEC, 7 February 2013 with Murray Baker, Acting Branch Manager	Potential biodiversity impacts. Survey coverage for subterranean fauna.	DEC – EMB advised they were satisfyied that the appropriate level of survey coverage had been demonstrated for the Proposal. Discussed in Sections 5.3, 5.4, 5.5 and 5.6.
DEC – Regional Branch / Licencing Regulation (now DER)	Meeting at DEC Karratha 21 March 2013 with Alana Kidd, Regional Manager	Dust, noise, pollution and management of dewater. Licence amendment for the future Licence amendment for the operational phase were discussed.	The existing Mount Whaleback Licence will be amended for the Hydrodynamic Trial to discharge to Ophthalmia Dam for 18 months. Discussed in Section 2.8.
DoW	Meeting at DoW, Perth, December 2012, with Gary Humphries	Dewatering, Licence amendments.	No concerns were raised. A 5C Licence amendment for the hydrodynamic trial has been issued. DoW advised they would comment on the referral if requested by OEPA.
OEPA	Meetings on 24 April and 22 August 2013 with Sally Bowman	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. OEPA officers requested that BHP Billiton Iron Ore address the potential impacts on bore V18.
Department of State Development (DSD)	Meeting on 18 July 2013 with Milka Klobucar and Paul Platt	State agreement act obligations, Project Proposal requirements and commitments to closure and rehabilitation under the State Agreement Act. The Department of State Development (DSD) advised they would discuss potential closure mechanisms with the OEPA.	BHP Billiton Iron Ore has provided a discussion in Sections 5.6.

7. References

Australian and New Zealand Environment Council (1990) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Australian Museum Business Services (2010) Assessment of Terrestrial Short-range Endemic Invertebrates, from Area C to Jinayri to Mount Newman Railway. Report prepared for BHP Billiton Iron Ore Pty Ltd.

Beard, J.S. (1980) A new phytogeographic map of Western Australia. Research Notes of the Western Australian Herbarium 3: 37–58.

Bennelongia Environmental Consultants (2013) Stygofauna Assessment at OB29/30/35, Mount Whaleback. Report prepared for BHP Billiton Iron Ore Pty Ltd.

BHP Billiton Iron Ore Pty Ltd. (1999) Proposal for Mining at Orebody 30 and 35.

BHP Billiton Iron Ore Pty Ltd (2012) Annual Environmental Report, Mt Whaleback, OB 29, 30 and 35.

BHP Billiton Iron Ore (2013) Mount Whaleback and Orebody 29/30/35 Mines, Environmental Guiding Principles, Revision 1.

BHP Billiton Iron Ore (20XX) Mining Operations Land Management Manual, MAN-ENV-LAND-NW-007.

BHP Billiton Iron Ore (20XX) Mining Operations Water Management Manual, SPR-IEN-H2O-NW-001.

Biologic Environmental Survey Pty Ltd (2011) OB35 and Western Ridge Vertebrate Fauna Survey. Report prepared for BHP Billiton Iron Ore Pty Ltd.

Biota Environmental Sciences Pty Ltd (in prep b) South Flank Short Range Endemic Survey Report. Report prepared for BHP Billiton Iron Ore Pty Ltd.

Brown, A., Thomson-Dans, C. and Marchant, N.J. (Eds.) (1998) Western Australia's Threatened Flora. Department of Conservation and Land Management, Western Australia.

Commonwealth of Australia (1992) National Strategy for Ecologically Sustainable Development.

Department of Climate Change and Energy Efficiency (2010) National Greenhouse Accounts (NGA) Factors.

Department of Environment and Conservation (2009) Biodiversity Values of Weeli Wolli Spring: A Priority Ecological Community.

Department of Environment and Conservation (2010) Ecological Communities Database Search. Provided by the Western Australia Department of Environment and Conservation.

Department of Environment and Conservation (2011a) *Goodenia nuda.* Webpage: http://florabase.calm.wa.gov.au/browse/profile/7530.

Department of Environment and Conservation (2011b) *Indigofera gilesii subsp. gilesii*. Webpage: http://florabase.calm.wa.gov.au/browse/profile/17715.

Department of Environment and Conservation (2011c) *Goodenia sp. East Pilbara.* Webpage: http://florabase.calm.wa.gov.au/browse/profile/29381.

Department of Environment and Conservation (2011d) *Acacia subtiliformis*. Webpage: http://florabase.calm.wa.gov.au/browse/profile/23528.

Department of Environment and Conservation and Western Australian Museum (2011) Nature Map. Website: http://naturemap.dec.wa.gov.au/default.aspx

Department of Industry, Tourism and Resources (2007) Leading Practice Sustainable Development Program for the Mining Industry - Managing Acid and Metalliferous Drainage.

Department of Mines and Petroleum (2006) Mining Environmental Management Guidelines: Mining Proposals in WA.

Department of Mines and Petroleum (2011) Draft Guidelines for Preparing Mine Closure Plans.

Department of Mines and Petroleum (2011a). Administration of Mine Closure Plans.

Department of Resources, Energy and Tourism (2009) Leading Practice Sustainable Development Program for the Mining Industry Series.

Department of Sustainability, Environment, Water, Population and Communities (2011a) Interim Biogeographic Regionalisation for Australia.

Department of Sustainability, Environment, Water, Populations and Communities (2011b) Survey Guidelines for Australia's Threatened Fish.

Department of Sustainability, Environment, Water, Populations and Communities (2011c) Survey Guidelines for Australia's Threatened Mammals.

Department of Sustainability, Environment, Water, Populations and Communities (2011d) Survey Guidelines for Australia's Threatened Reptiles.

Department of Sustainability, Environment, Water, Populations and Communities (2011e) Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the endangered northern quoll, Dasyurus hallucatus.

Department of the Environment, Water, Heritage and the Arts (2010a) Survey Guidelines for Australia's Threatened Bats.

Department of the Environment, Water, Heritage and the Arts (2010b) Survey Guidelines for Australia's Threatened Birds.

Department of the Environment, Water, Heritage and the Arts (2010c) Survey Guidelines for Australia's Threatened Frogs.

Department of Water (2006) Water Quality Protection Note No 30: Groundwater Monitoring Bores.

Department of Water (2009a) Pilbara Water in Mining Guideline.

Department of Water (2009b) Operational Policy No. 1.02: Policy on Water Conservation/Efficiency Plans: Achieving Water Use Efficiency Gains through Water Licensing.

Department of Water (2009c). Water Resources Data for Streamflow Site 708011 Fortescue River – Newman and 708012 Ophthalmia Dam – Mt Newman.

Department of Water (2010a) Water Quality Protection Note No. 52 – Stormwater Management at Industrial Sites.

Department of Water (2010b) Pilbara Regional Water Plan 2010-2030.

Department of Water (2010c) Operational Policy No. 5.08: Use of Operating Strategies in the Water Licensing Process.

Eberhard, S.M. and Humphreys, W.F. (1999) Stygofauna survey - Orebody 23 (Newman) and Mine Area C. Western Australian Museum, Perth.

Environmental Protection Authority (2000a) Environmental Protection of Native Vegetation, Position Statement No. 2.

Environmental Protection Authority (2000b) Prevention of Air Quality Impacts from Land Development Sites, Guidance Statement No. 18.

Environmental Protection Authority (2002a) Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3.

Environmental Protection Authority (2002b) Minimising Greenhouse Gas Emissions, Guidance Statement No. 12.

Environmental Protection Authority (2003a) Consideration of Subterranean Fauna in Groundwater and Caves During an Environmental Impact Assessment in Western Australia, Guidance Statement No. 54.

Environmental Protection Authority (2003b) Implementing Best Practice in Proposals Submitted to the Environmental Impact Assessment Process, Guidance Statement No. 55.

Environmental Protection Authority (2004a) Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, Guidance Statement No. 51.

Environmental Protection Authority (2004b) Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, Guidance Statement No. 56.

Environmental Protection Authority (2004c) Principles of Environmental Protection, Position Statement No. 7.

Environmental Protection Authority (2004d) Environmental Protection of Wetlands, Position Statement No. 4.

Environmental Protection Authority (2004e) Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia, Position Statement No. 5.

Environmental Protection Authority (2004f) Assessment of Aboriginal Heritage, Guidance Statement No. 41.

Environmental Protection Authority (2005) Environmental Protection in Natural Resource Management, Position Statement No. 8.

Environmental Protection Authority (2006a) Environmental Offsets, Position Statement No. 9.

Environmental Protection Authority (2006b) Rehabilitation of Terrestrial Ecosystems, Guidance Statement No. 6.

Environmental Protection Authority (2007a) Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia, Draft Guidance Statement No. 54a.

Environmental Protection Authority (2007b) Environmental Noise, Draft Guidance Statement No. 8.

Environmental Protection Authority (2008a) Environmental Offsets-Biodiversity, Guidance Statement No. 19.

Environmental Protection Authority (2008b) Environmental Guidance for Planning and Development, Guidance Statement No. 33.

Environmental Protection Authority (2009a) Sampling for Short-range Endemic Invertebrate Fauna for Environmental Impact Assessment in WA, Guidance Statement No. 20.

Environmental Protection Authority (2009b) Environmental Assessment Guideline No.1 ‘Defining a Proposal’.

Environmental Protection Authority (2010a) General Guide on Referral of Proposals to the Environmental Protection Authority under Section 38 of the Environmental Protection Act 1986. Environmental Protection Authority.

Environmental Protection Authority (2010b) Checklist for Documents Submitted for EIA on Marine and Terrestrial Biodiversity. Appendix 2 of Environmental Protection Authority (2010d) Timelines for Environmental Impact Assessment of Proposals.

Environmental Protection Authority (2010c) Environmental Protection Bulletin No. 1 - Environmental Offsets – Biodiversity.

Environmental Protection Authority (2010d) Timelines for Environmental Impact Assessment of Proposals.

Environmental Protection Authority (2013) Environmental Assessment Guideline 8 for Environmental Factors and Objectives. June 2013

Environmental Protection Authority (2013a) Environmental Assessment Guideline 9 for Application of a significance framework in the environmental impact assessment process (focusing on key enviornmental factors). June 2013

Environmental Protection Authority (2013b) Environmental Assessment Guideline 12 for Consideration of Subterranean fauna in environmental impact assessment in Western Australia.

Environmental Protection Authority (2013c) Environmental Protection Bulletin No.19 EPA involvement in mine closure. July 2013

Environmental Protection Authority and Department of Environment and Conservation (2010) Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment.

Environmental Resources Management Australia (2011a) Landscape and Visual Impact Assessment: Orebody 35 Iron Ore Project. Report Prepared for BHP Billiton Iron Ore.

Environmental Resources Management Australia (2011b) Orebody 35 Iron Ore Project Noise Impact Assessment. Report Prepared for BHP Billiton Iron Ore.

Environmental Resources Management Australia (2011c) Orebody 35 Iron Ore Project Air Quality Assessment. Report Prepared for BHP Billiton Iron Ore.

Finston, T.L., Johnson, M.S., Humphreys, W.F., Eberhard, S.M. and Halse, S.A. (2007) Cryptic speciation in two widespread subterranean amphipod genera reflects historical drainage patterns in an ancient landscape. Molecular Ecology 16: 355-365.

Finston, T.L., Francis, C.J. and Johnson, M.S. (2009) Biogeography of the stygobitic isopod Pygolabis (Malacostraca: Tainisopidae) in the Pilbara. Western Australia: evidence for multiple colonisations of the groundwater. Molecular Phylogenetics and Evolution 52: 448-460.

Halpern Glick Maunsell (2000) Hope Downs Rail Corridors Biological Survey. Unpublished report prepared for Hope Downs Management Services.

Halse, S.A., Scanlon, M.D., Cocking, J.S., Barron H.J. and Eberhard, S.M. (in prep) Pilbara Stygofauna: Deep Groundwater of an Ancient Landscape Contains Globally Significant Radiation of Biodiversity.

Harvey, M.S. (2002) Short-range endemism among the Australian fauna: some examples from non marine environments. Invertebrate Systematics 16: 555-570.

Hope Downs Management Services Pty Ltd (2000) Hope Downs Iron Ore Project Public Environment Report/Public Environment Review. Hope Downs Management Services Pty Ltd, Perth.

International Network for Acid Prevention (2010) Acid Rock Drainage Guide.

Isbell, R.F. (1998) The Australian Soil Classification. CSIRO Publishing, Melbourne.

Johnstone, R.E. and Storr, G.M. (1998) Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth, Western Australia.

Karanovic, I. (2007) Candoninae (Ostracoda) from the Pilbara region in Western Australia. Crustaceana Monographs 7: 1-433.

Kendrick, P. (2001) A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Pilbara 3 (PIL3 – Hamersley Subregion). Department of Conservation and Land Management.

Kepert, D. A. (2001) The Mapped Stratigraphy and Structure of the Mining Area C Region (the Black Monolith) An Eclectic Synthesis of Geological Mapping by BHPBIO Exploration 1994-2001. Internal BHP Billiton Iron Ore report.

Kneeshaw, M. (2008 [updated 2004]) Guide to the Geology of the Hamersley and North East Pilbara Iron Ore Provinces. BHP Billiton Iron Ore internal report (The Blue Book).

Mattiske Consulting Pty Ltd (2009) Flora and Vegetation of the Hope Downs 1 Area. Report prepared for Pilbara Iron.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. (1998) Australian Soil and Land Survey – Field Handbook. Australian Collaborative Land Evaluation Program, CSIRO Land and Water, Canberra.

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

Omotosho, S. (2007) Drilling Report for Jinayri, September 2006 – December 2006. Internal BHP Billiton Iron Ore report.

Onshore Environmental Consultants and Biologic Environmental Science Pty Ltd (2009) Biological Survey South Parmelia Exploration Leases.

Onshore Environmental Consultants (in prep) Flora and Vegetation Survey – Area C and Surrounds. Report prepared for BHP Billiton Iron Ore Pty Ltd.

Outback Ecology Services (2009a) Jimblebar Iron Ore Project Flora and Vegetation Assessment.

Outback Ecology Services (2009b) Area C Mining Operation Environmental Management Plan (Revision 4) A, D, P1 and P3 Deposits. Unpublished report for BHP Billiton Iron Ore Pty Ltd.

Outback Ecology Services (2009c) Orebody 24/25 Upgrade Terrestrial Invertebrate Short-range Endemic Assessment.

Outback Ecology Services (2009d) Jimblebar Iron Ore Project Terrestrial Invertebrate Short-range Endemic Assessment.

Outback Ecology Services (2010a) Area C to Jinayri to Mount Newman Railway Terrestrial Vertebrate Fauna Survey. Report prepared for BHP Billiton Iron Ore Pty Ltd.

Outback Ecology Services (2010b) Jinayri Mining Lease M244SA Soil Resources Survey.

Pilbara Flora (2009) Fauna Habitat Assessment of Hydrological Drill Targets at Jinayri North. Report prepared for BHP Billiton Iron Ore Pty Ltd.

Pitman, S. (2008) Jinayri 300mE x 100mN Drilling Report 2008. Internal BHP Billiton Iron Ore Report.

Strategen (2010) Hope Downs 4 Iron Ore Project Public Environmental Review. Report prepared for Hamersley HMS Pty Ltd.

SVT Engineering Consultants (2005) Environmental Noise Modelling at the Mount Whaleback (Newman) Operations.

The Institution of Lighting Engineers (2005) Guidance Notes for the Reduction of Obtrusive Light.

Tehnas, I.J. (1984) Weeli Wolli Exploration Report.

Trudgen, M. (1984) A Flora and Vegetation Survey of the Weeli Wolli Creek Area. Report prepared for the Mount Newman Mining Company Pty Ltd.

United States Department of Agriculture Forest Services (1974) Visual Management System.

University of Western Australia (UWA) (2012) Potential impacts of mining operations on groundwater dependent vegetation, Preliminary assessment. Prepared for Rio Tinto.

Van Vreeswyk, A.M.E., Payne, A.L., Leighton, K.A. and Hennig, P. (2004) An Inventory and Condition Survey of the Pilbara Region, Western Australia, Technical Bulletin No. 92. South Perth, WA.

Vipac Engineers and Scientists Ltd (2006) Newman Iron Ore Plant – RPG4 Noise Modelling.

Water and Rivers Commission (2000a) Water Quality Protection Guidelines No. 6 – Mining and Mineral Processing Minesite Stormwater.

Water and Rivers Commission (2000b) Statewide Policy No 5 – Environmental Water Provisions Policy for Western Australia,

Water and Rivers Commission (2000c) Statewide Policy No. 3: Policy Statement on Water Sharing.

Water and Rivers Commission (2000d) Water Quality Protection Guidelines No 1: Water Quality Management in Mining and Mineral Processing: An Overview.

Water and Rivers Commission (2000e) Water Quality Protection Guidelines No. 4: Mining and Mineral Processing - Installation of Minesite Groundwater Monitoring Bores.

Water and Rivers Commission (2000f) Water Quality Protection Guidelines No. 5: Mining and Mineral Processing - Minesite Water Quality Monitoring.

Water and Rivers Commission (2000g) Water Quality Protection Guidelines No. 9: Mining and Mineral Processing - Acid Mine Drainage.

Water and Rivers Commission (2000h) Water Quality Protection Guidelines No. 11: Mining and Mineral Processing - Mine Dewatering.

Western Australian Planning Commission (2007) Visual Landscape Planning in Western Australia.

Weston, A. and Trudgen, M. (1995) Vegetation and Flora Survey, Marillana/Weeli Wolli Creeks and Palaeochannel. Prepared for Woodward Clyde Pty Ltd.

Wilson, S. and Swan G. (2003) A Complete Guide to Reptiles of Australia. Reed New Holland, NSW.

Woodman Environmental Consultants (2009) Flora and Vegetation Survey, Area C Mining Operation Environmental Management Plan Revision 4 - A, D, P1 and P3 Deposits. Report BHP08-07-01 Rev 2: prepared for BHP Billiton Iron Ore Pty Ltd.

Woodman Environmental Consultants (2010) Area C to Jinayri Mount Newman Railway Flora and Vegetation Survey. Report prepared for BHP Billiton Iron Ore Pty Ltd.

World Commission on Environment and Development (1987) Our Common Future.

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Appendix A: Authority under the NJV

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Appendix B: Hydrogeological Assessment of OB29, OB30 and OB35 for Mining Below Water Table Approvals – RPS Aquaterra (2013)

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Appendix C: Orebody 29, 30, 35 – Groundwater Dependant Vegetation Impact Assessment – Onshore Environmental (2013)

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Appendix D: Stygofauna Assessment at OB29/30/35, Mount Whaleback – Bennelongia (2013)

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Appendix E: Orebodies 29,30 and 35: Preliminary Acid and Metalliferous Drainage Risk Assessment – SRK Consulting (2013)

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Appendix F: OB29/30/35 Mine Closure Plan (draft)

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